

RELOCATION OF THE CHICAGO BURLINGTON & QUINCY IN WESTERN IOWA.

When in 1868 the first line was run through Iowa for the location of what is now the Chicago Burlington & Quincy two objects were sought, viz.:—The most direct route from the Mississippi at Burlington to the Missouri River at Omaha, and such location as would make the road the cheapest to build. At that time land in western Iowa was worth but a dollar an acre and the railroad was considered so much of an experiment that the expense of cutting grades materially or of avoiding curves was not incurred. In view of the fact that the western part of the State on the Missouri water-shed is hilly, being traversed by divides running southward and by many broken ridges, the location of a railroad practically on top of the ground was difficult. It, therefore,

wider at the base than the plan based on the original slope called for. It has been found in general that this soil will stand best if the slopes are steep, approaching the vertical, thus affording the least chance for surface wash. By benching to the extent of removing the topsoil down to the clay and back at least 20 feet from the edge of the cut, it is expected no trouble will be occasioned by slides due to the weight of the earth on top.

In all the cuts where water has been encountered a system of tile drainage has been used. Straight tile 6 inches in diameter by 15 inches long has been laid in a trench about 5 feet below the rail on each side of the ballasted roadbed. This tile is embedded in cinders, and at each alternate 15 feet the trench is filled for a distance of 15 feet with cinders, which gives excellent opportunity for the surface water to



C. B. & Q. RELOCATION—LOOKING WEST ALONG THE NODAWAY FILL TOWARDS THE VILLISCA CUT.

speaks well for the engineering skill then employed that in the present relocation, involving deep cuts and heavy fills to avoid curves and grades, the saving in distance across the whole of Iowa will amount to less than 4 miles.

It is, of course, the elimination of short radius curves and steep grades that is expected to repay the road for the great expense of building what is practically a new double-track grade through the State. In this work the greatest improvement will be made in the hilly section between Nodaway and Red Oak, where a new grade is being built all the way, in some places as much as $\frac{3}{4}$ of a mile from the old line. On this section some new engineering problems have been encountered in the solution of the best way to handle the blue clay found in the deep cuts. There are two of these big cuts, one between Nodaway and Villisca, and one between the latter station and Stanton. The Villisca cut is 2,000 feet long and 85 feet deep at one point, being the deepest clay cut in the country, and, to the best of knowledge, in the world. The blue clay is of a heavy consistency and slacks on exposure to the air, crumbling into small pieces almost as hard as trap rock.

A little trouble was experienced with slides, due to the weight of the topsoil on the uphill side of the cut, but this action was met by excavating the roadbed some 20 feet

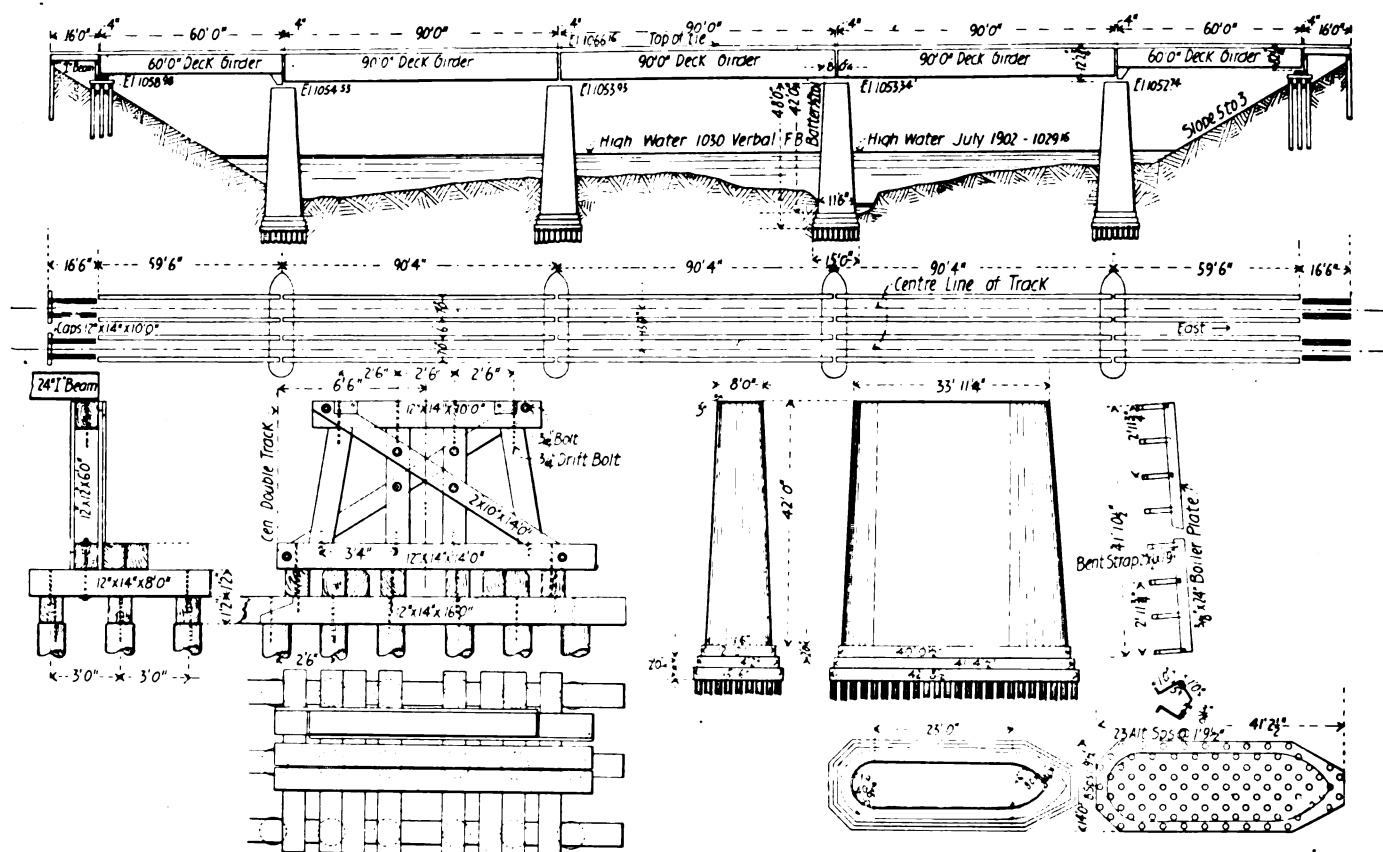
seep through into the trench and be carried away by the tile.

About 500,000 cubic yards of earth were removed from the Villisca cut and this was used in the fills at both ends. As shown in the profile and alignment this cut will reduce a bad curve with a sharp grade.

Between the cut and the Villisca station the road is carried across the Middle Nodaway River on a new 3-span deck girder bridge 12 feet above the level of the old structure. The piers for this bridge are of concrete, and in excavating for their foundations the only approach to rock formation on the whole division was encountered. Through the station yards beyond the bridge the old grade is maintained, although the line will be changed slightly and straightened.

West of Villisca is a heavy fill which, at places, is 50 feet above the bottoms and 40 feet above the old line. This fill is 7,500 feet long and contains about 800,000 yards of earth the first 10 feet of which was supplied from team borrow and the remainder was brought in on dump cars by the contractors.

The West Nodaway River is crossed on a 422-foot, 5-span deck girder bridge, supported on concrete piers. The three middle spans are each 90 feet long, and the piers are 40 feet high above the low water level, and 46 feet above the pile caps. These piers each contain 550 cubic yards of concrete



C. B. & Q. RELOCATION—DECK GIRDER BRIDGE OVER WEST NODAWAY RIVER.

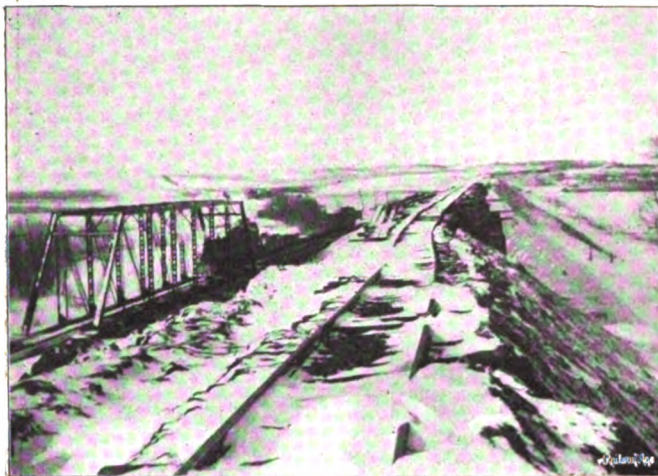


C. B. & Q. RELOCATION—CONCRETE PIERS AND TEMPORARY TRETTLE AT WEST NODAWAY RIVER.

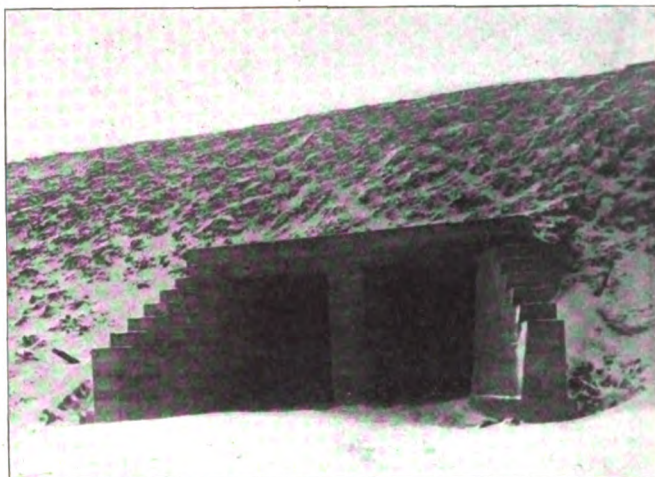
and are 34 feet long by 8 feet thick at the top, with a uniform batter of $\frac{1}{2}$ inch to the foot. The upstream noses are protected by steel shells anchored to the piers by means of long bolts, which were embedded at the time the concrete was laid. Each pier is supported on 98 piles, driven about 30 feet below the ground level.

Oak three of these crossings, the one shown being the highest. In each case the new line is above the old.

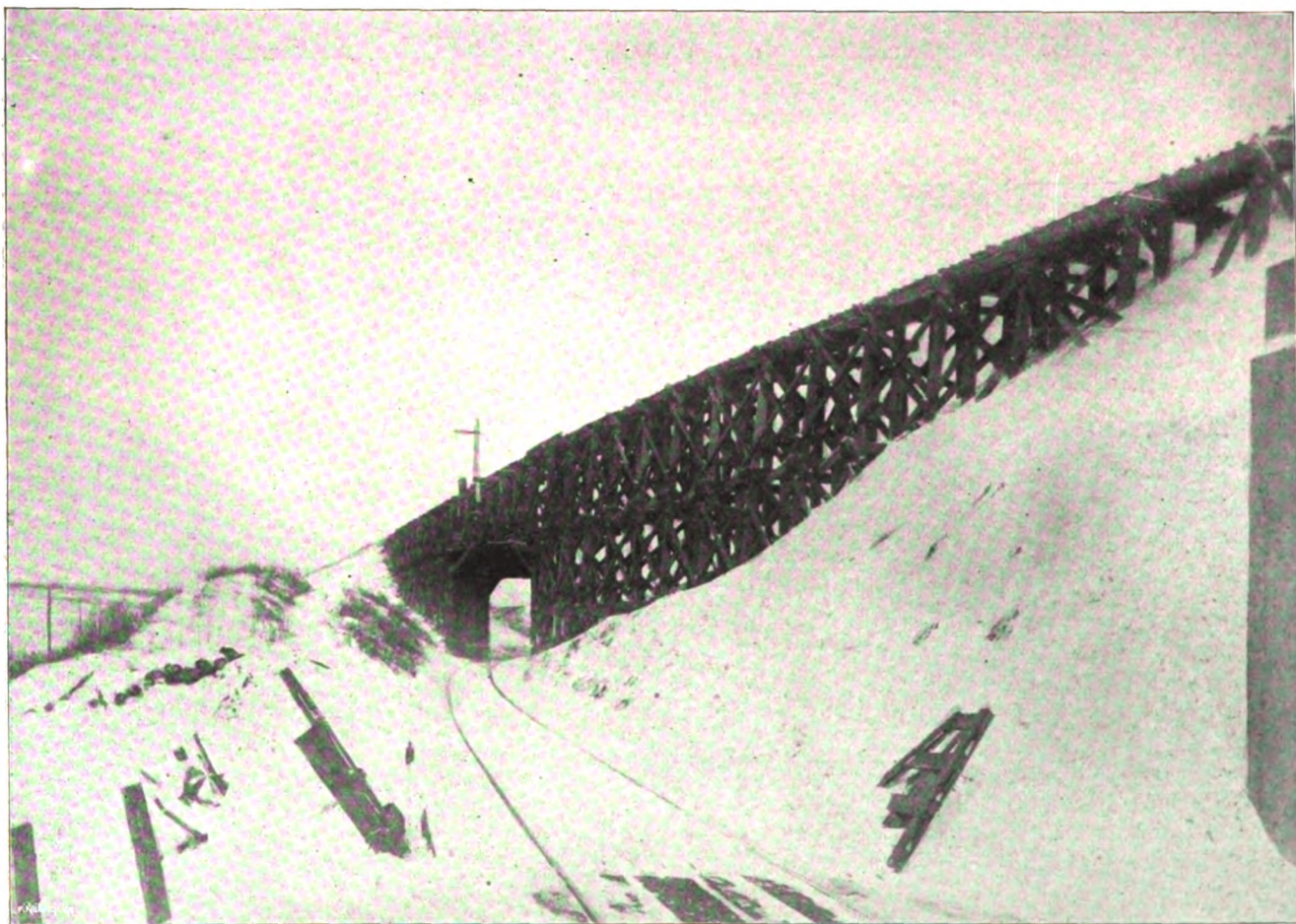
In connection with the line revision, in as far as has been possible, grade crossings have been avoided, and, as nearly all of the country roads crossing the railroad are built along the divides or in the bottoms, they usually intersect the



C. B. & Q. RELOCATION—LOOKING WEST ALONG THE 50-FOOT VILLISCA FILL. OLD LINE TO THE LEFT.



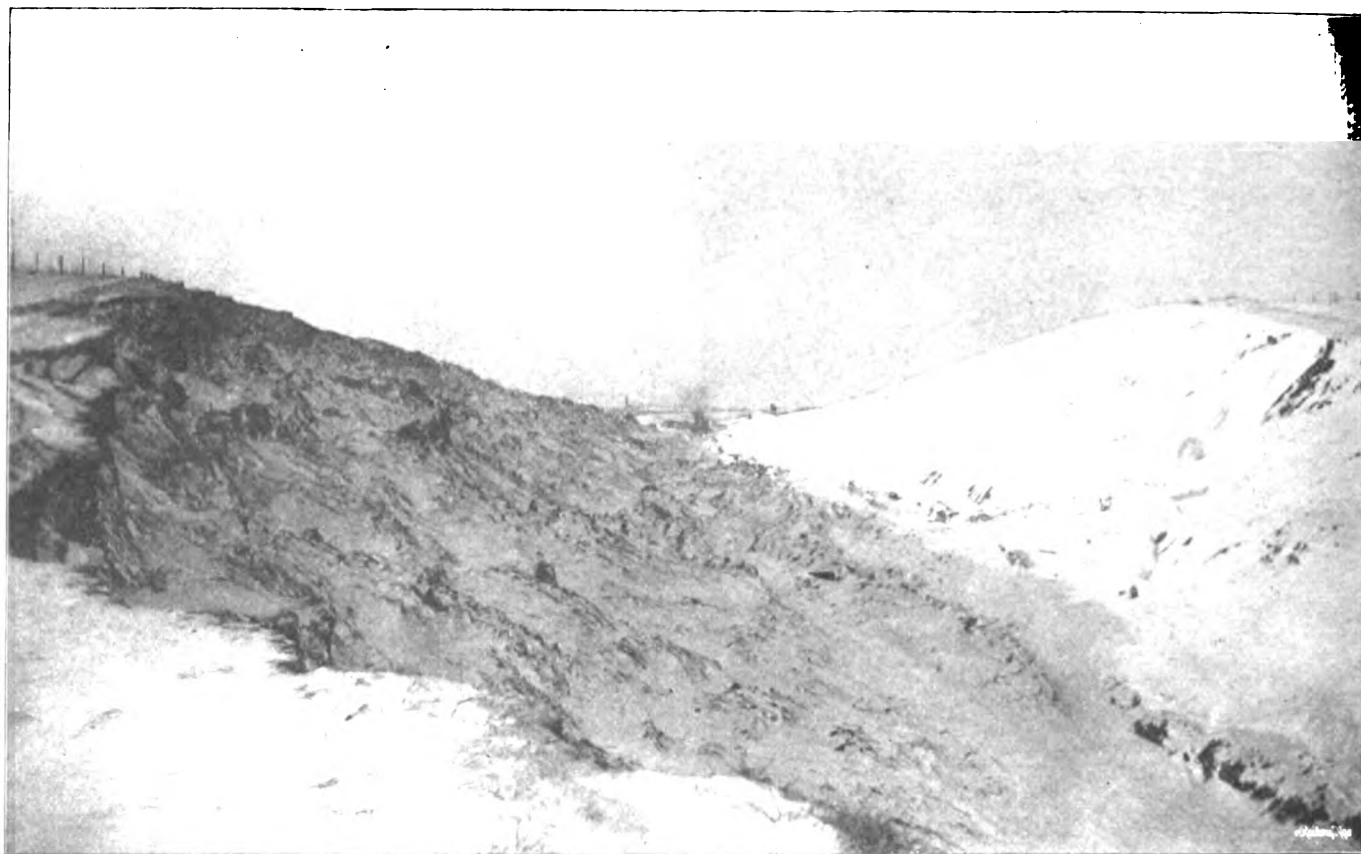
C. B. & Q. RELOCATION—HIGHWAY CULVERT UNDER THE VILLISCA EMBANKMENT.



C. B. & Q. RELOCATION—NEW GRADE CARRIED OVER PRESENT LINE WEST OF VILLISCA.

Just beyond the bridge the new line crosses the old at an elevation of 41 feet. A temporary trestle was built sufficiently strong to carry the new road and to leave a tunnel beneath for present traffic. This construction is shown herewith. At present the contractors' construction track is carried over the trestle. There are between Villisca and Red

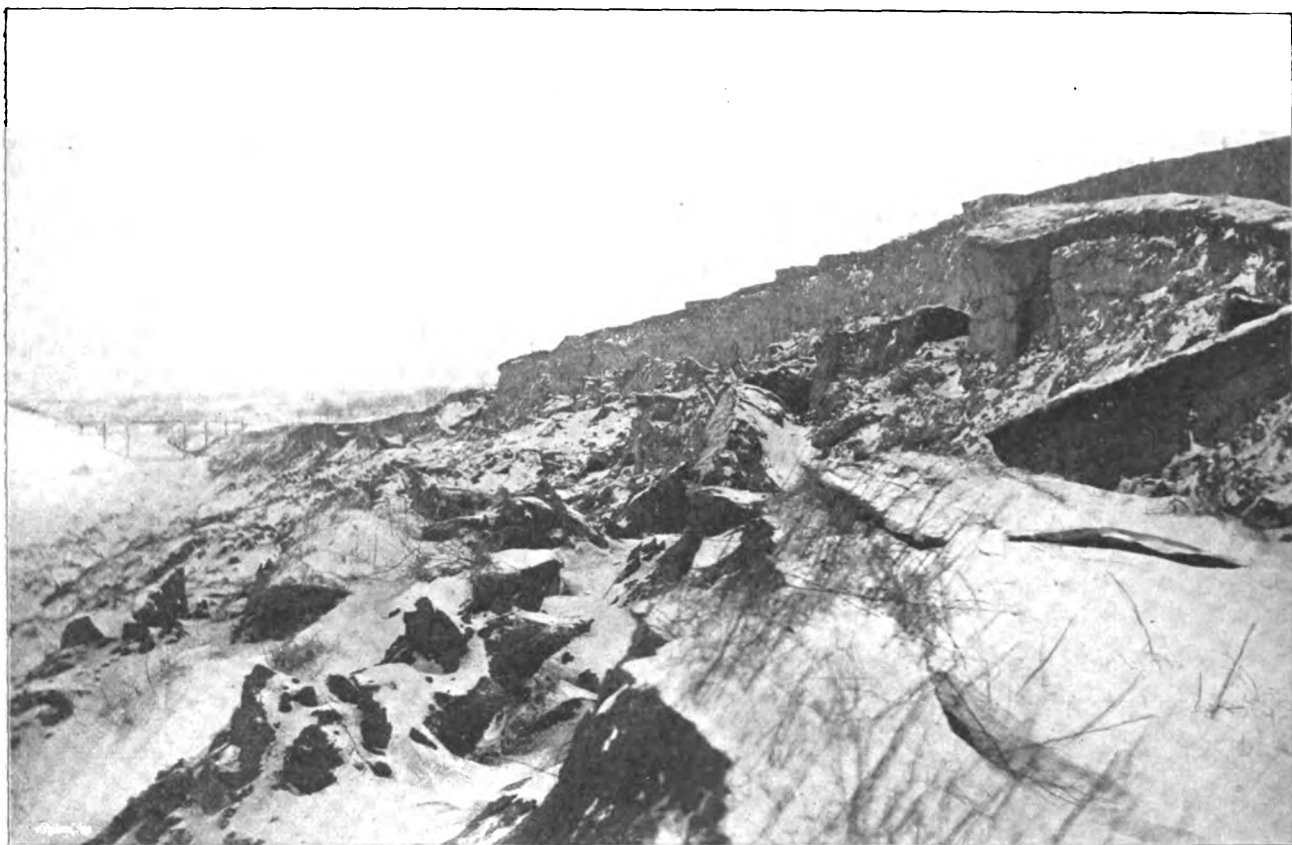
railroad at points where either cuts or fills have been made. In the former case the highways are carried above on wooden bridges, and in the latter case concrete culverts have been built. The one illustrated which goes through the high Villisca embankment has two passages, each being 12 feet wide by 13 feet high, and separated by a 4-foot concrete wall. The



C. B. & Q. RELOCATION—SLIDING CLAY CUT NEAR STANTON, LOOKING WEST.



C. B. & Q. RELOCATION—85-FOOT VILLISCA CUT, LOOKING EAST.



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side walls are 5 feet thick, and the whole is supported on 542 piles, which were cut off about 5 feet below the roadway. The roof is flat and is 3 feet thick, reinforced with I-beams laid about 2½ feet apart. The roadways are to be paved with vitrified brick, with side gutters. This subway is 172 feet long, and supports about 30 feet of embankment. It has now been in place a year and has shown no signs of settling in any part.

Three miles east of Stanton the two lines are ¼ mile apart, and it is in this section that the greatest difficulty has been encountered in the sliding clay. The Stanton cut is shown as it appeared after the bad slides of January. It is proposed to open this cut to grade by removing the material from the bottom until the sliding mass finds a permanent slope.

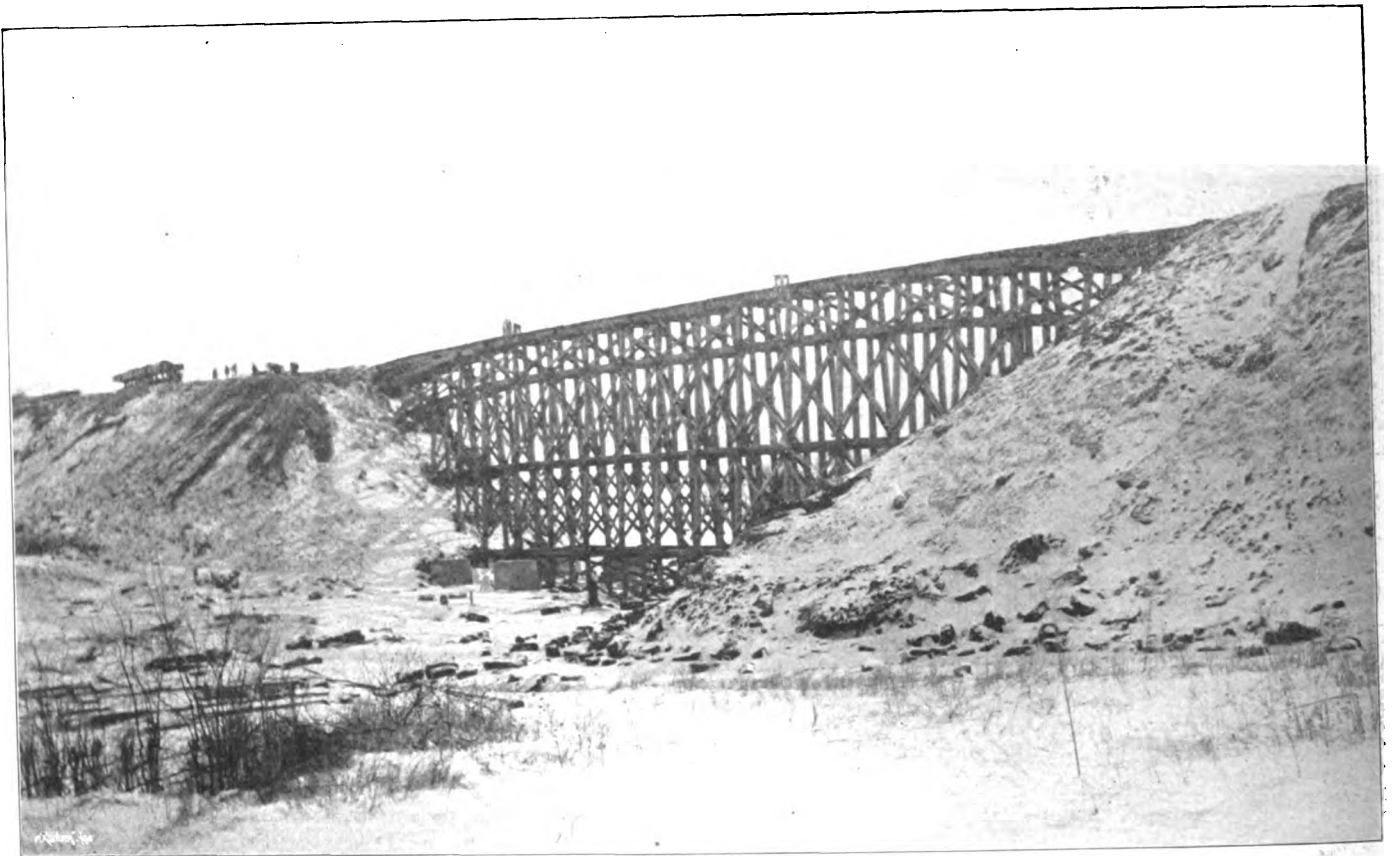
Over the Tarkio River will be built a 4-span deck girder bridge, which will be 65 feet above the creek bed. The towers

of 866 degrees. The distance is shortened 7,214 feet, and the ruling grade is reduced from 65 feet to 35 feet per mile. A number of 3-degree curves are reduced to curves of one degree, which is the sharpest used on the revised line.

The work of grading has been done by contract, the contractors between Nodaway and Red Oak being D. D. Streeter, Chicago; Mike Elmore, Omaha, and Lorimer & Gallagher, Chicago, each having separate sections. We are indebted for information and opportunity for obtaining photographs to Mr. W. L. Breckenridge, chief engineer, and Mr. F. W. Stevens, resident engineer at Villisca, under whose immediate supervision the work between Nodaway and Villisca has been done.

Electric Roads to Ship Coal.

The Coal Trade Journal states that Asa W. Jones, now president of the Youngstown & Southern Railway Company,



C. B. & Q. RELOCATION—65-FOOT TEMPORARY TRETTLE OVER TARKIO RIVER.

are of concrete and steel, the concrete foundations extending but a few feet above the river, from which points structural posts will be used. A trestle now bridges this stream and is in use by the contractors in widening the high fill at the approaches. The Stanton station will be moved about ¼ of a mile from its present position when the new road is placed in operation. The relocation is to extend through to Pacific Junction, and work is now under way from Red Oak west. As an illustration of the improvement made, in one instance the total curvature, between mile 428 and mile 431, will be reduced from 190 degrees 8 minutes to 26 degrees 44 minutes, with a reduction in length of 1,228 feet, and where now a 3-degree curve and a 65-foot grade occur there will be a 1-degree curve and a 34.5-foot grade.

In summarizing, over the 14 miles between Nodaway and the crossing west of Tarkio River, shown on the diagrams, the total curvature of the old line is 491 degrees, and with the new will be 196 degrees, a reduction of 295 degrees. Nine curves, most of them short, of 1 degree, will be used instead of nine curves of from 1½ to 3 degrees, with an average of 2 degrees 10 minutes, in the old line. On the 51 miles between Creston and Red Oak, the total curvature of the old line is 1,546 degrees, and of the new is 680 degrees, a saving

which proposes to build an electric line, has leased 1,000 acres of coal land southwest of Lisbon, O., on the proposed line. He and others interested in the company have leased other lands along the line and when it is completed they will make the experiment of shipping coal in that way. It has been claimed that it is not practical for electric roads to carry heavy freight, but this will test the matter, and should it prove satisfactory, other roads may take it up. Ohio has become almost a network of electric roads, and others are being built rapidly. It is believed there will shortly be a through line from Cincinnati to Toledo, and plans have been under way for some time for a line from Cleveland to Columbus and a portion of it has been built. A road is under construction from Columbus to Lancaster, and another has only a gap to fill to reach Zanesville. There are now lines from Cleveland to Canton, and a short stretch would put them into the Massillon field. There is a line from Columbus to Dayton, and arrangements have been made for an entrance to Cincinnati; so it can be seen how easily they can be converted into coal roads, should the management become convinced that it will pay to enter that line of business. Should it prove profitable to the Youngstown & Southern it will not take the others long to make arrangements to enter the trade. They are all carrying light freight now and have made a successful venture of it so far.