

MESSAGE

FROM

THE PRESIDENT OF THE UNITED STATES,

TRANSMITTING

COPIES OF SURVEYS

MADE IN PURSUANCE OF ACTS OF CONGRESS, OF 30TH APRIL, 1824,
AND 2D MARCH, 1829.

DECEMBER 16, 1829.

Read, and laid upon the table.

To the Speaker of the House of Representatives:

I have the honor to transmit herewith to the House of Representatives, a report of the Secretary of War, accompanying copies of surveys, made in pursuance of the acts of Congress passed the 30th of April, 1824, and the 2d of March, 1829; and to request that the House cause them to be laid before the Senate, as there are no duplicates prepared.

ANDREW JACKSON.

December 16th, 1829.

DEPARTMENT OF WAR,

December 12th, 1829.

SIR: I have the honor to present to you herewith, for transmission to Congress, copies of the reports and maps of the following surveys, viz:

1. Survey of Deep Creek, Virginia.
2. Survey of Pasquotank River, North Carolina.
3. Survey of the entrance of the River Teche, Louisiana.
4. Survey of the passes at the mouth of the Mississippi, La.
5. Survey of the water tract between Lake Pontchartrain and Mobile Bay.
6. Survey of the Desmoines and Rock River Rapids in the Mississippi.
7. Surveys with a view to the location of a Rail Road from Charleston to Hamburg, South Carolina.

The surveys, from No. 1 to 5, were made under an act of Congress passed the 2d of March, 1829, and Nos. 6 and 7 under the act of the 30th of April, 1824.

I have the honor to be
Your obedient servant.

JN. H. EATON.

To the PRESIDENT of the United States.

No. 1 and 2.

SURVEY OF DEEP CREEK, VA., AND PASQUOTANK RIVER, N. C.

FORTRESS MONROE,

November 12th, 1829.

Brigadier General C. GRATIOT,
Chief Engineer:

SIR: I have the honor to transmit to you, herewith, Lieutenant Mansfield's report of his survey of the Pasquotank River and Deep Creek, accompanied by four sheets of drawings, which exhibit, from minute surveys, those parts of the river and creek where the depth of water is not sufficiently great for the required navigation. They also exhibit the works by which it is proposed to improve the navigation of those parts.

On the importance of the line of Inland Navigation, a part of which these works are designed to improve, I have only to remark, that the two subscriptions by Congress to the stock of the Dismal Swamp Canal, which is a middle link in this line of communication, and the value of which is dependent on the state of the navigation through these natural and extreme links of the line, (the Pasquotank River and Deep Creek,) has placed the importance of these works in a light not to be affected by any observations I might be inclined to make. On the fitness of them to accomplish the particular object in view, I shall make a few remarks.

The Pasquotank, meandering through a heavily timbered swamp of Cypress and Gum, with a current never strong, and sometimes stagnant, varying in its direction with the wind, its surface elevated and depressed, from the same cause, from two and a half to three feet, and its waters always clear, is of a character to retain any artificial enlargement of its channel for a considerable time: it presents a case, therefore, where dredging may be resorted to with advantage; and one, I think, where it should be preferred to hazardous experiments upon the current of the river. It is therefore recommended to deepen the channel through the bar, above River Bridge and the sand shoals, by dredging: these appear to be the only places that require deepening, between the canal and Elizabeth City, a distance of eighteen miles. The cost of the above work is estimated at \$2,500. (See Estimate, marked A.)

Deep Creek is totally different in its character from Pasquotank River, and, to my mind, presents a case, where the expense of dredging alone will not be attended with a proportional benefit; every heavy rain carries into it a great quantity of earthy matter: its bed, above the canal, and even below, exhibits, in many places, at low water, naked shoals of fine sand and mud: its bottom is scoured by a strong current, especially about the last of an ebb tide, which sweeps the fine sand and mud further down the stream, from whence the flood tide has not sufficient force to remove it back: the shoals not unfrequently shift their position, and the whole channel, below the canal, is rapidly shoaling, from the descent of the sand from above. To

make any improvement on this Creek, approaching permanency, the velocity of the current upon the ebb tide must be diminished, a body of water thrown into the mouths of the small runs and ravines, which will check their current, and arrest the grosser particles of earth from being carried into the channel. Were this done, the channel at present existing might be preserved for many years, and, with the occasional application of a dredge, might, at a small expense, be matured for an indefinite time. To accomplish this, it will not be necessary to retain the water in the creek above ordinary high water: this will give, throughout the creek, $7\frac{1}{2}$ feet water, which will sufficiently attain every object, without the possibility of injury to any person or property. The details of this project are exhibited on Sheet No. 4, and the estimate of the cost is \$29,000. (See Estimate, marked B.) The reasons for preferring the location there given to the lock, to placing it in the Creek, are, 1st. a better foundation; 2d. greater safety; 3d. it is removed from the influence of any bar, that might be formed from the effects of the dam, at the mouth of the Creek; and 5th. shortening the distance, and avoiding a reach of the creek, the course of which is directly opposite to that of the general course of the river. The position of the dam was determined by the depth of water, the shortest being selected.

All of which is respectfully submitted, by

Your most obedient servant,

A. TALCOTT,
Lieutenant of Engineers.

A.

Estimate of the cost of improving Pasquotank River, to give $6\frac{1}{2}$ feet water below the debouch of the Dismal Swamp Canal.

For dredging Bar above River Bridge, estimated at 5600 yards, at 30 cts.	-	-	-	-	\$1680 00
For dredging Sand Shoals, 1700 yards	-	-	-	-	510 00
For removing trees, overhanging Channel	-	-	-	-	100 00
For Contingencies	-	-	-	-	210 00
					<hr/>
					\$2,500 00
					<hr/> <hr/>

NOTE.—The above estimate is founded on the supposition, that the Dredging Machine, belonging to the Dismal Swamp Canal Company, can be obtained to execute this work, free from charge.

A. TALCOTT,
Lieutenant of Engineers.

B.

Estimate of the cost of improving the Navigation of Deep Creek, to afford 6½ feet water below the debouch of the Dismal Swamp Canal.

<i>Lock.</i> —One Lock of stone, 100 by 22 feet, with guard gates: the wall 17 feet high, or 1½ feet above the highest gust tides.—Cost complete	\$17,000 00
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<i>Canal.</i> —Excavating above ½ tide, 14,225 yards, at 15 cts.	\$2,134 75
Ditto below ½ tide, 10,622 do - 25 cts.	2,655 50
Wharves and Piers, say 36,000 feet - 5 cts.	1,800 00
	<hr/>
	\$6,590 25
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<i>Dyke.</i> —Facing Dyke, 2,750 yards Sodding, at 50 cts.	\$1,375 00
Earth for centre of dyke, 5,000 yards, at 20 cts.	1,000 00
	<hr/>
	\$2,375 00
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<i>Dam.</i> —48 Piles for supporting plank piles, at \$6 each.	\$288 00
320 feet Heart pine, at 25 cts.	80 00
300 lbs. Smithery, for Spikes and Screw bolts	37 50
160 feet Sheet Piling, 17 feet long, 4 thick, heart pine, driving included, at \$3	480 00
160 perches of rough Stone, at \$2 25	400 00
	<hr/>
	\$1,285, 50
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RECAPITULATION.

Lock	\$17,000 00
Canal	6,590 25
Dyke	2,375 00
Dam	1,285 50
Contingencies	1,749 25
	<hr/>
	\$29,000 00
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A. TALCOTT,
Lieutenant of Engineers.

No. 3.

REPORT ON THE SURVEY OF THE RIVER TÈCHE, LOUISIANA.

PENSACOLA, *August 22d*, 1829.

SIR: In obedience to your orders, I have examined the bar at the mouth of the River Teche, and have the honor to submit the following, as the result of my examination, on the subjects called for by my instructions.

The accompanying sketch exhibits the difficulties at present existing in the navigation of the Teche, and suggests the only mode of removing them, viz: the opening of a direct communication to the sea, through the bar, near Point au Fer. This bar, like most others obstructing the mouths of rivers on the North side of the Gulf of Mexico, extends in a westerly direction; from Point au Fer to its western extremity, is seventeen miles. Vessels enter the Teche by a narrow and dangerous passage. Along the outside of this bar, to its western extremity, after turning the point, their course lies easterly, until they get opposite the mouth of the river, thence, in a northerly direction, to its entrance. The bar itself is composed of numerous long and narrow banks of dead oyster shells, running in a westerly direction, and separated from each other by deep holes, and small irregular channels. Wherever the bottom is not protected by a superstratum of shells, it is excavated to the depth of from eight to twelve feet by the tide, which here runs with great velocity, and will be a powerful accessory agent in accomplishing the contemplated improvement.

I have selected the point of the bar directly opposite the debouchment of the river, as combining, in the greatest degree possible, utility, with facility of opening. Since the excavated channel must necessarily be of limited width, it is extremely desirable that the course should be direct to the mouth of the river and its bearings, such as to afford entrance to the harbor with the prevalent winds. These properties will be found united in the channel above selected.

The circuitous and narrow pass, at present used, renders its navigation hazardous. Vessels are compelled to await a favorable wind before attempting to pass the bar—a delay not unfrequently attended with much danger, especially to crafts inward bound, during the prevalence of gales, so common to this portion of the Gulf, as they have no harbor within reach.

The extreme breadth of the bar, at the place selected for the proposed improvement, is two miles. To open a channel, fifty yards wide, to contain seven feet water at medium tides, will require the excavation of fifty-two thousand cubic yards of earth and shells.

The expense of removing this mass may be estimated at thirty thousand dollars, including the pay of the Superintendent, and other contingent expenses. I have predicated my estimate of the cost upon data furnished by the operations now in progression at Pascagoula, and Pass au Heron, upon a similar soil, allowances being made for the more exposed position of the bar of the Teche, and the consequent delays in the operations, as well as for its remoteness from any place whence supplies may be drawn.

DETAILS OF THE ESTIMATE.

One Dredging Machine, - - - - -	5,000
Two Receiving Scows, at \$450 each, - - - - -	900
Excavation of 52,000 cubic yards of earth and shells, at 36 cents per yard, - - - - -	18,720
Pay of Superintendent, and all other contingent expenses, - - - - -	5,380
	<hr/>
	<u>\$30,000</u>

Eight miles from Point au Fer, at the point noticed on sketch No. 1, the bar may be cut through at a less expense than the one estimated for. A reference to the sketch will shew, that, should this be thoroughly opened, the navigation would not be materially benefited. The present difficulties consist less in want of water, than in the irregular direction of the passage, the bars, which, at high tide, are covered, and are rendered doubly dangerous by abutting boldly upon the channel. Vessels at high tide can now enter the Teche, drawing eight feet water. Any attempt to procure a greater draft of water, would be attended with an expense which would increase, in a much greater ratio than the depth of the channel, owing to the great extent of that portion of the shoal having eight feet of water.

The immense importance of the projected improvement to a large and fertile portion of Louisiana, renders it an object of deep interest. The difficulties and dangers attendant upon exporting sugar from this river, though insufficient to discourage its culture, have greatly tended to retard the settlement of the rich sugar lands on its banks.

An additional importance is given to this work in a national point of view, by the ready access which will thus be furnished to the live oak timber abounding on the banks of the Atchafalaya, and the adjacent streams. This timber, which is deemed so important as to warrant the expenditure of large sums of money in the culture of trees, which can be available only at some distant period, is in the full vigor of maturity, daily falling under the axe of the planter, and by him applied to the ordinary purposes of fuel, and which, were the approach to it more easy, might be appropriated to those uses, in Naval construction, for which its durable qualities so peculiarly adapt it.

No doubt can exist as to the expediency of opening the bar of the Teche, except such as are predicated upon its liability to fill up, and these can hardly arise, when we consider the loose nature of the soil, and the strong tendency of the current to seek the shortest passage to the Ocean.

I have the honor to be, sir,

Very respectfully,

Your ob't serv't,

A. H. BOWMAN,
Lt. of Engineers.

To CAPT. W. H. CHASE,
Corps of Engineers.

I beg leave to mention the politeness of the Collectors of Mobile and New Orleans, and of the Captains of the Cutters Alabama, Louisiana, and Marion, for the facilities afforded by them, in expediting my voyage to and from the Teche.

No. 4.

REPORT OF THE SURVEY OF THE PASSES OF THE MISSISSIPPI.

REPORT accompanying the Survey of the Passes of the Mississippi River, with a view to improvements in the Navigation, building Light-Houses, and Buoys.

The facilities now afforded to the commercial marine for entering and departing from the Mississippi, consists of a Light-House on the Northeast Pass, $4\frac{1}{2}$ miles from the bar of the Southeast Pass, and $24\frac{1}{2}$ miles North-easterly from the bar of the Southwest Pass. The two latter Passes are now used by all vessels bound to and from the port of New Orleans.

This Light answers very well for vessels of small draft of water, that can cross the bar of the Southeast Pass. Such, however, is the superiority of the Southwest Pass, in depth of water on its bar, that, at the present time, all the larger class of vessels first make this light, and then retrace their course Southerly, for the Southwest Pass. If in the night, the best navigators cannot with safety make it. The risk of doubling South Point, and the uncertainty of finding the anchoring ground of the Southwest Pass, now compels all vessels to await the day-light before steering for their destination, and the most advantageous entrance into the Mississippi. At this Pass, therefore, a light would be very important; the more so, as the same light would answer very well for vessels employed in the growing and important trade with the Mexican and Colombian ports on the Gulf of Mexico, and for all vessels doubling the Tortugas. As, however, South Point is but four miles in latitude North of the proper position at the Southwest Pass for a light, a vessel steering for the latter Pass would be in danger of grounding on this point, there being fifty fathoms water within two miles of this hard sandy point, the only one of this character at the mouth of the Mississippi. A light, therefore, at this point, becomes very essential. That it may be known from the one on the Northeast Pass, and from those proposed for the Southwest Pass, it should be constructed as a revolving light, be of as great an altitude, and provided with a bell, to notify vessels of its vicinity in foggy and thick weather. In order, then, to distinguish with certainty the Southwest Pass from the others, it will be necessary to construct two Light-Houses there, both of which may be of small dimensions when compared with the others.

Vessels invariably make good their latitude, (coming from the Southward and Eastward,) before their longitude, being compelled so to do, by the risk of passing to the Westward of their intended point, which, if they are so unfortunate as to do, costs them much time to retrace their way, against the strong current and prevailing winds from the Northeast to Southwest, setting by the mouth of the Mississippi at most seasons of the year; and hence they first make the light at South Point, from whence they shape their course to the anchoring ground, indicated by the lights at the Southwest Pass, or Southeast Pass, to whichever they may be bound.

With these lights, every facility the nature of the case admits of, will be afforded for making the bars of the river; without them, great risk and danger present themselves to the commerce of a port, than which, few in the Union are more frequented, and from whence is shipped the immensely valuable produce of the Western and Southern States.

After making the anchoring ground off either of the Passes to which a vessel may be destined, the difficulty then presents itself to the pilot of knowing the deepest water, and the most favorable direction for crossing the bars. Neither trees, houses, or any other species of land mark, serve to point it out with sufficient accuracy.

The bar being, at both the navigable Passes, on the very edge of the shoal, (formed by the deposits of the river,) is some miles from the low marshy lands, forming the boundary of the river, presenting to the pilot an uninterrupted horizon on about three-fourths of the compass, when entering either of the Passes; and when departing from the river, no two objects in front of a vessel can be brought in a line, whereby to give with certainty the proper course.

To obviate these difficulties, Buoys become indispensably necessary: for want of them, or some land marks to indicate the bars, more than half the vessels entering the Mississippi ground, and are detained in consequence. I therefore recommend that a Buoy be placed on the bars of the Southeast and Southwest Passes, and a second one, from a quarter to a half a mile within them, by which, vessels bringing them in a line, may with certainty run in the deepest water.

It will be seen, on reference to the survey, that several shoal points exist in the vicinity and outside the bar of the Southwest Pass. These should be marked out by Buoys. It is necessary not only for the pilots, but commanders of vessels should be able to steer clear of them, when coming to anchor off the Pass.

Of improvements in the navigation, I am not aware of any other than the deepening of the channel across the bars. There are neither snags, sawyers, or shoals, within the mouth of the river, and in the limits of the survey, which may not be easily avoided by the customary precautions of a good "look out," and attention to the lead line.

As to deepening the bars, it is a project involving some uncertainty, notwithstanding it appears practicable, and nature has done much to facilitate its accomplishment.

On the bar of the Southwest Pass it will be perceived that the two horizontal curves of sixteen feet water approach each other within the eighth part of a mile; the shoalest point between them, at low water, I found to be $13\frac{1}{2}$ feet. If, then, a channel could be opened across the narrow slip, to the depth of 16 feet, great, indeed, would be the advantages accruing to the commercial interest. At present, many of the larger class of vessels, bound out, with full cargoes, cannot cross the bars without grounding. The practice in such cases is, to run them aground, and then, with anchors and cables, by main force, haul them over, availing themselves of the rise of the tide, (the maximum rise being only two feet, and but one tide in twenty-four hours, a peculiarity in the tides common to the North shore of the Gulf of Mexico.) This practice, although the bottom is soft, is attended with great delay, sometimes injury, and always of risk to the vessel and cargo. To obviate it, therefore, would be of vast importance.

Different plans of accomplishing this object have suggested themselves; one, by excavating a channel to the uniform depth of 16 feet at low water, and to a width of 300 feet, by a well constructed dredging machine, worked by steam; to effect which, it would be necessary to remove about 11,000 cubic yards of earth.

Another plan would be, to so loosen the soil on that part of the bar requiring deepening, that the force of the current, during the flood of the river, would carry the particles into the deep water of the Gulf; to be accomplished by means of a machine, partaking of the properties of the harrow, or plough, and by a steam vessel dragged back and forth over the surface to be deepened. The success of this plan will appear the more probable and certain, when it is considered that the soil of the river banks, once put in motion, is held in suspension for many miles, before it falls to the bottom; a fact sufficiently established by the observation of every mariner, who always discovers the muddy water of the Mississippi, and knows it by its color, for many miles from the land, out in the Gulf; as also from the knowledge, at New Orleans, and other places on the river, of the rise of the respective tributaries of the Mississippi, by the color of the soil held in suspension, (the several tributaries being different colors,) of which none is more remarkable than the Red River, its waters coloring the Mississippi to the sea.

Such being the case, if we succeed by any means in setting the soil on the bar afloat, the presumption is, that it will be carried into deep water before settling; the more especially, as the bar is on the very edge of the shoal, directly outside of which we find five fathoms water. In seeking for the causes that have formed and kept all the mouths or bars of the Mississippi uniformly very shoal, when compared with the depth of the river, I can discover nothing to discourage an effort being made to accomplish so desirable an object as the deepening the water on the bar of the Southwest Passage.

Again referring to the survey, it will be perceived that the river discharges its waters by the Southwest, South, Southeast, and Northeast Passes, Pass au Centre, and small bayous, not worthy particular mention, all partaking of the same features: for instance, their banks are level with the surface of the water, and increase in width, and consequently diminish in depth, as they approach the Gulf of Mexico.

They are evidently formed by the deposite of the river, until we reach the edge of the shoal. Here, a very remarkable, and, to me, unaccountable, formation is observed. It consists of numerous small islands, from two to fifteen feet above the level of the highest tides or floods of the Mississippi. In many places these isles, or mud formations, are observed to rise and fall, sometimes being just level with the surface of the water, and at others some feet above the highest water mark; this phenomenon has been most frequently observed at the small mud isles off the bar of the Southeast Pass, and has given rise to a common rumor that they are floating islands.

During the survey, I necessarily landed upon most of these islands, and invariably found that the water of the ocean, or rather salt water, was raised by a subaqueous power to the height of the island, whatever it might be above the level of the Gulf. There was a constant ebullition through an opening of still looser mud, (often in the centre of the Islands,) as in case of springs, bringing with it, however, the mud, from great depths, and depositing it on the surface, at different elevations, on different islands, above the surface of the Gulf.

Those islands where this subaqueous force appeared to have exerted itself for the longest time, assumed a concave form, and were, in some other respects, like the craters of volcanoes, when arrived at their greatest elevation; so that the island thus raised is equivalent to the force which had raised it, or possibly, by a diminution or cessation of that force, the islands subside, by falling in towards the centre. It is the uniformity of this operation which, no doubt, has led to the rumor of these floating islands. Some of them are of such recent formation, that vegetation, even of grass, had not yet commenced, others are covered with shrubs of years' growth; and, in some instances, the islands are daily disappearing, by the action of this subaqueous force undermining them and washing away the soil, which, most generally, is deposited on that side of the island to which the water from beneath commenced to flow; thus making an extensive flat or shoal, rising within a few inches of the level of the Gulf. Such appears to me to be the formation of the shoal points on the outside of the Southwest Pass, on which I propose to place buoys.

Surprising as it may seem, it is nevertheless a fact, attested by residents of the Balize, that ballast-stones, thrown overboard from vessels, which had grounded in several feet water, have since been found on the surface of one of these islands; and were unquestionably raised to that elevation by the singular force to which I have alluded.

So great indeed is this force or power, that, in some instances, it throws up acres of ground, without destroying the contiguity of the particles, raising it to the surface unbroken; and shewing plainly the successive deposits of the Mississippi, now inclined in various angles with the horizon. This is most distinctly observed on the three islands at the end of the Balize Bayou.

For the light-house on the Northeast Pass, one of these islands was selected. The building was finished, with the exception of the lantern, when it was found to have inclined so much, by the sinking of one side of the foundation, as to make it necessary to take down the whole fabric, and commence anew. My impression is, that it was placed on the edge of one of these springs, and where the force had ceased to act, leaving the spot hollow on that side to which the building inclined.

I have given the result of my observations on these singular islands so far in detail, in order that it may be seen how important it is, that much precaution be used in making fixtures of any kind here.

For the Light-houses, now recommended, such localities should be studiously avoided, and a selection made of sites formed by the natural deposits of the river, building them on foundations, similar to those which, by experience, we have found to answer well for the works of defence on Lake Pontchartrain and the Mississippi.

On the survey, I have designated the sites of the proposed Light-houses, with the view of securing the best foundations, and possessing other essential conditions.

The one on South Point, it is desirable to place on the most Southern extreme of the Mississippi deposit. The two smaller ones (say fifty feet each) I would recommend should be placed on a line with the Bar, and on the shoal between the Nine-foot and Maine Channels, at the Southwest Pass.

A third plan, for deepening the Bar of the Southwest Pass would be, the customary one in such cases, of forming jetties to confine the channel of the Pass to a uniform width to the deep water of the Gulf; a project that

would no doubt be attended with complete success, no location presenting more favorable assurances of the success of such a plan. To execute such a plan, all the stone, lumber, and even earth, would have to be drawn from a distance, the site affording no one article for the construction of the jetties. I would recommend that immediate means be taken, for placing two buoys at the Southeast Pass, four buoys at the Southwest Pass, three in reserve, to replace any that might be carried away by accident; and that measures be also taken to construct a revolving light at South Point, and two stationary lights at Southwest Pass.

As vessels would often make fast their lines to the buoys, rather than let go an anchor, and, from the soft nature of the bottom of the river, no anchors, calculated for securing a buoy alone, would remain in its position with the additional strain of one or more vessels, it would be advisable to provide by law for their preservation, proper position, from time to time, and renewal by spare ones, in case any one should be water-soaked, or removed by casualties.

To secure these objects; I would recommend that it be made an offence, punishable by fine, for making fast to any of the buoys, and that the Collector of the Port of New Orleans be at all times authorized, through his Inspectors of the Revenue, stationed at the Passes, and with the aid of the Revenue Cutter, to have this duty strictly attended to.

RICHARD DELAFIELD,
Captain of Engineers,

To Brig. Gen. CHARLES GRATIOT,
Chief Engineer.

Fort Jackson, July 6, 1829.

Annexed is a statement giving the amount of property to be benefited by the improvements mentioned in this Report. R. D.

EXPORTS of Cotton and Tobacco from the Port of New Orleans, during the last eight years, commencing 1st October, and ending 30th September.

WHITHER EXPORTED.	BALES OF COTTON.								HOGSHEADS OF TOBACCO.							
	1828 9.	1 2 8.	1826 7.	1825-6.	1824 5.	1823 4	1822-3.	1821-2.	1828-9.	1827 8.	1826-7.	1825-6.	1824-5.	1823 4.	1822-3.	1821-2.
Liverpool,	119036	134070	179526	107816	92301	56058	88180	56354	801	1322	1166	1589	1567	766	3344	467
London,	1550	70			25	399	144	611	1082	1222			411	1565	976	1604
Glasgow and Greenock,	8485	4020	12743	3162	6814	4553	6853	3914								
Cowes, Falmouth, &c.		1083	1270	1929		614	3922	3578	2684	2856	1666	300	652	451	2186	300
Cork and a Market,				3137	1492		1586						342			
Belfast,	1443	1637		874	1272								36			
Aberdeen,		1666														
Havre,	61968	57919	52174	58561	30609	32369	23582	29420	130	136	549					10
Bordeaux,	1992	1994	2680	1734	1599	983	412	1686	100	246	203		16	154	40	27
Marseilles,	11661	4833	3131	1998	242	609	1795	1401			18		60			
Nantz,	1809	1679	1742	1467	384	463										
Cette and Rouen	940		374					1050								
Amsterdam,	1563	661	898	977			367	411	1720	1276	1225	901		219	2990	1054
Rotterdam and Ghent,	38	729		516			167	82	324					611	329	
Flushing,	1039															
Bremen,	831	1525	1900	773			712	956	1186	3458	2271	1421	137	1356	2587	1660
Antwerp, &c.	5101	1379	4683	1865			2690			256					342	
Hamburgh,	4180	3806	1651	335	723	103	844	957	95	978	353	80	487	1951	1097	378
Gottenburgh,	201	115	147	34	50	43	224	34	407	558	334	259	473	691	551	193
Gibraltar, &c.				131		25	359	47	145	3498	2327	1963	2166	2358	887	837
Spain,									7902				201	355	258	
West Indies,				6		3		1357	98	746	436	636	193	951	484	497
Trieste, &c.	5095	1379							143	50						
Other foreign ports,						902		2742					30	575	342	
New York,	20009	38486	37207	36839	51810	28521	24640	28873	5197	9045	9322	5043	6620	6962	6995	7146
Boston,	12533	20006	9815	11903	7439	7842	5699	7279	713	6211	2742	3175	1366	3509	2047	2810
Providence, R. I.,	3570	13709	6932	8832	4804	5702	2818	1721		35	251	71	384			5
Philadelphia,	3449	9921	9265	5172	3260	3381	5638	10688	1433	2135	2370	1921	1287	3559	3106	3320

Baltimore,	1164	2744	3155	3053	1733	1250	799	2851	475	749	857	700	185	399	251	906
Charleston,									35	159	93	110	43	49	72	
Other Coastwise Ports,	492	1381	389	810		123		58	821	175	387	311	188	140	195	452
Total	267949	304848	329682	251924	204557	143943	171431	156030	25491	35111	26570	18480	16849	25910	29361	21995

RECAPITULATION.

Great Britain,	130514	142546	193539	116918	101904	61624	100685	64457	4567	5400	2832	1889	3008	2782	6506	2371
France,	78370	66425	60101	63760	32834	34424	25789	33557	230	382	770		76	154	40	37
North of Europe,	12953	8215	9279	4500	773	146	5004	2440	3732	6526	4183	2661	1102	4217	8178	3614
South of Europe,	5095	1379		137		930	359	4146	8288	4294	2763	2599	2590	4139	1971	1334
Coastwise,	41017	86283	66763	66609	69046	46819	39594	51430	8674	18509	16022	11331	10073	14618	12666	14639
Total,	267949	304848	329682	251924	204557	143943	171431	156030	25491	35111	26570	18480	16849	25910	29361	21995

MONTHLY ARRIVALS of Ships, Brigs, Schooners, Sloops, and Steamboats, for the last three years, ending 30th September, 1829: compiled from the New Orleans Price Current.

MONTHS.	1828-9.						1827-8.						1826-7.					
	Ships.	Brigs.	Schrs.	Sloops.	TOTAL	SBoats	Ships.	Brigs.	Schrs.	Sloops.	TOTAL	SBoats	Ships.	Brigs.	Schrs.	Sloops.	TOTAL	SBoats
October,	18	19	7	2	46	41	22	29	13	5	69	42	8	16	10	3	37	33
November,	46	53	12	5	116	55	40	44	19	5	108	64	23	40	20	2	85	50
December,	37	63	18	6	124	84	42	89	32	5	168	77	40	58	19	5	122	78
January,	27	52	28	25	132	97	32	57	23	3	115	89	21	56	24	1	102	58
February,	14	36	27	1	78	77	26	59	39	4	128	100	34	38	19	1	92	94
March,	30	47	21	6	104	88	44	50	25	8	127	89	40	53	37	5	135	109
April,	27	39	24	3	93	93	58	71	24	2	155	82	25	38	24	6	93	94
May,	24	47	31	7	109	89	44	33	18	1	96	93	13	43	19	4	79	71
June,	24	21	19	4	68	73	30	40	16		86	56	42	38	13	1	94	48
July,	19	23	15	1	58	34	2	12	5	1	20	35	10	19	18	4	51	26
August,	10	10	15	1	36	24	7	8	14	3	32	13	3	13	4	2	22	14
September,	6	10	8	1	25	15	5	10	8	1	24	16	12	16	12	1	41	23
Grand Total,	282	420	225	62	989	770	352	502	236	38	1128	756	271	428	219	35	953	698

No. 5.

SURVEY OF THE WATERS TRACT BETWEEN LAKE PONTCHARTRAIN
AND MOBILE BAY.

PENSACOLA, *May 11th*, 1829.

SIR: I have the honor to inform you that, in obedience to your orders of the 6th April last, I took measures to accomplish the examination of the "Waters Tract between Lake Pontchartrain and Mobile Bay;" and for that purpose I hired the schooner *Elizabeth*, Captain James Forsyth, in which vessel I visited all the passes and channels and islands between Lake Pontchartrain and Mobile Bay, where it may be necessary to build light-houses and to fix buoys or stakes.

The enclosed sketch of the examination will be found to be very correct, as it has been copied principally from the English chart of the Gulf of Mexico. I shall refer to this sketch in submitting to you the following observations:

A glance at the chart will at once show the importance of the navigation between New Orleans and Mobile, *within the Islands*, as it is much safer and more direct than that of the open Gulf, between the South Pass of Cat Island and Dauphin Island Pass. Any improvement and facilities, therefore, afforded to the inland navigation, must materially benefit the increasing intercourse between New Orleans and Mobile. An important improvement is being made at the Pass au Heron, by deepening the Pass so as to admit the passage of the largest vessels that can enter Lake Pontchartrain. This work will be accomplished by November next. The inland route will then be clear of all obstacles; and we have only to erect light-houses and to fix buoys at certain islands and channels to make a facile navigation.

Vessels leaving the light-house at the Bayou St. John's, can make the Point Aux Herbes in the night without difficulty; from that Point to the entrance of the Rigolets, the navigation is more difficult. A light-house at Fort Pike would remove the difficulty; it would be seen from Point Aux Herbes, distant eight miles. (See red lines on the Chart.) And it would likewise be seen by vessels in Lake Borgne entering the Rigolets from the Eastward. The distance to a point in Lake Borgne from Fort Pike, is ten miles. (See red line on the Chart.) From the Rigolets we proceed eastwardly to the Maheureux Islands, where it is proposed to anchor a small floating light-vessel, (say at St. Joseph's Island,) to enable vessels bound on either course to find their way through those islands. The distance between the last point in Lake Borgne and St. Joseph's Island is five miles. (See red lines on the Chart.) Proceeding farther to the Eastward, three Passes are presented to our choice for navigation: The Pass Christian, Pass Marianne, and the South Pass. The former communicate with the inland navigation, and the latter opens into the Gulf of Mexico.

The Pass Christian has only five feet water at common tides, and at low water no vessels may pass through it.

The Pass Marianne has at least ten feet water through it, at common tides. It is very easy of ingress and egress. At the Western entrance there is a

small sand island, called "Oyster Key." A beacon placed on this island will sufficiently mark the entrance on this side. Two buoys, as shewn on the chart, will clearly mark out the rest of the channel.

The distance between St. Joseph's Island and Oyster Key is ten miles; thence through the Pass, is eight miles.

In the South Pass the channel would be sufficiently marked out by four buoys, placed as shown in the chart. This Pass will be used by vessels from Pensacola, St. Marks, and Tampa Bay.

The distance from the West end of Cat Island to a point in the Gulf is ten miles. (See red lines.)

At the West end of Cat Island it is proposed to erect a light-house. This position is an excellent one, as it affords equal facilities to vessels entering the South Pass and Pass Marianne, either from the Eastward or Westward. Its position in relation to vessels at the different Passes will be shown by the red lines on the chart.

Continuing our course on to the Eastward, we arrive at Round Island. Its shoal is an extensive one, and it therefore would be necessary to place a buoy at the tail of it. From Round Island we proceed to the Petite Bois Pass; this Pass will be much used by vessels from Pensacola, St. Marks, and Tampa Bay; they will enter the Pass in heavy or unfavorable weather in preference to continuing their course up to South Pass. There is twelve feet water through this Pass. It is proposed to place a light-house on Sand Island, as shown in the chart. This light will afford equal facilities to vessels coming in from the Gulf of Mexico, and those which are bound either from New Orleans or Mobile by the Pass au Heron. Its position in relation to vessels on the different courses is shown by the red lines on the chart. We now arrive at Pass au Heron, at which point it is proposed to erect a small light-house for vessels passing it from Mobile and New Orleans.

There is a light-house at Mobile Point, but it is considered to be a bad one. The importance of a good light at the entrance of the Bay of Mobile is obvious, and I would suggest that the present establishment be improved. At Sand Island, near the Mobile Bar, it is proposed to erect an iron beacon. This beacon would afford great assistance to vessels in heavy weather, passing the Bar without pilots. One buoy should be placed at the West entrance of Dauphin Island Pass, for vessels making a harbor there in bad weather.

The foregoing are all the facilities in the way of light-houses and buoys, that are necessary to afford a facile navigation of the "Waters Tract between Lake Pontchartrain and Mobile Bay."

An appropriation has been made at the last session of Congress, to erect a light-house, and to place buoys at Pass Christian; and also for a floating light at the South Pass of Cat Island. I would recommend that neither of the above appropriations be applied, as the proposed light-house on the West end of Cat Island will supersede the necessity of constructing the others.

An appropriation was made some years since for a light-house on the West end of Cat Island.

Subjoined is an approximated estimate of cost of the several light-houses and buoys recommended in this report. Having no data to refer to, I shall state the probable cost in round numbers. The Treasury Department will understand the details.

For a Light-house at Fort Pike, - - - -	\$ 5,000 00
For a small floating Light-vessel, (to be built of live oak and cedar) at St. Joseph's Isle, - - - -	1,500 00

For an Iron Beacon at Oyster Key, West entrance of Pass Marianne, - - - - -	400 00
For two Buoys in Pass Marianne, - - - - -	200 00
For a Light-house at West end of Cat Island, - - - - -	10,000 00
Keeper's house, - - - - -	2,000 00
For four Buoys in South Pass, - - - - -	500 00
For one Buoy at tail of shoal of Round Isle, - - - - -	150 00
For a Light-house on Sand Island, at Petite Bois Pass, - - - - -	8,000 00
Keeper's house, - - - - -	2,000 00
For a small Light at Pass au Heron, - - - - -	3,000 00
Keeper's house, - - - - -	1,000 00
Improvement of Mobile Point Light, - - - - -	3,000 00
For an Iron Beacon on Sand Island near Mobile Bar, - - - - -	600 00
For one Buoy at West entrance of Dauphin Island Pass, - - - - -	150 00
Total estimate of cost, - - - - -	\$ 37,500 00

The above report and estimate is respectfully submitted.

WM. H. CHASE,
Captain of Engineers.

To General CHARLES GRATIOT,
Chief Engineer U. S. Washington City.

No. 6.

REPORT ON THE SURVEY OF THE DES MOINES AND ROCK RIVER RAPIDS,
IN THE MISSISSIPPI RIVER.

VERSAILLES, KENTUCKY, *July 12, 1829.*

SIR: In obedience to your order of December 30th, 1829, directing me, after having finished certain specified duties in Kentucky, to proceed to the Upper Mississippi, and there make a reconnoissance and survey of the Des Moines and Rock River rapids, with a view to overcoming the obstacles to the navigation of the river at those points; and directing me to be governed by the "Instructions of the Board of Engineers" in the manner of making my examinations, and of preparing my maps and report thereon: I have the honor to submit the result of my inquiries in reference to those subjects.

In discussing the subjects for consideration in this report, I shall give: First, a general description, topographical and geological of the Des Moines rapids. Secondly, a particular detail of the obstructions to the navigation, which it is proposed to remove. Thirdly, discuss the practicability of locating a canal on either bank of the river. Fourthly, discuss the practicability of deepening the channel of the river; and lastly, show the commercial advantages to be derived by making the rapids of the Mississippi no longer impediments to the navigation between the mining district, (90 miles above the Rock River rapids,) and Saint Louis. Also, I shall give all the information I have obtained in relation to the price of labor, materials for construction, &c. upon which may be predicated estimates of the expense of any plan of improvement which hereafter may be adopted.

The same order of arrangement will be followed when I speak of the Rock River rapids.

A topographical map, upon a scale of two inches to one mile, and a profile of the levels of the surface of the water, upon the same scale, for the distances, and a scale of fifty feet to one inch, for the ordinates, accompanies this report, and will be often referred to by it.

I deem it necessary to state, that the time I commenced this survey was the 13th of February, 1829, and at that time the Des Moines rapids were frozen with ice more than a foot thick, and this covered with snow about nine inches deep; consequently, my information herein communicated, is such as could be obtained under such opposing circumstances.

1. *General Description of the Des Moines Rapids.*

The Des Moines, or lower rapids of the Mississippi River, terminate about four miles above the mouth of the river of the same name, about three miles above Fort Edwards, and half a mile above Stillwell's woodyard, the first good steamboat landing below the rapids, on the right bank.

The survey was commenced at the last named place, where the river is half a mile wide, from the right bank to an island, with its surface five feet below high water mark, three hundred yards wide, with a narrow slew dividing it from the left shore.

The right bank is the bluff of the river, rising, though not abruptly, to the height of about eighty feet, and is composed of strata of common carbonate of lime, overlaid with clay and vegetable mould. The opposite shore, beyond the island, is low, and subject to inundation for about two hundred yards to the foot of the bluff, which forms the outermost barrier to the river, is abrupt, and about 120 feet high.

At the distance of half a mile, by reference to the map at No. 2, the bluff on the right bank has become perpendicular to the water, and presents a cliff of rock about 120 feet high. This cliff, which makes a prominent feature in the shores of the rapids, is a part of the strata of rock extending entirely across the bed of the river, forming the lower chain of the rapids, and is one of the land marks to the pilots. Immediately above this point, the bluff begins to recede, leaving a bottom which gradually increases in width until it attains about 300 yards, and again decreasing until the bluff becomes almost perpendicular at No. 15. This bottom is about three feet above the high water mark, (which is 18 feet above the low water mark at the foot of the rapids) and is bounded by the bluff, which keeps nearly an uniform height, presenting numerous ravines, from which flow several branches, only two of which are of any magnitude.

The right bank, from No. 15 to 18, the distance of about one mile, the bluff continues almost perpendicular to the water, presenting to the eye a wall of limestone; from No. 18 to 20 there is another bottom, similar to the one below, with three small branches irrigating it: from No. 20 to 21 the bluff comes for the third time in contact with the river, presenting a similar mass of rock to that last described; at No. 21 the bluff has again receded, and continues to recede to the head of the rapids, leaving an extensive prairie bottom on the right bank, as far as the eye can reach.

The left bank no where presents the bluff perpendicular to the waters edge, and no where, until the upper extremity of the rapids, has a bottom similar to the one described on the right bank. The bluff arises, from the margin of the river, in some places, very gradually, but in many others, at an angle of 45°, and in the whole extent, stratified with lime stone, appearing only to the eye, where the declivity has caused the water to wash its base.

The rapids have their head immediately below the Willow island, as marked on the map.

Besides the carbonate of lime, which is here found composing the strata, not only lining the banks, but, in three places, extending entirely across the bed of the river, there are, in this locality, embedded, several other minerals which hereafter may be valuable. The chasm in the bluff on the left bank, formed by Waggoner's branch, has its sides lined with a coal, slightly bituminous, and containing a considerable proportion of sulphur. It is so eligibly situated for mining, that it would require very little labor to extract it from the earth. The quantity appears to be very great. It is a mineral found in many other localities near the rapids. There are indications of sulphuret of lead—the specimens obtained were all small. Many of the crystalized varieties of calcareous spar, often formed into nodules (septuraen) are found lining the shores at the foot of the rapids; also, many large worn masses of granite, which seem not to be "in situ;" crystalized sulphuret of iron is abundant.

I will remark, before finishing my descriptions of the Des Moines rapids, that the bluffs and bottoms forming the banks are covered with a luxuriant

forest, indicating a fine soil, but, in a short distance from either shore of the river, the country is an open prairie.

2. *The obstructions to the Navigation.*

The ledges of rock composing the shores of the rapids, extend in three places across the bed of the river, forming three obstructions to the navigation, similar to dams in increasing the velocity and decreasing the depth of the water.

The exact locality of these obstructions I found it impossible to obtain, on account of the accumulated heaps of ice which were lodged upon them, and had the effect of damming the water in such a manner as to render it impossible to refer the soundings to the true low water mark. I have only been able to mark on the map, lines, between which the obstructions are found, and also a red line, denoting the channel which is now followed by the pilots.

At the termination of the lower chain is situated a rock, about 8 feet in altitude and 10 feet in diameter, of an irregular shape; which, at low water, has its top above the surface, and which is indicated at that stage of water, by the spray which is continually thrown over it. A channel of 8 feet water can be always found very near it, on either side. This rock in low water is a guide to the pilots; but in high water, when the rippling does not mark its situation, a dangerous obstruction.

From the rock described, usually called the "Big Rock," the lower chain extends for the distance of one mile. At low water, along the line marked the channel, the bottom is very irregular, the soundings showing, generally, less than three feet; but in many places the abrupt termination of the ledges of rock giving a depth of twelve feet. Below the Big Rock the bottom is sand, and the depth 15 feet; one and a fourth miles above the same point, following the channel, the bottom is again sand, and the depth 12 feet. Between these two points, the ledges of rock, projecting from either shore, sometimes meet, but in many places, have vacancies between each other. There are many loose rocks scattered over the rapids. These rocks have, in many places, filled up the cavities between the ledges of rock forming the bottom, and have thus rendered of greater magnitude the obstructions to the navigation. All the loose rock is subject to be moved by the ice, into the deepest cavities, in the ledges of rock or into the deep water below them. The ice first formed is in floating masses, which lodge against the loose rocks in the rapids, and is soon piled on the rocks in such quantities as to move them, until they arrive in water deep enough to let the superincumbent ice move off, and in this manner, I believe many parts of the channel are made dangerous to the passage of boats. During the time I made the survey, the mass of ice piled against the Big Rock was 12 feet in altitude, and in many other places on the rapids, I observed similar heaps.

The second obstruction is similar to the one described, situated at about the middle of the rapids, as marked on the map, and is usually called La Malize's chain.

The ledges of rock extend entirely across the bed of the river. In the channel, for the distance of about 300 yards, the depth of water is reduced to $3\frac{1}{2}$ feet; half a mile further, the depth is often 12, but in many places 3 feet; the loose rock renders this channel dangerous for boats of three feet draft.

Between La Malize's and the lower chain, the strata of rock extends more than half across the river; the channel is 12 feet deep and near the left shore; in low stages of water, pilots have been found necessary to guide boats into it.

The upper chain extends across the river, immediately below the Willow island, at the head of the rapids; the channel, for about 100 yards, passes over a smooth rock, and is reduced in depth to 3 feet: for half a mile further the channel is filled with loose rocks, the depth varying from 4 to 12 feet.

The distance from the head to the foot of the rapids is $11\frac{1}{4}$ miles. The width of the river is nearly uniform, and is about three-fourths of a mile.

3. *Locality for a Canal.*

At low water, the difference of the planes, at the surface, at the head and foot of the rapids, is 25' 5" 30" which would be the amount of lockage if a canal were constructed. If a canal was located on the right bank of the river, it will be seen, by reference to the topographical description and map, that the excavation at the head of the rapids will be three feet, the height of the bottom, above the high water mark, + 18 feet, the difference between the high and low water mark, + the depth of the water in the canal; all this excavation would be through strata of limestone. In three different places, making in all, the distance of $2\frac{1}{2}$ miles, the canal would have to be located in the river next the shore, or require an increased excavation through rock of 100 feet.

On the left bank, the locality offers no site so favorable as the bottom of the right bank.

I think the difficulties of constructing a canal on either bank of the river, almost insurmountable. I farther think, that there is another means of rendering the navigation over the rapids safe and good; for the same depth of water that can be obtained in low water over the sand bar, below them. I will proceed to it.

4. *Deepening the Channel.*

Before discussing the practicability of deepening the channel of the rapids, I will premise: First, that the rapidity of the current is not so great but that the most ordinary steamboats are enabled to pass up them, when the depth of water is sufficient. Second, that, at low water, the depth of 5 feet is all that can be obtained between the rapids and St. Louis, and consequently, 5 feet is all that is required on the rapids at that stage; in high water, the rapids are no obstruction.

Between the three chains of the rapids, the best channel should be ascertained, and marked by buoys, placed in sight of each other, which would give 12 feet depth. It is required to give 5 feet depth over the chains.

The lower chains will require, to effect this object, an excavation of rock for the distance of 880 yards, from the Big Rock ascending the line marking the channel, for the depth of 2 feet, and width of 120 feet, (which is three times the width of the largest boats on the Upper Mississippi,) making the solid content of $23,467\frac{2}{3}$ cubic yards: and for the distance of 880 yards further, require the removal of the loose rock, which I suppose will be about one-fourth the above in quantity. The narrowness of this channel would require buoys on both sides of it, and in sight of each other.

La Malize's Chain will require a similar excavation for 300 yards, same width, and $1\frac{1}{2}$ feet in depth, making the cubic capacity 6000 yards; also, the removal of the loose rock for the distance of half a mile.

The Upper Chain will require an excavation for 100 yards, 2 feet deep, and 120 feet wide, making $2,666\frac{2}{3}$ cubic yards. The loose rock for half a mile removed as in the other cases.

In making these statements of the quantity of the rock to be removed, I advance them as approximations to the truth; the rapids, covered with ice, did not permit me to ascertain, by soundings, the exact length of the part of the channel obstructed, but it allowed me to test, by my own observation, the information I received from the pilots, whom I had employed in making the survey.

To make the excavations in the channel of the River, will require the construction of coffer dams. They will have to be of a strength sufficient to resist the pressure of a swift current of water, and be anchored firmly to the rock bottom. I believe this practicable. After the water is bailed out of the coffer dam, the blowing of the rock will be as easy as upon the shore.

The removing of the loose rock will require some of the simplest applications of the mechanical powers, and boats to convey them to the shore.

The only approximation I can give to the velocity of the current, is a reference to the line of levels.

The execution of this design will require an examination in the month of November, when the river is generally at its lowest stage, for the purpose of making an exact location of that part of the channel to be excavated.

5. *Commercial Advantages.*

The navigation of the Mississippi River, above Saint Louis, is entirely obstructed by the formation of ice, which generally remains from three to four months, every year: it scarcely ever forms before the 15th of January, and is removed by the 15th of March; some seasons the time is less, but never greater. The navigation, for the remaining eight months of the year, is open between Saint Louis and the Falls of Saint Anthony, a distance of 1000 miles, for boats of four feet draught, with the exception of $11\frac{1}{4}$ miles, at the Des Moines Rapids, and $13\frac{3}{4}$ miles, at the Rock River Rapids.

During the freshets of the Mississippi, the rapids offer no hindrance to the communication between points, above and below them, for vessels of the largest size. The freshets continue about four months during the year, but the time of their commencement is variable.

The advantages to be obtained, by opening the navigation of the rapids, will be an increased time of four months, that boats of four feet draught can pass them safely; and this advantage must appear of the greatest importance when we come to take a view of the quantity of lead produced in the mining district, all of which finds its way to market, by passing down the rapids; of the quantity of provisions and merchandise consumed by those engaged in mining, all of which has to ascend the rapids: also, the facilities afforded to all persons engaged in the fur trade: and lastly, the military advantages to accrue to the Government, from the cheap and ready means a free navigation affords for the transportation of troops, munitions, supplies, &c.

I will take a short view of each one of these subjects. First: The lead mines which are on the Mississippi, and above the rapids, had, during the last year, nearly 10,000 persons engaged in labor and speculation; the whole product of their labour which is confined, as yet, to the one article of lead, was transported down the rapids, and the time of this transportation was confined to one third of the year. The supplies of provisions had to ascend the river during the same limited time.

The population, and consequently products of the mining district, has increased with an astonishing rapidity, during the last four years, and in all probability, will so continue; the advantages to accrue to this population,

by doubling the time of exportation of their products and importation of their necessaries, will be readily seen.

Secondly: The advantages accruing to the fur trade, will be the difference of expense between the freight of all their commodities in steamboats, and the batteaux now in use.

Thirdly: The military advantages to be gained, are, the cheapening the supplies for our Infantry posts, that are, at present, stationed above the rapids, either on the Mississippi, or its tributaries, and the important facilities an open navigation will ensure, should it become necessary, on account of Indian hostilities, to carry an important military force into their territory.

Any number of laborers that may be wanted, can be easily concentrated on the rapids, for the same wages paid to those engaged in mining at and near Galena, which is 12 dollars per month. Powder, iron, anchors, &c. can be obtained in Saint Louis, at a very small advance over the cheapest mart in the United States. Any quantity of timber, of the best quality, can be obtained from the banks of the rapids. A sufficient quantity of lumber, for the construction of the necessary buildings and coffer dams, would require the erection of a saw-mill.

ROCK RIVER RAPIDS.

1. *General Description of the Rock River Rapids.*

The Rock River, or Upper rapids of the Mississippi, have their termination near the foot of Rock Island, (on which is situated Fort Armstrong,) and about four miles above the mouth of Rock River.

The survey was commenced at the lower extremity of Rock Island, from which place the river is 550 yards to the right bank across the main channel of the river.

Rock Island extends up the river nearly 3 miles, and is nearest the left bank of the river, from which it is separated by a slew, more than 400 yards wide, at the head and foot of the island, but for about one mile between these points, reduced in width to 200 yards; the channel is on the other side of the island, the slew has a ledge of rocks extending across its head, and a sand bar at its foot. The head and foot of Rock Island present large masses of rock, the terminations of the strata which extends through it; its surface is about 15 feet above high water, and is covered with a thin forest and luxuriant under growth.

The left bank opposite the island is a prairie bottom, gently rising until it is bounded by the bluff, which is about 120 feet high, covered with trees, presenting numerous ravines, and continuing its direction in nearly a straight line up the river, for the distance of six miles, when it turns to the right, and continues in that direction until it reaches Rock River, leaving an extensive prairie between the Mississippi and Rock River, only about five feet above the high water mark of either river. From the head of Rock Island, to where the bluff and river recede from each other as described, the bottom is nearly 400 yards wide, and covered with a forest of oaks.

Campbell's Island is nearest the left bank, from which it is separated by a slew about 300 yards wide; it is $1\frac{1}{2}$ miles long, half a mile wide, its surface a few feet above the high water mark, and is covered with a forest of tall oaks. About opposite the middle of Campbell's Island, the bluff on the left bank again presents itself, similar in character to that below, and runs

up the river, leaving the bottom of an irregular width, and also runs out from the river in a direction nearly parallel to the bluff below, and like it terminates on Rock River, leaving the prairie described, about $1\frac{1}{2}$ miles wide between them. In this prairie there is the channel of a slew emptying into the Mississippi, near the foot of Campbell's Island, and extends to Rock River; in high water this channel is a canal, and runs in either direction, as either river may be highest.

From Campbell's Island to the head of the rapids, the bottom continues bounded by the bluff, variable in width, and in all its extent covered with a thin forest until near the head, where it becomes dense; the shore near the head of the rapids is lined with large masses of impure limestone, that will not turn into lime.

There are six branches emptying into the river on the left bank, as marked on the map, but all of them inconsiderable.

The right bank has a bottom from the head to the foot of the rapids, varying in width from 100 yards to three-fourths of a mile, and is bounded by the bluff, which is nearly an uniform height, and the same as the one on the opposite shore.

Wilson and Davenport's Islands are near the right bank, and above Campbell's Island; the last is nearly a mile long, but narrow, and both are overflowed by the freshets.

There is one considerable creek, about five miles above the commencement of the survey, emptying on the right bank; it flows with great velocity from the bluff, and has its bed worn through strata of limestone, about 15 feet wide.

The bottoms and bluff on the right bank, until we arrive near the head of the rapids, is a prairie, with a few scattering trees upon it.

The distance from the head to the foot of the rapids is $13\frac{3}{4}$ miles, and its width, except where it is widened by the islands, is about 1,000 yards.

Coal is the only valuable mineral yet found in the vicinity of the rapids; it may be found in several places on the right bank, and is used in the smith shop at Fort Armstrong.

2. *The Obstructions to the Navigation.*

The lower chain of the Rock River rapids is formed by the ledges of rock passing across the bed of the river a little above Tradersville, over which the current is very rapid, and the navigation only dangerous in low water, on account of the difficulty of keeping in the channel, which almost crosses the river. The loose rock removed, would, at low water, give a depth of 5 feet.

The Rock Island chain is near the head of the island, and is formed by the ledges of rock passing across the bed of the river, and appearing in two large masses, forming two small islands; the deepest water is where the red line marks the channel, and at low water is less than three feet.

The next obstruction is formed by the rock precipitated into the bed of the river by the creek described on the right bank, and only requires their removal to give a depth of six feet.

The Campbell's Island chain is a ledge of rocks passing obliquely from the head of C. I. to the right bank, and showing the strata on both shores; the channel passes from an indenture near the head of Campbell's Island, to near the foot of Wilson's Island, and, for about 100 yards, passes over a smooth rock, with the depth only three feet.

The Upper, or Sycamore chain, is formed by a large bed of rocks in the middle of the river, and extending very near either shore, leaving the deepest water near the left bank, which is at low water four feet.

Between the obstructions described, the channel is 12 feet deep, but very circuitous; a variation from it, leading boats upon ledges of rock, with the water not more than two feet deep.

3. *Locality for a Canal.*

The planes of the surface of the head and foot of the Rock River Rapids, at low water, is 21' 10" 57"', which would be the amount of lockage if a canal were constructed on either bank.

By reference to the topographical description, it will be seen that, on both banks of the rapids, from their head to foot, there is a bottom but a few feet elevated above the high water mark, and the only reason why either bank would not be considered a favorable site for a canal, is, that the greater part of the excavation would be through rock. But when it is considered that, in opening the navigation of the rapids, both the Des Moines and Rock River Rapids are between the points for which there is wanted an open communication, it will appear that there is no important advantage to be gained, by having the upper rapids opened more successfully than the lower ones; and, further, in my next chapter, I will show, that, if the Des Moines Rapids can be opened to the depth of five feet in the lowest stage of water, a comparison of the obstructions to be overcome, will show, that the Rock River Rapids can undergo the same improvement at a greatly decreased expense.

4. *Deepening the Channel.*

The same things are premised in regard to the velocity of the current, and the depth required over the chains, as when I spoke of the Des Moines Rapids. The same difficulties presented by the ice, as below, did not allow me to locate the precise part of the channel that was obstructed, but did enable me to draw lines between which they are found.

The lower chain will require an examination of the channel, which will be rendered 5 feet deep by the removal of the loose rock for 200 yards. It then should have a double row of buoys in sight of each other.

The Rock Island chain will require an excavation of rock 200 yards long, 120 feet wide, and 2 feet deep, making 5,333 $\frac{1}{2}$ cubic yards, and the removal of the loose rock for the same distance: also, a double row of buoys as before.

The middle obstruction will only require an examination to find the best channel, and to mark it with buoys.

The Campbell's Island chain will require an excavation of rock for 100 yards long, 120 feet wide, and 2 feet deep, making 2,666 $\frac{2}{3}$ cubic yards, and the loose rock removed for 200 yards; also a double row of buoys.

The Sycamore chain will require the removal of the loose rock for the distance of about 300 yards, and the channel marked by buoys.

I make these statements of the exact quantity and distance of the excavations to be made, and the part of the channel obstructed, as I did when speaking of the same project on the Des Moines Rapids, and advance them as the nearest approximations the season of the year allowed me to obtain. All the remarks made in the former part of this report, as to the construction, coffer dams, &c. &c. are here equally applicable.

5. *Commercial Advantages, &c.*

Under this head I have only to say, that the advantages to be derived from opening the navigation of the Des Moines Rapids, would be rendered almost nugatory, without the Rock River Rapids were rendered equally open, and that, when I spoke of the advantages to be gained, both Rapids were under consideration.

All of which is respectfully submitted.

I am, Sir, with great respect,

Your most obedient servant,

NAPOLÉON B. BUFORD,

Lt. 3d Artillery, on Topographical duty.

Brig. Gen. C. GRATIOT,

Chief Engineer.

No. 7.

REPORT ON THE CHARLESTON AND HAMBURG RAIL ROAD.

To the President and Directors of the South Carolina Canal and Rail Road Company.

GENTLEMEN: In obedience to the orders of Gen. Gratiot, Chief Engineer, by whom I was ordered to make the survey of the country between Charleston and Hamburg, with a view to the proposed rail-road, I have the honor to submit to you the following report relating thereto, illustrated by the maps and profiles as here enumerated.

General map and profile of the survey, on a scale of three miles to an inch, for horizontal distances, and one hundred feet to one inch for the ordinates of the profiles.

Detailed maps, Nos. 1 to 15, of the same, on a scale of four inches to one mile.

Profiles, Nos. 1 to 8, on the same horizontal scale, and on a vertical scale of fifty feet to one inch.

Although the primary object contemplated by the Company, was a communication by rail-road, between Charleston and Hamburg, yet the interests of a large portion of the State, and those of the Company, demanded that connexions between other points should be considered, and that the road now proposed should be so laid out as to facilitate, as much as possible, the accomplishment of so desirable an object. One of these points, which appears to promise the most advantages, is Columbia. The extensive trade of the branches of the Congaree, is now compelled to reach the sea through the embarrassing and uncertain navigation of the river below, and is such in amount as would amply repay for considerable expense and exertion to obtain it. Two lines, drawn from Charleston to Hamburg and Columbia, would form an acute angle together, and it would be evidently desirable to locate the route of the road to Hamburg, as much as circumstances would permit, along a line intermediate between these two, in order to render one stem of road subservient for as great a distance as possible, to the use of branches to both these places. This object was kept steadily in view during the survey; but a reference to the map will show that it has been only very partially accomplished in the line we pursued. The reasons which induced us to believe that it was inexpedient to do this further than we have done, will appear in the sequel of this report.

The country between Charleston and Hamburg is alluvial and almost entirely sand on the surface, except in the river bottoms, where the soil consists of a rich loam. The timber, with little exception, consists of several varieties of Yellow Pine on the high land, and Cypress in the swamps, or the immediate low banks of the rivers. The Live Oak flourishes and grows to a large size in situations exposed to the influence of the sea air. The pine, which is abundant throughout the whole extent of the line, is generally of an excellent quality, although that found within thirty or forty miles of Charleston, is of an inferior quality, being soft and very perishable when used in construction. There is scarcely any rock of any description to be

found in the whole extent now under consideration. The partial beds of inferior sandstone, and occasionally a soft shell limestone or tufa, are in such small quantity, as scarcely to form an exception to this observation.

It will be perceived, by reference to the maps, that we have surveyed only one general route between Charleston and Hamburg, although, in several instances, two or more lines have been examined, which, however, come again together in a distance of a few miles. In fact, the general direction of this route, appeared to us to be so strongly marked in its superiority over any other, as to leave no doubt as to the propriety of its selection, whatever partial deviations may be found expedient, from the exact line we pursued. The remarkable ridge of land, which extends in a N. W. direction, a few miles from, and parallel to the Edisto river, from near Givhan's ferry, to the Polecat pond, a distance of more than eighty miles, is very favorable to such a work as that in view, as a reference to the large maps and profiles will clearly show. Any line to the South of it, as, for instance, one by Barnwell court house, would have to cross, not only to several branches of the Salkehatchie, but also those of the Three Runs, a tributary of the Savannah river. These streams lie in ravines considerably depressed below the general plane of the country, and would, of course, offer so many serious obstacles to any work, which requires a nearly level surface to be maintained. The only inducement to prefer taking such a direction, would be an imaginary one, that of its being nearly in a straight line between the two extreme points of the road. In fact, in the present advanced state of knowledge on the subject, the establishing a communication between any two places in a straight line, which was formerly thought of such primary importance, is now deemed the consideration last to be consulted. Hence, in general, the absurdity of those conclusions, as to the proper route for a road, but more particularly a rail-road, drawn from an inspection of the map of the country, without a knowledge of the elevations and depressions of its surface.

The Northern bank of the Edisto and South Edisto rivers, in Orangeburg county, is much intersected, as the map of the State will show, by small streams, whose direction is transverse to that of the course of the river, and to that which would be required for our present work. These render the surface of the ground much broken, and would make it very difficult to form a line nearly approaching to level, across them.

These examinations having satisfactorily established the propriety of making the ridge to the South of the Edisto river, or as we shall call it, the South Edisto Ridge, a part of our line, it next became our object to consider how to connect it, with Charleston on the one side, and Hamburg on the other. On leaving Charleston, one of two courses would have to be adopted; either to keep on the neck of land between Cooper and Ashley rivers, or otherwise to cross Ashley river near the city, and continue thence nearly in a N. W. direction along the low grounds to the S. W. of that river. The difficulty and expense of making, and the inconvenience and interruption to the navigation when made, of a viaduct across a river of such breadth as the Ashley is in the lower part of its course, appeared so serious, that we concluded to confine ourselves, in this experimental survey, to the first course, and not to cross the Ashley until we arrived at Dorchester, or some distance above: but it is strongly recommended, that, before the final location of the road be adopted, such minute surveys and examinations be made, as shall place the decision of this question beyond all doubt.

We have supposed that the proper point for crossing the Edisto river would be near Givhan's ferry. This conclusion is so far strengthened by all our examinations; but the exact spot can only be determined by the more minute surveys which will become necessary for the exact location of the road. The object we before mentioned, of making one line of road subservient, for as great a distance as possible, to a communication both to Hamburg and Columbia, would have rendered it desirable to have kept on the North side of the Edisto, for some distance above its great bend near Givhan's: but, in pursuing such a course, we would have to encounter such serious obstacles, of which the Cypress swamp and Four-holes swamp are the principal, that we soon abandoned this plan as entirely inexpedient.

It must be observed that the experimental lines we run in this part of the survey are very imperfect, and do not pretend to determine, even approximately, the route the road should pursue. This portion was executed at the last period of our work, when the excessive rains of the Winter had so filled the low grounds with water, that it was impracticable for us to pursue the directions we wished, and we were compelled to follow the roads to make any progress. These lines will, however, serve to give a general idea of the surface of the country, and will be sufficient to point out the most proper direction to make the further surveys for the location of the road. From the circuitous path we were thus forced to pursue, our maps and profiles will show a greater distance, by several miles, than the route of the rail-road will probably be when it shall be more carefully and minutely traced.

A reference to the maps will show that the highest ground intervening between Charleston and Hamburg is near the Horse Pen Pond, and is 499 feet above the level of mid-tide. The distance between these two places, by the principal line we pursued, is 156 miles; but, as the course we were compelled to take, for the reasons just mentioned, was much more circuitous than that which the road will probably follow, we will assume this distance at 150 miles.

It is clearly to be desired that the road should, if practicable, be so laid out as to have an uniform ascent from Charleston to the summit, a distance of 132 miles, and thence a single descent, either uniform or partly by inclined plane, to Hamburg. The surface of the ground will not admit of this plan being exactly followed, but the deviations from it which are necessary may be made so partial as to offer but little practical inconvenience. The greatest deviation will be between Charleston and the Edisto River, where the gently undulating nature of the ground, and the ridges running transversely to our direction, render it very difficult to preserve a perfectly uniform line. In this distance, however, the highest ground passed over is 61.6 feet above tide, and is near to the East bank of the Edisto. Notwithstanding these circumstances, it is confidently believed that, with quite moderate cutting and embankment, the road may be laid out with several alternate ascents and descents, but for the greater part of the distance almost exactly level, and no where to exceed a greater inclination than 8 to 10 feet in the mile, except, perhaps, at the descent to the Edisto, where two or three feet more may possibly be necessary. The East bank of that river is high and flat, while the West bank presents a swamp of from half to three-quarters of a mile in breadth. As this swamp is now sometimes overflowed, it will be necessary to raise the road above its surface: the extent to which it may be found expedient to do this will regulate the amount of the descent which will be here required.

From the Edisto to the summit at Horse Pen Pond, a distance of 96 miles, the ground is so remarkably favorable that the road may be laid out, for the greater part of the distance, with scarcely any alteration of the natural surface, at a gradual ascent of from four to six feet per mile. Even on those portions where the ground is more irregular it will not be necessary to exceed eight to ten feet per mile, except in one instance, where it will, perhaps, be necessary to have an ascent of fifteen or sixteen feet per mile, for a little more than two miles.

From the summit to Hamburg, the declination of the ground is much more rapid. We made several surveys in this distance, which are detailed on the maps and profiles, on different suppositions of the best plan to overcome the elevation. We will select, as an example, for our present purpose, the route by Williams' farm and Wise's creek, as suited to the supposition of one or more inclined planes being adopted at or near the summit, to which plan the ground is very favorable. Near Williams' house it descends, as will be seen by reference to the profile, 215 feet in $1\frac{3}{4}$ miles. The whole distance, by this route, from the summit to Hamburg, being $17\frac{1}{2}$ miles, and the descent 383 feet, it leaves 173 feet descent for a distance of $16\frac{1}{2}$ miles, or between 10 and 11 feet per mile. But as, from the irregularities of the valley of Horse creek, an uniform descent is not practicable with reasonable means, it will probably be necessary to make this descent, in some places, at the rate of 16 to 18 feet per mile.

The selection of a proper plan for the road between the summit and Hamburg will require more care and consideration than any other part of the work, and can therefore only be determined on after a very minute examination of the ground, and a careful comparison of the relative advantages of the different plans. It seems proper, also, to defer the execution of this portion until the last, in order to profit by the experience gained on the easier sections. Whatever plan, however, may be adopted, it is gratifying to know that suitable ground may be found for its execution.

From this general view, it will be seen how eminently the surface of the ground is suitable to the proposed work. The abundance of excellent timber on the greater part of the line, which the proprietors have offered gratuitously for its use, is another circumstance highly in its favor. The swamps, which it is necessary occasionally to pass, offer no serious obstacles, the bottom being composed of solid material, affording a firm foundation for any embankment it may be required to place on it. The only places where a want of this solidity may be apprehended are the alluvial bottom lands of the Savannah River and Horse Creek, and perhaps in a less degree on the banks of the Edisto and Ashley Rivers.

On the Construction of the Road.

Whatever difference of opinion there may be as to the proper materials of which the road should ultimately be constructed, there can be no doubt but that, in the first instance, wood is the most suitable substance to be used in its formation. Of this we fortunately have an abundant supply at hand, of the best quality, and such as may be made, with proper precaution, reasonably durable, notwithstanding the unfavorable nature of the climate to its preservation.

In the present deficiency of accurate data, to decide positively on the superiority of locomotive or horse power, when applied to any given work, it would be clearly unwise to construct the road so as to exclude either of

these powers from it. I therefore propose so to construct it that it may be adapted either to the use of horses or locomotive engines, whichever experience shall finally decide in favor of, or to the use of both at the same time.

The probable extent of trade on the road can scarcely be expected, for some time, to be too great to be accommodated by a single track, provided with occasional viaducts, and the whole kept under proper regulation. The rails to be made of the best yellow pine, to measure not less than 6 by 9 inches, and 16, 24, or 32 feet in length; or, in some instances, where it cannot be otherwise cut without loss, in lengths of 20 or 28 feet—the log to be, in every instance, cut longitudinally through the centre, and the inner upper edge square, for the reception of the iron plate, and the outer upper edge to be bevelled off from near the edge of the plate. The object of this bevel is both to cast off more readily the water from the surface of the rail, and also to afford a rail of greater size and strength, entirely free from sap, from a given tree, than could otherwise be done. To promote this object still more, the lower outer edge might also be permitted to be partially bevelled off. The rails to be placed parallel to each other, 4 feet 6 inches apart, and supported on sills of lightwood, (or live oak, where it can be readily procured,) 8 feet apart from centre to centre. These sills to be sufficiently large to be sunk at least 4 or 5 inches in the earth, and to raise the under surface of the rail 4 to 6 inches above the surface of the ground. The rail and sill to be let into each other sufficiently to secure them in their places, and made fast by a locust or live oak key. At each intermediate distance between two sills, a post of lightwood to be placed perpendicularly under each rail, so as to make its bearings four feet apart. Where the proper level of the road is above the natural surface of the road, it is proposed, in certain situations, instead of embankment, to raise the rails on posts or piles, properly tied and braced together, as is practised on the Delaware and Hudson road.

Such a construction as the above, would not admit the horse-path to be formed between the rails in the ordinary method. Some provision must therefore be made for the use of this kind of power. Several expedients offer themselves for the purpose. The first is to form the horse-path on one side of the track, the animal to be fastened to the foremost carriage, in such a manner as to diminish as much as possible, the inconvenience of the obliquity of his action. The greatest disadvantage to be apprehended from this obliquity, is the tendency of the carriage to move sideways, which would produce a constant rubbing of one of the flanges of the wheel against the rail.

This, however, I conceive might be nearly, if not entirely obviated, by a friction or guide wheel, placed nearly horizontally, on a frame in front of the carriage, and running against the inner edge of the iron plate, furthest from the horse. To this frame, the horse is to be attached, so as to make the line of his traction as nearly parallel to the road, as may be.

Should this method be found disadvantageous, another might be resorted to, which would, however, be more expensive; of forming a horse-path of two inch planks, nailed on the sills. This path need not be more than about two feet wide, as the horse would soon, from habit, secure himself from accident from stepping off its side.

A third method is to form a path on each side of the track, and to attach a horse on each side of the foremost carriage, by means of a bar sufficiently long for this purpose. This mode is in use at Mauch Chunk, and is there

much approved of. It is plain, that, by using it, all obliquity of action of the moving power, is got rid of. The principal objection to it, is the necessity, to avoid loss of power, of the convoys or trains of carriages being always sufficiently large to employ advantageously the power of two horses.

Such being the mode of construction proposed in the first instance, the road will, undoubtedly, when completed, be amply sufficient for all the purposes that may be required of it. But it must be expected, that, when it shall require to be renewed, the very facility of conveyance offered by it, will render the materials much less abundant than at present, more especially the light wood. This substance forms so excellent a fuel for steam machinery in general, and is so peculiarly adapted to the use of the locomotive engine, that it will be extensively sought after and used. It will then, probably, be necessary to adopt a more durable construction, by substituting, in place of the present sills of lightwood, sills or blocks of granite, brought either from the Eastern States, or the Chesapeake, or from the Savannah river, above Augusta. To these sills or blocks, the wooden rails might be fastened by small iron chains; as on the Mauch Chunk road. Should a still more durable plan be judged advantageous, the wooden rails might be replaced either by granite blocks, covered with plates of iron, as used in Massachusetts, or by rails entirely of iron, according to the English plan.

I have proposed, in the above plan, the iron plates to be laid on the inner edge of the wooden rail. This was done on the supposition of the flanges of the wheels being placed inside, as in the common construction of the carriage. An experiment, however, is about to be made on the Baltimore and Ohio road, of placing the flanges on the outside of the wheel. This variation from the common practice is supported by several strong reasons in its favor, but has not yet, as far as I know, been applied in practice. Its comparative value, however, will be satisfactorily ascertained by actual trial, in sufficient time for it to be adopted on the present road, if it be found to be an improvement.

As there is no timber of a suitable quality for this work, on the line, within a considerable distance from Charleston, and as the Edisto ridge produces an abundant supply of the best kind, I would recommend that, in the first instance, the road be located and graduated, from Charleston as far as to where a supply can be procured; and that the laying of the rails be commenced at this spot, to which the iron plates would have been carried by the ordinary conveyances of the country. The distance of this transportation would gradually diminish as the work advanced towards Charleston. By this plan, each portion of the road would become, as soon as finished, subservient to the construction of the remainder, and its expense would be considerably diminished.

In using the road, I would recommend that the maximum weight, allowed to any carriage with its load, be fixed at much less than is the usual practice; and that, if the locomotive engine be adopted, its weight should be diminished as much as possible. For this purpose, I would respectfully suggest the expediency of directing the ingenuity of the country to the subject, by offering such premium as may be judged proper, for the best model of a locomotive engine, combining lightness and power, and adapted to the use of light wood. The superior nature of this fuel for such purpose renders it probable, that much improvement might be made in the construction of the ordinary engine.

In order to guard the work as much as possible from unnecessary decay by shade, and also to protect it from destruction by the fires, which occasionally occur in the woods through which it will pass, it will be proper to secure the possession of a strip of land, on each side of the track, from which all the timber is to be removed. A total breadth of two hundred feet would probably not be found more than sufficient for the purpose.

The general principles which should govern the location of rail-roads, having been repeatedly set forth in reports made on the subject in different parts of the country, I should not now recur to the subject, if it were not to correct erroneous ideas, which are frequently entertained by persons, who have not paid particular attention to the subject. These principles establish clearly: 1st. That where the amount of trade on a given line is equal in both directions, the most perfect line of road is one exactly level, and that any ascent or descent is an imperfection. 2. That where the amount of trade descending in one direction is five times that returning, the proper direction of the road, to make equal power sufficient for the transportation both ways, is about fifteen feet per mile; and less for a less difference. 3d. That it is found that an ordinary horse can draw with a force of one hundred and twenty-five pounds, at the rate of three miles per hour, for six hours every day—and on a level rail-road he can draw, at this speed,

On an ascent of 10 feet per mile	9.25 tons
15	7.42
20	6.29
25	5.68
	5.18

and on an ascent of 32 feet per mile, he can only draw 4.62 tons, or half his performance on a level road. From this it follows, that every 32 feet of perpendicular ascent in a road is equivalent, as to the power expended in transportation, to a mile in distance, or, in other words, a portion of road one mile, in length and ascending 32 feet, requires the same expenditure of power to draw a given weight up it, as would be sufficient to draw the same weight two miles on a level road.

It is deduced from these data, that, as the inclination of the surface of a rail-road increases, its utility decreases in very rapid ratio, so that, over an undulating line, of even what would be generally considered moderate ascent and descent, the rail-road would be decidedly inferior in useful effect to a common turnpike. It is true that even in such a case the rail-road would require a less power than the turnpike, to move a weight on it: but other causes would operate to its disadvantage, which are familiar to persons conversant on the subject, but which it is not necessary to dwell on here.

These results are drawn from experiments on friction, made with the common carriage. But, if the advantages which are promised by the invention of the several friction carriages that have been proposed, become realized, the superiority of a level road over one of even moderate inclination, will be much greater than above stated.

I now proceed to make an estimate of the probable cost of the work, made on the plan I have stated. In this, I shall make considerable use of the estimate of Col. Blanding, altering it principally in such particulars, respecting which, more precise information has been obtained, than he was possessed of at the time.

The first item of expense, the graduation and preparation of the road, will be extremely variable on different parts, some portions requiring scarcely

any labor, for this purpose, for several miles together. I believe, from attentive comparison of the different parts, that the average sum I have stated, of \$ 800 per mile, will be ample to cover the expense.

Expense per mile,			
Graduation, &c.	-	-	\$ 800 00
11,250 running feet of wooden rail, including vi-			
afuges, at 25 dollars per mile	-	-	281 25
660 sills, of light wood, 12 by 14 inches, and 8			
feet long, at 87½ cents	-	-	577 50
1,320 piles, of light wood, at 12 cents	-	-	165 00
Piles and timber for raising road occasionally	-	-	60 00
Laying the timber and workmanship	-	-	518 00
200 barrels of tar, at 75 cents	-	-	150 00
19 tons of iron plate, including sidelings, at \$ 60			
per ton, at Charleston	-	-	1,140 00
Delivering the same on road, average price \$ 5			95 00
Fastening and putting down 1056 rails, 10 feet			
each, at 37½ cents per rail	-	-	395 00
			<hr/>
Expense per mile	-	-	\$ 4,180 75
Therefore, 150 miles	-	-	627,112 50
Bridge over Ashley river	-	-	4,000 00
Do. over Edisto	-	-	11,000 00
Do. Horse Creek	-	-	2,500 00
Several small bridges	-	-	2,000 00
Inclined plane at summit, steam engine machinery, houses, &c.			8,000,00
			<hr/>
			\$ 654,612 50
Add for engineers, superintendence, contingencies, &c. 5 per			
cent.	-	-	32,730 62½
			<hr/>
Total cost	-	-	\$ 687,342 12½

Or (omitting fractions) \$ 4,582 per mile.

It is not a part of my duty to shew how far the probable advantages to be derived from this work would exceed its cost, not only in the pecuniary returns it would give to its enterprising undertakers, but also in the great benefits it would confer on the large district of country within its influence. The accurate data, collected at different times, by committees of the company, place this in so strong a point of view as should be sufficient to satisfy the most incredulous, and which render it unnecessary to insist on the subject here. But, besides this, there is one other strong argument in favor of executing the proposed work, which it is proper to mention. It is the only kind of improvement on the common heavy sandy roads of the country, which can advantageously be made, the want of materials rendering the execution of a common turnpike impracticable.

However great the advantages which the calculations made, respecting this work, have promised, there is no doubt but that they have been underrated, from its having hitherto been regarded with a partial view, merely as a communication from Charleston to the Savannah river, at Hamburg. But, this portion once made, there is every reason to believe that the advantages and facilities it would develop, would clearly point out the propriety of extending it still further, to grasp a far greater prize; and that it would not stop until it reached the Tennessee river. This noble stream, as is well known,

flows through an extensive valley, of great fertility, which is destined to support a dense population. Its trade offers a reward too rich not to demand every exertion to obtain it.

Respecting the advantages to be derived from a communication from the Tennessee River, Eastward, to the Atlantic coast, I beg leave to refer to the report of the United States' Board of Internal Improvement, made October 23, 1826, on the Chesapeake and Ohio Canal. Many of the observations and calculations there made, respecting that work, will apply here. After developing the immense resources of the Western States, and the necessity of their having numerous communications with the sea, the report remarks: "These States will, therefore, require a certain number of outlets to facilitate the exportation of all their products, and the importation of the returns; and it is doubtful if even four of these outlets will be found practicable between the Juniata and the Savannah River, even by the combination of canals and rail-ways. Thus, instead of fearing that these communications will not be profitable, we should rather apprehend that, at a future day, they will be found insufficient for the passage of the trade between the West and the East. The insurmountable obstacles opposed by nature, are thus the only ones which should limit our efforts: for, the more economical outlets we can open through this chain, the more will the resources of the West develop themselves, and the more will the East and the West become united by indissoluble bonds of a common interest."

In a military point of view, the Charleston and Hamburg rail-road is highly important to the State, as it will afford the means of concentrating, almost momentarily, at any given point of its line, the military strength of an extensive district of country. The advantage of such a facility, particularly in adding to the security of its commercial capital, against foreign attack, is too obvious to require to be insisted on.

In making the survey, which forms the subject of this report, I was assisted by Messrs. Harrison, Swift, Guion, Anderson, and Belin, United States' Assistant Civil Engineers, who were assigned to this duty by the Engineer Department. To the persevering industry of these gentlemen, under an exposure to the weather of a most inclement season, and to their skill and intelligence, I owe the satisfactory and timely execution of the survey. I was unable to render them any aid, except in the very commencement of our operations: after which, I was disabled by indisposition, contracted by unavoidable exposure, and confined for the remainder of the season to Charleston. The numerous maps and profiles which accompany this report, have been drawn by Messrs. Harrison, Anderson, and Belin.

To Col. Pettival, Civil Engineer in the service of the Company, I am greatly indebted for the able advice and assistance which he cheerfully rendered us in every stage of our operations, and which his professional knowledge and acquaintance with the country, rendered highly valuable to us.

I beg, also, to be permitted to express my thanks to the several Committees of the Board of Directors, for the polite manner in which they afforded us every facility, both for carrying on the work and for our comfort, in their power, notwithstanding the vexatious trouble to which we were sometimes compelled to subject them.

I am, gentlemen, respectfully,

Your obedient servant,

WM. HOWARD,

Civil Engineer.