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Survey, etc., of road from Mendota to Big Sioux River. Letter from the Secretary of War, transmitting report of the survey, &c., of road from Mendota to the Big Sioux River

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SURVEY, ETC., OF ROAD FROM MENDOTA TO BIG SIOUX  
RIVER.

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LETTER

FROM

THE SECRETARY OF WAR,

TRANSMITTING

*Report of the survey, &c., of road from Mendota to the Big Sioux river.*

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APRIL 28, 1854.—Ordered to be printed.

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WAR DEPARTMENT,  
*Washington, April 25, 1854.*

SIR: In compliance with the resolution of the House of Representatives of the 22d December last, "that the Secretary of War be requested to furnish the House of Representatives, as soon as practicable, with a copy of the report, estimates, and map of the survey of the road from Mendota to the Big Sioux river," I have the honor to submit herewith a report of the colonel of topographical engineers, enclosing the papers called for.

Very respectfully, your obedient servant,

JEFFN. DAVIS,  
*Secretary of War.*

Hon. LINN BOYD,  
*Speaker of the House of Representatives.*

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BUREAU OF TOPOGRAPHICAL ENGINEERS,  
*Washington, April 24, 1854.*

SIR: I have the honor of transmitting herewith a copy of the report, estimate, and map of the survey of the road from Mendota to the Big Sioux river, called for by a resolution of the House of Representatives of the 22d December, 1853.

Respectfully, sir, your obedient servant,

J. J. ABERT,  
*Col. Corps Top. Eng.*

Hon. JEFFERSON DAVIS,  
*Secretary of War.*

WASHINGTON, *April 1, 1854.*

SIR: In obedience to your instructions, dated May 5, 1853, I proceeded to St. Louis, accompanied by my assistant, Mr. J. Tilton, corps of engineers, and there organized a party for the survey of the Mendota military road. Having laid in our supplies, we took passage in the steamer El Paso for Council Bluff City, which we reached after a pleasant trip of ten days.

By the advice of Colonel Robert Campbell, of St. Louis, to whom we are under many obligations, we procured our horses and oxen at Weston and Council Bluff, and having completed our outfit at the latter place, we commenced our march up the Missouri river to the mouth of the Big Sioux.

We followed the road to Fort Pierre, on the left bank of the river, meeting with little difficulty, except at the crossing of the Little Sioux, where we were two days in passing over six miles of overflowed bottoms, or wet prairie, extending from the bluffs to the river. Here the oxen mired, and we had to transport the baggage, provisions, and instruments, by hand, and by the same means to drag the empty wagons. However, in dry weather this route offers no obstacle to teams, all the streams being bridged, or having ferries over them.

The bottoms along the Missouri are from five to fifteen miles broad, of rich alluvial soil, with occasional pretty groves of cotton-wood and oak, which relieve the otherwise monotonous scenery. There are as yet very few settlers in this region, but, as the grass is very fine, it will before long be in great demand for raising cattle for the California and Oregon emigrants—a very lucrative business, and rapidly increasing in importance.

The climate is healthy, and not subject to as great extremes of heat and cold as in the same latitude on our Atlantic coast.

After a march of 120 miles, we arrived at a settlement called Bluff City. It has an excellent landing, and the substratum being of limestone, preserves it from the encroachments of the ever-changing Missouri—a great desideratum along the whole of the upper Missouri, which is constantly shifting its sand-bars, changing its channels, and washing away its banks. There is considerable timber in the vicinity, and the soil is very rich. As yet there are but few settlers, and these are mostly French voyageurs, who, having become tired of service with the Fur Company, have selected this place as their home, and, with Indian or half-breed wives, they seem to enjoy a happy and contented life. They cultivate a few acres of corn and potatoes, game and fish supplying their other simple wants.

But a new era is about to dawn. The restless and enterprising Anglo-Saxon has, within the last year, set his foot here and laid out a town—a certain indication that the region has passed forever from the Indian and his mercurial friend, the voyageur.

At our encampment on Floyd's creek, June 15, we lost, by drowning, one of our number, Cyrus Scott, of Kentucky—a young man who, in his short service with us, had, by his amiability and many good qualities, gained the good opinion of all. He was bathing in the creek, and getting into deep water, and not being able to swim, he perished before any assistance could be rendered.

We arrived at the mouth of the Big Sioux on the 17th of June, and pitched our camp on the farm of Mr. Bruyere, a Canadian Frenchman, who, having married a woman of the Sioux tribe, has lived here for twenty years, exercising a most beneficial influence over all the Indians in the vicinity.

We regretted not finding him at home, having calculated on getting some valuable information from him concerning our proposed route, he being one of the very few white persons that has ever made the trip from the Missouri to the mouth of the Minnesota, and his farm being the last vestige of civilization we were to meet for 180 miles.

We could not obtain any white person for a guide, so we engaged an Indian who professed to be well acquainted with the country; but, for some unknown reason, he left the third day without giving us the slightest notice, and we saw him no more. He was of little assistance, however, having a very inadequate idea of the kind of country best suited for a good road, and not at all disposed to comprehend the instructions of the engineer to avoid the hills—his idea of a good road being the shortest distance between two points that could be passed over on horseback.

The country in the vicinity of the mouth of the Big Sioux and beyond the bottoms of the Missouri is a broken and desolate region, destitute of timber, and presenting an endless succession of conical hills from 50 to 150 feet in height, of thin sandy soil, covered with wild sage and thin short grass. This country embraces several hundred square miles east of the Big Sioux, and is called in the vernacular the "Potato Hill country," from its resemblance to a series of vast potato hills. Possessing neither minerals nor timber, and an indifferent soil, it can never be of much value, and it is probable that the deer and elk will long roam undisturbed over its uninviting solitudes.

For convenience in making out the estimates and describing the country, we have divided the line into six divisions. The distances were measured with a 100-foot chain, and pickets or stakes were placed every 600 feet. We tried the odometer, but found it unsuitable: the delays incident to examining it at every station, in order to set the stake and to take the vertical angle, occupied more time and was more troublesome than measuring the distances with the chain.

The courses were taken with the circumferenter, and the irregularities of the ground ascertained both by it and barometrical observations, taken with great care by Mr. Cross with a fine cistern barometer. The profiles of the route by both processes are submitted, and, although not coincident, both conform in representing the general features of the country.

The result of our experience with a single barometer shows that observations so taken cannot be relied upon to exhibit the minor features, although sufficiently accurate to represent the general character of the country.

The topography of the country along the route was sketched, and is now represented in a map accompanying this report. We have also made another map embracing the State of Iowa, the ceded part of the Territory of Minnesota, including the Indian reservations south of the 47th deg. of north latitude, and most of the pine region of Wisconsin.

As we passed over but a limited portion of this region, our map is of course a compilation. We took Nicollet's map as the basis, as all subsequent researches have established the accuracy of his observations and the fidelity of his descriptions.

We have also collated from the best sources all that is known in regard to the position and size of many lakes not laid down by Nicollet, the extent and character of the woods, forests, marshes, prairies, and streams, with the villages and towns that have recently sprung into existence, as also the roads that are already constructed and those that are being built or proposed.

By a glance at our map, the intelligent emigrant will be able to select either a prairie or a timber country for his future home without the trouble of expensive and laborious personal examination.

The geological, mineralogical, and botanical characteristics of the country, have been thoroughly examined by Dr. Owen and his able assistants, and admirably treated in his elaborate report.

The healthfulness of the climate and productiveness of the soil of Minnesota are not surpassed by the most favored regions of our country. The southern and western portions are perhaps too thinly timbered to be densely populated until a system of ditching and hedging shall be adopted, or until the inhabitants themselves shall dot these magnificent prairies with groves—a less difficult task than clearing the forest, which is usually the labor of a life-time.

Locust trees are admirably adapted to this purpose, as in six or eight years enough timber for ordinary farming purposes could be grown.

Although this region is far north of the more densely populated portions of the United States, yet the cold is not so intense, nor the climate so changeable, as that of Massachusetts. During the summer the heat is ample in intensity and duration to perfect all the cereal grains, and the long snows of winter protect the wheat from the freezing out so common to the valley of the Ohio.

Having premised these few general remarks with regard to the climate and productions of Minnesota, I will now proceed to describe more particularly the character of the country along the route of the proposed military road.

#### *First division.*

Having explored the country between the Big Sioux and Floyd's creek for twenty miles to the northward, and ascertaining the only practicable route to be by the valleys of Hog-weed and Floyd's creeks, we commenced the survey, June 20th, at the mouth of the Big Sioux, and, crossing the Missouri bluffs, 150 feet in height, we descended into the valley of Hog-weed creek. Following along its bottoms for thirteen miles, and crossing the creek three times to avoid the hills, we left it and traversed very rolling prairie between it and Floyd's creek for seventeen miles further, and then descended into its bottoms, which we followed along its western side for sixteen miles and crossed it. This division terminates here, and is 46 miles and 840 yards in length. The estimated cost of construction is \$104 06 per mile.

In following up the valleys of these creeks, we crossed numerous gullies varying from four to ten feet in depth; but, as they rarely exceeded ten feet in width, we readily made temporary bridges of willows and grass to pass our cattle and wagons over. The bottoms, varying from a few feet to several miles in width, are of rich alluvial soil and covered with high grass, but almost entirely destitute of timber. The best route for a railway from the Missouri river is to depart from Sergeant's bluff, or, as it is now called, Bluff City, and follow up the valley of Floyd's creek for about fifty miles. Here the character of the country changes, and, leaving the "Potato Hill" region, there will be no difficulty in locating the road in any desirable direction. Although I have made no estimates for a railway, not being called upon to do so by my instructions, still I hazard nothing in stating that, as far as the surface of the country is concerned, there will be no serious obstacle in connecting the Missouri, at the point above mentioned, with the Mississippi at or near St. Paul. In the event of not discovering a suitable pass through the mountains along the route surveyed by Governor Stevens, this will be the most direct and practicable route from the Northwest to the Pacific.

After leaving the Missouri, there are no very desirable locations for farms along this division; and, possessing neither minerals nor timber, it will be long before the more favored regions of the North and West will be so filled with population as to bring this country into demand.

#### *Second division.*

This division, beginning at Floyd's creek, and terminating at the crossing of the Little Sioux, passes over rich undulating prairies, entirely destitute of timber, but covered with high grass, affording the most luxuriant pasturage. Here, a few years since, was the great buffalo range. A few herds are yet to be seen, with many elk and deer, which enliven the otherwise monotonous landscape.

Traversing forty miles of prairie, we arrived at the river Ocheyedan, a beautiful little stream, with pebbly bed, and fordable except during freshets. The bottoms, a mile broad, are exceedingly fertile, and covered with grass seven feet high. Excellent fish abound in this stream; and were timber abundant, this country, from the fertility of the soil, the pure and bracing atmosphere and beautiful scenery, would be one of the most desirable places for settlement in Iowa.

At our encampment on this stream, we were gladdened in the morning by the approach of a small herd of buffalo. After an exciting chase, we succeeded in cutting off and pistoling one with our Colt's revolvers; and bearing him into camp, he proved a most welcome addition to our commissariat.

Passing over ten miles of rich rolling prairie, we crossed the Little Sioux. Here this division, which is 49 miles 1,293½ yards long, terminates. The average cost of construction, including bridges over all the streams, is only \$73 per mile.

The Little Sioux is the first place along our route, after leaving the Missouri, that offers good inducements for the opening of farms. The soil is excellent, and there is sufficient timber for farming purposes

along its banks. Judging by the depth and rapidity of its current at our crossing, I should think that it would be navigable for large barges from its source, in Spirit lake, to its mouth, thus affording a cheap and expeditious natural outlet for the surplus productions.

#### *Third division.*

After leaving the Little Sioux, we enter what Nicollet so aptly has styled the "Undine Region." Much of the surface of the country is covered with isolated circular ponds, with gravel-beds, varying from fifty yards to a mile in diameter, and from one to twenty feet deep. At least one-fourth of the country is occupied with them. Some of the larger are fringed with timber, and have numerous boulders on their borders.

Passing over twenty miles of gently rolling prairie, interspersed with numerous ponds, we reach the Des Moines river, which has a swift current, and is from 6 to 10 feet in depth, and from 70 to 120 feet wide. Timber, principally of oak, ash, and hickory, is abundant on its banks, and, as the soil is good, it offers many attractions to the settler. Ten miles further, over much the same character of country, we cross the boundary-line between Iowa and Minnesota, and enter a region of larger lakes. In this vicinity are Spirit, Okamanpidan, and Omanhu lakes. These are large and beautiful sheets of water, from six to ten miles long, and from one to five broad, full of delicious fish, and bordered with timber. Around Lake Okamanpidan is the largest body of timber, between the Missouri and the Minnesota, on our route.

In the wet season this division will be difficult for heavily loaded wagons, as much of it will be covered with water; but in the summer, or during the frosts of winter, it will be passable without any work.

From the boundary-line to the end of this division, at the Chaniushkah river, the country is rolling prairie, with timber generally near. There are many ponds, connected by marshes, which, to make the road passable at all seasons, will require embankments, and small culverts or bridges.

The Chaniushkah is one of the numerous branches of the Mankato or Blue Earth river. Where we crossed, it is a small stream, fordable, with gravelly bottoms, and timber in abundance on its banks.

Numerous boulders, varying in size from a pebble to a mass of 150 cubic yards, are scattered over the prairie and around the borders of the lakes. They are not sufficiently numerous, however, to interfere with the cultivation of the soil, which is rich, and offers many inducements to the emigrant, particularly in the vicinity of the Okamanpidan and Omanhu lakes, and upon the Des Moines and Chaniushkah rivers.

This division is 51 miles and 1,206 yards in length, and the estimated cost of construction is \$134 93 per mile.

#### *Fourth division.*

Leaving the Chaniushkah, we passed over nine miles of high rolling prairies, gravelly, and interspersed with numerous circular shallow ponds. Here we crossed Perch river, which is a little stream, taking



its source in a small lake of the same name, and after meandering the prairie for fifteen miles, making a very slight indentation in its surface, it empties into the Wattonwan. From Perch river we pass over a rich, level prairie country, interspersed with disconnected ponds, for twelve miles, when we reach the Wattonwan river. This stream is well wooded, and, at our crossing, was about forty feet wide and three deep. Before crossing this stream, we ran a line along its southern bank, and crossing the Mankato river near its junction with the Wattonwan, we followed along its eastern bank, over a dry, level prairie, until we reached the hills bordering the Lesneur river. In descending these we had great difficulty in preserving our maximum grade of 5°; and also, after crossing this stream, the approach to the Minnesota river was very rugged. We therefore determined to return, and endeavor to find a more practicable route on the western side of the Mankato. Going back twenty-five miles, and crossing the Wattonwan a few miles above its mouth, we followed along the western side of the Mankato, over level prairie, interspersed with numerous ponds and marshes, to the first bench of the Minnesota river. The descent to the second bench, one hundred feet below, is easy, requiring very little side-cutting; thence over dry and rocky country, thinly studded with scrubby oak for three miles, to the Mankato, which we crossed near its mouth; and thence over a low bottom for a mile, to the village of Mankato, where this division terminates.

As this last route proved to be the shortest and least expensive, we adopted it.

After passing over 180 miles of prairie unoccupied by a single white settler, we were agreeably surprised to find at the mouth of the Mankato a flourishing settlement of 200 intelligent and energetic countrymen. Their village, styled "Mankato City," is on the eastern bank of the Minnesota at the great bend; and, being in the heart of a rich agricultural region and on a river navigable for steamboats for three or four months in the year, it possesses all the elements of future prosperity and importance. A few Sioux Indians still lingered about their ancient village, but the mass of the tribe had gone to their new home further up the Minnesota.

The Mankato and its numerous tributaries being generally well timbered, and flowing through a country unsurpassed in the salubrity of its climate and the productiveness of its soil, offers great attractions to the enterprising farmer.

This division is 41 miles and 1,140 yards in length. The estimated cost of construction is \$228 38 per mile.

#### *Fifth division.*

Leaving the village of Mankato, we followed along the second bottom of the Minnesota river, over dry, level prairie for eleven miles, to Babcock's mill. These bottoms are from one to three miles wide and about fifty feet above the river. Along the bases of the bluffs the soil is very rich, but towards the river a stratum of sandstone mixed with lime lies very near the surface, which, although very favorable for a road, is but little suited to agricultural purposes.



At Babcock's mill the second bottom disappears, and wide low bottoms, annually overflowed, take its place. In consequence of this we were compelled to leave the river and ascend to the table-land, which is about 300 feet above the Minnesota. Here we entered what is known by the name of the "Big Woods" of Minnesota. It is the largest body of timber between the Missouri and Mississippi rivers, extending one hundred miles to the north and forty to the east. Oak, ash, linn, walnut, and maple, are the most abundant, but almost every variety of deciduous timber is found.

Numerous beautiful lakes, abounding in fish of the most delicious flavor, are embosomed in this forest. Some of these lakes are eight miles long, and deep enough to float a frigate, having a beautiful gravel beach, with occasional large boulders, along the shore. Others are shallow and filled with wild rice, which, in the fall, attracts great numbers of wild fowl to their waters. It is also a valuable article of food to the Indian. Wet meadows or marshes frequently connect chains of these lakes. These are covered with very high grass, affording fine pasturage for cattle and making excellent hay. Some are too marshy for grazing, but are easily drained.

The lakes in this region occupy about one-sixth of the area, the marshes probably as much, and the rest, gently undulating and densely timbered, with a soil of inexhaustible fertility, offers the best locations for farms of any country we saw along the route.

Opposite Traverse des Sioux we struck a road, newly cut out, from Rockbend (a short distance above Traverse des Sioux) to St. Paul, by Captain Dodd, of Minnesota. This gentleman, with a surveyor and ten men and two teams, had been employed 109 days in cutting out this road and bridging the streams. It materially assisted our survey, and enabled us to get through the "Big Woods" several weeks sooner than we would otherwise have done without this—our only guide among this unexplored labyrinth of lakes and marshes.

I have included in the estimates the cost of cutting out this road, and take pleasure in recommending that Captain Dodd and his party be paid for their labor out of the appropriation for making the Mendota military road.

This division terminates near Lake Eagle, in the "Big Woods," and is 43 miles and 208 yards in length, and is estimated to cost \$352 18 per mile.

#### *Sixth division.*

Continuing for eight miles through very much the same character of country as that described above, we enter the "Oak Barrens," so called from the stunted character of the timber. This has been caused by the annual fires which sweep over it, consuming the grass and stunting the timber. The surface of the country is broken, and the soil is not very rich. There are but few lakes or marshes along this portion of our route, and no desirable locations. After passing over fourteen miles of this kind of country, we entered the Vermillion prairie, a most fertile and beautiful region, traversed by the Vermillion river.

This prairie has its northwestern boundary about twelve miles from the Minnesota river, and extends to the Mississippi on the east and to Iowa on the south. The surface is gently undulating, and the soil rich. Occasional beautiful groves of oak relieve its otherwise monotonous appearance, and afford charming sites for residences. Here, after a most tedious month spent in the woods, during which we were excessively annoyed by mosquitoes, we were again gladdened by evidences of civilization. On a beautiful lake, near the western boundary of the prairie, a town called Lakeville has recently been laid out and several buildings erected. This lake is about six miles long, and connected by a chain of smaller ones with the Minnesota. We followed along near the northwestern boundary of the prairie for twelve miles, and then entered the oak openings, so called from the thinness of the timber and the absence of underbrush. Passing over nine miles of very broken country, interspersed with small lakes, we struck the Mendota and Cannon river road, and as it occupied the best ground we followed it for about six miles into Mendota. Along it there are a number of farms which have been cultivated for many years by the original French settlers and half-breeds.

Mendota is a small village, near the mouth of the Minnesota river, opposite Fort Snelling. Although one of the oldest settlements in the Territory, and possessing many geographical advantages, it is completely overshadowed by St. Paul, situated six miles below on the Mississippi river. This is partly due to the Indian title not having been extinguished, and the military reserve preventing settlers from locating land in its vicinity. It has long been a trading post of the American Fur Company and the residence of the Hon. H. H. Sibley, a gentleman to whom we, in common with all recent explorers of that country, are under many obligations for valuable information and assistance. I take pleasure also in acknowledging my obligations to the Hon. Mr. Rice and Captain Dodd, both of Minnesota. These gentlemen have long resided in the Territory, and are very familiar with its geography. They have taken great interest in our map, and contributed much information in regard to the position and size of lakes, villages, roads, timber, &c.

Our field labors terminated at Mendota, having traversed 224 miles of prairie, forty miles of thick woods, and fifteen miles of oak openings; making the distance from the mouth of the Big Sioux, on the Missouri, to the mouth of the Minnesota, on the Mississippi, 279 miles.

The estimated cost of constructing a good military road between these points—including the sum of \$3,270 to Captain Dodd and his party—is \$52,475 68, being an average cost of \$188 18 per mile.

It is important to the prosperity of the Territory that at least that portion of the road between Mendota and Mankato should be constructed at once. It is also important in a military point, as it is the most direct and practicable route from Fort Ridgely—the new post on the Minnesota—to Fort Snelling, on the Mississippi; and, as the river is only navigable a few months in the year, it is absolutely necessary that a route by land should be speedily opened. There are also several thousand inhabitants along the Minnesota who have no other direct outlet for their surplus produce during a greater portion of the year.

But it is needless to enlarge upon the importance of establishing a road through this region; its increasing importance is too well known to require any additional arguments in its favor. The 20,000 inhabitants of the best classes of our hardy pioneers and enterprising farmers now scattered over its broad extent, and busily employed in making solitudes—hitherto untrodden save by the savage—smile with beautiful villages, and the earth teem with abundant fruits, will not ask in vain the fostering hand of government.

In conclusion, I would suggest, in case Congress should make the appropriation for building the road, that Mr. J. Tilton, my able and accomplished assistant, would be a very suitable person to superintend its construction—his knowledge of the country and the route surveyed being a strong recommendation in his favor.

I am, sir, very respectfully, your obedient servant,

J. L. RENO,

*Brevet Capt. Ordnance Dept. U. S. A.*

Col. J. J. ABERT,

*Chief Topographical Engineers.*

*Recapitulation of estimates for the Mendota military road, from the mouth of the Big Sioux, on the Missouri river, to Mendota, at the mouth of the Minnesota river, 278 miles and 1,520 yards: surveyed in the summer of 1853.*

No. of division.	From	To	Distance.	Cost.
1	Mouth of Big Sioux.....	Crossing of Floyd's river.....	46 miles and 840 yards.....	\$4,399 19
2	Crossing of Floyd's river.....	Crossing of Little Sioux river.....	49...do...do..1,293 <sup>1</sup> ...do.....	3,305 97
3	Crossing of Little Sioux river.....	Crossing of Chaniushkah river.....	51...do...do..1,206 <sup>3</sup> ...do.....	6,337 76
4	Crossing of Chaniushkah river.....	Mankato city, or Minnesota river.....	41...do...do..1,140 ..do.....	8,647 52
5	Mankato city.....	Station No. 2050, in "Big Woods".....	43...do...do.. 208 ..do.....	13,898 74
6	Station No. 2050.....	Mendota, at mouth of Minnesota river.....	46...do...do.. 352 ..do.....	8,143 26
				44,732 44
Add ten per cent. for engineering, &c.....				4,473 24
Add for cost of "Dodd's road," now made from Traverse des Sioux to St. Paul, and partly adopted on divisions 5 and 6 of this location.....				3,270 00
Total cost of Mendota military road.....				52,475 68
Average cost per mile.....				188 18

*Specifications.*

First. The road will be opened one hundred feet wide; all trees, brush, and shrubs, to be cut down for that width.

Second. All trees, brush, and shrubs, of whatever size, on a centre strip of fifty feet in width, to be grubbed for at least nine inches below the surface of the ground, and all impediments to the safe and easy motion of vehicles removed from said centre strip.

Third. In all low or wet places, a good solid sufficiently embanked roadway, of at least twenty feet wide on top, to be made of good, firm, dry material, earth or gravel, or, where required, of logs, covered with earth or gravel at least six inches in depth.

Fourth. In places where the road is made on side-hill, the driveway will be eighteen feet wide, with a good ditch on the upper side, and such cross-ditches and culverts as will protect the road from wash. The road at such places to be provided with a substantial rail or log parapet, as the engineer may direct.

Fifth. All ascents to be reduced to eight feet nine inches to the hundred feet, and all inequalities upon the surface of the road to be smoothed off or filled up.

Sixth. The bridges of twenty feet span and less to be made of good, sound, durable timber, none of which is to square less than one foot; to be built with four stringers, hewn square, and resting on timber abutments made of logs flattened on two sides, well trenailed and tied together—flooring to be of two-inch plank, well spiked to the stringers, and the whole provided with a good and substantial railing.

Seventh. Bridges of more than twenty feet span will be made according to plans which will be exhibited in the office.

Eighth. The slopes of excavation will be one and a quarter foot to the foot perpendicular; and of embankment, one and a half foot to the foot.

Ninth. Sufficient outside ditches to drain the road will be made, according to the direction of the engineer or agent in charge, at such points as he may direct.

Tenth. The whole construction of the road to be under charge of the engineer or agent in charge, who retains the right to make such alteration in the location of the road, or the plans of bridges, culverts, and mechanical work, as may in his opinion be advantageous to the work; and any difference resulting from such change shall be estimated by said engineer or agent in charge.