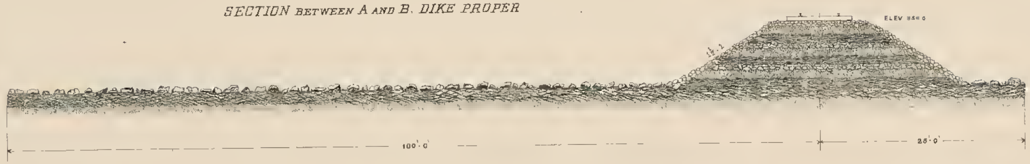
C. B. & Q. R. R.

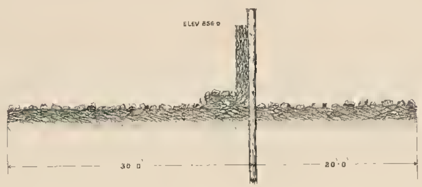
RULO BRIDGE

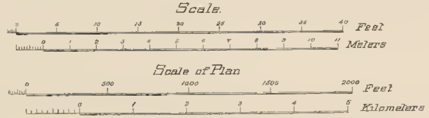
DETAILS OF DIKE

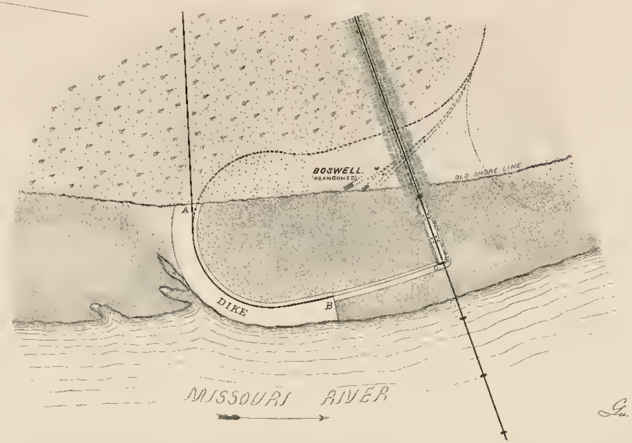
SECTION BETWEEN A AND B. DIKE PROPER



SECTION BETWEEN B AND C. SCREEN.







Geo. S. Morison
Ch. Eng'r

Compliments of

GEO. S. MORISON,

Chief Engineer.

The Rookery,
Chicago.

THE RULO BRIDGE.

A REPORT

To CHARLES E. PERKINS, PRESIDENT of the Chicago, Burlington & Quincy Railroad,

BY

GEORGE S. MORISON, Chief Engineer of the Rulo Bridge.

SUBJECTS.

APPENDICES.

PLATES.

1890.

CHICAGO, MAY 1, 1890.

CHARLES E. PERKINS, ESQ.,

President Chicago, Burlington & Quincy Railroad.

Dear Sir:-

I submit the following final report in relation to the construction of the bridge across the Missouri river at Rulo, Nebraska.

Yours truly,

GEO. S. MORISON,

Chief Engineer Rulo Bridge.

THE RULO BRIDGE.

I.

PRELIMINARY NARRATIVE.

Before the completion of the Plattsmouth Bridge in 1880, the importance of a lower crossing of the Missouri to accommodate the Southern lines of your Nebraska system of railroad, became apparent, and I was instructed by you to make an examination with a view to locating such a bridge near the mouth of the Little Nemaha. This examination was made in the season of 1880-'81 and resulted in the selection of a location near the little village of Aspinwall about two miles below the mouth of the Little Nemaha. A bridge built here would have made a direct connection between the railroad leading westerly from Nemaha City to Beatrice and the branch on the east side of the river from Corning to Villisca.

Subsequently the acquisition of the Hannibal & St. Joseph R. R. by your company made a more southerly crossing desirable and the fact that the Atchison & Nebraska R. R. (a portion of your Nebraska System) followed down the valley of the Great Nemaha indicated that a location at Rulo near the mouth of the Great Nemaha would have decided commercial advantages over the Aspinwall location.

The season of 1883-'84 was therefore devoted to examinations and surveys in the neighborhood of the mouth of the Great Nemaha.

The beginning of the work may be fixed as September 13th, 1883, when Mr. B. L. Crosby the Resident Engineer arrived at Rulo. The location at Rulo was fixed by me and borings were actually begun one week after Mr. Crosby's arrival.

These borings showed a state of affairs quite unlike that usually found in the Missouri River, there being no rock within any reasonable depth, but a stiff bed of blue clay, of an average thickness of about 15 feet was found under the alluvial sand, this clay resting on a bed of coarse sand and gravel of varying thickness, which itself rested on a bed of clay, the surface of which was nearly level and which from its stratified character was found to be more truly a shale than a clay. These borings showed that though the bridge when built would be of a satisfactory character, the cost of the foundations would be exceptionally large. It was evidently expedient to examine other points in the same neighborhood.

Borings were accordingly made in the spring and summer of 1884 at White Cloud 10 miles below Rulo and at Arago 10 miles above Rulo, these being the nearest points at which the general topography of the country indicated that the construction of a bridge would be feasible. The borings at White Cloud gave better results than at Rulo, as rock bottom was reached, but at Arago, on the east side of the river, hard material was found only at a depth of 123 feet from top of sand bar, this material being a very soft sand stone. The difficulties in approaching a bridge at either of these points were so great that Rulo was selected as decidedly the best location.

The width of the river at ordinary high water stage at Rulo was about 1600 feet, the channel being next to the west shore. This width being greater than the width required to pass the river, it was determined to reduce this width to about 1100 feet by the construction of a dike above the bridge. Construction of this dike was authorized in October 1884, work was begun on the track leading to this dike October 22d; the dike itself was begun on the 4th of December and completed May 7th, 1885, and an extension in the form of a permeable screen made in the following May and June.

Authority for the construction of the bridge was obtained from the general government in 1884 by an Act which became a law June 18th, 1884. This Act is printed in full in Appendix B.

The location of the bridge had been definitely fixed at the time that Rulo was selected in preference to any other place. The character of the bridge was, however, not fixed at this time. It was evident to me from the beginning that the only proper structure was a high bridge without a draw, the western approach to which would run nearly due west connecting with the Atchison & Nebraska Railroad in the Nemaha valley. In this opinion I had the hearty support of Mr. R. J. McClure, Chief Engineer of the Chicago, Burlington & Quincy R. R. and Mr. J. F. Barnard, then General Manager of the Hannibal & St. Joseph R. R. who really had been the first to call attention to the merits of Rulo as a place for crossing the Missouri River.

There was, on the other hand, a decided demand by some of the operating officials of the company for a low bridge, the west approach to connect with the old track of the Atchison & Nebraska R. R. in front of the town of Rulo, which ran south along the Missouri bottom till it reached the Nemaha valley. The merits of a high bridge scheme was its simplicity, a less cost of maintenance of the bridge and the fact that it shortened the through distance two miles. The only advantage of the low bridge scheme was that it avoided the deep cut west of Rulo, and a careful estimate showed that a low bridge would be the more expensive of the two. The difference in opinion prevented an early determination of the plan of bridge and did much to render the cost of real estate on the west side of the river unreasonably large.

In 1885 and before the character of bridge had been determined, I asked for authority to put in the foundation of Pier I (the eastern pier) with a view of determining more fully the character of the material on which the piers would rest. This authority was granted and work was actually begun December 3, 1885, this foundation being finished in the following April.

The character of the bridge was finally determined and the plans were submitted to the Secretary of War for approval July 19, 1886. No effort was made to get this approval quickly, and it was not finally received until February 25, 1887, work, however, had meanwhile been in progress.

In May 1886 authority was given to continue the construction of the bridge in earnest and the work was prosecuted from this time forward without delay under the direct charge of Mr. B. L. Crosby as Resident Engineer.

The winter of 1886-87 was unfavorable for work, it being one in which the ice formed and broke up several times, this causing some delay and increasing the cost of the work.

The last span of the bridge was swung September 24, 1887, and on the afternoon of October 2d the first locomotive crossed the bridge, and it was opened to traffic immediately thereafter.

The great cut on the west approach to the bridge was, however, not yet completed, and for nearly two years the traffic crossing the bridge was taken over the old line between Rulo and Rulo Y.

On June 3, 1889 the excavation for the great cut was completed, though the track remained to be laid and much ditching to be done; on July 14th the first train passed through the great cut. The ballasting of the track through the great cut was completed September 8th.

On November 1, 1889, the bridge with its approaches was turned over to the operating department as a completed structure.

II.

GENERAL DESCRIPTION.

The Rulo bridge is a single track railroad bridge. It consists of three channel spans each 375 feet long between centers of end pins, resting on four piers of granite masonry (numbered from east to west), at each end of which are three 125 feet deck spans, the spans being separated by iron towers 25 feet long, making the length of the iron structure at each end of the channel spans 425 feet. The end pins are placed 4 ft. 6 in. between centers over Piers II and III, and 3 ft. 6 in. between centers over Piers I and IV, and the end pin of the deck span is 1 ft. ½ in. from the back of the bolster, thus making the entire length of the whole structure from end to end of iron or steel work, 1993 feet 1 inch.

The bridge is built on a grade of 0.4 per cent. (21.12 ft. per mile) ascending westward. The clearance at the center of the east span was 53 feet above the water of April 14, 1884, and that at the center of the west span 56 feet above the same high water, this stage of high water being about six feet below the highest water observed except that of 1881; these clearances were both accepted in the approval of the plans by the Secretary of War. The actual clearances above the extraordinary flood of 1881, so far as this can be determined, are 43.5 and 46.5 feet respectively. Since the construction of this bridge, a Standard High Water has been established by the Missouri River Commission at this place (circular of April 24, 1889); the clearances above this high water are 50.8 and 47.8 feet respectively.

The east approach is 15,220 feet long from a connection with the track built by the St. Joseph & Nebraska R. R., in Section 36, T. 61 N., R. 40 W., to the end of the iron work, the maximum grade on this approach being 0.5 per cent. (26.4 ft. per mile.)

The west approach is 19,260 feet long from the west end of the iron work to the connection with the Atchison & Nebraska R. R., the maximum grades being 0.4 per cent. (21.12 ft. per mile) in each direction, excepting a short piece of one per cent. put in temporarily at the connection.

Besides the two approaches proper, a third approach, called the Atchison connection, was built connecting the west approach with the old line of the Atchison & Nebraska R. R., this connection being 1.36 miles long, with maximum grades of 1.5 per cent. (79.2 ft. per mile).

Pier IV the west pier stands on the edge of the river bank which is 530 feet distant from the base of the bluff, the intermediate ground being a piece of bottom land of about the elevation of high water, but which is composed so largely of the tough soil known as gumbo, that the action of the river upon it is very slow. The only protection required was a quantity of riprap revetment at Pier IV and extending a moderate distance above and below; this riprap must be carefully watched and may require extension sooner or later.

The only protection on the east side is the dike, which was the first work done in the construction of the bridge, and which has acted admirably.

All the levels taken during the construction of the bridge were tied to the benches established by the Missouri River Commission and referred to a tide water datum, this datum being 412.71 feet below the St. Louis City Directrix.

III.

SUBSTRUCTURE.

The substructure comprises the four granite piers which support the channel span and sixteen small cylindrical piers which support the towers which carry the deck spans. The principal piers are numbered from I to IV, Pier I beginning at the east end. These four piers are built on pneumatic caissons of the following dimensions:—

Pier I,	53	feet	long,	25	feet	wide	and	18	feet high.
Pier II.	55	"	"	27	"	"	"	18	" "
Pier III,	55	"	"	27	"	"	"	18	" "
Pier IV,	53	"	"	25	"	"	"	30	" "

All caissons were built with a side batter of one in twenty-four.

The foundations were put in by the company's own men under the direction of the Resident Engineer. The masonry was built by contract by the firm of Drake & Stratton.

The caisson for Pier I was built in a pit excavated on the dry sand bar on the east side of the river. The caissons for Piers II and III were built in position on pile false work and lowered with screws to the bottom of the river. The caisson for Pier IV was built in a pit excavated in the shore close to the river.

The pneumatic machinery was purchased from the Missouri Valley & Blair Railway and Bridge Co., and was the same machinery that had been used in sinking the foundations of the bridge at Blair crossing. The machinery was first set up on the east side of the river near the site of Pier I. Subsequently all of the machinery was transferred to the steamer John Bertram, which was purchased from the Sioux City & Pacific R. R., having been built to be used as a car transfer boat at Blair Crossing. This steamer arrived at Rulo May 28, 1886, and when equipped with the full outfit of pneumatic machinery, formed an admirable tool.

The caisson for Pier I was built of pine with an iron cutting edge and planked with two thicknesses of pine plank. The other caissons were built in the same way, except that the iron cutting edges were made heavier and the large sill timbers were of oak.

The caisson for Pier I is surmounted by 53 feet of crib work built in three sections and stepped down to 46 feet by 18 feet at the top of the upper section. The caissons for Piers II and III are surmounted by 42 feet of crib work built with the same batter as the caissons, but with the corners cut off so as to make the horizontal section that of an irregular octagon, the crib being sheathed with oak plank and the corners plated with 3-8 inch iron.

The caisson for Pier IV is surmounted by 50 feet of crib work 48 feet by 20 feet, the sides being plumb.

Both caissons and crib work were filled with Portland cement concrete.

The excavation of the pit for Pier I was begun December 3rd, 1885, the framing of the caisson December 14th and the setting up of the cutting edge January 15, 1886.

The caisson was finished February 13th and the concrete filling was begun February 18th. Air pressure was put on February 20th and on March 19th the caisson reached the clay at elevation 792.1. After sinking about four feet into the clay a test pit was begun March 30th and sunk 19.3 ft. through the first clay into the gravel which separated the upper clay from the lower clay and which at the site of this pier was only 3.4 feet thick. No increase of air pressure was required during the sinking of this test pit until the gravel was reached, and then it became necessary to increase the pressure at once to the full amount corresponding to the actual depth. This test pit showed the upper clay to be a perfectly homogeneous layer on which it was considered safe to found Piers I and IV, while it was thought best to sink Piers II and III to the lower clay. The test pit having served its purpose the excavation was filled up and the sinking of the caisson was continued till April 5th when an elevation of 785.88 was reached. The sealing of the working chamber was begun on the following day and completed on the 9th of April, thus finishing the first foundation.

No further work was done on the foundation till after the high water season, when the first foundation taken in hand was Pier IV.

The excavation of the pit for Pier IV was begun July 15th, 1886; erection of the cutting edge on July 23rd and the caisson was completed and lowered on the ground August 17th. Concreting was begun August 19th and air put on this caisson August 22nd. The caisson reached the upper clay at elevation 799.2 September 9th. The clay, though identical in character with that found at Pier I, showed signs of having been disturbed. A test pit was sunk in this clay and while it was being sunk a horizontal crack was observed on which the upper portion moved over the lower portion about 1½ inches in a south easterly direction. It became perfectly evident that it was necessary to sink to lower clay, which was an expensive process. On the 19th of October a leak was discovered in the well leading to the air lock, and further trouble was experienced in the same way three days later, this defect being clearly due to bad workmanship. The caisson finally reached the lower clay on the 29th of October and on the 5th of November sinking was stopped at elevation 765.09 and sealing begun. The sealing was completed on the 8th of November and air let off on the following day.

No masonry was laid on either Pier I or IV until the completion of the foundation.

The first work done on Pier III was to drive a pile break water above the pier, which was begun September 11th, 1886, and this was immediately followed by the construction of the falsework. The erection of the caisson was begun October 9th and finished November 9th. Shallow water was obtained by sinking brush below the pile protection and thus forming a sand bar at the pier site. Meanwhile, a winter bridge had been built by the Operating Department about one quarter of a mile below the bridge line, and this bridge caused an ice pack which extended above the bridge line and caused very serious trouble. On the 24th of November the caisson was lowered until it floated on the water. Concreting was begun on the following day, but the trouble with ice prevented rapid progress. On the 28th of November all access to the pier was cut off by ice and a gang of thirty men were imprisoned there till the following morning. These difficulties were over on December 1st and the construction of the crib was begun, on the 4th of December air pressure was put on. The crib was finished January 9, 1887, its concrete filling January 11th, and masonry was begun January 14th. On the 6th of January the caisson had reached the first clay; on February 10th it had passed through the first clay and reached the gravel. The second clay was reached at elevation 766.9 on March 12th. From the 1st of March to March 10th it became necessary to abandon the foundation while the ice went out. On March 18th the foundation was again abandoned just as it was ready for sealing, and during the high water of the next two weeks, the pier was entirely submerged. On the 12th of April air pressure was again put on and it was found that the caisson had settled 1.14 ft. into the clay. In order to fit the courses of masonry it became necessary to sink 1.07 ft. further to elevation 763.53. On the 19th of April the sealing of the working chamber began and the foundation was finished on the 26th.

The first work done on Pier II was on the 5th of January 1887, when the driving of piles for the staging was begun. The erection of the cutting edge was begun on the 14th and the caisson was finished on February 5th; it was lowered on the 10th of February, landed on the 12th and air pressure put on on the 15th, the machinery on the Bertram supplying air for both Piers II and III and the sinking being continued in this way till the 23rd of February. Air pressure was again put on on the 18th of March; the crib and concrete filling were finished on the 8th of April, and the upper clay was reached on the 10th of April. The pier was abandoned April 12th so as to leave the steamer free to work on Pier III; work was resumed April 26th, and was then continued without interruption; the second clay was reached June 4th, the sealing of the working chamber began on the 10th, and this, the last foundation of the Rulo Bridge, was completed June 18th.

The sinking through clay was greatly facilitated by the use of a special air lock with an elevator arrangement attached by which the air pressure in the caisson was made to lift a bucket of clay to a lock above the masonry, which lock was worked entirely from the outside and when opened the bucket was dumped by the outside attendant. This special lock, known among the engineers as a "clay hoist" and among the workmen as a "go-devil" is shown in detail on Plate 10; the movement is precisely the same as that commonly used in hydraulic elevators, except that instead of water pressure, the air from the caisson was made available for power.

The full details of the four piers are given on Plates 4, 5, 6 and 7, and of the caissons on Plate 8. The rate of progress is shown graphically on Plate 9. Full records of the progress and details of sinking these foundations were kept and are given in Appendix D. The detail cost is given in Appendix E.

The cost of the four foundations is shown in detail in the table below.

This cost includes all concrete and other material below the masonry.

In this statement the item of freight charges is simply what is known as "company's freight" being freight on the lines of the C. B. & Q. R. R. system.

	Cost, excluding Freight Charges.	Freight Charges.	Cost, including Freight Charges.			
FOUNDATION I:						
CAISSON—						
Materials	$3,879.25	$ 569.53	$ 4,448 78			
Labor	1,928.17	—	1,928.17	$ 6,376.95		
CONCRETE FILLING—						
Materials	4,044.22	1,153.02	5,197.24			
Labor	1,536.99	—	1,536.99	6,734.23	$13,111.18	
CRIB—						
Materials	3,935.11	1,121.05	5,056.16			
Labor	1,264 97	—	1,264.97	6,321.13		
CONCRETE FILLING—						
Materials	6,889.20	1,372.85	8,262.05			
Labor	2,306.13	—	2,306.13	10,568.18	16,889 31	
CUTTING EDGE, AIR-LOCK, SHAFTS, ETC.	2,124.96	303.44	2,428.40	—	2,428.40	
SINKING—						
Materials	1,184 76	297.64	1,482.40			
Labor	9,440.52	—	9,440.52		10,922.92	
ERECTION AND REMOVAL OF MACHINERY	1,999.85	—	1,999 85	—	1,999.85	
	40,534 13	4,817.53				$45,351.66
FOUNDATION II:						
CAISSON—						
Materials	3,314.51	1,053.24	4,367.75			
Labor	3,079.51	—	3,079.51	7,447.26		
FALSE WORK—						
Materials	1,051.86	291.12	1,342.98			
Labor	981.68	—	981.68	2,324.66		
CONCRETE FILLING—						
Materials	4,182.06	1,101.70	5,283.76			
Labor	3,169.65	—	3,169 65	8,453.41	18,225.33	
CRIB—						
Materials	2,648.81	860.87	3,509,68			
Labor	2,349.19	—	2,349.19	5,858.87		
CONCRETE FILLING—						
Materials	6,371.15	1,600.74	7,971.89			
Labor	3,896 89	—	3,896 89	11,868.78	17,727.65	
CUTTING EDGE, AIR-LOCK, SHAFTS, ETC.	3,850.65	344.34	4,194.99	—	4,194.99	
SINKING—						
Materials	2,001.54	557.63	2,559.17			
Labor	15,827.67	—	15,827.67		18,386.84	
ERECTION AND REMOVAL OF MACHINERY	549 86	—	549.86	—	549.86	
	$53,275.03	$5,809.64				$59,084.67
FOUNDATION III:						
CAISSON—						
Materials	$3,265,21	$ 983.55	$4,248.76			
Labor	4,077.20	—	4,077.20	$ 8,325.96		
FALSE WORK—						
Materials	785.97	119.91	905.88			
Labor	1,249.73	—	1,249.73	2,155.61		
CONCRETE FILLING—						
Materials	4,036.01	911.76	4,947.77			
Labor	3,317 58	—	3,317.58	8,265.35	$18,746.92	
CRIB—						
Materials	3,286.68	994.89	4,281.57			
Labor	2,664.74	—	2,664.74	6,946.31		
CONCRETE FILLING—						
Materials	7,253.66	1,274 60	8,528.26			
Labor	3,884.73	—	3,884.73	12,412.99	19,359.30	
CUTTING EDGE, AIR-LOCK, SHAFS, ETC.	4,256.63	315 89	4,572.52	—	4,572.52	
SINKING—						
Materials	2,223.83	537.71	2,761.54			
Labor	19,697 44	—	19,697.44		22,458.98	
ERECTION AND REMOVAL OF MACHINERY	520.59	—	520.59	—	520.59	
	60,520.00	5,138.31				$65,658.31
FOUNDATION IV.						
CAISSON—						
Materials	3,980.38	806.05	4,786.43			
Labor	2,551.45	—	2,551.45	7,337.88		
CONCRETE FILLING—						
Materials	4,092.87	550.00	4,642.87			
Labor	1,917.96	—	1,917.96	6,560.83	13,898.71	
CRIB—						
Materials	2,586 37	497.66	3,084.03			
Labor	2,134 96	—	2,134 96	5,218.99		
CONCRETE FILLING—						
Materials	7,088.43	1,329.03	8,417.46			
Labor	1,986.97	—	1,986.97	10,404.43	15,623.42	
CUTTING EDGE, AIR-LOCK, SHAFTS, ETC.	3,155.20	337.53	3,492.73	—	3,492.73	
SINKING—						
Materials	1,733.42	373.58	2,107.00			
Labor	15,047.99	—	15,047.99	—	17,154.99	
ERECTION AND REMOVAL OF MACHINERY	478.26		478,26	—	478.26	
	46,754.26	3.893.85				$50,648.11
GRAND TOTAL COST OF FOUR MAIN FOUNDATIONS	$201,083.42	$19,659.33				$220,742.75

It will be observed that the cost of the foundation of Pier III was $6,574 more than that of Pier II although the quantities of material are almost identical in the two piers, the extra cost being due to the interruption and other difficulties from ice and the incidental troubles connected therewith.

The contract for the masonry was let on July 23rd, 1886 to Geo. S. Field & Co. and transferred by them on the 2nd of August with my consent to the firm of Drake & Stratton. The dimension work is of granite quarried near St. Cloud, Minn.; the backing is of Anamosa limestone from Stone City, Iowa.

The specifications for the masonry are given in Appendix C.

The first stone laid was on Pier IV, the masonry of this pier being begun November 27th, 1886 and finished March 25th, 1887. The masonry of Pier III was begun January 14th, 1887 and completed May 19th, 1887. The masonry for Pier II was begun April 12th, 1887, and finished August 10th, 1887. The masonry for Pier I was begun April 19th, 1887, and completed August 9th, 1887.

The cost of masonry is shown in detail in the following table:

	PIER I.				PIER II.				PIER III.				PIER IV.			
Estimate—																
Masonry laid @ $27.40 per cubic yard	cu. yds. 561.80	—	—	$15,393.32	cu. yds. 128.59	—	—	$35,233.66	cu. yds. 1.317.00	—	—	$36,085.80	cu. yds. 814.40	—	—	$22,314.56
Labor—Replacing Course	—	—	—	—	—	—	—	9.10	—	—	—	5.30	—	—	—	—
Cutting and Drilling for Cramps	—	—	—	—	—	—	—	32.40	—	—	—	—	—	—	—	—
130 lbs. ⅞ in. Round Iron for Cramps	—	—	—	—	—	—	—	3 90	—	—	—	—	—	—	—	—
Freight Charges on Stone	—	—	$655.09	—	—	—	$1,599.56	—	—	—	$1,515.69	—	—	—	$993.62	—
Freight Charges on Sand	—	—	126.23	—	—	—	289.93	—	—	—	295.91	—	—	—	182.95	—
				781.32				1,889.49				1,811.60				1,176.57
	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Eagle Cement @ $2.55 per bbl.	bbls. 107	$273.75	—	—	bbls. —	—	—	—	bbls. —	—	—	—	bbls. —	—	—	—
Freight Charges	—	100.57	—	—	—	—	—	—	—	—	—	—	—	—	—	—
			374.32													
Alsen Cement @ $2.70 per bbl.	24	64.80	—	—	202	$545.40	—	—	428	$1,155.60	—	—	389	$1,050.30	—	—
Freight Charges	—	10.34	—	—	—	100.43	—	—	—	254.76	—	—	—	191.77	—	—
			75.14				645.83				1,410.36				1,242.07	
Alsen Cement @ $2.80 per bbl.	26	72.80	—	—	187	523.60	—	—	—	—	—	—	—	—	—	—
Freight Charges	—	10.92	—	—	—	92.97	—	—	—	—	—	—	—	—	—	—
			83.72				616.57									
Alsen Cement @ $3.25 per bbl.	69	224.25	—	—	5	16.25	—	—	—	—	—	—	—	—	—	—
Freight Charges	—	9.90	—	—	—	.18	—	—	—	—	—	—	—	—	—	—
			234.15				16.43									
Dyckerhoff Cement @ $2.72 per bbl.	60	163.20	—	—	233	633.76	—	—	220	598.40	—	—	52	141.44	—	—
Freight Charges	—	29.77	—	—	—	115.85	—	—	—	130.96	—	—	—	25.63	—	—
			192.97				749.61				729.36				167.07	
				960 30				2,028 44				2,139.72				1,409.14
Total	—	—	—	$17,134.94	—	—	—	$39,196.99	—	—	—	$40,042.42	—	—	—	$24,900.27
Cost per Yard of Masonry	—	—	—	30.50	—	—	—	30.48	—	—	—	30.40	—	—	—	30.57
Average Cost per Yard of Masonry	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	30.49

The total cost of the four piers including the foundations and masonry is given in the following table:

	Cost, excluding Freight.			Freight Charges.			Cost, including Freight.			Gross Volume.	Cost per Cubic Ft.	Cu. Ft. Sunk (Area of base × feet sunk)	Cost per Cubic Ft.	Vertical Ft. Sunk below Standard Low Water.	Cost per Vertical Foot.
FOUNDATION I:										Cubic Feet.	Cents.		Cents.		
Caisson and Filling	$13.513.59	—	—	$2,025.99	—	—	$15 539 58	—	—	23,093.16	67.2				
Crib and Filling	14,395.41	—	—	2,493 90	—	—	16,889.31	—	—	53,568.12	31.5				
Sinking Caisson	10,625.28 }	—	—	297.64	—	—	12,922.77	—	—	—	—	760.02	16.6	57.36	$220.10
Erection and Removal of Machinery	1,999.85 }	$40.534.13			$4.817.53			$45.351.66							
FOUNDATION II:															
Caisson and Filling	19,629.92	—	—	2,790.40	—	—	22,420.32	—	—	25,930 31	86.4				
Crib and Filling	15,266.04	—	—	2,461.61	—	—	17,727.65	—	—	45,764.09	38.7				
Sinking Caisson	17,829.21 }	—	—	557.63	—	—	18,936.70	—	—	—	—	115.488.45	15.9	77.77	236.34
Erection and Removal of Machinery	549.86 }	53.275.03			5,809.64			59.084.67							
FOUNDATION III:															
Caisson and Filling	20,988.33	—	—	2,331.11	—	—	23.319 44	—	—	25.930.31	89.9				
Crib and Filling	17,089 81	—	—	2,269.49	—	—	19,359.30	—	—	46,015.00	42.1				
Sinking Caisson	21,921.27 }	—	—	537.71	—	—	22,979.57	—	—	—	—	118,369.35	19.0	79.71	281.76
Erection and Removal of Machinery	520.59 }	60,520.00			5,138.31			65,658.31							
FOUNDATION IV:															
Caisson and Filling	15,697.86	—	—	1,693.58	—	—	17,391.44	—	—	27,368.21	63.5				
Crib and Filling	13,796.73	—	—	1,826.69	—	—	15,623.42	—	—	49,563.36	31.5				
Sinking Caisson	16,781.41 }	—	—	373.58	—	—	17,633.25	—	—	—	—	103,548.75	16.6	78.15	219.51
Erection and Removal of Machinery	478.26 }	46,754.26			3,893.85			50,648.11							
COST OF FOUNDATIONS	—	—	$201,083.42	—	—	$19,659.33	—	—	$220,742.75						
MASONRY PIER I	—	16,192.12	—	—	942.82	—	—	17,134.94							
" " II	—	36,998.07	—	—	2,198.92	—	—	39,196.99							
" " III	—	37,845.10	—	—	2,197.32	—	—	40,042.42							
" " IV	—	23.506 30	—	—	1,393.97	—	—	24,900.27							
TOTAL COST OF MASONRY			114,541.59			6,733.03			121,274.62						
TOTAL COST OF FOUR PIERS,	—	—	$315,625 01	—	—	$26,392.36			$342,017.37						

The towers which carry the approach spans are supported on brick piers, the plans of which are given on Plate 12. An excavation was made at the site of each pier in which nine piles were driven; a further excavation was then made around the piles and filled with concrete. In this concrete was buried an annular washer from which six anchor rods extended upwards. The pier was then built up with hard brick laid in Portland cement mortar around the rods and surmounted with a wrought iron cap plate. Another annular washer was then placed on this cap plate and the rods screwed up till an initial strain of five tons was obtained in each rod; the cap plate, which was formed of a plate and a circular channel iron was then filled with Portland cement concrete; a second cap plate was then put on top and the whole riveted up. The design was based on the principle that the tension in the rods would always keep the brick work under strain and so prevent its jarring loose. These piers were built by the day by the company's own men, the total cost of the 16 piers being $23,264.66 of which $1,479.55 was for freight.

The amount of masonry and concrete in the entire bridge is as follows:

	MASONRY. Cubic Yards.	BRICK. Cubic Yards.	CONCRETE. Cubic Yards.	TOTAL.
Pier I	561.8	—	2,109 8	2,671.6
Pier II	1,285.9	—	1,986.1	3,272.0
Pier III	1,317.0	—	1,949.0	3,266 0
Pier IV	814.4	—	2,267.0	3,081.4
16 Small Piers	—	263.8	266.7	530.5
Total	3,979.1	263.8	8,578 6	12,821.5

The total cost of the substructure was then as follows:

Four Main Piers	$342,017.37
Sixteen Small Piers	23,264.66
	$365,282.03

The east end of the east deck span rests on a timber pier around which the embankment has now been filled; the west end of the west approach span rests upon a concrete block resting on the embankment and allowed to settle with the embankment, the end of the span being raised as settlement occurs. Both the timber pier and the concrete block have been treated in the accounts as parts of the approaches, though this distribution is not strictly correct.

IV.

SUPERSTRUCTURE.

The superstructure consists of three through spans and six deck spans, three at each end.

Each through span is 375 feet long between centers of end pins, fifty feet deep and twenty-two feet between centers of trusses. Expansion is provided at the west end of every span, that is at the upper end, the bridge being on a grade.

Each deck span is 125 feet long between centers of end pins, 17 feet 6 inches deep, the trusses placed 12 feet between centers. The spans are separated by iron towers 25 feet long, thus making each set of deck spans with intermediate towers a continuous structure 425 feet long, divided into 17 equal panels of 25 feet each. The trusses are fastened rigidly to the posts which form the towers; expansion is provided at each end of the 425 feet, the expansion of the central span being taken out by the spring of the towers.

Proposals were invited from a number of prominent bridge builders and on the 2d of August 1886 the contract for the superstructure was closed with the Edgemoor Iron Co., by whom the entire work was manufactured. With my approval the Edgemoor Iron Co. sub-let the erection to the firm of Baird Bros., and it was done under the immediate direction of Mr. Andrew Baird.

The through spans are of the double system Whipple type, the trusses being divided into 15 panels of 25 feet each. The top chord, end posts, eye bars, floor beams, rods, bolsters, rollers, rail-bearing plates and pins, are of steel. All other parts are of wrought iron except the heavy wall plates resting on the masonry, washers and ornamental work, which are of cast iron. The details of these spans are given on Plates 14, 15, 16, 17 and 18.

The deck spans are of the single system Whipple type. The pins, rollers, rail-bearing plates and eye bars are of steel. The other portions are of wrought iron except the heavy wall pedestals, which are of cast iron. The details of these spans are given in Plates 19 and 20.

The trusses of the long spans were proportioned to carry a uniform moving load of 3000 lbs. per lineal foot of bridge, the effect of a moving load in excess of that due to a uniform load of equal intensity being estimated on the basis of 5000 lbs. per foot.

The floor system is proportioned for a total load of 6000 lbs. per lineal foot of track. The top lateral system is proportioned to resist a wind pressure of 300 lbs. per lineal foot and the bottom lateral system a wind pressure of 500 lbs. per lineal foot. The computed strains are given on Plate 22.

The deck spans are proportioned for a total load of 5000 lbs. per foot, all treated as moving load.

The steel compression members in top chords and end posts are made as nearly as possible of symmetrical section, the metal in the top cover plate being practically the same as in the two balance plates and the lacing below. The compression strains on these members was limited to 15,000 lbs. per square inch of net section, the net section being obtained by deducting from the gross section the amount by which the cover plate exceeds the balance plates. The tensile strain in the bottom chord was limited to 14,000 lbs. per square inch and somewhat less in the web members.

In the approach spans the tensile strain on steel was limited to 13,000 lbs. per square inch, the largest strain being in the center panel of the bottom chord.

The weights of iron and steel in the through spans are as follows:

	Three Spans.		Average per Span.	
	lbs.	lbs.	lbs.	lbs.
Steel	—	1,554,168	—	518,056
Wrought Iron in Trusses	860,127		286,709	
Wrought Iron in Floor	483,867		161,289	
Total Wrought Iron		1,343,994		447,998
Cast Iron	—	60,056	—	20,019
Total	—	2,958,218	—	986,073

The weights of iron and steel in the deck spans are as follows:

	Six Spans.		Average per Span	
	lbs.	lbs	lbs.	lbs
Steel	—	170,379	—	28,396
Wrought Iron in Trusses	343,913		57,319	
Wrought Iron in Floor	278,266		46,378	
Total Wrought Iron		622 179		103,697
Cast Iron	—	7,094	—	1,182
Total	—	799,652	—	133,275
Four Towers	—	213,441		
Total		1,013 093		

The specifications under which the superstructure was manufactured are given in Appendix F.

The steel was all open hearth steel, the total number of melts used being 161, made by the following parties:

Cambria Iron and Steel Co.	82 melts.
Carnegie, Phipps & Co., Limited	52 "
Pennsylvania Steel Co.	5 "
Pittsburgh Steel Casting Co.	22 "

The work was manufactured by the Edgemoor Iron Co. at its works near Wilmington, Dela.

The first set of eye bars tested did not meet the requirements of the specifications, a considerable number of them breaking in the head; it seemed probable, however, that the breakage was not due to any defect in the bars, but to the fact that the machine was not strong enough to break them and that its own failings caused irregular strains. I therefore thought best to open the question anew and make the rejection of the bars depend on a second set of tests to be made in the large testing machine at Athens, Penna.; the results of these tests are given in Appendix G and on these tests the eye bars were accepted.

The trusses were erected on pile false work, a large traveler taking the place of upper false work. Thedates at which the several parts were erected is shown in the following table:

	First Iron Placed.	Span Swung.
East Approach Spans . . .	Sept. 4, 1887.	Sept. 14, 1887.
Span I-II	Sept. 18, 1887.	Sept. 24, 1887.
Span II-III	Aug. 14, 1887.	Aug. 18, 1887.
Span III-IV	May 21, 1887.	May 27, 1887.
West Approach Spans	April 13, 1887.	July 20, 1887.

The last span would have been swung three days earlier but was delayed waiting for material.

The timber floor was placed on the superstructure by the company's own men, working under the direction of the Resident Engineer. The painting was also done by the company's own men working under the direction of the Resident Engineer.

The total cost of the superstructure is given in the following table:-

THROUGH SPANS.			
Iron, Steel and Ornamental Work	$103,827.91		
Freight Charges on same from Chicago	4,001.34		
		$107,829 25	
Labor,—Erection	—	29,730.00	
Miscellaneous Material: Cement, Iron Borings, Sal [Ammonia, Sulphur	—	57.75	
			$137.617.00
DECK SPANS.			
Iron and Steel	33.854.76		
Freight Charges	1,442.40		
		35,297.16	
Labor—Erection	—	6,499.00	
Filling Castings	—	13.85	
Jacking up End of Spans	—	31.81	
Boxing Bars	—	18.00	
Switching Charges	—	2.75	
Miscellaneous Material: Iron Borings, Sal Ammonia &c.	—	55.84	
			41,918.41
FLOOR.			
Material	—	7.771.23	
Freight	—	922.48	
Labor	—	2,802.12	
			11,495 83
PAINTING.			
Material	—	1,340.95	
Labor	—	4,107.87	
			5,448.82
Total Superstructure, ...	—	—	$196,480.06

V.

APPROACHES.

The east approach to the Rulo Bridge is 2.88 miles long from the connection with the track of the St. Joseph & Nebraska R. R. to the east end of the iron work. Of this approach the 2000 feet next to the bridge was built originally as a timber trestle and subsequently filled in with material hauled from the great cut on the west approach. The remainder of the approach was built as an earth embankment, the material being generally borrowed from the sides, though a portion of the higher embankment was taken with a steam shovel from a pit in the bottom land. The total amount of earth in this Approach is as follows:—

Borrowed from sides . . .	229,853 cubic yards.
Borrowed from steam shovel pit	150,775 " "
Hauled from west side . .	326,970 " "
Total	707,598 cubic yards.

The west approach is 3.64 miles long from west end of the iron work to the connection with the Atchison & Nebraska track in the Nemaha bottom. There are on this Approach three cast iron pipe culverts and four small trestles having an aggregate length of 495 feet. All the remainder is earth work the total quantity being as follows:—

Earth excavation	hauled to east side	. . .	326,970 cubic yards.
"	" used in embankment	. .	240,173 " "
"	" wasted	. . . .	32,358 " "
"	" borrowed	. . . . . .	44,340 " "
Rock	"	. . . .	2,700 " "
	Total	. . . .	646,541 cubic yards.

These quantities include an extra width of grading for a distance of 1200 feet at the Rulo station grounds.

The Atchison connection is 1.36 miles long leading southward from the west approach, with which it connects 760 feet from the west end of the iron work. There is a trestle 680 feet long in the town of Rulo, and a pile trestle 48 feet long near the connection with the old track, the remainder of the line being earthwork. The amount of material handled on this line was 42,718 cubic yards.

The alignment and gradients on the Approaches are shown on Plate 2.

The contract for the earthwork of the Approaches was let May 19, 1886, to S. Dwight Eaton, of Burlington, Iowa. This contract covered both the East and West Approaches and the Atchison connection; it was not signed till June 26, 1886.

Grading was begun on the Atchison connection June 18, 1886, on the West Approach June 22d and on the East Approach July 13, 1886. The line from the east end of the great cut to the connection with the Atchison & Nebraska track was not built till after the bridge was opened, the line to the west being made by way of the Atchison Connection, trains running backwards between Rulo Station and Rulo Y, although the bridge was opened for traffic on the 2d of October.

No earth was taken across the river from the great cut till November 23, 1887. More than seven weeks of the best season of the year being lost through unnecessary delays; from that time forward the work was handled with rather more efficiency and the entire West Approach was completed and ready for the track on June 3d, 1889.

The great cut has a maximum depth of 82 feet. It is excavated through material of a mixed character, it being generally a sandy clay but containing some masses of hard blue clay and pockets of sand; these pockets of sand were generally filled with water, which water ran out when the excavation was made and did not reappear. The bottom of the cut is formed everywhere of hard clay, excepting near the summit at the west end. The cut was laid out with a 50 foot base with slopes of one horizontal to two vertical. In some instances these slopes were slightly increased, and some of the material was left in the base so that the finished width was generally not more than 40 feet. The cut was thoroughly ditched, left of sufficient width to be kept clean permanently, and the track was thoroughly ballasted. The character of the material, however, in this cut is such that it will require constant attention for a number of years in keeping the ditches clean, so as to avoid saturating the material in the sides of the cut by standing water; I regret to say that this has not been properly attended to since the work was completed.

A line nine tenths of a mile long was built connecting the East Approach with the dike above the bridge, the only object being to make a convenient line of access in case any repairs should be needed after the old tracks on the east side should be taken up; this line has at the east end a grade of three per cent. 158.4 ft. per mile.

VI.

PROTECTION WORK.

The principal protection work is the dike on the east side. The position and plans of this dike are shown on Plate 23. The foundation of the dike was made of a woven willow mattress 125 feet wide, extending 100 feet inside and 25 feet outside of the center line of the track laid on the dike. On this as a foundation was built an embankment of brush and rock, which was carried to an elevation of 856 and on which a track was laid. This dike was built by the company's own forces in the winter of 1884 '85.

The dike was subsequently extended 700 feet down stream to Pier I by a permeable screen made by driving a series of piles through a woven mattress 50 feet wide and subsequently putting another mattress on the outside of the piles the lower edge resting on the first mattress and the upper edges wired to the piles. The effect of this screen was to allow the river to permeate through the screen so that there would be a current on both sides of the screen and thus entirely prevent the formation of an eddy at the lower end of the dike.

The dike worked perfectly, and during the high water season of 1885, a deposit was formed below it nearly as high as the top of the dike. A good growth of willows now covers the ground between the dike and the bridge line.

There was used in the construction of the dike 3571 cords of brush, 8712 tons of riprap stone, 2273 feet of piles and 4223 lbs. of wire.

The only protection work done on the west side was to riprap the shore in the neighborhood of Pier IV; for this 2530 tons of stone were used.

VII.

COST.

The cost of the bridge and approaches is given in the following table:

	Cost exclusive of Freight Charges.			Freight Charges.			Cost, including Freight.		
Protection East Shore	$ 14,495.02			$4,028.63			$18,523.65		
Protection West Shore	2,048.42			956.85			3,005.27		
Total Protection			$16,543.44			$4,985.48			$ 21,528.92
Foundation Pier I	40,534.13			4,817.53			45,351.66		
Foundation Pier II	53,275.03			5,809.64			59,084.67		
Foundation Pier III	60.520.00			5,138.31			65.658.31		
Foundation Pier IV	46,754.26			3,893.85			50,648.11		
Total Foundations		$201,083.42			$19,659.33			$220,742.75	
Masonry Pier I	16,192.12			942.82			17,134.94		
Masonry Pier II	36,998.07			2,198.92			39.196.99		
Masonry Pier III	37,845.10			2,197.32			40,042.42		
Masonry Pier IV	23,506.30			1,393.97			24,900.27		
Total Masonry		114,541.59			6,733.03			121,274.62	
Approach Piers	—	21,786.11		—	1,478.55		—	23,264.66	
Total Substructure	—		337,411.12	—		27,870.91			365.282.03
Through Spans	133,615.66			4,001.34			137,617.00		
Deck Span	40,476.01			1,442.40			41,918.41		
Bridge Floor	10,573.35			922.48			11,495.83		
Painting	5,448.82			—			5,448.82		
Total Superstructure			190,113.84			6,366.22			196,480.06
East Approach, Grading and Masonry *	74,813.56			2,881.20			77,694.76		
East Approach, Trestle	18,907.08			3,242.79			22,149.87		
West Approach, Grading and Masonry	151,481.64			6,528.08			158,009.72		
West Approach, Trestle	3,528.43			403.68			3,932.11		
Atchison Connection, Grading and Masonry	8,632.12			70.67			8,702.79		
Atchison Connection Trestle	6,906.34			350.11			7,256.45		
Permanent Track	72,705.99			4,319.91			77,025.90		
Total Approaches			336,975.16			17,796.44			354,771.60
Service Tracks,	14,314.16			680.58			14,994.74		
Tools and Machinery	12,327.42			1,467.11			13,794.53		
Buildings	3,800.51		30,442.09	197.69		2,345.38	3,998.20		32,787.47
Engineering Salaries	45,400.64						45,400.64		
Engineering and Office Expenses	4,134.03		49,534.67				4,134.03		49,534.67
Total cost			$961,020.32			$ 59.364.43			$1,020,384.75

The item of freight includes freight only over the C. B. & Q. System. In comparing the cost of this bridge with that of other structures the cost without freight forms the most correct basis for comparison.

This table may be condensed into the following:

	Cost, exclusive of Freight Charges	Freight Charges.	Cost, including Freight Charges.
Substructure	$337.411.12	$27.870 91	$365.282.03
Superstructure	190,113.84	6,366.22	196,480 06
Total Bridge Propei	527,524.96	34.237.13	561,762.09
Protection Works	16,543.44	4,985.48	21,528.92
Approaches	336,975.16	17,796.44	354.771.60
Service Tracks, Tools and Buildings	30,442.09	2,345.38	32,787.47
Engineering and Expenses	49.534.67	—	49,534 67
Total Cost	$961,020.32	$59,364.43	$1,020,384 75

This is the total cost of the Rulo bridge and approaches as built under my charge; the following additional items have, however, been charged to the cost of the bridge:

Land Damages	$46,721.35
Watching	5,296.91
Preliminary Expenses	340.25
Rulo Yard	98.34
	$52,456.85

Which makes the total cost $1,072,841.60. Against this the construction cost is really entitled to a considerable credit for the amount of abandoned line on each side of the river. The item of watching covers the 25 months from October 1, 1887 to November 1, 1889, during which whole period the bridge was in use.

APPENDIX A.

LIST OF ENGINEERS, CONTRACTORS AND EMPLOYEES.

ENGINEERS AND COMPANY'S EMPLOYEES.

NAME AND OCCUPATION.	TIME OF SERVICE.
Geo. S. Morison, Chief Engineer.	
Benjamin L. Crosby, Resident Engineer	Sept. 13, 1883, to Dec. 31, 1889.
Edwin Duryea, Jr., Assistant Engineer	Mar. 22, 1886 " Nov. 21, 1886.
Mark A. Waldo, Assistant Engineer	May 29, 1886, " June 16, 1887.
W. S. Macdonald, Assistant Engineer	Aug. 9, 1886, " Feb. 25, 1889.
A. J. Himes, Assistant Engineer	July 7, 1888, " Oct. 31, 1889.
W. R. Johnson, Rodman	Nov. 17, 1885, " Oct. 31, 1889.
J. M. Richardson, Clerk	July 18, 1886, " Oct. 31, 1889.
R. F. Thayer, Timekeeper	June 23, 1886, " Aug. 13, 1887.
E. P. Butts, Inspector of Stone at Quarries	Sept. 1, 1886, " July 15, 1887.
John Naegeley, Inspector of Superstructure	Sept. 20, 1886, " Oct. 6, 1887.
Paul Willis, Assistant Inspector of Superstructure	Dec. 15, 1886, " July 13, 1887.
P. H. Aylward, Supt. Pressure Work	Feb. 12, 1886, " Sept. 1, 1887
Charles Connor, Master Mechanic	Dec. 10, 1885, " July 23, 1887.
J. Rick, Foreman of Carpenters,	Dec. 11, 1885, " May 13, 1886.
S. S. Warrington, Foreman of Carpenters	June 10, 1886, " Apr. 7, 1887.
Birton Reed, Inspector of Masonry	Nov. 19, 1886, " Feb. 25, 1887.
Charles Stears, Inspector of Masonry	May 4, 1887, " July 18, 1887.
John Newman, Foreman of Laborers	Nov. 28, 1884, " Feb. 25, 1887.

CONTRACTORS.

NAME.	NATURE OF WORK.
Drake & Stratton	Masonry.
James Doig, Supt. at Rulo.	
Edgemoor Iron Co.	Superstructure.
Baird Bros., Sub-Contractors for Erection.	
S. Dwight Eaton	Grading Approaches.
J. S. Wattles	East Approach Trestle.

APPENDIX B.

ACT OF JUNE 18, 1884, AUTHORIZING CONSTRUCTION OF RULO BRIDGE AND CONTRACT WITH WAR DEPARTMENT.

An act to anthorize the construction of a bridge across the Missouri River at some accessible point within ten miles north and ten miles south of the town of Rulo, in the county of Richardson, in the State of Nebraska.

Be it Enacted by the Senate and House of Representatives of the United States of America in Congress Assembled:—

That the Atchison and Nebraska Railway Company, an incorporation organized under the laws of the State of Nebraska, is hereby anthorized to construct and maintain a bridge across the Missouri River at such a point as may be hereafter selected by said corporation within ten miles north and ten miles south of the town of Rulo, in the county of Richardson, in the State of Nebraska, as shall best promote the public convenience and welfare and the necessities of business and commerce, and also to construct accessory works to secure the best practicable channel-way for navigation and confine the flow of the water to a permanent channel at such point, and also to lay on and over said bridge a railway track for the more perfect connection of any railroads that are or shall be constructed to said river at or opposite said point; and said corporation may construct and maintain ways for wagons, carriages, and for foot-passengers, charging, and receiving reasonable toll therefor as may be approved from time to time by the Secretary of War.

Sec. 2. That said bridge shall be constructed and built without interference with the security and convenience of navigation of said river beyond what is necessary to carry into effect the rights and privileges hereby granted; and in order to secure that object the said company or corporation shall submit to the Secretary of war, for his examination and approval, a design and drawings of the bridge, and a map of the location, giving, for the space of one mile above and one mile below the proposed location, the topography of the banks of the river, the shore-lines at high and low water, the direction and strength of the currents at all stages, and the soundings, accurately showing the bed of the stream, the location of any other bridge or bridges, and shall furnish such other informatinn as may be reqnired for a full and satisfactory understanding of the subject; and until the said plan and location of the bridge are approved by the Secretary of War the bridge shall not be built:

Provided, That if the said bridge shall be made, with unbroken and continuous spans, it shall have three or more channel spans, and shall not be of less elevation in any case than fifty feet above extreme high-water mark, as understood at the point of location, to the bottom chord of the bridge, nor shall the spans of said bridge be less than three hundred feet in length, and the piers of said bridge shall be parallel with the current of said river, and the main span shall be over the main channel of the river, and not less than three hnndred feet in length:

And Provided also, that if any bridge built under this act shall be constructed as a draw-bridge, the same shall be constructed as a pivot-bridge, with a draw over the main channel of the river at an accessible and navigable point, and with spans of not less than one hundred and sixty feet in length in the clear on each side of the central or pivot pier of the draw, and the next adjoining span or spans to the draw shall not be less than three hundred feet, and the head room under such span shall not be less than ten feet above high water mark.

Provided Also, That said draw shall be opened promptly upon reasonable signal for the passing of boats; and said company or corporation shall maintain, at its own expense from sunset till sunrise, such lights or other signals on said bridge as the Light-House Board shall prescribe:

Provided also, That all railway companies desiring to use said bridge shall have and be entitled to equal rights and privileges in the passage of the same, and in the use of the machinery and fixtures thereof, and of all the approaches thereto, under and upon such terms and conditions as shall be prescribed by the Secretary of War, upon hearing the allegations and proofs of the parties, in case they shall not agree.

Sec. 3. That the Secretary of War is hereby authorized and directed, upon receiving such plan and map and other information, and upon being satisfied that a bridge built on such plan and with snch accessory works and at snch locality will conform to the prescribed conditions of this act, to notify the company that he approves the same, and upon receiving such notification the said company may proceed to an erection of said bridge, conforming strictly to the approved plan and location; and should any change be made in the plan of the bridge or said accessory works, during the progress of the work thereon such change shall be subject likewise to the approval of the Secretary of War; and in case of any litigation arising from any obstruction or alleged obstruction to the free navigation of said river caused or alleged to be caused by said bridge, the case may be brought in the circuit court of the United States of the State of Nebraska or State of Iowa in which any portion of said obstruction or bridge may be located.

Sec. 4. That the said bridge and accessory works, when built and constructed nnder this act and according to the terms and limitations thereof, shall be lawful structures; and said bridge shall be recognized and known as a post-route, upon which also no higher charge shall be made for the transmission over the same of the mails, the troops, and the mnnitions of war of the United States than the rate per mile paid for the transportation over the railroads or public highways leading to said bridge; and said bridge shall enjoy the rights and privileges of other post-routes in the United States; and Congress reserves the right at any time to regulate by appropriate legislation the charges for freight and passengers over said bridge.

Sec. 5. That the United States shall have the right of way for such postal-telegraph lines across said bridge as the Government may construct or control.

Sec. 6. That Congress shall have power at any time to alter, amend, or repeal this act so as to prevent or remove all material and substantial obstructions to the navigation of said river by the construction of said bridge and its accessory works; and the expense of altering said bridge or removing such obstructions shall be at the expense of the owners of or persons controlling such bridge.

Received by the President, June 6, 1884.

(Note by the Department of State.—The foregoing act having been presented to the President of the United States for his approval, and not having been returned by him to the House of Congress in which it originated within the time prescribed by the Constitution of the United States, has become a law without his approval.)

CONTRACT.

Whereas, By an Act of Congress of June 18, 1884,—23 Stats. 45—entitled, "An Act to authorize the construction of a bridge across the Missouri River at some accessible point within ten miles north and ten miles south of the town of Rulo, in the county of Richardson, in the State of Nebraska," it was enacted that the Atchison & Nebraska Railway Company, an incorporation organized under the laws of the State of Nebraska, is hereby authorized to construct and maintain a bridge across the Missouri River at a point within ten miles north and ten miles south of the town of Rulo, in the county of Richardson, in the State of Nebraska, and to construct accessory works to secure the best practicable channel-way for navigation, and also to lay on and over said bridge a railway track; to construct and maintain ways for wagons, carriages and foot passengers, charging and receiving reasonable toll therefor as may be approved from time to time by the Secretary of War, and

Whereas, It was further enacted by the Act of Congress aforesaid, that the said bridge shall be constructed and built without interference with the security and convenience of navigation of said river beyond what is necessary to carry into effect the rights and privileges hereby granted; and in order to secure that object the said company or corporation shall submit to the Secretary of War for his examination and approval, a design and drawings of the bridge, and a map of the location, giving, for the space of one mile above and one mile below the proposed location, the topography of the banks of the river, the shore lines at high and low water, the direction and strength of the currents at all stages, and the soundings, accurately showing the bed of the stream, the location of any other bridge or bridges, and shall furnish such other information as may be required for a full and satisfactory nnderstanding of the subject; and until the said plan and location of the bridge are approved by the Secretary of War, the bridge shall not be built, and

Whereas, The Secretary of War is antborized and directed by said Act of Congress, upon receiving snch plan and map and other information, and upon being satisfied that a bridge built on such plan and with snch accessory works and at such locality will conform to the prescribed conditions of said Act, to notify the company that he approves the same, and

Whereas, The Atchison and Nebraska Railway Company in accordance with the provisions of the Act of Congress aforesaid, has submitted to the Secretary of War for examination and approval its design and drawing of the said bridge, and a map of the location of the same, as by said Act of Congress required, and

Whereas, The Chief of Engineers, United States Army, has reported, "That from the best and most reliable information attainable by this office, contained in the papers herewith, it is believed that the plans of the bridge at Rulo are substantially in accordance with the requirements of the Act of Congress" aforesaid.

Now Therefore, I, William C. Endicott, Secretary of War, having examined and considered the plan and location of the bridge submitted by the said Atchison and Nebraska Railway Company, as aforesaid, which said plan and map of location are hereto attached and form part of this instrument, do hereby approve the same.

But it is understood and agreed that this approval is given upon the express conditions following—

1. That the said bridge shall be erected at the point indicated in the map of location submitted, and be constructed in accordance with the provisions of said Act of Congress, and the plan submitted and attached as aforesaid.

2. That shonld any change be made in the plan of said bridge during the progress of construction such change shall be subject to the approval of the Secretary of War.

Witness my hand this 25th day of February, 1887.

Wm. C. Endicott, Secretary of War.

This instrument is also executed by the Atchison and Nebraska Railway Company, by its President G. W. Holdrege, thereto lawfully authorized this 12th day of February, 1887, in testimony of its acceptance of the provisions of the said Act of Congress, and the conditions therein imposed.

THE ATCHISON AND NEBRASKA RAILWAY CO.

In presence of — G. W. Holdrege, President

Thos. Miller,
Wm. A. Higgins,
C. D. Dorman,

Attest,
J. C. Taylor, Secretary.

APPENDIX C.

SPECIFICATIONS FOR MASONRY.

There will be four piers, numbered from east to west. Piers I and IV will be within the shore lines, and will contain approximately 550 and 800 cubic yards of masonry. Piers II and III will be in the river, and will contain approximately 1,300 cubic yards each. The masonry of Piers I and IV will be started on finished concrete foundations, and above the surface of the water. The masonry of Piers II and III will rest on foundations put in by the plenum pneumatic process, the bottom of the masonry finishing about twelve feet below low water, and about twenty-five feet of masonry having to be laid while the sinking of the foundations is in progress.

The masonry will be first-class rock face work, laid in regular courses. The face stones, including coping, will be of granite, which shall be of uniform character throughout, and acceptable to the Engineer. The backing may be of any good, sound limestone.

The piers shall conform in all respects to the plans furnished by the Engineer.

No course shall be less than sixteen inches thick, and no course shall be thicker than the course below it. The upper and lower beds of every stone shall be at least one quarter greater in both directions, than the thickness of the course, and no face stone shall measure less than thirty inches in either horizontal direction. In general, every third stone of each course shall be a header, and there shall be at least two headers in each course between the shoulders. No stone will be considered a header that measures less than five feet from the face. The headers shall be so arranged as to form a bond entirely through the pier, either by bonding against a face stone in the opposite side of the course, or by bonding with a piece of backing not less than three feet square which shall bond with a face stone on the opposite side. In all cases the interior bonding shall be further secured by placing in the course above, a stone of the full thickness of the course, and at least three feet square, over the interior joints. Special care shall be taken with the bonding of the ice breaker cut water, the stones of which shall be so arranged that the face stones are supported from behind by large pieces of backing.

All joints shall be pitched to a true line, and dressed to one quarter of an inch for at least twelve inches from the face. Beds, both upper and lower, shall be pitched to a true line, and dressed to one quarter of an inch. Joints shall be broken at least fifteen inches on the face. The bottom beds shall always be the full size of the stone.

The pointed up-stream starlings of Piers II and III, from the footing courses to the small coping at the offset, shall have a fine pointed face, with no projection exceeding one-half inch from the pitch line of the joints. There shall be a draft line three inches wide, around the lower edge of the belting course below the coping, and on the edge of the pointed starlings. The entire coping over the whole pier, and the small copings over the starlings, shall have smooth bush-hammered surfaces and faces. All other parts of the work shall have a rough quarry-face, with no projection exceeding three inches from the pitch line of the joints.

The face stones of each entire course of Piers II and III above the footing courses and below the offset at the top of the pointed starlings, shall be doweled into the course below with round dowels of one and one-eighth inch iron, extending six inches into each course. The dowels shall be from eight to twelve inches back from the face and six inches on each side of every joint; the stones of the upper course shall be drilled through before setting after which the drill-hole shall be extended six inches into the lower course: a small quantity of mortar shall then be put into each hole, the dowel dropped in and driven home, and the hole filled with mortar and rammed. The three courses below the coping shall have the joints bound with cramps of ⅞" round iron, twenty inches long between the shoulders, the ends sunk three inches into each stone.

The stones in the coping under the bearings of the trusses shall be according to special plans, to be furnished. They shall have good beds for their entire size, and shall have a full bearing on large stones with dressed beds in the belting course below the coping.

The stones of the backing shall have dressed beds. The backing shall generally be of the same thickness as the face stones, but two thicknesses of backing may be used for one course of face stones, provided no backing is less than twelve inches thick.

All stones shall be sound, free from seams, and other defects, and the quarries shall be approved by the Engineer. All limestone shall be laid on natural beds.

All stones shall be laid in full mortar beds. They shall be lowered on the bed of mortar, and brought to a bearing with a maul. No spalls will be allowed, except in small vertical openings in the backing. Thin mortar joints will not be insisted on, but the joints shall be properly cleaned on the face and pointed in mild weather, the pointing to be driven in with a caulking iron.

The mortar will be composed of cement and clean, coarse sand, satisfactory to the Engineer, in proportions varying from one to three parts of sand to one of cement, as may be directed by the Engineer, for different parts of the work. When the stone is laid in freezing weather the contractor shall take such precautions to prevent the mortar from freezing as shall be satisfactory to the Engineer.

No material shall be measured, nor included in estimates, which does not form a part of the permanent structure.

The Railroad Company will furnish free transportation from Kansas City or Council Bluffs, or any intermediate point on the K. C., St. J. and C. B. R. R. to the bridge site, for stone actually used in the piers. Free transportation will also be furnished from any approved limestone quarry in Nebraska, not more than 75 miles from Rulo, on a railroad operated by the C. B. & Q. R. R. Co. This free transportation is given on the assumption that the stone is to be cut at the quarry, and if the contractors prefer to cut at the bridge site, a charge will be made at the rate of eight mills per ton per mile for the difference between the weight of the stone transported and the finished weight, as laid in the piers. Any stone transmitted free, and not used, will be the property of the Railroad Company.

The Railroad Company will furnish cement for mortar, which must be handled from the cars, or store-houses by the Contractor, who will be held responsible for any loss or waste.

The Contractor will be required to furnish all tools of every description and all materials, except cement, and will be responsible for all damages which may occur from the conduct of the work embraced in his contract.

RECORD OF SINKING CAISSONS. PIER I.

Date.	Elevations of Cutting Edge					Sunk in 24 Hours.	Elevations of Ground					Average Penetration of Caisson	Water Gauge.	Depth Immersed.	Weights.										Air Pressure.		Reaction due to Air Pressure.	Net Weight.	Surface in Contact.	Average Weight per sq. ft. on surface exposed to friction.	Remarks.
															Caisson.			Crib.			Air Lock, Shaft, etc.	Masonry.	Sand.	Total.	Indicated.	Calculated.					
	N. E.	N. W.	S. E.	S. W.	Average.		N. E.	N. W.	S. E.	S. W.	Average.				Timber.	Iron.	Concrete.	Timber.	Iron.	Concrete.											
					C	D					E	F E—C	G	H G—C										I	K	L	M L × A	N I—M	O	P N÷O	
1886. Feb.						Ft.						Ft.		Ft.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Lbs.	Lbs.	Tons.	Tons.	Sq. Ft.	Lbs.	
18	844.37	844.38	844.37	844.46	844.39	—	—	—	—	—	—	—	—	—	155	25	—	—	—	—	6	—	—	186	—	—	—	—	—	—	Began Concreting at 8 a. m.
19	844.12	844.15	844.00	844.18	844.11	0.28	—	—	—	—	—	—	—	—	155	25	166	—	—	—	6	—	—	352	—	—	—	—	—	—	
20	844.02	844.00	843.86	844.12	844.00	0.11	847.00	847.00	847.00	847.00	847.00	3.00	848.35	4.35	155	25	392	5	—	—	6	—	—	583	4	1.88	179	404	460	1756	Started air pumps at 8:15 a. m. Started Water Pumps at 8 a. m.
21	841.24	841.47	842.17	842.44	841.83	2.17	851.49	849.04	851.02	850.57	850.53	8.70	848.55	6.82	155	25	578	6	—	—	6	—	3	773	2.75	2.95	281	492	1047	940	Began building crib. Material passed through, river sand.
22	837.95	837.56	838.25	837.92	837.92	3.91	851.50	851.80	850.29	853.02	851.65	13.73	848.90	10.98	155	25	578	21	1	209	7	—	24	1020	4.75	4.75	452	568	1560	728	
23	834.35	834.37	834.53	834.65	834.47	3.45	852.70	851.20	850.40	852.40	851.67	17.20	849.30	14.83	155	25	578	36	2	422	8	—	38	1264	6	6.42	611	653	2621	498	
24	830.89	830.76	831.70	831.67	831.25	3.22	852.30	849.90	850.01	851.00	850.80	19.55	849.70	18.45	155	25	578	48	2	612	8	—	58	1486	7	7.98	760	726	2951	492	
25	850.64	830.47	830.28	830.16	830.39	0.86	852.10	850.50	850.60	851.00	851.05	20.66	849.90	19.51	155	25	578	64	3	612	9	—	69	1515	8	8.44	804	711	3113	457	
26	828.26	827.96	828.30	828.00	828.13	2.26	852.10	850.50	850.60	851.00	851.05	22.92	850.05	21.92	155	25	578	64	3	729	9	—	93	1656	9	9.48	903	753	3443	455	
27	825.03	824.87	824.45	824.40	824.69	3.44	849.92	849.00	848.90	849.50	849.33	24.64	850.20	25.51	155	25	578	72	4	855	9	—	101	1799	10	11.04	1052	747	3694	404	
28	825.03	824.85	824.46	824.40	824.69	0.00	850.40	854.50	854.10	853.50	853.12	28.43	850.35	25.66	155	25	578	92	6	875	9	—	150	1890	10.4	11.10	1057	833	4060	410	
Mar.																															
1	824.49	824.33	824.40	824.36	824.39	0.30	854.20	854.00	853.30	854.80	854.07	29.68	850.80	26.41	155	25	578	92	6	1007	9	—	163	2035	11	11.43	1089	946	4430	427	
2	819.37	819.30	819.56	819.58	819.45	4.94	852.60	852.10	852.20	852.50	852.35	32.90	850.00	30.55	153	25	578	105	6	1184	10	—	196	2259	13	13.22	1259	1000	4900	409	
3	814.69	814.69	814.64	814.70	814.68	4.77	850.10	849.60	851.80	851.90	850.85	36.17	849.10	34.42	155	25	578	120	7	1357	10	—	230	2482	15	14.89	1418	1064	5377	395	
4	810.46	810.57	809.72	809.89	810.16	4.52	848.50	847.40	849.00	850.20	848.78	38.62	848.70	38.54	155	25	578	131	7	1530	12	—	256	2694	17	16.67	1588	1106	5734	385	
5	808.65	808.83	807.43	807.65	808.14	2.02	846.90	846.40	850.53	850.63	848.61	40.47	848.25	40.11	155	25	578	138	8	1682	12	—	290	2888	17.5	17.35	1653	1235	5989	412	
6	806.53	806.68	805.28	805.52	806.00	2.14	853.30	853.50	854.00	855.00	853.95	47.95	847.70	41.70	155	25	578	160	9	1682	12	—	426	3047	19.5	18.04	1718	1329	7022	378	
7	806.47	806.65	805.27	805.50	805.97	0.03	853.20	853.40	855.40	854.60	854.15	48.18	847.40	41.43	155	25	578	164	10	1735	12	—	430	3109	19.5	17.92	1707	1402	7053	397	
8	804.81	805.01	803.46	803.70	804.25	1.72	853.90	854.30	854.80	855.00	854.50	50.25	847.20	42.95	155	25	578	164	10	1735	12	—	468	3147	19	17.58	1770	1377	7339	375	
9	804.81	805.00	803.46	803.70	804.25	0.00	853.80	854.20	854.80	854.90	854.42	50.17	846.95	42.70	155	25	578	164	10	1735	12	—	466	3145	19.5	18.47	1759	1386	7328	378	
10	804.79	804.98	803.45	803.70	804.23	0.02	853.87	854.07	855.01	854.87	854.45	50.22	846.45	42.22	155	25	578	164	10	1735	12	—	467	3146	19	18.27	1740	1406	7335	383	
11	804.79	804.98	803.45	803.70	804.23	0.00	853.87	854.07	855.01	854.87	854.45	50.22	846.25	42.02	155	25	578	166	10	1735	12	—	467	3148	18.5	18.18	1732	1416	7335	386	
12	803.31	803.48	802.08	802.29	802.79	1.44	852.30	852.80	854.60	853.60	853.32	50.53	846.20	43.41	155	25	578	168	10	1898	12	—	473	3319	19	18.78	1789	1530	7378	414	
13	803.27	803.46	802.07	802.28	802.77	0.02	852.30	852.91	854.60	853.90	853.43	50.66	845.95	43.18	155	25	578	185	10	2053	12	—	475	3493	19	18.68	1779	1714	7396	463	
14	800.92	801.07	799.96	800.15	800.52	2.25	850.40	851.80	852.40	852.30	851.72	51.20	845.80	45.28	155	25	578	188	11	2325	13	—	485	3780	20	19.59	1866	1914	7470	512	
15	798.54	798.60	798.16	798.27	798.39	2.13	853.00	853.00	852.60	852.00	852.65	54.26	845.40	47.01	155	25	578	188	11	2379	13	—	541	3890	20.5	20.34	1937	1953	7892	494	
16	795.90	795.80	795.87	795.85	795.85	2.54	851.90	852.60	851.00	852.40	851.97	56.12	845.20	49.35	155	25	578	209	11	2610	13	—	575	4176	21.2	21.35	2034	2142	8149	525	
17	793.60	793.51	793.58	793.50	793.56	2.29	850.90	850.40	850.20	852.40	850.97	57.41	845.40	51.84	155	25	578	231	12	2610	15	—	598	4224	22	22.43	2136	2088	8327	501	Sand.
18	792.31	792.08	792.13	791.98	792.12	1.44	850.50	852.00	853.00	853.00	852.12	60.00	847.60	55.48	155	25	578	231	13	2610	15	—	658	4285	23.1	24.00	2286	1999	8676	460	Reached clay.
19	792.02	791.78	791.85	791.70	791.84	0.28	851.50	852.60	852.70	852.80	852.40	60.56	848.70	56.86	155	25	578	231	13	2671	15	—	676	4364	24	24.60	2343	2021	8749	462	
20	791.40	791.12	791.23	791.07	791.20	0.64	850.90	851.70	852.80	852.30	851.92	60.72	850.20	59.00	155	25	578	231	13	2835	14	—	681	4532	25	25.53	2432	2100	8770	479	
21	791.41	791.14	791.24	791.07	791.21	—	851.00	851.80	852.80	851.40	851.75	60.54	849.10	57.89	155	25	578	231	13	2835	14	—	675	4526	24	25.05	2386	2140	8747	489	
22	791.40	791.11	791.22	791.04	791.19	0.01	851.00	851.90	852.60	852.30	851.95	60.76	849.70	58.51	155	25	578	231	13	2835	20	—	682	4539	25	25.31	2411	2128	8775	485	
23	791.40	791.14	791.22	791.04	791.20	—	850.90	851.80	852.20	852.20	851.78	60.58	851.90	60.70	155	25	578	231	13	2835	20	—	676	4533	25	26.26	2501	2032	8752	464	
24	791.39	791.12	791.20	791.01	791.18	0.01	851.00	851.60	854.00	852.00	852.15	60.97	851.40	60.22	155	25	578	231	13	2835	20	—	689	4546	25	26.05	2481	2065	8803	469	
25	791.37	791.09	791.19	790.99	791.16	0.02	851.00	852.00	854.00	852.00	852.25	61.09	851.50	60.34	155	25	578	231	13	2835	20	—	692	4549	25	26.11	2487	2052	8818	465	
26	789.86	789.55	789.79	789.57	789.69	1.47	852.60	856.60	853.80	855.00	854.50	64.81	851.80	62.11	155	25	578	234	13	2835	20	—	808	4668	25.5	26.87	2559	2109	9302	453	
27	789.84	789.54	789.79	789.57	789.69	0.00	853.50	856.00	855.00	855.00	854.87	65.18	851.25	61.56	155	25	578	234	13	2835	20	—	820	4680	25.3	26.63	2537	2143	9350	458	
28	789.85	789.54	789.78	789.57	789.69	0.00	855.00	856.60	854.80	855.00	855.35	65.60	850.60	60.91	155	25	578	234	13	2835	20	—	835	4695	25.5	26.35	2510	2185	9411	464	
29	788.53	788.20	788.48	788.24	788.36	1.33	854.00	855.70	853.88	853.84	854.35	65.99	850.00	61.64	155	25	578	234	13	2835	20	—	845	4705	25.5	26.67	2540	2165	9455	457	
30	787.84	787.52	787.77	787.55	787.67	0.69	853.10	855.60	853.20	855.26	854.29	66.62	849.50	61.83	155	25	578	234	13	2835	20	*50	805	4775	25	26.75	2548	2227	9537	466	Blew pressure off to 9 lbs. in settling. Began excavation for test pit.
31	787.83	787.51	787.77	787.54	787.66	0.01	852.30	854.40	853.10	853.20	853.25	65.59	848.90	61.24	155	25	578	234	13	2835	20	50	833	4743	25	26.49	2525	2220	9403	472	Referred to bottom of "Test Pit" column H = 68.7 ft., L = 29.72 lbs., M = 2831 tons, [N = 1912 tons, P = 407 lbs.
April.																															
1	787.83	787.55	787.74	787.50	787.66	0.00	852.30	854.40	853.10	853.20	853.25	65.59	848.50	60.84	155	25	578	234	13	2835	20	50	833	4743	25	26.32	2507	2236	9405	475	H=75.4 ft., L = 32.62 lbs., M = 3107 tons, N = 1636 tons, P = 348 lbs.
2	787.83	787.55	787.74	787.50	787.66	0.00	852.30	854.40	853.10	853.20	853.25	65.59	848.20	60.54	155	25	578	234	13	2835	20	50	833	4743	34	26.19	2495	2248	9403	478	Test pit reached gravel. H = 80.8 ft., L = 34.96 lbs., M = 3330 tons, N = 1413 tons, P
3	787.85	787.51	787.76	787.53	787.66	0.00	852.70	854.60	853.20	853.10	853.40	65.74	847.80	60.14	155	25	578	234	13	2835	20	50	837	4747	36	26.02	2478	2269	9423	481	H = 82.3 ft., L = 35.61 lbs., M = 3392 tons, N = 1355 tons, P = 288 lbs., [= 300 lbs.
4	787.14	786.81	787.05	786.82	786.95	0.71	851.30	853.80	852.90	852.50	852.62	65.67	847.60	60.65	155	25	578	234	13	2835	20	50	835	4745	26	26.24	2499	2246	9413	477	
5	786.15	785.82	786.04	785.80	785.95	1.00	852.20	853.80	852.20	851.80	852.50	66.55	848.20	62.25	155	25	578	234	13	2835	20	50	862	4772	25	26.93	2565	2207	9528	463	
6	786.15	785.82	786.04	785.80	785.95	0.00	852.20	853.80	852.20	851.80	852.50	66.55	848.65	62.70	155	25	578	234	13	2835	15	—	862	4717	25	27.13	2584	2133	9528	447	Began sealing Caisson at 9 45 p. m.
7	786.09	785.76	785.97	785.72	785.88	0.07	854.10	854.30	852.40	851.70	853.12	67.24	848.80	62.92	155	25	578	234	13	2835	15	—	884	4739	25	27.22	2593	2146	9618	446	
8	786.09	785.76	785.97	785.72	785.88	0.00	854.10	854.30	852.40	851.70	853.12	67.24	848.55	62.67	155	25	578	234	13	2835	15	—	884	4739	24	27.11	2582	2157	9618	448	
9	786.09	785.76	785.97	785.72	785.88	0.00	853.80	853.90	852.30	852.20	853.05	67.10	848.20	62.32	—	—	—	—	—	—	—	—	—	—	26	26.96	—	—	—	—	Finished filling working chamber at 5 a. m. Took air off at 2:15 p. m.

*Rubble Stone Piled on Crib.

RECORD OF SINKING CAISSONS. PIER II.

Date.	Elevations of Cutting Edge. N. E.	N. W.	S. E.	S. W.	Average	Sunk in 24 Hours	Elevations of Ground. N. E.	N. W.	S. E.	S. W.	Average of 12 Soundings.	Average Penetration of Caisson	Water Gauge.	Depth Immersed.	Weights. Caisson. Timber.	Caisson. Iron.	Caisson. Concrete.	Crib. Timber.	Crib. Iron.	Crib. Concrete.	Air Lock, Shaft, etc.	Masonry.	Sand.	Water.	Total	Air Pressure. Indicated.	Air Pressure. Calculated.	Reaction due to Air Pressure.	Net Weight	Surface in Contact	Average Weight per sq. ft. on surface exposed to friction	Remarks.
1887					C	D					E	F E—C	G	H G—C											I	K	L	M L×A	N I—M	O	P N÷O	
Feb.						Ft.						Ft.		Ft.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Lbs.	Lbs.	Tons.	Tons.	Sq. Ft.	Lbs.	
10	850.88	850.88	850.88	850.88	850.88	—	—	—	—	—	—	—	846.30	—	177	32	—	—	—	—	7	—	—	—	216	—	—	—	—	—	—	Caisson built at elev. 850.88. Began lowering at 8 30 a. m.
11	843.32	843.32	843.32	843.32	843.32	7.56	—	—	—	—	—	—	846.40	3.08	177	32	—	—	—	—	7	—	—	—	216	—	—	—	—	—	—	Began concreting at 12 40 p. m. Stopped at 3.30 p. m.
12	838.65	838.65	838.65	838.65	838.65	4.67	—	—	—	—	—	—	846.45	7.80	177	32	—	—	—	—	7	—	—	—	216	—	—	—	—	—	—	
13	837.79	837.79	837.79	837.79	837.79	0.86	—	—	—	—	—	—	846.45	8.66	177	32	109	—	—	—	7	—	—	—	325	—	—	—	—	—	—	
14	837.15	837.15	837.15	837.15	837.15	0.64	—	—	—	—	—	—	846.30	9.15	177	32	297	—	—	—	7	—	—	—	513	—	—	—	—	—	—	
15	837.13	837.13	837.13	837.13	837.15	0.02	—	—	—	—	—	—	846.35	9.22	177	32	515	—	—	—	7	—	—	—	731	—	—	—	—	—	—	Put on air at 6.45 p. m. Started water pumps at 8:45 a. m.
16	836.31	836.23	836.04	835.98	836.14	0.99	839.40	837.40	838.20	841.70	838.99	2.85	846.45	10.31	177	32	725	—	—	—	7	—	—	7	948	5.	4.46	476	472	460	2054	
17	829.86	830.25	829.91	830.32	830.08	6.06	846.20	843.40	837.40	842.10	842.04	11.96	846.45	16.37	177	32	764	—	—	—	7	—	—	—	980	—	—	—	—	—	—	Pegan building crib in P. M. Stopped water pumps 4:10 a m. Resumed work in Pier
18	829.85	830.22	829.89	830.30	830.06	0.02	845.70	843.75	837.70	842.00	842.11	12.05	846.75	16.69	177	32	764	8	—	—	8	—	—	—	989	—	—	—	—	—	—	[III at 7 a. m., 17th.
19	829.84	830.22	829.89	830.31	830.06	0.00	845.30	844.00	837.60	841.80	842.02	11.96	847.00	16.94	177	32	856	28	1	53	8	—	—	—	1155	—	—	—	—	—	—	
20	829.81	830.20	829.86	830.27	830.03	0.03	844.50	843.30	837.40	842.30	841.76	11.73	847.30	17.27	177	32	856	43	2	168	8	—	—	—	1286	—	—	—	—	—	—	
21	829.77	830.08	829.79	830.09	829.93	0.10	843.10	841.60	839.40	841.60	841.56	11.63	847.60	17.67	177	32	856	49	3	337	9	—	16	19	1498	7.	7.64	816	682	1861	733	Resumed work in Pier II at 6:45 a. m. Started water pumps at 6:55 a. m.,
22	824.17	824.35	824.32	824.53	824.34	5.59	848.20	848.40	847.80	848.20	846.04	21.70	847.65	23.31	177	82	856	55	3	490	9	—	112	30	1764	11.	10.08	1076	688	3420	402	Coarse sand and rubbish.
23	820.55	820.48	820.37	820.32	820.43	3.91	847.80	847.60	847.40	848.70	846.82	26.39	847.65	27.22	177	32	856	55	3	690	9	—	—	—	—	—	—	—	—	—	—	Stopped water pumps at 5 a. m. Resumed work in Pier III at 6.45 a. m.
24	820.54	820.46	820.36	820.31	820.42	0.01	847.00	847.20	847.00	848.20	846.37	25.95	847.65	27.23	177	32	856	55	3	752	9	—	—	—	—	—	—	—	—	—	—	Working in Pier III.
25	—	—	—	—	—	—	847.00	846.80	847.00	846 40	846.19	—	847.60	—	177	32	856	67	4	752	9	—	—	—	—	—	—	—	—	—	—	" " "
26	—	—	—	—	—	—	846.80	846.00	835.60	837.60	839.78	—	847.60	—	177	32	856	86	5	752	9	—	—	—	—	—	—	—	—	—	—	" " "
27	820.52	820.46	820.35	820.30	820.41	—	847.00	845.60	847.80	848.00	846.08	25.67	847.45	27.04	177	32	856	92	6	752	9	—	—	—	—	—	—	—	—	—	—	" " "
28	—	—	—	—	—	—	847.30	843.80	847.30	847.30	845.75	—	847.30	—	177	32	856	92	6	752	9	—	—	—	—	—	—	—	—	—	—	" " "
Mar.																																
1	—	—	—	—	—	—	846.00	846.20	847.20	847.20	845.98	—	847.25	—	177	32	856	92	6	752	9	—	—	—	—	—	—	—	—	—	—	All work suspended—ice too weak.
2	820.54	820.45	820.35	820.29	820.41	0.01	846.20	846.20	846.70	846.20	845.90	25.49	847.20	26.79	177	32	856	92	6	892	9	—	—	—	—	—	—	—	—	—	—	" " "
3	820.52	820.43	820.33	820.28	820.39	0.02	846.50	846.30	846.60	846.30	845 68	25.29	847.35	26.96	177	32	856	92	6	1033	9	—	—	—	—	—	—	—	—	—	—	" " "
4	820.50	820.43	820.31	820.27	820.38	0.01	847.10	844.60	846.70	846.60	845.80	25.42	847.60	27.22	177	32	856	92	6	1219	9	—	—	—	—	—	—	—	—	—	—	" " "
5	820.48	820.39	820.28	820.24	820.35	0.03	843.90	842.70	846.60	847 00	845.38	25.03	847.55	27.20	177	32	856	92	6	1346	9	—	—	—	—	—	—	—	—	—	—	" " "
6	820.48	820.40	820.28	820.24	820.35	0.00	844.00	842.20	847.10	847.40	845.39	25.04	847.40	27.05	177	32	856	110	7	1346	9	—	—	—	—	—	—	—	—	—	—	" " "
7	—	—	—	—	—	—	845.00	843.00	847.00	847 00	845.42	—	847.00	—	177	32	856	116	7	1346	9	—	—	—	—	—	—	—	—	—	—	" " "
8	—	—	—	—	—	—	—	—	—	—	—	—	846.90	—	177	32	856	116	7	1346	9	—	—	—	—	—	—	—	—	—	—	Ice went out at 5 p. m.
9	—	—	—	—	—	—	—	—	—	—	—	—	845.90	—	177	32	856	116	7	1346	9	—	—	—	—	—	—	—	—	—	—	
10	—	—	—	—	—	—	—	—	—	—	—	—	847.00	—	177	32	856	116	7	1346	9	—	—	—	—	—	—	—	—	—	—	Resumed work in Pier III at 11.30 a. m
11	820.42	820.35	820.27	820.21	820.31	0.04	—	—	—	—	—	—	847.15	26.84	177	32	856	116	7	1346	9	—	—	—	—	—	—	—	—	—	—	Working in Pier III.
12	—	—	—	—	—	—	838.72	838.20	846.20	843.70	840.32	—	848.20	—	177	32	856	116	7	1346	9	—	—	—	—	—	—	—	—	—	—	" " "
13	—	—	—	—	—	—	—	—	—	—	—	—	849.00	—	177	32	856	116	7	1346	9	—	—	—	—	—	—	—	—	—	—	" " "
14	—	—	—	—	—	—	834.00	820 50	836.50	838.50	831.09	—	850.50	—	177	32	856	116	7	1346	9	—	—	—	—	—	—	—	—	—	—	" " "
15	—	—	—	—	—	—	820.50	820.50	837.50	838 00	827.12	—	850.45	—	177	32	856	116	7	1346	9	—	—	—	—	—	—	—	—	—	—	" " "
16	—	—	—	—	—	—	—	—	—	—	—	—	850.45	—	177	32	856	116	7	1346	9	—	—	—	—	—	—	—	—	—	—	" " "
17	—	—	—	—	—	—	826.20	821.70	836.20	838.70	828.74	—	850.20	—	177	32	856	116	7	1346	9	—	—	—	—	—	—	—	—	—	—	" " "
18	820.30	820.23	820.21	820.13	820.22	0.09	824.70	825.70	839.70	838.10	832.19	12.27	850.60	30.38	177	32	856	116	7	1346	9	—	—	—	—	—	—	—	—	—	—	Put air on at 1:45 p. m. Started water pumps at 4 20 p. m.
19	816.71	817.01	817.02	817.33	817.02	3.20	825.70	825.70	835.20	840.70	829.02	12.00	851.15	34.13	177	32	856	116	7	1346	9	—	20	178	2741	15.	14.76	1376	1165	1960	1138	Sand. Pumps stopped at 10:30 p. m.
20	815.38	815.98	815.04	815.65	815.51	1.51	826.80	826.20	836.80	837.20	829.20	13.69	850.20	34.69	177	32	856	116	7	1429	9	—	26	179	2831	16.	15.00	1602	1229	2188	1123	Pumps started at 7.10 a. m. and stopped at 3 15 p. m.
21	813.66	813.85	813.85	814.06	813.86	1.65	825.40	829.40	836.00	830.70	832.11	18.25	849.45	35.59	177	32	856	127	8	1563	10	—	54	174	3001	16.5	15.39	1643	1358	2920	930	" 8.25 a. m. " 2:45 p. m.
22	811.12	811.28	810.98	811.15	811.13	2.73	828.40	826.40	834.40	839.40	833.32	22.19	849.40	38.27	177	32	856	135	8	1694	12	—	116	139	3169	18.	16.55	1767	1402	3458	811	" 7.20 a. m " 10:35 p. m.
23	809.06	809.23	809.16	809.35	809.20	1.93	827.90	827.40	833.90	839.40	834.70	25.50	849 40	40.20	177	32	856	145	9	1855	12	—	172	162	3420	18.	17.39	1857	1563	3904	801	" 7 00 a. m. " 2:35 p. m.
24	808.69	808.90	808.38	808.61	808.65	0.55	826.90	826.90	832.90	839.90	830.82	22.17	848.95	40.30	177	32	856	155	10	1983	12	—	116	194	3535	19.	17.43	1861	1674	3458	968	" 7.10 a. m " 6:35 p. m.
25	806.44	806.50	806.97	807.05	806.74	1.91	828.30	824.80	832.80	839.80	830.97	24.23	848.80	42.06	177	32	856	162	10	2106	13	—	156	188	3700	20.	18.19	1942	1758	3733	942	" 6·55 a. m. " 6.35 p. m.
26	805.42	805.60	806.34	816.53	805.97	0.77	—	—	832.20	829.20	830.97	25.00	852.20	46.23	177	32	856	175	11	2217	13	—	163	244	3888	21.	20.00	2136	1752	3837	913	" 8:35 a. m. " 12:40 p. m. Current too swift for soundings.
27	804.69	804.55	804.62	804.59	804.61	1.36	—	—	—	—	—	—	854.00	49 39	177	32	856	178	11	2217	13	—	70	289	3843	21.	21.36	2281	1562	2069	1510	Current too swift for soundings. Pressure men and others working in bar saving
28	804.58	804.31	804 31	804.07	804.32	0.29	–	814.80	—	814.80	816.80	12.48	854.75	50.43	177	32	856	178	11	2217	13	—	24	381	3889	22.5	21.81	2329	1560	1994	1565	" " " [material, track, etc. from flood.
29	804.59	804.31	804.31	804.05	804.33	0.00	—	—	—	—	820.90	16.58	855.30	50.98	177	32	856	178	11	2217	13	—	38	381	3903	23.	22.05	2354	1549	2646	1171	" " "
30	804.55	804.29	804.26	804.03	804.28	0.04	819.60	819.60	819.60	819.60	820·85	16.57	855.65	51.37	177	32	856	178	11	2217	13	—	38	387	3909	22.5	22.22	2373	1536	2646	1161	
31	804.55	804.29	804.25	804.03	804.28	0.00	819.30	821.30	819.30	821.30	821.05	16.77	855 30	51.02	177	32	856	178	11	2217	13	—	38	381	3903	22.	22.07	2357	1546	2678	1155	
April.																																
1	804.54	804.28	804.24	804.01	804.27	0.01	818.30	816.30	818.30	816.30	820.90	16.63	854 30	50.03	177	32	856	178	11	2217	13	—	38	365	3887	21.5	21.64	2311	1576	2646	1190	
2	804.41	804.13	804.06	803.81	804.10	0.17	820.40	816.40	822.40	821.40	819.74	15.64	853.40	49.30	177	32	856	178	11	2217	13	—	35	358	3877	21.5	21.32	2277	1600	2493	1283	
3	804.35	804.11	803.94	803.67	804.02	0.08	823.50	821 50	821.50	825.50	822.33	18.31	852.50	48.48	177	32	856	178	11	2416	13	—	54	337	4074	21.0	20.97	2239	1835	2920	1257	Pumps started at 7:20 a. m. Sand, gravel and balls of clay.
4	803.82	803.78	802.79	802.79	803.30	0.72	825.70	821.70	822.70	825.70	823.03	19.73	851 75	48.45	177	32	856	178	11	2500	13	—	77	323	4167	21.5	20.96	2238	1929	3122	1235	
5	801.85	801.90	802.07	802.17	802.00	1.30	823.90	825.90	823.90	825.90	823.90	21.90	850.90	48.90	177	32	856	196	12	2500	13	—	112	341	4239	21.5	21.15	2268	1971	3420	1152	
6	800.35	800.31	799.79	799.70	800.04	1.96	825.10	824.10	821.10	825.10	823.02	22.98	851.15	51.11	177	32	856	196	12	2500	13	—	129	333	4248	23.	22.11	2361	1887	3556	1061	Finished crib. Pumps stopped at 6:40 p. m. and started at 10.50 p. m.
7	799.53	799.63	799.29	799.42	799.47	0.57	825.50	824.50	820.50	828 00	824.63	25.16	851.50	52.03	177	32	856	198	13	2626	14	—	166	323	4405	23.5	22.51	2404	2001	3857	1038	Pumps stopped at 9:20 p. m.
8	797.82	797.93	798.61	798.72	798.27	1.20	827.40	826 40	824 40	828.40	826.32	28.05	850.40	52.13	177	32	856	198	13	2775	14	—	216	299	4580	22.5	22.55	2408	2172	4240	1024	Caisson on clay in north end. Started at 12 45 p m.
9	794.82	794.97	795.17	795.30	795.07	3.20	826.50	825.50	825.00	828.50	826.31	31.24	849.50	54 43	177	32	856	198	13	2810	14	—	276	300	4676	24.	23.54	2514	2162	4673	925	Finished concreting crib.
10	792.45	792.76	792.55	792.89	792.66	2.41	829.00	830.00	827.00	833.50	831.17	38.51	849.05	56.39	177	32	856	198	13	2810	14	—	423	263	4786	24.5	24.39	2604	2182	5632	775	Pumps stopped at 9:25 a. m.
11	791.37	791.47	791.23	791.34	791.35	1.31	826.90	827.90	826.90	832.40	830.07	38.72	848.90	57.55	177	32	856	198	13	2810	14	—	427	259	4786	25.	24.99	2668	2118	5662	749	Pumps started at 8:25 a. m. and finished at 5 10 p. m. Caisson in clay.
12	791.35	791.46	791.21	791.32	791.34	0.01	—	—	—	—	—	—	848.60	57.26	177	32	856	198	13	2810	14	—	—	—	—	—	—	—	—	—	—	Cut off air at 6 55 a. m. and resumed work in Pier III.
13	791.34	791.44	791.21	791.34	791.33	0:01	—	—	—	—	—	—	848.60	57.27	177	32	856	198	13	2810	14	74	—	—	—	—	—	—	—	—	—	Working in Pier III.
14	791.33	791.43	791.20	791.34	791.33	0.00	—	—	—	—	—	—	848.80	57.47	177	32	856	198	13	2810	14	234	—	—	—	—	—	—	—	—	—	" "
15	791.34	791.43	791.18	791.33	791.32	0.01	—	—	—	—	—	—	849.15	57.83	177	32	856	198	13	2810	15	333	—	—	—	—	—	—	—	—	—	" "
16	—	—	—	—	—	—	—	—	—	—	—	—	849.80	—	177	32	856	198	13	2810	15	406	—	—	—	—	—	—	—	—	—	" "

PIER II.—Continued.

Date.	Elevations of Cutting Edge. N. E.	N. W.	S. E.	S. W.	Average. C	Sank in 24 Hours. D	Elevations of Ground. N. E.	N. W.	S. E.	S. W.	Average of 12 Soundings. E	Average Penetration of Caisson. F E—C	Water Gauge. G	Depth Immersed H G—C	Weights. Caisson. Timber.	Caisson. Iron.	Caisson. Concrete.	Crib. Timber	Crib. Iron	Crib. Concrete.	Air Lock, Shaft, etc.	Masonry.	Sand.	Water.	Total. I	Air Pressure Indicated K	Air Pressure Calculated. L	Reaction due to Air Pressure M L×A	Net Weight. N I—N	Surface in Contact O	Average Weight per sq. ft. on Surface Exposed to friction. P N÷O	Remarks.
1887 April.						Ft.						Ft.		Ft.	Tons.	Tons.	Tons.	Tons	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Lbs.	Lbs.	Tons	Tons.	Sq. Ft	Lbs.	
17	791.30	791.43	791.19	791.30	791.31	0.01	—	—	—	—	—	—	850.10	58.79	177	32	856	198	13	2810	15	480	—	—	—	—	—	—	—	—	—	Working on Pier III.
18	—	—	—	—	—	—	—	—	—	—	—	—	850.20	—	177	32	856	198	13	2810	15	480	—	—	—	—	—	—	—	—	—	" "
19	—	—	—	—	—	—	—	—	—	—	—	—	849.85	—	177	32	856	198	13	2810	15	540	—	—	—	—	—	—	—	—	—	" "
20	—	—	—	—	—	—	835.10	829.10	837.10	836.10	834.02	—	849.70	—	177	32	856	198	13	2810	15	540	—	—	—	—	—	—	—	—	—	" "
21	—	—	—	—	—	—	836.20	831.20	838.70	837.20	837.25	—	849.60	—	177	32	856	198	13	2810	15	540	—	—	—	—	—	—	—	—	—	" "
22	—	—	—	—	—	—	—	—	—	—	—	—	849.30	—	177	32	856	198	13	2810	15	540	—	—	—	—	—	—	—	—	—	" "
23	791.33	791.43	791.22	791.32	791.32	—		—	—	—	—	—	849.10	57.78	177	32	856	198	13	2810	15	540	—	—	—	—	—	—	—	—	—	" "
24	—	—	—	—	—	—		—	—	—	—	—	848.90	—	177	32	856	198	13	2810	15	540	—	—	—	—	—	—	—	—	—	" "
25	—	—	—	—	—	—	-	—	—	—	—	—	848.65	—	177	32	856	198	13	2810	15	540	—	—	—	—	—	—	—	—	—	" "
26	—	—	—	—	—	—		—	—	—	—	—	848.75	—	177	32	856	198	13	2810	15	540	—	—	—	—	—	—	—	—	—	Put on air at 7.00 p. m.
27	791.30	791.41	791.14	791.26	791.28	0.03		—	—	—	—	—	848.45	57.17	177	32	856	198	13	2810	15	540	—	—	—	26.	24.73	2641		—	—	Set up clay hoist and began working it at 6 p. m.
28	791.27	791.40	791.13	791.23	791.26	0.02	829.10	827.10	829.10	833.10	829.85	38.59	848.15	56.89	177	32	856	198	13	2810	22	540	423	251	5322	26.	24.61	2628	2694	5632	956	Clay.
29	791.23	791.38	791.09	791.25	791.24	0.02	829.10	827.10	829.60	833.10	830.60	39.36	848.10	56.86	177	32	856	198	13	2810	22	540	442	240	5330	25.5	24.59	2626	2704	5744	941	
30	790.04	790.19	789.88	790.09	790.05	1.19	833.90	831.90	829.90	833.90	832.15	42.10	847.90	57.85	177	32	856	198	13	2810	22	540	504	219	5371	26.5	25.02	2618	2753	6100	903	
May																																
1	789.48	789.62	789.40	789.53	789.51	0.54	836.60	833.60	830.60	833.60	833.22	43.71	847.60	58.09	177	32	856	198	13	2810	22	540	536	206	5390	27.	25.13	2683	2707	6311	857	
2	789.42	789.53	789.28	789.41	789.41	0.10	838.50	833.50	831.00	833.50	833.50	44.09	847.50	58.09	177	32	856	198	13	2810	22	540	550	198	5396	26.	25.13	2683	2713	6358	853	
3	788.56	788.28	787.94	788.07	788.11	1.30	838.50	833.50	831.50	833.50	834.00	45.89	847.55	59.44	177	32	856	198	13	2810	22	540	590	197	5435	27.	25.71	2745	2690	6595	816	
4	787.71	787.79	787.51	787.67	787.67	0.44	841.40	833.40	830.40	833.40	834.44	46.77	847.40	59.73	177	32	856	198	13	2810	22	540	610	192	5450	26.	25.84	2759	2691	6707	802	
5	787.53	787.64	787.34	787.48	787.50	0.17	839.20	837.20	830.20	833.20	834.87	47.37	847.20	59.70	177	32	856	198	13	2810	22	540	628	181	5457	26.5	25.82	2757	2700	6781	796	Clay hoist broke down at 5 a. m.—Sacking out.
6	787.39	787.48	787.22	787.33	787.36	0.14	839.40	838.60	830.40	833.20	835.15	47.79	847.10	59.74	177	32	856	198	13	2810	22	540	636	177	5461	26.5	25.84	2759	2702	6834	791	
7	786.48	786.57	786.29	786.41	786.44	0.92	838.75	836.95	830.25	832.40	834.61	48.17	847.05	60.61	177	32	856	198	13	2810	22	540	649	186	5483	26.5	26.22	2800	2683	6885	779	
8	786.03	786.10	785.85	785.96	785.98	0.46	838.10	835.10	830.10	831.60	834.06	48.08	847.10	61.12	177	32	856	198	13	2810	22	540	644	150	5442	27.	26.44	2823	2619	6873	762	Clay hoist started up at 10:40 a. m.
9	785.67	785.76	785.51	785.60	785.63	0.35	839.20	838.20	835.20	834.20	835.87	50.24	847.20	61.56	177	32	856	198	13	2810	22	540	695	182	5525	27.	26.63	2844	2681	7152	759	
10	785.62	785.72	785.45	785.58	785.59	0.04	839.30	838.30	834.30	832.30	835.64	50.05	847.30	61.71	177	32	856	198	13	2810	22	540	691	187	5526	28.5	26.69	2849	2677	7128	751	
11	784.11	784.15	784.02	783.95	784.06	1.53	838.20	837.20	835.20	833.20	836.03	51.97	847.20	63.14	177	32	856	198	13	2810	22	540	739	195	5582	27.5	27.31	2916	2666	7365	724	
12	783.85	783.90	783.71	783.78	783.81	0.25	838.60	836.60	836.60	834.60	836.38	52.57	847.50	63.69	177	32	856	198	13	2810	22	540	754	202	5604	28.	27.55	2942	2662	7451	714	
13	783.73	783.80	783.59	783.76	783.70	0.11	838.90	836.90	839.90	832.90	836.82	53.12	847.90	64.20	177	32	856	198	13	2810	22	540	772	204	5624	28.	27.77	2965	2659	7516	707	
14	783.33	783.38	783.14	783.21	783.26	0.44	837.80	836.80	840.80	833.80	837.22	53.96	847.80	64.54	177	32	856	198	13	2810	22	540	790	204	5642	28.5	27.92	2981	2661	7632	697	
15	781.59	781.64	781.50	781.54	781.57	1.69	834.70	833.70	834.70	833.70	835.28	53.71	847.75	66.18	177	32	856	198	13	2810	22	540	784	252	5684	28.5	28.63	3057	2627	7594	692	
16	781.54	781.58	781.45	781.50	781.52	0.05	833.40	833.70	837.70	836.70	835.18	53.66	847.75	66.23	177	32	856	198	13	2810	22	540	784	255	5687	28.5	28.65	3059	2628	7588	693	
17	781.53	781.56	781.46	781.48	781.51	0.01	836.20	834.70	841.70	836.70	837.35	55.84	847.70	66.19	177	32	856	198	13	2810	22	540	840	252	5740	28.5	28.63	3057	2683	7868	682	
18	779.72	779.76	779.68	779.73	779.72	1.79	835.35	836.50	840.50	836.50	837.17	57.45	847.50	67.78	177	32	856	198	13	2810	22	540	831	271	5750	28.5	29.32	3130	2620	7819	670	
19	779.41	779.42	779.38	779.40	779.40	0.32	838.25	835.25	835.25	831.25	835.08	55.68	847.25	67.85	177	32	856	198	13	2810	22	540	836	268	5752	28.5	29.35	3134	2618	7843	667	
20	779.30	779.29	779.24	779.26	779.27	0.13	835.10	829.10	837.10	836.10	834.01	54.83	847.10	67.83	177	32	856	198	13	2810	22	550	814	281	5753	29.5	29.34	3133	2620	7736	677	
21	779.05	779.08	778.98	779.07	779.04	0.23	836.20	831.20	838.70	837.00	837.23	58.19	849.20	70.16	177	32	856	198	13	2810	22	648	905	298	5959	30.	30.35	3241	2718	8158	666	Put on section supply shaft—Stopped clay hoist from 7:25 a. m. to 6:45 p. m.
22	777.57	777.56	777.52	777.50	777.54	1.50	835.25	832.25	839.25	837.25	836.25	58.71	849.25	71.71	177	32	856	198	13	2810	22	735	916	336	6095	30.	31.02	3312	2783	8226	676	
23	776.69	776.72	776.70	776.69	776.70	0.84	834.25	834.25	839.25	835.25	835.67	58.97	849.30	72.60	177	32	856	198	13	2810	22	735	917	361	6121	31.	31.40	3353	2768	8237	672	Stopped clay hoist from 10:20 a. m. to 11 40 a. m.
24	776.61	776.59	776.58	776.58	776.59	0.11	832.25	833.55	838.55	832.55	834.47	57.88	849.55	72.96	177	32	856	198	13	2810	22	812	897	393	6210	31.	31.56	3370	2840	8040	706	
25	776.04	776.06	776.05	776.03	776.04	0.55	835.00	835.00	838.00	835.00	837.50	61.46	850.00	73.96	177	32	856	198	13	2810	22	906	1015	346	6375	31.	31.99	3416	2959	8554	692	Clay.
26	775.13	775.14	775.13	775.10	775.12	0.92	834.70	834.70	838.70	834.70	835.62	60.50	849.70	74.58	177	32	856	198	13	2810	22	1007	975	387	6477	31.5	32.26	3445	3032	8441	720	Caisson in gravel
27	774.74	774.74	774.74	774.70	774.73	0.39	833.25	834.25	839.25	835.25	835.33	60.60	849.25	74.52	177	32	856	198	13	2810	22	1060	979	384	6531	31.5	32.24	3443	3088	8453	730	
28	773.48	773.47	773.50	773.45	773.48	1.25	834.80	834.80	837.80	833.80	834.71	61.23	848.80	75.32	177	32	856	198	13	2810	22	1080	1004	392	6584	31.5	32.58	3479	3105	8523	728	
29	772.31	772.31	772.38	772.31	772.33	1.15	832.30	831.30	835.30	835.30	834.30	61.97	848.30	75.97	177	32	856	198	13	2810	22	1101	1040	391	6640	32.	32.86	3509	3131	8615	727	
30	772.09	772.08	772.15	772.08	772.10	0.23	831.20	832.20	837.20	834.20	834.47	62.37	848.20	78.10	177	32	856	198	13	2810	22	1101	1055	386	6650	32.5	32.92	3515	3135	8659	724	
31	770.34	770.33	770.55	770.47	770.42	1.68	833.05	835.05	835.05	833.05	834.26	63.84	848.05	77.63	177	32	856	198	13	2810	22	1101	1111	397	6717	33.	33.58	3586	3131	8869	711	
June.																																
1	770.33	770.33	770.53	770.46	770.41	0.01	832.20	833.20	838.00	835.20	834.22	63.81	848.20	77.79	177	32	856	198	13	2810	22	1101	1111	402	6722	32.	33.65	3593	3129	8809	710	Stopped clay hoist from 2 p. m. to 4 p. m.
2	768.65	768.63	768.86	768.78	768.73	1.68	829.15	833.15	835.15	834.15	833.32	64.59	848.15	79.42	177	32	856	198	13	2810	22	1101	1153	431	6793	33.	34.36	3669	3124	8885	703	
3	768.12	768.09	768.31	768.22	768.18	0.55	830.80	831.80	838.80	833.80	832.63	64.45	848.80	80.62	177	32	856	198	13	2810	22	1101	1148	470	6827	33.5	34.87	3723	3104	8875	700	Put on section supply shaft—Stopped clay hoist from 7.23 a. m. to 6.45 p. m.
4	767.80	767.76	767.95	767.86	767.84	0.34	831.60	832.60	837.60	834.60	833.68	65.84	849.15	81.31	177	32	856	198	13	2810	22	1162	1218	451	6939	33.5	35.17	3756	3184	9052	703	Stopped clay hoist from 7 a. m. to 11:30 a. m. Clay at 767.72.
5	766.64	766.59	766.79	766.71	766.68	1.16	831.00	832.00	835.00	833.00	832.08	65.40	849.05	82.37	177	32	856	198	13	2810	23	1255	1193	498	7055	34.	35.63	3805	3250	8969	724	
6	766.57	766.51	766.73	766.62	766.61	0.07	829.00	831.00	835.00	832.20	830.44	63.83	849.30	82.69	177	32	856	198	13	2810	23	1255	1117	550	7036	34.	35.77	3820	3216	8809	730	
7	766.10	766.05	766.27	766.16	766.14	0.47	830.40	831.40	836.00	834.40	832.78	67.64	849.45	83.31	177	32	856	198	13	2810	23	1311	1255	496	7171	34.	36.04	3848	3323	9096	730	
8	765.95	765.89	766.09	766.00	765.98	0.16	—	—	—	—	832.78	66.80	850.50	84.52	177	32	856	198	13	2810	23	1311	1263	525	7208	34.5	36.56	3904	3304	9112	725	Stopped clay hoist from 4:40 p. m. to 8:30 p. m.
9	765.66	765.62	765.75	765.68	765.68	0.30	—	—	—	—	832.78	67.10	851.45	85.77	177	32	856	198	13	2810	23	1311	1277	536	7253	36.	37.10	3962	3291	9141	720	Finished using clay hoist at 1:45 p. m.
10	765.49	765.44	765.59	765.53	765.51	0.17	—	—	—	—	832.78	67.27	851.90	86.39	177	32	856	198	13	2810	17	1311	1287	569	7270	37.5	37.37	3990	3280	9161	715	Began filling working chamber.
11	765.47	765.42	765.58	765.51	765.49	0.02	—	—	—	—	—	—	852.60	87.11	177	32	856	198	13	2810	17	1311	—	—	—	37.5	37.68	4023	—	—	—	
12	—	—	—	—	—	—	—	—	—	—	—	—	853.40	—	177	32	856	198	13	2810	17	1335	—	—	—	36.	—	—	—	—	—	
13	—	—	—	—	—	—	—	—	—	—	—	—	854.00	—	177	32	856	198	13	2810	17	1335	—	—	—	36.	—	—	—	—	—	Thermometer 100° in lock.
14	765.47	765.42	765.58	765.49	765.49	0.00	—	—	—	—	—	—	854.10	88.61	177	32	856	198	13	2810	17	1335	—	—	—	35.	38.33	4093	—	—	—	Gangs working 2 hours per day, account of heat.
15	—	—	—	—	—	—	—	—	—	—	—	—	853.85	—	177	32	856	198	13	2810	17	1335	—	—	—	34.5	—	—	—	—	—	
16	—	—	—	—	—	—	—	—	—	—	—	—	853.35	—	177	32	856	198	13	2810	17	1335	—	—	—	32.	—	—	—	—	—	Pressure varying from 30 lbs. to 34 lbs.
17	—	—	—	—	—	—	—	—	—	—	—	—	853.15	—	177	32	856	198	13	2810	17	1335	...	—	—	32.	—	—	—	—	—	" " " "
18	—	—	—	—	—	—	—	—	—	—	—	—	852.95	—	177	32	856	198	13	2810	17	1335	—	—	—	—	—	—	—	—	—	Ran pressure down to 25 lbs. at 5:40 p. m.
19	—	—	—	—	—	—	—	—	—	—	—	—	853.15	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	Took off air at 7:05 a. m.
20	765.44	765.39	65.55	765.49	765.47	0.02	—	—	—	—	—	—	853.55	88.08	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	Final elevation of cutting edge 765.47.

RECORD OF SINKING CAISSONS. PIER III.

Date	Elevations of Cutting Edge. N. E.	Elevations of Cutting Edge. N. W.	Elevations of Cutting Edge. S. E.	Elevations of Cutting Edge. S. W.	Elevations of Cutting Edge. Average.	Sunk in 24 Hours.	Elevations of Ground. N. E.	Elevations of Ground. N. W.	Elevations of Ground. S. E.	Elevations of Ground. S. W.	Elevations of Ground. Average.	Average Penetration of Caisson.	Water Guage	Depth Immersed	Weights. Caisson. Timber.	Weights. Caisson. Iron.	Weights. Caisson. Concrete.	Weights. Crib. Timber.	Weights. Crib. Iron.	Weights. Crib. Concrete	Weights. Air Lock, Shaft, etc.	Weights. Masonry.	Weights. Sand.	Weights. Water.	Weights. Total.	Air Pressure. Indicated.	Air Pressure. Calculated.	Reaction due to Air Pressure.	Net Weight.	Surface in Contact.	Average Weight per sq. ft. on Surface Exposed to friction	Remarks.
1886					C	D					E	F E—C	G	H G—C											I	K	L	M L × A	N I—M	O	P N÷O	
Nov.						Ft.						Ft.		Ft.	Tons.	Tons.	Tons	Tons.	Tons	Tons.	Tons.	Tons.	Tons.	Tons.	Tons	Lbs.	Lbs.	Tons.	Tons.	Sq. Ft.	Lbs.	
23	846.80	846.80	846.80	846.80	846.80	—	—	—	—	—	—	—	842.20	—	177	34	—	—	—	—	7	—	—	—	218	—	—	—	—	—	—	Caisson built at elev. 846.80
24	842.10	842.10	842.10	842.10	842.10	4.70	—	—	—	—	—	—	842.05	—	177	34	—	—	—	—	7	—	—	—	218	—	—	—	—	—	—	Began lowering caisson in P. M.
25	833.30	833.30	833.30	833.30	833.30	8.80	—	—	—	—	—	—	842.70	9.40	177	34	89	—	—	—	7	—	—	5	312	—	—	—	—	—	—	Began concreting in A. M.
26	830.70	830.70	830.70	830.70	830.70	2.60	—	—	—	—	—	—	841.90	11.20	177	34	114	—	—	—	7	—	—	9	341	—	—	—	—	—	—	
27	828.80	829.30	829.80	829.80	829.42	0.28	—	—	—	—	—	—	841.80	12.38	177	34	114	—	—	—	7	—	—	11	343	—	—	—	—	—	—	
28	—	—	—	—	829.10	0.32	—	—	—	—	—	—	843.00	13.90	177	34	205	—	—	—	7	—	—	15	438	—	—	—	—	—	—	
29	—	—	—	—	829.10	0.00	—	—	—	—	—	—	842.60	13.50	177	34	434	—	—	—	7	—	—	15	667	—	—	—	—	—	—	
30	829.40	829.60	828.90	828.40	829.10	0.00	831.10	831.60	830.10	829.10	830.00	00.90	842.60	13.50	177	34	605	—	—	—	7	—	—	15	838	—	—	—	—	145	—	
Dec.																																
1	828.70	827.70	829.20	828.20	828.40	0.60	828.00	826.40	828.00	829.40	828.83	00.43	842.90	14.50	177	34	605	—	—	—	7	—	—	15	838	—	—	—	—	69	—	Began building crib.
2	828.30	827.60	829.20	828.20	828.32	0.08	828.90	827.10	828.90	828.90	828.85	00.53	842.90	14.58	177	34	605	8	—	—	7	—	—	17	848	—	—	—	—	86	—	
3	—	—	—	—	828.32	0.00	827.75	827.25	829.25	831.25	829.29	00.97	841.25	12.93	177	34	605	8	—	—	7	—	—	13	844	—	—	—	—	159	—	
4	827.90	825.90	829.70	827.50	827.75	0.57	826.70	824.70	829.70	827.70	827.90	00.15	841.70	13.95	177	34	605	16	1	—	7	—	—	15	855	—	—	—	—	24	—	Put on air at 10 a. m. 4 lbs. Started water pumps at 4 p. m.
5	826.70	824.70	828.10	826.90	826.60	1.15	830.20	826.30	828.70	824.90	828.45	1.85	842.70	16.10	177	34	762	30	2	—	7	—	—	22	1034	5.	6.96	743	291	299	1946	Pumps stopped at 9 35 p. m. Sand.
6	825.80	825.93	825.30	825.46	825.62	0.98	834.20	827.80	829.20	826.60	829.82	4.20	843.00	17.38	177	34	830	30	2	110	7	—	1	24	1215	6.	7.51	802	413	678	1218	
7	825.53	825.72	825.06	825.30	825.40	0.22	834.70	827.90	829.90	827.10	829.71	4.31	842.90	17.50	177	34	830	30	2	300	8	—	1	24	1406	6.	7.54	805	601	694	1732	
8	825.11	825.39	823.79	824.12	824.60	0.80	833.70	828.20	830.20	830.20	829.85	5.25	843.20	18.60	177	34	830	30	2	300	8	—	2	32	1415	7.	8.04	859	556	846	1314	Pumps started at 6.55 a m.
9	821.63	821.39	821.60	821.40	821.51	3.09	836.25	833.75	830.55	831.25	832.72	11.21	843.75	22.24	177	34	830	42	3	530	8	—	15	57	1696	9.	9.62	1027	669	1796	744	Pumps stopped at 5 35 a. m.
10	821.48	821.21	821.32	821.10	821.28	0.23	836.10	833.10	830.60	832.30	833.23	11.95	844.10	22.82	177	34	830	45	3	530	8	—	19	61	1707	7.5	9.87	1054	653	1912	682	Cut off air from 1 p. m. to 5 p. m. to change position of boat.
11	820.90	820.70	820.90	820.70	820.80	0.48	825.80	824.80	831.80	827.80	833.80	13.00	844.90	24.10	177	34	830	57	3	530	9	—	25	69	1734	8.	10.42	1113	621	2076	600	
12	820.76	820.68	820.74	820.74	820.73	0.07	824.40	821.40	827.40	830.40	826.95	6.22	843.40	22.67	177	34	830	57	3	530	9	—	3	61	1704	8.	9.80	1046	658	1001	1314	Pumps started at 11 a. m.
13	818.14	818.22	817.64	817.79	817.95	2.78	823.30	821.30	827.30	831.50	827.17	9.22	843.30	25.35	177	34	830	63	4	700	9	—	9	90	1916	9.5	10.96	1170	746	1480	1000	Pumps stopped at 11 p. m.
14	815.56	815.59	815.62	815.69	815.62	2.33	821.40	819.90	827.60	832.60	826.61	10.99	843.40	27.78	177	34	830	63	4	767	9	—	15	111	2010	10.5	12.01	1282	728	1761	827	
15	815.56	815.59	815.62	815.69	815.62	0.00	822.10	821.00	828.10	832.10	826.38	10.76	844.10	28.48	177	34	830	70	5	767	9	—	15	118	2025	11.5	12.32	1316	709	1724	822	
16	815.56	815.59	815.63	815.68	815.62	0.00	822.80	820.80	832.80	827.80	827.30	11.68	843.80	28.18	177	34	830	78	5	767	9	—	19	113	2032	11.5	12.19	1302	730	1898	769	
17	815.55	815.58	815.63	815.69	815.61	0.01	823.80	821.80	831.60	833.00	828.33	12.72	843.80	28.19	177	34	830	88	6	933	9	—	24	113	2214	11.5	12.19	1302	912	2032	897	
18	815.00	815.06	815.27	815.22	815.16	0.45	822.20	822.20	831.81	831.60	828.30	15.14	844.25	29.09	177	34	830	88	6	933	9	—	25	119	2221	12.5	12.58	1343	878	2099	836	
19	813.29	813.14	813.21	813.12	813.19	1.97	823.90	824.30	831.90	830.70	828.14	14.95	843.90	30.71	177	34	830	99	6	933	9	—	31	133	2252	12.5	13.28	1418	834	2372	703	
20	813.26	813.14	813.21	813.13	813.19	0.00	823.95	824.45	830.55	830.95	829.47	16.28	843.45	30.26	177	34	830	99	6	1049	9	—	37	124	2365	11.	13.09	1398	967	2595	745	
21	813.26	813.12	813.20	813.10	813.17	0.02	823.60	825.60	833.60	831.60	829.62	16.45	843.55	30.38	177	34	830	99	6	1168	9	—	38	124	2485	12.	13.14	1403	1082	2622	825	Pumps started at 7. a. m.
22	810.52	810.50	811.06	811.13	810.80	2.37	831.90	830.90	831.90	832.50	832.72	21.92	843.90	33.10	177	34	830	99	6	1168	9	—	112	82	2517	14.5	14.32	1529	988	3420	577	Pumps stopped at 2:45 p. m. and started at 4.50 p. m.
23	808.86	808.70	808.54	808.44	808.64	2.16	833.20	834.40	830.50	833.40	832.57	23.93	843.40	34.76	177	34	830	114	7	1281	10	—	145	113	2711	16.	15.03	1605	1106	3692	599	" " 4.00 a. m. " 11:00 p. m.
24	807.01	807.20	806.92	807.19	807.08	1.56	833.60	834.00	829.60	833.40	833.69	26.61	843.60	36.52	177	34	830	120	8	1387	10	—	191	106	2863	17.	15.80	1687	1176	4053	580	" " 11:45 a. m.
25	806.23	806.52	806.50	806.13	806.35	0.73	835.00	836.00	829.50	833.00	833.54	27.19	843.50	37.15	177	34	830	127	8	1387	10	—	201	109	2883	16.5	16.07	1716	1167	4132	565	
26	806.23	806.52	806.13	806.15	806.35	0.00	835.50	832.10	832.10	832.30	833.62	27.27	843.10	36.75	177	34	850	127	8	1495	10	—	203	104	2988	17.	15.89	1697	1291	4142	623	
27	806.09	806.39	806.01	806.38	806.22	0.13	836.10	832.50	831.10	834.50	834.22	28.00	843.50	37.28	177	34	830	127	8	1538	10	—	216	102	3042	17.5	16.12	1721	1321	4240	623	Pumps started at 9 45 a. m.
28	803.79	804.15	803.68	804.19	803.95	2.27	839.60	830.40	831.30	833.60	834.69	30.74	843.60	39.65	177	34	830	127	8	1538	10	—	267	102	3093	18.	17.15	1831	1262	4606	548	
29	802.29	802.39	802.25	802.40	802.33	1.62	836.50	837.70	835.50	831.50	836.27	33.94	843.45	41.12	177	34	830	148	9	1538	10	—	329	85	3160	18.5	17.79	1900	1260	5051	500	Pumps stopped at 3 a. m.
30	801.26	801.24	801.15	801.17	801.21	1.12	837.00	842.40	831.70	833.00	835.96	34.75	844.70	43.49	177	34	830	148	9	1750	10	—	346	105	3409	19.5	18.81	2089	1320	5138	513	Pumps started at 11.15 a. m.
31	799.22	799.26	798.99	799.08	799.14	2.07	836.50	838.10	831.30	830.60	835.53	37.59	845.10	45.96	177	34	830	151	10	1906	12	—	379	120	3619	21.	19.88	2123	1496	5355	558	
1887. Jan.																																
1	796.44	796.46	796.78	796.84	796.63	2.51	835.70	836.10	831.00	829.70	835.13	38.50	845.70	49.07	177	34	830	172	11	1906	12	—	423	137	3702	22.	21.22	2266	1436	5632	509	Pumps stopped at 9:35 a. m.
2	796.16	796.20	796.51	796.59	796.37	0.26	835.40	834.60	830.30	839.50	834.62	38.25	846.00	49.63	177	34	830	172	11	2048	12	—	419	147	3850	24.	21.47	2293	1557	5595	556	
3	796.17	796.18	796.51	796.58	796.36	0.01	836.00	835.00	829.60	832.00	834.95	38.59	846.05	49.64	177	34	830	178	11	2115	12	—	423	147	3927	23.	21.47	2293	1634	5632	580	Pumps started at 1.10 p. m.
4	794.27	794.21	794.38	794.38	794.31	2.05	834.60	835.00	830.10	832.10	835.13	40.82	846.10	51.79	177	34	830	178	11	2186	12	—	474	147	4049	24.5	22.40	2392	1647	5935	555	
5	793.25	793.22	793.07	793.07	793.15	1.16	834.40	834.50	831.60	835.10	835.80	42.65	846.15	53.00	177	34	830	182	12	2298	12	—	515	146	4206	24.5	22.92	2447	1759	6173	569	Pumps stopped at 4 p. m. and started at 7.05 p. m. Sand and mud.
6	792.07	792.10	791.87	791.95	791.99	1.16	838.00	836.70	832.40	834.60	836.72	44.73	846.40	54.41	177	34	830	196	12	2298	12	—	562	135	4256	25.	23.53	2513	1743	6443	541	Finished building crib at 10 a m. Pumps stopped at 2.50 a. m. Sacking out [clay.
7	791.03	791.08	790.88	790.96	790.99	1.00	838.30	839.20	832.70	833.70	836.62	45.63	846.75	55.76	177	34	830	198	13	2439	12	—	585	142	4430	24.5	24.12	2576	1854	6559	565	Caisson on clay.
8	791.02	791.05	790.86	790.93	790.96	0.03	839.70	840.50	852.70	835.20	837.58	46.62	847.20	56.24	177	34	830	198	13	2439	12	—	607	137	4447	25.	24.33	2598	1849	6687	553	
9	790.94	790.98	790.77	790.86	790.89	0.07	838.40	836.40	830.40	833.90	836.61	45.72	847.40	56.51	177	34	830	198	13	2439	12	—	587	152	4442	25.5	24.44	2610	1852	6571	557	
10	789.94	790.00	789.68	789.81	789.86	1.03	840.00	840.00	832.80	834.50	836.84	46.98	847.50	57.64	177	34	830	198	13	2439	12	—	616	154	4475	25.5	24.93	2662	1811	6736	538	
11	788.94	789.92	789.62	789.71	789.77	0.09	838.50	839.70	829.50	843.10	836.02	46.25	847.50	57.73	177	34	830	198	13	2533	12	—	598	164	4559	26.	24.57	2666	1893	6659	570	Finished concreting crib at 2:30 p. m.
12	788.96	789.04	788.71	788.82	788.88	0.89	840.60	837.60	830.60	833.90	836.65	47.77	847.60	58.72	177	34	830	198	13	2541	12	—	636	159	4600	26.	25.40	2712	1888	6834	553	
13	788.94	789.01	788.69	788.80	788.86	0.02	840.60	837.60	830.60	834.60	837.22	48.36	847.60	58.74	177	34	830	198	13	2541	12	—	619	159	4613	27.	25.41	2713	1900	6910	550	
14	788.92	789.00	788.67	788.79	788.84	0.02	840.30	837.70	831.20	835.00	837.88	49.04	847.70	58.86	177	34	830	198	13	2541	13	—	666	144	4616	25.5	25.46	2718	1898	6998	543	Began laying masonry in P. M.
15	788.92	788.99	788.67	788.78	788.84	0.00	841.20	838.20	832.70	833.70	837.80	48.86	847.75	58.91	177	34	830	198	13	2541	13	62	661	147	4676	28.	25.48	2721	1955	6972	561	
16	787.90	787.94	787.72	787.81	787.84	1.00	841.00	836.30	832.50	834.30	837.52	49.68	847.70	59.86	177	34	830	198	13	2541	13	146	675	149	4776	26.5	25.89	2765	2011	7103	566	Set up clay hoist in p. m.
17	786.95	786.99	786.81	786.88	786.91	0.93	839.80	835.20	830.60	832.30	836.97	50.06	847.80	60.89	177	34	830	198	13	2541	19	223	691	168	4894	27.	26.34	2812	2082	7128	584	Started clay hoist at 4.10 p. m.
18	786.82	786.85	786.71	786.77	786.79	0.12	840.20	838.80	836.30	834.10	838.92	52.13	847.85	61.06	177	34	830	198	13	2541	19	275	742	143	4972	27.5	26.41	2820	2150	7393	581	Clay hoist froze up at 10 a m Started at 12 00 p. m.
19	786.71	786.75	786.61	786.67	786.69	0.10	839.00	836.90	838.90	836.30	837.55	50.84	847.95	61.26	177	34	830	198	13	2541	19	317	711	167	5007	27.5	26.50	2829	2178	7228	603	" " " " 4 a. m. " " 7.30 a. m. Stopped at 4 p m. for
20	786.62	786.64	786.54	786.57	786.59	0.10	839.00	836.80	838.80	835.40	837.96	51.37	847.85	61.21	177	34	830	198	13	2541	19	378	724	157	5071	28.	26.48	2828	2243	7295	615	Sacking out. [repairs.
21	786.48	786.52	786.42	786.46	786.47	0.12	840.10	836.90	836.90	832.00	838.12	51.65	847.95	61.48	177	34	830	198	13	2541	19	439	729	160	5140	28.	26.58	2839	2301	7331	628	Started clay hoist at 11 45 a. m.
22	786.11	786.15	786.05	786.08	786.10	0.37	840.00	837.00	836.80	832.60	837.68	51.58	847.85	61.75	177	34	830	198	13	2541	20	439	728	167	5147	28.	26.71	2852	2295	7332	627	
23	784.98	784.97	784.97	784.94	784.97	1.13	838.30	837.40	835.70	833.00	836.89	51.92	847.75	62.78	177	34	830	198	13	2541	20	473	739	186	5211	28.	27.16	2900	2311	7365	627	
24	784.88	784.89	784.86	784.85	784.87	0.10	839.00	837.60	835.30	832.60	836.64	51.77	847.65	62.78	177	34	830	198	13	2541	20	473	732	190	5208	28.5	27.16	2900	2308	7347	628	Stopped clay hoist for repairs at 7.30 a. m.
25	784.79	784.80	784.76	784.75	784.78	0.09	842.10	839.80	837.40	833.90	838.37	53.59	847.40	62.62	177	34	830	198	13	2541	20	529	781	158	5281	28.5	27.09	2893	2388	7578	630	Started clay hoist at 12.15 p. m.
26	784.28	784.28	784.21	784.24	784.25	0.53	843.30	839.70	834.70	834.30	838.69	54.44	847.30	63.05	177	34	830	198	13	2541	20	566	810	157	5346	28.5	27.27	2912	2434	7686	633	
27	783.55	783.55	783.50	783.48	783.52	0.73	843.30	842.90	834.90	834.30	836.91	53.39	847.20	63.68	177	34	830	198	13	2541	20	633	829	158	5433	28.5	27.55	2942	2491	7806	638	
28	782.39	782.35	782.37	782.30	782.35	1.17	842.70	840.70	834.00	833.00	838.38	56.03	847.00	64.65	177	34	830	198	13	2541	20	633	846	175	5467	29.	27.97	2987	2480	7887	629	
29	782.33	782.29	782.12	782.27	782.30	0.05	840.10	842.40	833.80	833.30	837.79	55.49	846.85	64.55	177	34	830	198	13	2541	20	633	831	181	5458	28.5	27.92	2981	2477	7819	634	
30	782.20	782.17	782.38	782.13	782.17	0.13	840.10	843.00	833.70	832.70	837.35	55.18	846.70	64.53	177	34	830	198	13	2541	20	633	825	185	5454	29.	27.91	2980	2474	7779	636	
31	781.63	781.58	781.58	781.55	781.59	0.58	846.50	843.00	833.50	832.90	837.46	55.87	846.70	65.11	177	34	830	198	13	2541	20	633	840	196	5482	29.	28.16	3007	2475	7868	629	
Feb.																																
1	780.36	780.31	780.35	780.27	780.32	1.27	840.80	833.50	833.50	833.70	835.28	54.96	846.80	66.48	177	34	830	198	13	2541	20	633	818	253	5517	29.	28.76	3071	2446	7751	631	
2	780.25	780.16	780.22	780.16	780.20	0.12	838.80	834.80	835.30	832.30	835.04	54.84	846.85	66.65	177	34	830	198	13	2541	20	633	814	255	5515	30.	28.83	3078	2437	7736	630	
3	780.20	780.10	780.16	780.11	780.14	0.06	839.00	835.00	835.30	832.30	835.00	54.86	846.80	66.66	177	34	830	198	13	2541	20	633	814	255	5515	29.5	28.83	3078	2437	7736	630	
4	779.86	779.79	779.84	779.78	779.82	0.32	839.60	835.00	833.30	832.40	835.30	55.68	846.85	67.03	177	34	830	198	13	2541	20	633	836	249	5531	29.5	28.99	3096	2435	7843	621	Stopped clay hoist at 3:30 p. m. and started at 6:30 p. m.
5	777.69	777.61	777.75	777.65	777.67	2.15	841.50	835.30	832.90	832.40	835.57	57.90	846.90	69.23	177	34	830	198	13	2541	20	633	897	275	5618	30.5	29.95	3198	2420	8121	596	" " " " 9:00 a. m. " 5.00 p. m.
6	777.68	777.56	777.61	777.49	777.58	0.09	840.00	834.60	831.90	832.70	834.85	57.25	846.90	69.32	177	34	830	198	13	2541	20	662	879	288	5642	31.	29.99	3202	2440	8040	607	" " From 2:30 to 5:45 p. m. repairs. Raised clay hoist 5 p m
7	777.46	777.33	777.39	777.28	777.36	0.22	840.30	834.90	832.70	832.70	835.15	57.79	846.90	69.54	177	35	830	198	13	2541	20	662	891	284	5650	31.	30.08	3212	2438	8108	601	
8	777.28	777.14	777.19	777.08	777.17	0.19	840.00	834.20	834.70	833.00	835.36	58.19	846.70	69.53	177	34	830	198	13	2541	20	735	905	311	5764	30.5	30.08	3212	2552	8158	625	Stopped clay hoist from 5:15 a. m. to 9:20 a. m. Repairs.

APPENDIX D.—Continued.

PIER III.—Continued.

Date.	Elevations of Cutting Edge N. E.	N. W.	S. E.	S. W.	Average.	Sunk in 24 Hours.	Elevations of Ground. N. E.	N. W.	S. E.	S. W.	Average	Average Penetration of Caisson.	Water Gauge.	Depth Immersed	Weights. Caisson. Timber.	Caisson. Iron.	Caisson. Concrete.	Crib. Timber.	Crib. Iron.	Crib. Concrete.	Air Lock, Shaft, etc.	Masonry.	Sand.	Water.	Total	Air Pressure. Indicated.	Air Pressure. Calculated.	Reaction due to Air Pressure	Net Weight.	Surface in Contact	Average Weight per sq. ft. on surface exposed to friction.	Remarks.
1887					C	D					E	F F—C	G	H G—C											I	K	L	M L×A	N I—M	O	P N÷O	
Feb.						Ft						Ft		Ft.	Tons.	Tons.	Tons.	Tons	Tons.	Tons	Tons.	Tons.	Tons.	Tons.	Tons.	Lbs	Lbs.	Tons.	Tons.	Sq. Ft.	Lbs.	
9	776.02	775.89	775.95	775.84	775.92	1.25	841.60	835.60	834.60	833.60	835.85	59.93	846.60	70.68	177	34	830	198	13	2541	20	807	952	286	5858	31.	30.57	3264	2594	8376	620	Clay.
10	775.92	775.80	775.87	775.86	775.84	0.08	835.00	834.90	836.30	832.30	835.48	59.64	846.30	70.46	177	34	830	198	13	2541	20	866	944	284	5907	31.	30.48	3255	2652	8340	636	Stopped clay hoist from 3:30 p. m. to 7 45 p. m. Gravel and Coarse Sand.
11	774.77	774.61	774.74	774.60	774.68	1.16	834.70	835.00	837.60	833.40	836.17	61.49	849.40	71.72	177	34	830	198	13	2541	21	916	1015	280	6025	31.	31.02	3312	2713	8554	634	" " at 12:30 p. m.
12	774.74	774.62	774.72	774.60	774.67	0.01	836.20	835.90	839.20	833.60	836.79	62.12	846.45	71.78	177	34	830	198	13	2541	21	916	1040	265	6035	32.	31.05	3315	2720	8625	631	Started " at 5:30 p. m.
13	774.74	774.62	774.73	774.60	774.67	0.00	836.40	836.90	836.40	836.30	837.12	62.45	846.45	71.78	177	34	830	198	13	2541	21	916	1055	268	6053	32.	31.05	3315	2738	8659	632	Stopped " at 8:30 a. m. and started at 10:20 a. m.
14	773.63	773.50	773.63	773.49	773.56	1.11	835.30	839.60	835.30	838.80	837.66	64.10	846.30	72.74	177	34	830	198	13	2541	21	916	1127	247	6104	32.5	31.47	3360	2744	8834	621	" " at 10:40 a. m. Put on Section Supply Shaft.
15	773.44	773.31	773.44	773.31	773.37	0.19	834.80	840.30	838.20	838.50	838.25	64.88	846.35	72.98	177	34	830	198	13	2541	22	916	1169	231	6134	32.	31.57	3371	2763	8916	620	Started " at 7:00 a. m. and stopped at 6 30 p. m.
16	772.08	771.98	772.15	772.07	772.07	1.30	836.20	839.20	835.70	837.40	837.42	65.35	846.45	74.38	177	34	830	198	13	2541	22	995	1190	260	6258	32.	32.17	3435	2823	8962	630	Working in P. II.
17	772.08	771.96	772.16	772.08	772.07	0.00	837.10	836.10	837.40	837.20	837.13	65.06	846.45	74.38	177	34	830	198	13	2541	22	1067	1177	267	6326	32.5	32.17	3435	2891	8936	647	Started clay hoist at 9:10 a. m.
18	772.04	771.94	772.09	772.03	772.02	0.05	836.40	834.70	837.10	837.00	836.92	64.90	846.75	74.73	177	34	830	198	13	2541	22	1142	1169	282	6408	33.5	32.33	3452	2956	8918	651	Stopped " at 8 45 a. m. and started at 3 p. m.
19	772.03	771.89	772.03	771.96	771.98	0.04	836.00	835.80	837.00	836.80	837.25	65.27	847.00	75.02	177	34	830	198	13	2541	22	1182	1190	279	6466	33.	32.45	3465	3001	8962	668	" " " " 11:15 a. m.
20	771.93	771.83	771.96	771.89	771.90	0.08	838.60	836.30	835.30	835.30	837.02	65.12	847.30	75.40	177	34	830	198	13	2541	22	1239	1177	297	6528	33.	32.62	3483	3045	8936	681	
21	770.72	770.64	770.70	770.63	770.67	1.23	835.40	834.10	835.60	835.80	836.37	65.70	847.60	76.93	177	34	830	198	13	2541	22	1239	1208	325	6587	34.	33.28	3554	3033	9000	674	Working in Pier II.
22	770.70	770.65	770.70	770.63	770.67	0.00	835.60	835.40	836.80	835.30	836.56	65.89	847.65	76.98	177	34	830	198	13	2541	22	1239	1218	321	6593	33.5	33.30	3556	3037	9052	671	" "
23	770.72	770.64	770.70	770.62	770.67	0.00	835.60	834.80	836.60	834.60	836.48	65.81	847.65	76.98	177	34	830	198	13	2541	22	1239	1218	321	6593	34.5	33.30	3556	3037	9052	671	Started clay hoist at 7 a. m.
24	770.71	770.64	770.69	770.63	770.67	0.00	836.60	834.60	835.40	835.20	836.21	65.54	847.65	76.98	177	34	830	198	13	2541	22	1249	1200	331	6595	34.5	33.30	3556	3039	8984	676	
25	769.36	769.29	769.37	769.34	769.34	1.33	836.60	834.60	838.40	835.10	836.71	67.37	847.60	78.26	177	34	830	198	13	2541	22	1249	1292	318	6674	34.5	33.85	3615	3059	9173	666	
26	769.21	769.15	769.21	769.19	769.19	0.15	836.40	834.20	838.40	835.00	836.54	67.35	847.60	78.41	177	34	830	198	13	2541	22	1259	1292	322	6688	34.5	33.92	3622	3066	9173	668	Stopped clay hoist at 8 a. m. and started at 12 m.
27	768.61	768.54	768.66	768.59	768.60	0.59	839.20	834.40	835.80	834.50	835.82	67.22	847.45	78.85	177	34	830	198	13	2541	22	1259	1284	341	6699	35.	34.11	3642	3057	9155	667	
28	768.27	768.23	768.25	768.19	768.24	0.36	835.60	833.40	835.00	833.30	835.28	67.04	847.30	79.06	177	34	830	198	13	2541	22	1259	1277	352	6703	35.5	34.20	3652	3051	9141	667	Clay.
Mar.																																
1	768.02	767.99	768.00	768.00	768.00	0.24	836.00	832.70	834.20	833.10	834.49	66.59	847.25	79.25	177	34	830	198	13	2541	22	1259	1212	399	6685	35.	34.28	3660	3025	8988	673	Stopped clay hoist at 2.55 p. m. Cut off air at 5.55 p. m.
2	767.56	767.49	767.50	767.46	767.50	0.50	835.70	832.60	836.20	833.40	834.96	67.46	847.20	79.70	177	34	830	198	13	2541	22	1259	—	—	—	—	—	—	—	—	—	Work suspended. River breaking up.
3	767.54	767.46	767.49	767.45	767.49	0.01	835.90	833.30	835.70	832.80	835.29	67.80	847.35	79.86	177	34	830	198	13	2541	22	1259	—	—	—	—		—	—	—	—	
4	767.52	767.47	767.47	767.46	767.48	0.01	835.60	832.40	836.60	833.60	835.12	67.64	847.60	80.12	177	34	830	198	13	2541	22	1259	—	—	—	—	—	—	—	—	—	
5	767.52	767.47	767.47	767.45	767.48	0.00	836.00	832.50	836.30	833.70	835.34	67.86	847.55	80.07	177	34	830	198	13	2541	22	1259	—	—	—	—		—	—	—	—	
6	767.52	767.47	767.48	767.45	767.48	0.00	835.70	832.70	836.20	836.30	835.82	68.34	847.40	79.92	177	34	830	198	13	2541	22	1259	—	—		—	—	—	—	—	—	
7	—	—	—	—	—	—	—	—	—	—	—	—	847.00	—	177	34	830	198	13	2541	22	1259	—	—	—	—	—	—	—	—	—	
8	—	—	—	—	—	—	—	—	—	—	—	—	846.90	—	177	34	830	198	13	2541	22	1259	—	—	—	—	—	—	—	—	—	Ice went out at 4 50 p. m.
9	—	—	—	—	—	—	—	—	—	—	—	—	845.90	—	177	34	830	198	13	2541	22	1259	—	—	—	—	—	—	—	—	—	
10	—	—	—	—	—	—	—	—	—	—	—	—	847.00	—	177	34	830	198	13	2541	22	1259	—	—	—	—	—	—	—	—	—	Put on air at 10:40 a. m. Started clay hoist at 3.25 p. m.
11	767.54	767.45	767.44	767.42	767.46	0.02	—	—	—	—	—	—	847.15	79.69	177	34	830	198	13	2541	22	1259	247	848	6169	35.5	34.48	3682	2487	4466	1111	Current too swift for soundings.
12	767.24	767.14	767.23	767.21	767.21	0.25	—	—	—	—	—	—	948.20	80.99	177	34	830	108	13	2541	22	1259	267	977	6318	35.5	35.05	3742	2576	4606	1118	
13	—	—	—	—	—	—	—	—	—	—	—	—	849.00	—	177	34	830	198	13	2541	22	1259	—	—	—	35.5	35.04	3742	—	—	—	
14	—	—	—	—	—	—	—	—	—	—	—	—	850.50	—	177	34	830	198	13	2541	22	1259	—	—	—	35.5	35.04	3742	—	—	—	Cut off air at 4:50 p. m. Took boat ashore to coal up.
15	—	—	—	—	—	—	—	—	—	—	—	—	850.45	—	177	34	830	198	13	2541	22	1259	—	—	—	—	—	—	—	—	—	Put on air at 3:52 p. m. Started clay hoist at 6 p. m.
16	766.23	766.17	766.35	766.36	766.28	0.93	—	—	—	—	—	—	850.45	84.17	177	34	830	198	13	2541	22	1259	329	1040	6443	36.5	36.42	3889	2554	5031	1014	
17	766.16	766.11	766.27	766.29	766.21	0.07	—	—	—	—	—	—	850.20	83.99	177	34	830	198	13	2541	22	1259	—	—	—	—	—	—	—	—	—	Stopped clay hoist at 11:40 p. m.
18	765.71	765.67	765.78	765.78	765.74	0.47	—	—	—	—	—	—	850.60	84.86	177	34	830	198	13	2541	22	1259	—	—	—	—	—	—	—	—	—	Cut off air at 7:40 a. m. Abandoned Pier on account high water.
19	—	—	—	—	—	—	—	—	—	—	—	—	851.15	—	177	34	830	198	13	2541	16	1259	—	—	—	—	—	—	—	—	—	Working in Pier II.
20	—	—	—	—	—	—	—	—	—	—	—	—	850.20	—	177	34	830	198	13	2541	16	1259	—	—	—	—	—	—	—	—	—	" "
31	—	—	—	—	—	—	—	—	—	—	—	—	849.45	—	177	34	830	198	13	2541	16	1259	—	—	—	—	—	—	—	—	—	" "
22	—	—	—	—	—	—	—	—	—	—	—	—	849.40	—	177	34	830	198	13	2541	16	1259	—	—	—	—	—	—	—	—	—	" "
23	765.59	765.53	765.64	765.64	765.60	0.14	—	—	—	—	—	—	849.40	83.80	177	34	830	198	13	2541	16	1259	—	—	—	—	—	—	—	—	—	" "
24	—	—	—	—	—	—	—	—	—	—	—	—	848.95	—	177	34	830	198	13	2541	16	1259	—	—	—	—	—	—	—	—	—	" "
25	—	—	—	—	—	—	—	—	—	—	—	—	848.80	—	177	34	830	198	13	2541	16	1259	—	—	—	—	—	—	—	—	—	" "
26	—	—	—	—	—	—	—	—	—	—	—	—	852.20	—	177	34	830	198	13	2541	16	1259	—	—	—	—	—	—	—	—	—	" "
27	—	—	—	—	—	—	—	—	—	—	—	—	854.00	—	177	34	830	198	13	2541	16	1259	—	—	—	—	—	—	—	—	—	" "
28	—	—	—	—	—	—	—	—	—	—	—	—	854.75	—	177	34	830	198	13	2541	16	1259	—	—	—	—	—	—	—	—	—	" " Pier III entirely submerged
29	—	—	—	—	—	—	—	—	—	—	—	—	855.30	—	177	34	830	198	13	2541	16	1259	—	—	—	—	—	—	—	—	—	" " " "
30	—	—	—	—	—	—	—	—	—	—	—	—	855.65	—	177	34	830	198	13	2541	16	1259	—	—	—	—	—	—	—	—	—	" " " "
31	—	—	—	—	—	—	—	—	—	—	—	—	855.30	—	177	34	830	198	13	2541	16	1259	—	—	—	—	—	—	—	—	—	" " " "
Apr.																																
1	—	—	—	—	—	—	—	—	—	—	—	—	854.30	—	177	34	830	198	13	2541	16	1259	—	—	—	—	—	—	—	—	—	" " " "
2	—	—	—	—	—	—	—	—	—	—	—	—	853.40	—	177	34	830	198	13	2541	16	1259	—	—	—	—	—	—	—	—	—	" "
3	—	—	—	—	—	—	—	—	—	—	—	—	852.50	—	177	34	830	198	13	2541	16	1259	—	—	—	—	—	—	—	—	—	" "
4	764.58	764.52	764.64	764.67	764.60	1.00	—	—	—	—	—	—	851.75	87.15	177	34	830	198	13	2541	16	1259	394	1096	6558	—	—	—	6558	5454	2404	" "
5	—	—	—	—	—	—	—	—	—	—	—	—	850.90	—	177	34	830	198	13	2541	16	1259	—	—	—	—	—	—	—	—	—	" "
6	764.59	764.54	764.63	764.68	764.61	—	—	—	—	—	—	—	851.15	86.54	177	34	830	198	13	2541	16	1259	379	1086	6533	—	—	—	6533	5382	2427	" "
7	—	—	—	—	—	—	—	—	—	—	—	—	851.50	—	177	34	830	198	13	2541	16	1259	—	—	—	—	—	—	—	—	—	" "
8	—	—	—	—	—	—	—	—	—	—	—	—	850.40	—	177	34	830	198	13	2541	16	1259	—	—	—	—	—	—	—	—	—	" "
9	—	—	—	—	—	—	—	—	—	—	—	—	849.50	—	177	34	830	198	13	2541	16	1259	—	—	—	—	—	—	—	—	—	" "
10	—	—	—	—	—	—	—	—	—	—	—	—	849.05	—	177	34	830	198	13	2241	16	1259	—	—	—	—	—	—	—	—	—	" "
11	—	—	—	—	—	—	—	—	—	—	—	—	848.90	—	177	34	830	198	13	2541	16	1259	—	—	—	—	—	—	—	—	—	" "
12	—	—	—	—	—	—	—	—	—	—	—	—	848.60	—	177	34	830	198	13	2541	16	1259	—	—	—	—	—	—	—	—	—	
13	764.57	764.51	764.64	764.66	764.60	—	—	—	—	—	—	—	848.60	84.00	177	34	830	198	13	2541	16	1259	—	—	—	—	—	—	—	—	—	Put on air at 3:35 p. m.
14	764.58	764.52	764.64	764.64	764.60	0.00	—	—	—	—	—	—	848.80	84.20	177	34	830	198	13	2541	22	1259	329	1040	6443	36.	36.43	3890	2553	5031	1013	Started clay hoist 7 a. m. Stopped from 7:30 a. m. to 9:30 a. m.
15	764.54	764.50	764.62	764.65	764.58	0.01	—	—	—	—	—	—	849.15	84.57	177	34	830	198	13	2541	22	1259	345	1043	6462	36.5	36.59	3907	2555	5118	1000	
16	764.54	764.52	764.63	764.65	764.59	—	—	—	—	—	—	—	849.80	85.21	177	34	830	198	13	2541	22	1259	355	1060	6489	36.5	36.43	3890	2599	5189	1001	
17	764.45	764.36	764.52	764.54	764.47	0.12	—	—	—	—	—	—	850.10	85.63	177	34	830	198	13	2541	22	1259	362	1068	6504	36.5	37.05	3956	2548	5251	970	
18	763.91	763.90	764.00	763.98	763.95	0.52	—	—	—	—	—	—	850.20	86.25	177	34	830	198	13	2541	22	1259	377	1077	6528	36.5	37.32	3985	2543	5382	945	
19	763.55	763.50	763.61	763.63	763.57	0.38	—	—	—	—	—	—	849.85	86.28	177	34	830	198	13	2541	22	1259	377	1077	6528	36.5	37.33	3986	2542	5387	944	
20	—	—	—	—	—	—	—	—	—	—	—	—	849.70	—	177	34	830	198	13	2541	22	1259	—	—	—	—	—	—	—	—	—	Stopped clay hoist at 12:45 a. m. Sacking out from 4 p. m. to 5:30 p. m. Began sealing caisson at 4:27 p. m. on 19th.
21	—	—	—	—	—	—	—	—	—	—	—	—	849.60	—	177	34	830	198	13	2541	22	1259	—	—	—	35.5	—	—	—	—	—	
22	—	—	—	—	—	—	—	—	—	—	—	—	849.30	—	177	34	830	198	13	2541	22	1259	—	—	—	35.	—	—	—	—	—	
23	—	—	—	—	—	—	—	—	—	—	—	—	849.10	—	177	34	830	198	12	2541	22	1259	—	—	—	—	—	—	—	—	—	
24	763.57	763.49	763.60	763.61	763.57	0.00	—	—	—	—	—	—	848.90	85.33	177	34	830	198	13	2541	22	1259	—	—	—	34.	36.92	3942	—	—	—	
25	—	—	—	—	—	—	—	—	—	—	—	—	848.65	—	177	34	830	198	13	2541	22	1259	—	—	—	—	—	—	—	—	—	
26	—	—	—	—	—	—	—	—	—	—	—	—	848.75	—	177	34	830	198	13	2541			—	—	—	—	—	—	—	—	—	
27	763.54	763.52	763.62	763.65	763.58	—	—	—	—	—	—	—	848.45	84.87	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	Finished sealing caisson at 1 a. m. Cut off air at 8:10 a. m.
28	763.52	763.50	763.59	763.49	763.53	0.04	—	—	—	—	—	—	848.15	84.62	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	

RECORD OF SINKING CAISSONS. PIER IV.

Date.	Elevations of Cutting Edge N. E.	N. W.	S. E.	S. W.	Average.	Sunk in 24 Hours.	Elevations of Ground. N. E.	N. W.	S. E.	S. W.	Average.	Average Penetration of Caisson.	Water Gauge	Depth Immersed.	Weights: Caisson. Timber.	Iron.	Concrete.	Crib Timber.	Iron.	Concrete.	Air Lock, Shaft, etc.	Masonry.	Sand.	Total.	Air Pressure. Indicated.	Calculated.	Reaction due to Air Pressure.	Net Weight	Surface in Contact.	Average Weight per sq. ft. on Surface Exposed to friction	Remarks.
1886					C	D						E	F E—C	G	H G—C										I	K	L	K L×A	N I—K	O	P N÷O	
Aug.						Ft.							Ft.		Ft.	Tons.	Tons.	Tons.	Tons.	Tons	Tons.	Tons.	Tons.	Tons.	Tons.	Lbs.	Lbs.	Tons.	Tons.	Sq. Ft.	Lbs.	
18	846.99	847.11	847.05	847.05	847.05	—	—	—	—		847.00	—	846.20	—	155	30	—	—	—	—	7	—	—	192	—	—	—	192		—	
19	844.69	844.88	845.43	845.72	845.18	1.87	—	—	—	—	847.00	1.92	846.00	0.82	155	30	—	—	—	—	7	—	—	192	—	—	—	192	295	—	
20	844.69	844.88	845.43	845.72	845.18	0.00	—	—	—	—	847.00	1.92	845.80	0.62	155	30	98	—	—	—	7	—	—	290	—	—	—	290	295	—	
21	843.74	843.78	843.77	844.01	843.83	1.35	—	—	—	—	847.00	3.17	845.75	1.92	155	30	238	—	—	—	7	—	—	429	—	—	—	429	486	—	
22	842.62	842.36	843.02	842.99	842.75	1.08	—	—	—	—	846.80	4.05	845.80	3.05	155	30	285	35	—	—	7	—	1	513	2.	1.32	126	387	621	1246	Started air pumps at 7:05 a. m. Water pumps at 7:30 a. m.
23	842.61	842.36	843.03	842.99	842.75	0.00	—	—	—	—	846.50	3.75	845.70	2.95	155	30	354	49	2	—	7	—	—	597	2.	1.28	122	475	619	1535	
24	841.21	841.38	841.92	841.91	841.60	1.15	—	—	—	—	846.20	4.60	845.60	4.00	155	30	399	49	2	—	7	—	1	643	3.7	1.73	165	478	703	1360	
25	839.77	839.65	840.42	840.52	840.09	1.51	—	—	—	—	845.90	5.81	845.40	5.31	155	30	399	56	2	—	7	—	3	652	4.	2.30	219	433	889	974	
26	837.00	837.02	840.10	840.34	838.61	1.48	—	—	—	—	845.60	6.99	845.30	6.69	155	30	399	71	2	—	7	—	4	668	5.	2.89	275	393	1070	732	
27	836.87	837.05	836.50	836.90	836.84	1.77	—	—	—	—	845.30	8.46	845.20	8.36	155	30	399	71	3	—	7	—	7	672	5.9	3.62	345	327	1291	507	
28	836.48	836.73	836.54	836.93	836.67	0.17	—	—	—	—	845.00	8.33	845.10	8.43	155	30	399	85	3	—	7	—	7	686	5.9	3.65	348	338	1285	529	
29	833.24	833.04	833.79	833.77	833.46	3.21	—	—	—	—	844.70	10.24	845.00	11.54	155	30	399	85	4	—	7	—	12	692	6.	4.99	475	217	1560	278	
30	832.72	832.51	833.55	833.76	833.14	0.32	843.90	844.90	844.90	844.90	844.40	11.26	844.90	11.76	155	30	443	85	5	136	7	—	15	876	6.7	5.09	485	391	1714	456	
31	830.49	830.57	830.84	831.32	830.80	2.34	844.85	844.85	844.85	844.85	844.85	14.05	844.85	14.05	155	30	443	85	5	136	7	—	26	887	8.	6.08	579	308	2131	289	Gumbo.
Sept.																															
1	827.99	827.84	828.09	828.13	828.01	2.79	844.29	847.04	846.89	844.88	845.78	17.77	844.80	16.79	155	30	443	85	5	286	7	—	45	1056	8.	7.26	692	364	2684	271	Sand.
2	821.78	821.93	821.37	821.70	821.70	6.31	843.78	845.23	846.37	844.50	844.97	23.27	844.80	23.10	155	30	443	85	5	309	9	—	75	1111	8.1	9.99	952	159	3499	90	
3	817.34	817.49	817.31	817.66	817.45	4.25	843.78	845.49	846.31	845.66	845.31	27.86	844.80	27.35	155	30	443	98	6	514	9	—	113	1368	12.	11.83	1127	241	4167	115	
4	817.32	817.45	817.33	817.63	817.43	0.02	846.62	845.95	846.83	845.63	846.26	28.77	844.95	27.52	155	30	443	107	6	808	10	—	126	1685	12.	11.91	1135	550	4291	256	
5	817.29	817.43	817.42	817.62	817.44	—	845.79	846.63	846.92	846.42	846.44	29.00	844.85	27.41	155	30	443	116	7	1018	10	—	128	1907	13.2	11.86	1130	777	4325	359	
6	810.06	810.13	809.98	810.42	810.15	7.29	842.06	843.43	844.78	843.42	843.42	33.37	844.70	34.55	155	30	443	138	8	1185	10	—	195	2164	14.	14.95	1424	740	4942	299	
7	804.43	804.31	806.03	806.16	805.23	4.92	845.03	845.31	844.63	844.16	844.83	39.60	844.70	39.47	155	30	443	151	9	1365	10	—	298	2461	16.	17.08	1627	834	5801	287	
8	801.99	801.97	802.87	802.96	802.45	2.78	844.49	844.47	844.37	843.96	844.32	41.87	844.70	42.25	155	30	443	174	10	1522	12	—	350	2696	19.5	18.28	1741	955	6115	312	
9	799.90	799.89	800.02	800.15	799.99	2.46	844.70	845.39	843.52	844.15	844.44	44.45	844.85	44.86	155	30	443	196	11	1637	12	—	397	2881	21.2	19.41	1849	1032	6471	319	Clay in north end.
10	798.75	798.71	799.01	799.12	798.90	1.09	844.75	845.21	844.51	844.12	844.65	45.75	844.85	45.95	155	30	443	196	11	1637	12	—	424	2908	20.	19.88	1894	1014	6678	303	Put on clay hoist.
11	798.59	788.54	798.78	798.91	798.70	0.20	844.59	845.04	844.78	844.91	844.83	46.13	845.00	46.30	155	30	443	196	11	1750	18	—	427	3030	18.5	20.03	1908	1122	6703	334	
12	798.62	798.24	798.39	798.51	798.35	0.35	844.26	845.24	845.39	843.51	844.60	46.25	844.90	46.55	155	30	443	196	11	1750	18	—	429	3032	19.	20.14	1919	1113	6719	331	
13	797.89	797.91	797.92	798.05	797.94	0.41	844.39	844.91	844.92	846.55	845.19	47.25	844.85	46.91	155	30	443	196	11	1750	18	—	447	3050	19.2	20.30	1934	1116	6857	325	
14	796.98	796.96	796.73	796.86	796.88	1.06	843.98	843.96	845.73	846.36	845.01	48.13	844.90	48.02	155	30	443	196	11	1750	18	—	464	3067	20.5	20.78	1979	1088	6979	312	
15	796.97	796.96	796.72	796.86	796.88	0.00	843.98	843.96	845.73	846.36	845.01	48.13	844.80	47.92	155	30	443	196	11	1750	18	—	464	3067	20.	20.73	1975	1092	6979	313	
16	795.50	795.47	795.44	795.55	795.49	1.39	844.50	845.21	845.74	845.05	845.12	49.63	844.80	49.31	155	30	443	196	11	1750	18	—	491	3094	20.6	21.33	2032	1062	7186	295	
17	795.50	795.46	795.45	795.55	795.49	0.00	844.50	846.46	845.75	846.05	845.69	50.20	844.70	49.21	155	30	443	196	11	1750	18	—	501	3104	21.	21.29	2028	1076	7264	[illegible]	
18	794.18	794.15	794.27	794.38	794.25	1.24	845.58	845.85	845.60	845.61	845.66	51.41	844.60	50.35	155	30	443	196	11	1912	18	—	523	3288	20.3	21.78	2075	1213	7431	320	
19	794.07	794.05	794.17	794.28	794.14	0.11	845.58	845.85	845.60	845.61	845.66	51.52	844.45	50.21	155	30	443	196	11	1912	18	—	525	3290	21.	21.72	2069	1221	7446	36	
20	793.50	793.86	794.00	794.11	793.97	0.17	845.40	845.76	845.80	845.11	845.52	51.55	844.40	50.43	155	30	443	196	11	1912	18	—	526	3291	21.	21.82	2079	1212	7451	325	
21	792.74	792.70	792.91	793.03	792.85	1.12	845.14	845.60	845.61	845.03	845.44	52.59	844.30	51.45	155	30	443	196	11	1912	18	—	545	3310	21.	22.26	2121	1189	7594	313	
22	792.74	792.70	792.91	793.02	792.84	0.01	845.14	845.60	845.61	845.03	845.44	52.60	844.30	51.46	155	30	443	196	11	1912	18	—	545	3310	22.	22.26	2121	1189	7594	313	
23	791.03	791.03	791.07	791.20	791.08	1.76	844.03	845.33	845.57	845.50	845.11	54.03	844.25	53.17	155	30	443	196	11	1912	18	—	571	3326	22.	23.00	2191	1135	7793	291	Stopped clay hoist at 7:20 a. m. Cracked on one side.
24	791.00	791.00	791.04	791.18	791.05	0.03	844.03	845.33	845.57	845.50	845.11	54.06	844.25	53.20	155	30	443	205	12	1912	18	—	571	3336	25.3	23.02	2193	1163	7797	297	
25	790.97	790.95	791.02	791.16	791.02	0.03	844.97	845.45	845.02	845.16	845.12	54.10	844.25	53.23	155	30	443	205	12	1973	18	—	572	3408	25.	23.03	2194	1214	7802	311	Clay hoist repaired at 8:15 p. m.
26	790.95	790.95	791.00	791.15	791.02	0.00	844.97	845.45	845.02	845.16	845.12	54.10	844.30	53.28	155	30	443	205	12	1973	19	—	572	3409	25.	23.05	2196	1213	7802	311	
27	789.55	789.56	789.47	789.60	789.55	1.47	844.45	844.96	845.47	845.10	844.99	55.44	844.40	54.85	155	30	443	214	12	1973	19	—	597	3443	24.	23.73	2261	1182	7987	296	
28	789.55	789.53	789.47	789.60	789.55	0.00	944.20	845.01	845.22	845.03	844.86	55.31	844.45	54.90	155	30	443	214	12	2069	19	—	594	3536	24.	23.75	2262	1274	7969	319	
29	787.74	787.74	787.72	787.88	787.77	1.78	843.95	845.06	844.96	844.96	844.73	56.96	844.35	56.58	155	30	443	214	12	2069	19	—	624	3566	25.	24.48	2332	1234	8197	301	
30	787.71	787.71	787.70	787.87	787.75	0.02	843.71	845.11	844.70	844.87	844.60	56.85	844.35	56.60	155	30	443	214	12	2069	19	—	622	3564	25.	24.49	2333	1231	8181	301	
Oct.																															
1	787.70	787.70	787.70	787.86	787.74	0.01	843.71	845.11	844.70	844.87	844.60	56.86	844.60	56.86	155	30	443	214	13	2069	19	—	622	3565	25.	24.60	2343	1222	8133	300	Raised clay hoist.
2	786.35	786.39	786.37	785.55	786.42	1.32	845.05	845.49	844.77	844.95	845.06	58.64	844.75	58.33	155	30	443	218	13	2148	19	—	655	3681	25.	25.24	2404	1277	8429	303	
3	786.36	786.37	786.36	786.55	786.41	0.01	845.05	845.49	844.77	844.95	845.06	58.65	844.80	58.39	155	30	443	218	13	2205	19	—	655	3738	25.5	25.26	2406	1332	8430	316	
4	786.34	786.35	786.34	786.52	786.39	0.02	844.94	845.35	845.04	844.52	844.96	58.57	844.55	58.16	155	30	443	232	13	2205	19	—	654	3751	25.	25.16	2397	1354	8419	321	
5	784.73	784.75	784.66	784.82	784.74	1.65	844.73	845.35	844.46	844.82	844.84	60.10	844.30	59.56	155	30	443	232	13	2205	19	—	681	3778	27.	25.77	2455	1323	8630	306	
6	784.70	784.70	784.64	784.79	784.71	0.03	845.20	845.50	844.64	845.19	845.18	60.47	844.20	59.49	155	30	443	232	13	2304	19	—	688	3884	27.	25.74	2452	1432	8681	329	
7	782.99	782.99	782.77	782.93	782.92	1.79	844.39	844.99	844.44	844.60	844.60	61.68	844.05	61.13	155	30	443	250	14	2304	19	—	710	3925	27.	26.45	2520	1405	8848	317	
8	782.96	782.94	782.74	782.91	782.89	0.03	844.39	844.99	844.44	844.60	844.60	61.71	843.95	61.06	155	30	443	254	15	2329	20	—	711	3957	27.	26.42	2517	1440	8852	325	
9	781.31	781.30	780.98	781.14	781.18	1.71	844.31	845.30	843.98	844.44	844.51	63.33	843.85	62.67	155	30	443	254	15	2465	20	—	740	4122	28.5	27.11	2583	1539	9076	339	
10	781.30	781.29	780.96	781.12	781.17	0.01	844.31	845.30	843.98	844.44	844.51	63.34	843.85	62.68	155	30	443	254	15	2572	20	—	740	4229	28.5	27.12	2583	1646	9078	362	Stopped clay hoist at 3 p. m.
11	780.04	780.03	779.78	779.94	779.95	1.22	844.04	845.13	844.08	844.64	844.47	64.52	843.80	63.85	155	30	443	254	15	2607	20	—	762	4286	28.	27.63	2632	1654	9240	358	Sand and gravel. Started water pumps at 7 a. m.
12	777.99	777.95	777.92	778.06	777.98	1.97	843.99	845.05	843.92	844.36	844.33	66.35	843.80	65.82	155	30	443	259	15	2607	15	—	795	4319	30.	28.48	2713	1606	9493	338	
13	777.95	777.90	777.95	778.01	777.93	0.05	843.99	845.05	843.92	844.36	844.33	66.40	843.80	65.87	155	30	443	272	16	2640	15	—	796	4367	30.	28.50	2715	1652	9500	348	Started clay hoist at 8 p. m.
14	775.93	775.87	775.93	776.07	775.95	1.98	844.43	845.27	842.93	844.37	844.25	68.30	843.85	67.90	155	30	443	272	16	2662	21	—	831	4430	31.	29.38	2799	1631	9762	334	
15	775.92	775.86	775.92	776.05	775.94	0.01	844.43	845.27	842.93	844.37	844.25	68.31	843.95	68.01	155	30	443	272	16	2795	21	—	831	4563	31.	29.42	2803	1760	9763	360	
16	773.79	773.74	773.81	773.94	773.82	2.12	844.29	845.64	843.31	843.94	844.29	70.47	843.95	70.13	155	30	443	272	16	2896	21	—	870	4703	32.5	30.34	2890	1813	10061	360	Gravel.
17	773.78	773.74	773.80	773.94	773.82	0.00	844.29	845.64	843.31	843.94	844.29	70.47	843.80	69.98	155	30	443	272	16	2929	21	—	870	4736	32.5	30.28	2885	1851	10061	368	
18	773.79	773.74	773.80	773.92	773.81	0.01	844.29	845.64	843.31	843.94	844.29	70.48	843.85	70.04	155	30	443	272	16	2929	21	—	871	4737	32.5	30.30	2886	1851	10063	368	South lock cracked at 3 a. m. in corner of inside well.
19	771.63	771.56	771.69	771.80	771.67	2.14	844.23	845.26	843.19	843.80	844.12	72.45	843.90	72.23	155	30	443	285	16	2929	21	—	906	4785	33.5	31.25	2927	1858	10335	359	Stopped clay hoist 7. a. m. to 9 p. m. Cracked on other side.
20	771.62	771.55	771.69	771.80	771.67	0.00	844.42	845.45	842.79	843.80	844.12	72.45	843.90	72.23	155	30	443	285	16	3023	22	—	906	4880	34.	31.25	2927	1953	10335	378	South lock leaking badly.
21	771.61	771.53	771.67	771.81	771.66	0.01	844.13	845.21	842.59	843.67	843.90	72.24	843.90	72.24	155	30	443	299	17	3043	22	—	902	4911	33.5	31.25	2927	1984	10306	385	Stopped work 11 p. m. Outside well of lock badly cracked.
22	770.34	770.28	770.39	770.53	770.39	1.27	843.84	844.98	842.39	843.53	843.67	73.28	843.95	73.56	155	30	443	303	17	3135	22	—	921	5026	29.7	31.82	3031	1995	10449	382	
23	770.29	770.24	770.35	770.49	770.34	0.05	843.84	844.98	842.39	843.53	843.67	73.33	844.20	73.86	155	30	443	303	17	3158	22	—	922	5050	30.	31.05	3044	2006	10458	383	
24	770.28	770.22	770.34	770.48	770.33	0.01	843.84	844.98	842.39	843.53	843.67	73.34	844.00	73.67	155	30	443	303	17	3197	22	—	922	5089	33.	31.87	3036	2053	10458	393	Resumed at 9 a. m. Well lined with oak.
25	770.27	770.22	770.33	770.48	770.33	0.00	843.84	844.98	842.39	843.53	843.67	73.34	844.00	73.67	155	30	443	303	17	3197	22	—	922	5089	34.	31.87	3036	2053	10458	393	South lock abandoned. North lock braced.
26	769.75	769.70	769.81	769.96	769.80	0.53	844.55	845.10	842.81	844.36	844.20	74.40	844.30	74.50	155	30	443	303	17	3197	22	—	942	5109	34.5	32.23	3070	2039	10466	380	
27	768.21	768.16	768.22	768.39	768.25	1.55	844.71	844.56	842.44	844.49	844.05	75.80	844.20	75.95	155	30	443	303	17	3197	22	—	967	5134	34.5	32.86	3130	2004	10797	371	
28	768.20	768.16	768.22	768.38	768.24	0.01	844.71	844.56	842.44	844.49	844.05	75.81	844.20	75.96	155	30	443	303	17	3223	22	—	967	5160	34.5	32.85	3130	2030	10798	376	
29	767.46	767.40	767.42	767.57	767.46	0.78	844.06	844.30	842.92	844.57	844.19	76.73	844.00	76.54	155	30	443	303	17	3223	22	—	984	5177	35.25	33.11	3154	2023	10925	370	Reached clay on west side.
30	767.38	767.33	767.34	767.49	767.38	0.08	844.06	844.30	842.92	844.57	844.19	77.22	844.00	76.62	155	30	443	303	17	3223	22	—	993	5186	35.5	33.15	3158	2028	10993	370	
31	767.03	766.99	767.00	767.14	767.04	0.34	844.28	844.19	842.70	842.64	843.45	77.36	844.00	76.96	155	30	443	303	17	3223	22	—	996	5189	35.5	33.30	3172	2017	11013	366	
Nov.																															
1	766.83	766.78	766.78	766.93	766.83	0.21	845.33	843.78	842.48	843.93	843.88	77.05	843.95	77.12	155	30	443	303	17	3223	22	—	990	5183	35.5	33.37	3179	2004	10970	365	
2	766.19	766.14	766.14	766.28	766.19	0.64	845.19	843.64	842.94	842.98	843.69	77.50	843.85	77.66	155	30	443	303	17	3223	22	—	998	5191	35.5	33.60	3201	1990	11032	360	
3	766.19	766.13	766.13	726.27	766.18	0.01	845.19	843.64	842.94	842.98	843.69	77.51	843.80	77.62	155	30	443	303	17	3223	22	—	998	5191	35.5	33.58	3199	1992	11033	360	
4	766.07	766.02	766.00	766.14	766.06	0.12	843.47	844.12	844.00	843.44	843.76	77.70	843.85	77.79	155	30	443	303	17	3223	16	—	1002	5195	35.5	33.66	3206	1989	11059	359	Took off clay hoist.
5	765.15	765.08	765.07	765.21	765.13	0.93	842.95	844.08	842.87	842.91	843.20	78.07	843.85	78.72	155	30	443	303	17	3223	16	—	1009	5196	35.5	34.06	3245	1951	11110	351	Began concreting at 11:25 a. m.
6	—	—	—	—	—	—	—	—	—	—	—	—	844.00	—	155	30	443	303	17	3223	16	—	—	—	35.	—	—	—	—	—	
7	—	—	—	—	—	—	—	—	—	—	—	—	844.00	—	155	30	443	303	17	3223	16	—	—	—	35.	—	—	—	—	—	Finished filling caisson at 8:30 p. m.
8	—	—	—	—	—	—	—	—	—	—	—	—	844.00	—	155	30	443	303	17	3223	16	—	—	—	34.5	—	—	—	—	—	Took off air at 7:30 a. m.
9	765.10	765.06	765.02	765.17	765.09	0.04	—	—	—	—	—	—	844.10	79.01	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	

APPENDIX E.

TIME, COST AND MATERIALS USED IN FOUNDATIONS. PIER I.

Date,	Principal Foreman.		Night Foreman.		Sub Foremen.		Lock Tenders.		Pressure Men.		Coffeehouse Men.		Coffee.		Sugar.		Candles.		Red Lead		Wick.		Coal for Heating, 200 lbs.		Linseed Oil.		Ditching Outside.	
1886	Days.	Amount.	Days.	Amount.	Days.	Amount.	Days.	Amount.	Days.	Amount.	Days	Amount.	Lbs.	Amount.	Lbs.	Amount.	No.	Amount.	Lbs.	Amount.	Lbs	Amount.	Boxes.	Amount.	Pints.	Amount.	Days.	Amount.
Feb.																			70	4.20					24	1.50		
20	1	6.00	1	3.57	3	9.00	2	4.50	26	58.50	1	1.50	5	0.63	5	0.31	31	0.39	—	—	—	—	1	0.31	—	—	—	—
21	1	6.00	1	3.57	3	9.00	2	4.50	24	54.00	2	3.00	2½	0.31	5	0.32	24	0.30	—	—	—	—	1	0.32	—	—	—	—
22	1	6.00	1	3.57	3	9.00	2	4.50	27^{5}	61.87	2	3.00	2½	0.32	5	0.31	41	0.51	1½	0.09	—	—	1	0.31	1	0.06	—	—
23	1	6.00	1	3.57	3	9.00	2	4.50	25	56.25	2	3.00	2½	0.31	5	0.32	30	0.38	2½	0.15	½	0.09	1	0.32	1	0.06	—	—
24	1	6.00	1	3.57	3	9.00	2	4.50	22	49.50	2	3.00	2¼	0.28	10	0.63	22	0.28	—	—	—	—	1	0.31	—	—	—	—
25	1	6.00	1	3.57	2	6.00	2	4.50	25	56.25	2	3.00	2¼	0.28	5	0.31	14	0.18	1½	0.09	—	—	1	0.32	1	0.07	—	—
26	1	6.00	1	3.57	3	9.00	2	4.50	24	54.00	2	3.00	2½	0.32	10	0.63	24	0.30	—	—	—	—	—	—	—	—	—	—
27	1	6.00	1	3.57	2	6.00	2	4.50	18	40.50	2	3.00	2½	0.31	5	0.31	9	0.11	—	—	—	—	1	0.31	—	—	—	—
28	1	6.00	1	3.57	2	6.00	2	4.50	23	51.75	2	3.00	2½	0.32	5	0.32	21	0.26	—	—	—	—	1	0.32	—	—	—	—
Mar.																												
1	1	6.00	1	3.22	3	9.00	2	4.50	27	60.75	2	3.00	2½	0.31	10	0.63	36	0.45	—	—	—	—	1	0.31	—	—	5^{4}	8.10
2	1	6.00	1	3.22	3	9.00	2	4.50	27	61.50	2	3.00	2½	0.32	5	0.32	29	0.36	5	0.30	½	0.10	1	0.32	2	0.13	9^{4}	13.50
3	1	6.00	1	3.22	3	9.00	2	4.50	27	61.50	2	3.00	2	0.25	5	0.31	27	0.34	—	—	—	—	1	0.31	—	—	14	19.60
4	1	6.00	1	8.22	3	9.50	2	5.00	29	70.75	2	3.00	4	0.50	10	0.63	42	0.53	5	0.30	½	0.09	1	0.32	2	0.12	8^{8}	12.02
5	1	6.00	1	3.22	4	13.00	2	5.00	35	87.50	2	3.00	2	0.25	10	0.63	32	0.40	—	—	—	—	1	0.31	—	—	5^{4}	8.41
6	1	6.00	1	3.22	4	13.00	2	5.00	35	87.50	2	3.00	5	0.62	10	0.63	42	0.53	—	—	—	—	1	0.32	—	—	5^{8}	7.28
7	1	6.00	1	3.22	4	13.00	2	5.00	33	82.50	2	3.00	2½	0.31	5	0.31	36	0.45	—	—	—	—	—	—	—	—	6^{5}	9.10
8	1	6.00	1	3.22	4	13.00	2	5.00	31	77.50	2	3.00	5	0.63	5	0.32	18	0.23	—	—	—	—	1	0.34	—	—	12^{4}	19.13
9	1	6.00	1	3.22	4	13.00	2	5.00	33	82.50	2	3.00	2½	0.32	10	0.63	31	0.39	—	—	—	—	1	0.34	—	—	10^{5}	16.23
10	1	6.00	1	3.22	4	13.00	2	5.00	18	45.00	2	3.00	2	0.25	5	0.31	2	0.03	—	—	—	—	1	0.34	—	—	19	44.74
11	1	6.00	1	3.22	—	—	2	5.00	—	—	2	3.00	—	—	—	—	7	0.09	—	—	—	—	1	0.34	—	—	—	—
12	1	6.00	1	3.22	2	6.50	2	5.06	16	40.00	2	3.00	4	0.50	10	0.63	13	0.16	—	—	—	—	1	0.34	—	—	3^{8}	4.62
13	1	6.00	1	3.22	4	13.00	2	5.00	32	80.00	2	3.00	2½	0.31	5	0.32	12	0.15	—	—	—	—	—	—	—	—	7^{8}	10.92
14	1	6.00	1	3.23	4	13.00	2	5.00	32	80.00	2	3.00	4½	0.57	5	0.31	20	0.25	5	0.30	½	0.10	1	0.34	2	0.13	9^{8}	13.44
15	1	6.00	1	3.23	4	13.00	2	5.00	34	85.00	2	3.00	4½	0.56	6	0.38	9	6.11	—	—	—	—	1	0.34	—	—	18	25.75
16	1	6.00	1	3.23	4	13.00	2	5.00	33	82.50	2	3.00	2½	0.32	10	0.63	6	0.08	—	—	—	—	—	—	—	—	7^{5}	11.05
17	1	6.00	1	3.33	4	13.00	2	5.00	31	76.50	2	3.00	4½	0.57	5	0.31	6	0.07	5	0.30	½	0.09	1	0.31	2	0.12	11	15.40
18	1	6.00	1	3.23	4	13.00	2	5.00	34	85.00	2	3.00	4½	0.59	5	0.32	8	0.10	—	—	—	—	1	0.32	—	—	8^{2}	12.33
19	1	6.00	1	3.23	4	13.00	2	5.00	39^{5}	98.75	2	3.00	4½	0.63	10	0.63	6	0.08	—	—	—	—	1	0.31	—	—	—	—
20	1	6.00	1	3.23	5	16.25	2	5.00	44^{5}	111.25	2	2.00	4½	0.64	5	0.31	4	0.05	—	—	—	—	1	0.32	—	—	—	—
21	1	6.00	1	3.23	6	19.50	2	5.00	46	115.00	2	3.00	4½	0.63	10	0.63	—	—	5	0.30	½	0.10	1	0.31	2	0.13	—	—
22	1	6.00	1	3.23	6	19.50	2	5.00	51^{5}	128.75	2	3.00	4¾	0.66	10	0.63	12	0.15	—	—	—	—	1	0.31	—	—	—	—
23	1	6.00	1	3.23	6	19.50	2	5.00	53^{5}	133.75	2	3.00	4¾	0.67	10	0.63	6	0.07	—	—	—	—	1	0.32	—	—	—	—
24	1	6.00	1	3.23	6	19.50	2	5.00	53	132.50	2	3.00	5	0.70	5	0.32	5	0.06	—	—	—	—	1	0.32	—	—	—	—
25	1	6.00	1	3.23	6	19.50	2	5.00	54	135.00	2	3.00	5	0.70	10	0.63	10	0.12	—	—	—	—	1	0.31	—	—	—	—
26	1	6.00	1	3.23	6	19.50	2	5.00	55	137.50	2	3.00	5	0.70	5	0.31	—	—	—	—	—	—	1	0.32	—	—	—	—
27	1	6.00	1	3.23	6	19.50	2	5.00	52^{5}	131.25	2	3.00	5	0.70	10	0.63	6	0.08	—	—	—	—	1	0.31	—	—	—	—
28	1	6.00	1	3.23	6	19.50	2	5.00	54	135.00	2	3.00	5	0.70	5	0.32	—	—	—	—	—	—	1	0.32	—	—	—	—
29	1	6.00	1	3.23	6	19.50	2	5.00	55	137.50	2	3.00	5	0.70	10	0.63	—	—	—	—	—	—	1	0.31	—	—	—	—
30	1	6.00	1	3.23	6	19.50	2	5.00	53	132.50	2	3.00	5½	0.77	10	0.63	3	0.04	—	—	—	—	1	0.32	—	—	—	—
31	1	6.00	1	3.23	6	19.50	2	5.00	54	135.00	2	3.00	4¾	0.66	10	0.63	6	0.07	—	—	—	—	1	0.31	—	—	—	—
Apr.																												
1	1	6.00	1	3.33	6	19.50	2	5.00	51^{5}	128.75	2	3.00	5½	0.77	5	0.31	2	0.02	—	—	—	—	1	0.32	—	—	—	—
2	1	6.00	1	3.33	6	19.50	2	5.00	54	135.00	2	3.00	5	0.70	10	0.63	10	0.13	—	—	—	—	1	0.31	—	—	—	—
3	1	6.00	1	3.34	6	19.50	2	5.00	55	137.50	2	3.00	5¼	0.73	10	0.63	2	0.03	—	—	—	—	1	0.32	—	—	—	—
4	1	6.00	1	3.33	6	19.50	2	5.00	55	137.50	2	3.00	5¼	0.74	10	0.63	6	0.08	—	—	—	—	1	0.31	—	—	—	—
5	1	6.00	1	3.33	6	19.50	2	5.00	55	137.50	2	3.00	4½	0.63	5	0.32	12	0.15	—	—	—	—	1	0.32	—	—	—	—
6	1	6.00	1	3.34	6	19.50	2	5.00	55	137.50	2	3.00	4½	0.64	10	0.63	—	—	—	—	—	—	2	0.63	—	—	—	—
7	1	6.00	1	3.33	6	19.50	2	5.00	56	140.00	2	3.00	2½	0.35	5	0.31	—	—	—	—	—	—	1	0.31	—	—	—	—
8	1	6.00	1	3.33	6	19.50	2	5.00	53^{5}	133.75	2	3.00	4½	0.63	10	0.63	24	0.30	—	—	—	—	1	0.32	—	—	—	—
9	1	6.00	1	3.34	6	19.50	2	5.00	55	137.50	2	3.00	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		294.00		162.13		690.25		239.00		4618.37		145.50		24.31		22.10		8.86		6.03		0.57		14.35		2.32		251.62

Date,	Day Engineer.		Night Engineer		Firemen		Coal Passers.		Pump Men.		Laborers on Hoist		Coal for Boilers.		Black Oil.		Signal Oil.		Tallow.		Waste.		Coal Oil.		Totals for Each Day.	Feet Sunk per day	Material.	Camerons. Hrs Run.	Camerons. No. of revo-l'tns.	Rev's. of Air pumps	Remarks.
1886	Days	Amount	Days	Amount	Days.	Amount	Days.	Amount	Days.	Amount.	Days.	Amount.	Tons.	Amount.	Pints.	Amount.	Pints.	Amount.	Lbs.	Amount.	Lbs.	Amount.	Pints.	Amount.							
Feb.																									5.70						
20	2	7.30	½	1.50	2	4.80	1	2.10	1	2.40	—	—	7^{0}	23.94	—	—	—	—	14	0.91	—	—	8	0.11	127.77	2.17	sand	21⅔	38	—	
21	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	—	—	8^{3}	26.15	8	0.11	8	0.34	12	0.78	—	—	8	0.11	133.21	3.91	"	22 11/12	38	36	
22	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	—	—	7^{8}	24.57	16	0.22	—	—	15	0.98	—	—	—	—	139.71	3.45	"	22¼	38	29	
23	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	—	—	7^{0}	23.94	8	0.11	—	—	14	0.91	4	0.28	8	0.11	133.70	3.22	"	21 1/12	38	32	
24	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	—	—	4^{8}	14.49	8	0.11	8	0.34	4	0.26	—	—	8	0.11	116.78	0.86	"	20 10/12	38	28	
25	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	—	—	6^{4}	19.22	16	0.22	—	—	8	0.52	—	—	—	—	124.93	2.26	"	23 11/12	39	27	
26	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	—	—	5	15.75	16	0.22	8	0.34	18	1.17	3	0.31	16	0.22	123.63	3.44	"	9⅝	40	15	
27	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	—	—	1^{8}	5.67	—	—	—	—	4	0.26	½	0.04	16	0.22	95.20	0.00	"	—	—	15	
28	2	7.30	1	3.30	2	4.80	2	4.20	1	2.40	—	—	3	9.45	16	0.22	—	—	4	0.26	—	—	16	0.22	108.19	0.30	"	5 7/12	37	11	
Mar.																															
1	2	7.30	1	3.30	2	4.80	2	4.20	1	2.40	—	—	5^{8}	17.33	—	—	—	—	12	0.78	—	—	8	0.11	136.49	4.94	"	19⅝	36	19	
2	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	—	—	7	22.05	8	0.11	—	—	9	0.59	1	0.07	8	0.11	149.90	4.77	"	21	38	28	
3	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	—	—	6^{8}	21.42	16	0.22	—	—	10	0.65	—	—	16	0.22	154.94	4.52	"	24	37	22	
4	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	—	—	6^{8}	19.53	—	—	—	—	—	—	4	0.28	—	—	156.19	2.02	"	24	36	35	
5	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	—	—	5	15.75	8	0.11	8	0.34	12	0.78	1	0.07	8	0.11	169.28	2.14	"	20 11/12	36	29	
6	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	—	—	6	18.90	8	0.11	—	—	—	—	—	—	8	0.11	170.62	0.03	"	24	35	38	
7	3	11.30	1	3.30	2	4.80	2	4.20	2	4.80	—	—	6^{5}	21.28	16	0.22	—	—	4	0.26	—	—	—	—	173.05	1.72	"	21	36	39	
8	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	—	—	5^{8}	20.06	—	—	—	—	4	0.26	½	0.03	—	—	173.12	0.00	"	16 5/6	35	30	
9	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	3^{1}	4.47	4^{8}	16.32	—	—	—	—	9	0.59	—	—	—	—	176.41	0.02	"	5 1/12	37	29	
10	3	11.30	1	3.30	2	4.80	2	4.20	2	4.80	6^{3}	9.39	3^{9}	13.26	8	0.11	—	—	2	0.13	—	—	16	0.22	172.40	0.00	"	—	—	31	
11	2	7.30	1	3.30	2	4.80	2	4.20	1	2.40	—	—	3^{6}	11.90	—	—	8	0.50	4	0.26	2	0.14	—	—	52.45	1.44	"	—	—	41	
12	2	7.30	1	3.30	2	4.80	2	4.20	1	2.40	1	1.40	6^{4}	22.78	—	—	8	0.34	2	1.13	—	—	—	—	116.62	0.02	"	23⅔	36	42	
13	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	4^{8}	6.30	6^{9}	23.12	—	—	8	0.50	9	0.59	—	—	—	—	176.83	2.25	"	22 6/12	35	42	
14	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	4^{4}	5.74	7^{1}	24.14	8	0.11	—	—	5	0.33	2	0.14	—	—	180.53	2.13	"	23¾	37	41	
15	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	3^{5}	4.90	8^{7}	29.58	—	—	—	—	8	0.52	—	—	8	0.11	201 88	2.54	"	23 1/12	38	39	
16	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	4^{4}	6.16	8^{8}	27.82	—	—	—	—	4	0.26	—	—	—	—	183.45	2.29	"	21 1/12	36	38	[pumps,
17	2	7.30	1	3.30	2	5.40	2	4.20	2	4.80	—	—	7^{5}	23.63	8	0.11	—	—	12	0.78	—	—	—	—	174.42	1.44	clay	23 1/12	70	38	Clay hoist substituted for Cameron
18	2	7.30	1	3.30	2	5.40	2	4.20	2	4.80	7^{2}	10.22	4^{1}	13.86	8	0.11	—	—	2	0.13	—	—	—	—	178.21	0.28	"	9 11/12	44	32	Pump men running clay hoist.
19	2	7.30	1	3.30	2	5.40	2	4.20	1	2.00	10^{1}	14.72	3^{4}	9.77	—	—	—	—	2	0.13	—	—	8	0.11	177.56	0.64	"	—	—	33	
20	2	7.30	1	3.30	2	5.40	2	4.20	2	4.00	10^{2}	16.07	2^{8}	8.19	—	—	—	—	2	0.13	—	—	—	—	194.64	0.00	"	—	—	18	
21	2	7.30	1	3.30	2	5.40	2	4.20	—	—	9^{6}	15.82	2^{1}	6.62	16	0.22	—	—	4	0.26	—	—	—	—	196.95	0.01	"	—	—	14	
22	2	7.30	1	3.30	2	5.40	2	4.20	2	4.00	9^{6}	13.44	2^{8}	8.19	—	—	—	—	2	0.13	1	0.07	—	—	213.26	0.00	"	—	—	24	
23	2	7.30	1	3.30	2	5.40	2	4.20	2^{8}	4.40	9^{6}	13.44	2^{8}	7.88	8	0.11	8	0.34	4	0.26	—	—	—	—	218.80	0.01	"	—	—	27	
24	2	7.30	1	3.30	2	5.40	2	4.20	1^{5}	3.20	10	14.00	3^{1}	9.77	8	0.11	—	—	3	0.19	—	—	—	—	218.10	0.02	"	—	—	35	
25	2	7.30	1	3.39	1	3.00	2	4.20	2	4.40	7^{2}	10.08	3^{6}	11.34	—	—	—	—	2	0.13	1	0.07	—	—	217.31	1.47	"	—	—	29	
26	2^{6}	9.30	1	3.30	2	5.40	2	4.20	2	4.80	7^{8}	10.08	3^{8}	10.40	—	—	—	—	2	0.13	—	—	—	—	223.17	0.00	"	—	—	24	
27	2	7.30	1	3.30	2	5.40	2	4.20	2	4.80	9^{2}	12.88	2^{8}	8.19	8	0.11	—	—	2	0.13	1	0.07	—	—	216.08	0.00	"	—	—	28	
28	2	7.30	1	3.30	2	5.40	2	4.20	2	4.80	9^{1}	13.58	3^{8}	10.40	16	0.22	—	—	5	0.33	—	—	—	—	222.60	1.33	"	—	—	26	
29	2	7.30	1	3.30	2	5.40	2	4.20	1	2.40	9^{6}	13.44	3^{8}	11.34	—	—	—	—	2	0.13	—	—	—	—	223.38	0.69	"	—	—	22	
30	2	7.30	1	3.30	2	5.40	2	4.20	2	4.80	9^{6}	13.44	1^{1}	5.36	8	0.11	8	0.50	4	0.26	1	0.07	8	0.11	215.84	0.01	"	—	—	34	Began excavation for test pit,
31	2	7.30	1	3.30	2	5.40	2	4.20	2	4.80	9^{6}	13.44	3^{4}	10.71	—	—	—	—	4	0.26	—	—	—	—	222.81	0.00	"	—	—	31	
Apr.																															
1	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	9^{6}	13.44	4^{3}	13.55	8	0.11	—	—	4	0.26	—	—	8	0.11	218.87	0.00	"	—	—	36	
2	2	7.30	1	3.30	2	4.80	2	4.20	2	4.40	5^{2}	7.28	5^{8}	18.27	16	0.22	—	—	4	0.26	1	0.07	—	—	223.70	0.00	"	—	—	40	Reached gravel in test pit.
3	2	7.30	1	3.30	2	4.80	2	4.20	—	—	2	2.80	3^{9}	12.29	—	—	—	—	2	0.13	—	—	8	0.11	210.98	0.71	"	—	—	37	
4	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	9^{6}	13.44	5^{1}	16.07	—	—	—	—	4	0.26	—	—	—	—	230.26	1.00	"	—	—	37	
5	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	9^{6}	13.44	3^{8}	10.40	—	—	—	—	2	0.13	—	—	—	—	224.12	0.00	"	—	—	27	
6	2	7.30	1	3.30	2	4.80	2	4.20	1	2.40	9^{6}	13.44	2^{9}	9.14	16	0.22	8	0.34	2	0.13	1	0.07	—	—	221.58	0.07	"	—	—	31	Began sealing caisson at 9:45 p. m.
7	2	7.30	1	3.30	2	4.80	2	4.20	—	—	—	—	2^{9}	9.14	—	—	—	—	2	0.13	1	0.07	—	—	206.74	0.00	"	—	—	28	
8	2	7.30	1	3.30	2	4.80	2	4.20	—	—	—	—	1^{5}	4.73	8	0.11	—	—	2	0.13	—	—	8	0.11	197.14	0.00	"	—	—	20	
9	2	7.30	1	3.30	2	4.80	2	4.20	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	193.94	0.00	"	—	—	22	Finished sealing caisson at 5 a. m. [Took air off at 2:15 p. m.
		367.70		159.90		241.80		203.70		187.20		286.85		737.66		3.96		3.88		16.99		1.75		2.64	8693.44						

Other expenses charged to sinking . . $2229.48

$10922.92

TIME, COST AND MATERIALS USED IN FOUNDATIONS. PIER II.

Date 1887	Principal Foreman Days	Principal Foreman Amount	Night Foreman Days	Night Foreman Amount	Sub Foremen Days	Sub Foremen Amount	Lock Tenders Days	Lock Tenders Amount	Pressure Men Days	Pressure Men Amount	Coffee House Men Days	Coffee House Men Amount	Coffee Lbs	Coffee Amount	Sugar Lbs	Sugar Amount	Candles No.	Candles Amount	Red Lead Lbs	Red Lead Amount	Wick Lbs	Wick Amount	Coal for heating 200 lbs. Boxes	Coal for heating Amount	Linseed Oil Pints	Linseed Oil Amount	Day Engineers Days	Day Engineers Amount	Night Engineers Days	Night Engineers Amount	Firemen Days	Firemen Amount	Coal Passers Days	Coal Passers Amount	Pump Men Days	Pump Men Amount	Laborers on Hoist Days	Laborers on Hoist Amount	Coal for Boilers Tons	Coal for Boilers Amount	Signal Oil Pints	Signal Oil Amount	Black Oil Pints	Black Oil Amount	Tallow Lbs	Tallow Amount	Waste Lbs	Waste Amount	Lard Oil Pints	Lard Oil Amount	Totals for Each Day	Feet Sunk per day	Material	Cameron Pumps Hours run	Cameron Pumps No. of revolutions	Air Pumps No. of revolutions	Remarks
Feb.																																																									
10	1	4.47	—	—	—	—	—	—	54^{1}	54.17	—	—	—	—	—	—	—	—	40	2.40	—	—	—	—	16	1.00	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	16	0.24	—	—	—	—	—	—	62.28	7.56	—	—	—	—	Carpenters and laborers began lowering caisson.
11	1	4.47	—	—	0^{6}	1.63	—	—	19	40.45	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	16	0.24	—	—	—	—	—	—	46.79	4.67	—	—	—	—	
12	1	4.47	—	—	—	—	—	—	3^{7}	8.00	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	16	0.24	—	—	—	—	—	—	12.71	0.86	—	—	—	—	
13	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		0.64	—	—	—	—	
14	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		0.02	—	—	—	—	
15	—	—	—	—	0^{6}	1.50	—	—	5	11.25	—	—	—	—	—	—	—	—	3	0.18	¼	0.05	—	—	1	0.06	1	4.00	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	0.07	—	—	17.11	0.99	sand	10⅚	38	—	
16	1	6.00	1	3.57	3	9.00	2	4.50	28^{8}	64.12	2	3.00	3	0.66	5	0.30	45	0.56	—	—	—	—	3	1.02	—	—	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	—	—	4^{1}	14.28	8	0.34	8	0.12	8	0.50	1	0.07	8	0.11	32.57	6.06	"	20⅓	38	29	
17	—	—	1	3.57	0^{6}	1.50	1	2.25	15	33.75	1	1.50	3	0.67	4	0.24	18	0.23	3	0.18	¼	0.05	—	—	1	0.06	—	—	1	3.30	1	2.40	1	2.10	1	2.40	—	—	4^{1}	15.30	—	—	8	0.12	—	—	1	0.07	—	—	169.69	0.02	"	—	—	25	
18	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		—	"	—	—	—	Working in P. III.
19	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		—	"	—	—	—	" "
20	1	6.00	—	—	0^{7}	1.50	1	2.25	4	9.00	1	1.50	1	0.22	2	0.12	—	—	2	0.12	¼	0.05	—	—	½	0.04	2	7.30	—	—	1	2.40	1	2.10	—	—	—	—	6^{8}	23.46	—	—	8	0.12	8	0.50	1	0.07	—	—	56.75	0.10	"	—	—	23	
21	1	6.00	1	3.58	2	6.00	1	2.25	17	38.75	2	3.00	4	0.90	10	0.60	30	0.37	3	0.18	¼	0.05	2	0.68	1	0.06	2	7.30	1	3.30	2	4.80	2	4.20	1	2.40	—	—	6^{7}	22.78	8	0.34	8	0.12	—	—	1	0.07	—	—	107.73	5.59	"	23	40	21	
22	1	6.00	1	3.57	3	9.00	1	2.25	32	72.00	2	3.00	2	0.45	5	0.30	38	0.48	—	—	—	—	—	—	—	—	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	—	—	6^{8}	23.46	—	—	8	0.12	8	0.50	1	0.07	—	—	145.60	3.91	coarse	21⅔	35	33	
23	—	—	1	3.57	1	3.00	1	2.25	10	22.50	1	1.50	2	0.45	—	—	14	0.17	—	—	—	—	—	—	—	—	—	—	1	3.30	1	2.40	1	2.10	1	2.40	—	—	6^{8}	23.46	—	—	8	0.12	—	—	1	0.07	—	—	67.29	0.01	sand &	—	—	25	
24	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		—	rub-	—	—	—	Working in P. III.
25	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		—	bish	—	—	—	" "
26	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		—	—	—	—	—	" "
27	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		—	—	—	—	—	" "
28	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		—	—	—	—	—	" "
Mar.																																																									
1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		—	—	—	—	—	" "
2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		—	—	—	—	—	Work suspended. River breaking up.
3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		—	—	—	—	—	" "
4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		—	—	—	—	—	" "
5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		—	—	—	—	—	" "
6	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		—	—	—	—	—	" "
7	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		—	—	—	—	—	" "
8	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		—	—	—	—	—	" "
9	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		—	—	—	—	—	" "
10	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		—	—	—	—	—	Working in P. III.
11	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		—	—	—	—	—	" "
12	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		—	—	—	—	—	" "
13	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		—	—	—	—	—	" "
14	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		—	—	—	—	—	" "
15	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		—	—	—	—	—	" "
16	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		—	—	—	—	—	" "
17	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		—	—	—	—	—	" "
18	½	3.00	1	—	1	3.00		1.12	11	24.75		.75	3	0.70	8	0.52	12	0.16	—	—	—	—	—	—	—	—	1	3.65		1.65		1.20		1.05		1.20	—	—	6^{8}	23.46	8	0.34	8	0.12	8	0.50	1	0.07	—	—	67.24	3.20	—	14½	34	34	
19	1	6.00	1	3.22	3	9.00	2	4.50	28^{6}	64.13	2	3.00	4	0.94	9	0.58	4	0.05	3	0.18	¼	0.05	2	0.68	1	0.06	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	—	—	6^{7}	22.78	—	—	8	0.12	—	—	1	0.07	—	—	139.76	1.51	sand	15½	41	27	
20	1	6.00	1	3.22	1	3.00	2	4.50	9	20.25	2	3.00	4	0.94	10	0.65	2	0.03	—	—	—	—	—	—	—	—	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	—	—	6^{8}	23.46	—	—	8	0.12	8	0.52	1	0.07	—	—	90.16	1.65	"	8	40	23	
21	1	6.00	1	3.22	1^{2}	3.60	2	4.50	10^{8}	24.30	2	3.00	4	0.94	10	0.65	14	0.17	3	0.18	¼	0.05	—	—	1	0.06	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	—	—	6^{8}	23.46	8	0.34	8	0.12	—	—	1	0.07	8	0.11	95.17	2.73	"	18⅓	40	25	
22	1	6.00	1	3.22	2	6.00	2	4.50	21	47.25	2	3.00	4	0.94	8	0.52	6	0.08	—	—	—	—	—	—	—	—	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	—	—	6^{8}	23.46	—	—	8	0.12	8	0.50	1	0.07	—	—	119.46	1.93	"	14	39	23	
23	1	6.00	1	3.22	1	3.25	2	4.75	11	27.50	2	3.00	4	0.94	7	0.45	2	0.02	—	—	—	—	—	—	—	—	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	—	—	6^{8}	23.46	—	—	8	0.12	—	—	1	0.07	—	—	97.18	0.55	"	7⅓	37	19	
24	1	6.00	1	3.22	2	6.50	2	5.00	22	55.00	2	3.00	3	0.71	6	0.39	9	0.11	—	—	—	—	3	1.02	—	—	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	—	—	6^{8}	23.46	—	—	8	0.12	8	0.50	1	0.07	—	—	129.50	1.91	"	11⅓	37	18	
25	1	6.00	1	3.22	2	6.50	2	5.00	21	53.75	2	3.00	4	0.94	12	0.78	2	0.03	—	—	—	—	—	—	—	—	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	—	—	6^{8}	23.46	8	0.34	8	0.12	—	—	1	0.07	—	—	127.61	0.77	"	11⅓	38	26	
26	1	6.00	1	3.22	0^{8}	1.63	2	5.00	6	15.00	2	3.00	3	0.70	6	0.39	—	—	—	—	—	—	4	1.36	—	—	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	—	—	6^{8}	22.10	—	—	8	0.12	6	0.38	1	0.07	—	—	83.37	1.36	"	$4\frac{1}{12}$	36	16	
27	1	6.00	1	3.22	1	3.25	2	5.00	3	7.50	2	3.00	4	0.94	6	0.39	4	0.05	—	—	—	—	—	—	—	—	2	7.30	1	3.30	2	4.80	2	4.20	1	2.40	—	—	6^{8}	23.46	—	—	4	0.06	—	—	1	0.07	—	—	74.94	0.29	—	—	—	—	Protecting tracks, etc., account of high water.
28	1	6.00	1	3.22	1	3.25	2	5.00	5	12.50	2	3.00	3	0.70	4	0.26	3	0.04	—	—	—	—	—	—	—	—	2	7.30	1	3.30	2	4.80	2	4.20	1	2.40	—	—	6^{8}	23.46	—	—	4	0.06	—	—	1	0.07	—	—	79.56	—	—	—	—	—	" "
29	1	6.00	1	3.22	1^{6}	4.87	2	5.00	16	40.00	2	3.00	1	0.23	4	0.26	6	0.08	—	—	—	—	3	1.02	—	—	2	7.30	1	3.30	2	4.80	2	4.20	1	2.40	—	—	6^{8}	22.44	8	0.34	4	0.06	—	—	1	0.07	8	0.11	108.70	—	—	—	—	—	" "
30	1	6.00	1	3.22	1	3.25	2	5.00	11	27.50	2	3.00	2	0.47	2	0.13	—	—	—	—	—	—	1	0.34	—	—	2	7.30	1	3.30	2	4.80	2	4.20	1	2.40	—	—	6^{8}	23.12	—	—	4	0.06	—	—	1	0.07	—	—	94.16	—	—	—	—	—	" "
31	1	6.00	1	3.22	—	—	2	5.00	—	—	2	3.00	4	0.94	6	0.39	2	0.03	—	—	—	—	—	—	—	—	2	7.30	1	3.30	2	4.80	2	4.20	1	2.40	—	—	6^{8}	23.46	8	0.34	4	0.06	—	—	1	0.07	—	—	64.51	—	—	—	—	—	" "
Apr.																																																									
1	1	6.00	1	3.33	—	—	2	5.00	—	—	2	3.00	4	0.94	8	0.52	—	—	—	—	—	—	—	—	—	—	2	7.60	1	3.30	2	4.80	2	4.20	1	2.40	—	—	6^{8}	23.46	—	—	4	0.06	—	—	1	0.07	—	—	64.68	—	—	—	—	—	" "
2	1	6.00	1	3.33	—	—	2	5.00	—	—	2	3.00	3	0.70	6	0.39	—	—	—	—	—	—	3	1.02	—	—	2	7.60	1	3.30	2	4.80	2	4.20	1	2.40	—	—	6^{8}	22.44	8	0.34	4	0.06	—	—	1	0.07	8	0.11	64.76	—	—	—	—	—	Pressure men concreting.
3	1	6.00	1	3.34	2	6.50	2	5.00	22	55.00	2	3.00	3	0.71	6	0.39	3	0.04	—	—	—	—	1	0.34	—	—	2	7.60	1	3.30	2	4.80	2	4.20	2	4.80	—	—	6^{8}	23.12	8	0.34	8	0.12	8	0.50	1	0.07	—	—	129.17	0.72	sand	$23\frac{6}{12}$	35	25	
4	1	6.00	1	3.33	4	13.00	2	5.00	46	115.00	2	3.00	5	1.17	8	0.52	7	0.09	—	—	—	—	—	—	—	—	2	7.60	1	3.30	2	4.80	2	4.20	2	4.80	—	—	6^{8}	23.46	—	—	8	0.12	—	—	1	0.07	—	—	195.46	1.30	"	23¼	38	24	
5	1	6.00	1	3.33	4	13.00	2	5.00	46	115.00	2	3.00	4	0.94	8	0.52	10	0.12	—	—	—	—	4	1.36	—	—	2	7.60	1	3.30	2	5.80	2	4.20	2	4.80	—	—	6^{4}	22.10	—	—	8	0.12	8	0.50	1	0.07	—	—	195.76	1.96	"	23⅔	36	24	
6	1	6.00	1	3.34	4	13.00	2	5.00	41^{5}	103.75	2	3.00	3	0.71	6	0.39	1	0.01	4	0.24	½	0.10	—	—	2	0.12	2	7.60	1	3.30	2	4.80	2	4.20	2	4.80	—	—	6^{8}	23.46	—	—	8	0.12	—	—	1	0.07	—	—	184.01	0.57	"	$18\frac{11}{12}$	38	26	
7	1	6.00	1	3.33	3^{5}	11.38	2	5.00	40^{5}	101.25	2	3.00	3	0.70	6	0.39	—	—	—	—	—	—	—	—	—	—	2	7.60	1	3.30	2	4.80	2	4.20	2	4.80	—	—	6^{8}	17.14	8	0.34	8	0.12	8	0.52	1	0.07	—	—	173.94	1.20	"	$20\frac{6}{12}$	39	27	
8	1	6.00	1	3.33	4	13.00	2	5.00	47	117.50	2	3.00	3	0.71	6	0.39	6	0.07	—	—	—	—	—	—	—	—	2	7.60	1	3.30	2	4.80	2	4.20	2	4.80	—	—	6^{8}	15.38	—	—	8	0.12	—	—	1	0.07	—	—	189.27	3.20	"	23⅔	39	18	
9	1	6.00	1	3.34	4	13.00	2	5.00	46	115.00	2	3.00	4	0.94	8	0.52	6	0.08	—	—	—	—	4	0.89	—	—	2	7.60	1	3.30	2	4.80	2	4.20	2	4.80	—	—	6^{7}	14.49	—	—	8	0.12	8	0.50	1	0.07	—	—	187.65	2.41	"	23⅚	39	21	
10	1	6.00	1	3.33	4	13.00	2	5.00	46	115.00	2	3.00	3	0.70	8	0.52	20	0.25	—	—	—	—	—	—	—	—	2	7.60	1	3.30	2	4.80	2	4.20	2	4.80	—	—	6^{8}	15.38	8	0.34	8	0.12	—	—	1	0.07	—	—	187.41	1.31	"	$2\frac{9}{12}$	37	27	
11	1	6.00	1	3.33	3	9.75	2	5.00	32^{3}	81.25	2	3.00	3	0.71	6	0.39	5	0.06	—	—	—	—	—	—	—	—	2	7.60	1	3.30	2	4.80	2	4.20	2	4.80	—	—	6^{8}	15.38	—	—	8	0.12	6	0.38	1	0.07	—	—	150.14	0.01	clay	8¼	39	21	
12	—	—	1	3.34	1^{5}	4.87	1	2.50	18^{3}	46.25	1	1.50	1	0.23	4	0.26	—	—	—	—	—	—	—	—	—	—	—	—	1	3.30	1	2.40	1	2.10	1	2.40	—	—	—	—	—	—	8	0.12	—	—	—	0.07	—	—	69.34	0.01	—	—	—	22	Working in P. III.
13	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		—	—	—	—	—	" "
14	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		—	—	—	—	—	" "

APPENDIX E.—Continued.

PIER II.—Continued.

Date.	Principal Foreman.		Night Foreman.		Sub Foremen.		Lock Tenders.		Pressure Men.		Coffee house Men.		Coffee.		Sugar.		Candles.		Red Lead.		Wick.		Coal for heating, 200 lbs.		Linseed Oil.		Day Engineers.		Night Engineer.		Firemen.		Coal Passers.		Pump Men.		Laborers on hoist.		Coal for Boilers.		Signal Oil.		Black Oil.		Tallow.		Waste.		Coal Oil.		Totals for each day.	Feet sunk per day.	Material.	Cameron Pumps.		Air Pumps.	Remarks.
1887.	Days.	Amount.	Days.	Amount.	Days.	Amount.	Days.	Amount.	Days.	Amount.	Days.	Amount.	Lbs.	Amount.	Lbs.	Amount.	No.	Amount.	Lbs.	Amount.	Lbs.	Amount.	Boxes.	Amount.	Pints.	Amount.	Days.	Amount.	Days.	Amount.	Days.	Amount.	Days.	Amount.	Days.	Amount.	Days.	Amount.	Tons.	Amount.	Pints.	Amount.	Pints.	Amount.	Lbs.	Amount.	Lbs.	Amount.	Pints.	Amount.				Hours run.	No. of revolutions.	No. of revolutions.	
April.																																																									
15	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		—	—	—	—	—	Working in Pier III.
16	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		—	—	—	—	—	" "
17	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		—	—	—	—	—	" "
18	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		—	—	—	—	—	" "
19	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		—	—	—	—	—	" "
20	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		—	—	—	—	—	" "
21	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		—	—	—	—	—	" "
22	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		—	—	—	—	—	" "
23	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		—	—	—	—	—	" "
24	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		—	—	—	—	—	" "
25	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		—	—	—	—	—	" "
26	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		—	—	—	—	—	" "
27	1	6.00	1	3.34	3	9.75	2	5.00	32	80.00	2	3.00	2	0.47	4	0.26	5	0.06	4	0.24	¼	0.05	—	—	2	0.12	2	7.60	1	3.30	2	4.80	2	4.20	1	2.40	2	3.40	5	11.35	8	0.34	8	0.12	—	—	1	0.07	—	—	145.87	0.02	clay	—	—	24	
28	1	6.00	1	3.33	4	13.00	2	5.00	42	105.00	2	3.00	3	0.70	4	0.26	—	—	—	—	—	—	—	—	—	—	2	4.60	1	3.30	2	4.80	2	4.20	2	4.80	9^{6}	16.32	5	11.35	—	—	8	0.12	—	—	1	0.07	—	—	188.85	0.02	"	—	—	28	
29	1	6.00	1	3.33	4	13.00	2	5.00	42^{6}	106.25	2	3.00	4	0.94	8	0.50	10	0.13	—	—	—	—	2	0.45	—	—	2	7.60	1	3.30	2	4.80	2	4.20	2	4.80	9^{6}	16.32	4^{8}	10.90	—	—	8	0.12	—	—	1	0.07	—	—	190.71	1.19	"	—	—	23	
30	1	6.00	1	3.34	4	13.00	2	5.00	42	105.00	2	3.00	3	0.71	6	0.37	6	0.07	—	—	—	—	—	—	—	—	2	7.60	1	3.30	2	4.80	2	4.20	2	4.80	9^{6}	16.32	5	17.00	—	—	8	0.12	—	—	1	0.07	—	—	194.70	0.54	"	—	—	27	
May.																																																									
1	1	6.00	1	3.23	4	13.00	2	5.00	41	102.50	2	3.25	4	0.94	6	0.38	6	0.08	—	—	—	—	3	1.02	—	—	2	7.60	1	3.30	2	4.80	2	4.20	2	4.80	9^{6}	16.32	4^{7}	15.98	8	0.34	8	0.12	—	—	1	0.07	—	—	192.93	0.10	"	—	—	26	
2	1	6.00	1	3.23	4	13.00	2	5.00	40	100.00	2	3.00	3	0.70	6	0.37	2	0.02	—	—	—	—	3	1.02	—	—	2	7.60	1	3.30	2	4.80	2	4.20	2	4.80	9^{6}	16.32	4^{7}	15.98	—	—	8	0.12	—	—	1	0.07	—	—	189.53	1.30	"	—	—	21	
3	1	6.00	1	3.23	4	13.00	2	5.00	41^{5}	103.75	2	3.00	3	0.71	8	0.50	2	0.03	—	—	—	—	—	—	—	—	2	7.60	1	3.30	2	4.80	2	4.20	2	4.80	9^{6}	16.32	5	17.00	—	—	8	0.12	—	—	1	0..7	—	—	193.43	0.44	"	—	—	22	
4	1	6.00	1	3.23	4	13.00	2	5.00	41	102.50	2	3.00	4	0.94	6	0.38	3	0.04	—	—	—	—	3	1.02	—	—	2	7.60	1	3.30	2	4.80	2	4.20	2	4.80	9^{7}	16.25	4	15.98	—	—	8	0.12	—	—	1	0.07	—	—	192.23	0.17	"	—	—	22	
5	1	6.00	1	3.23	4	13.00	2	5.00	42^{5}	106.25	2	3.00	3	0.70	6	0.37	8	0.10	—	—	—	—	—	—	—	—	2	7.60	1	3.30	2	4.80	2	4.20	1	2.40	11	19.74	5	17.00	8	0.34	8	0.12	—	—	1	0.07	—	—	197.22	0.14	"	—	—	14	
6	1	6.00	1	3.23	4	13.00	2	5.00	43	107.50	2	3.00	4	0.98	4	0.25	8	0.10	—	—	—	—	1	0.34	—	—	2	7.60	1	3.30	2	4.8.	2	4.20	1	2.40	12	21.72	4^{9}	16.66	—	—	8	0.10	—	—	1	0.07	—	—	200.25	0 92	"	—	—	13	
7	1	6.00	1	3.23	5	16.25	2	5.00	53^{5}	133.75	2	3.00	5	1.27	8	0.50	3	0.04	—	—	—	—	—	—	—	—	2	7.60	1	3.30	2	4.80	2	4.20	1	2.40	12	21.06	5	17.00	—	—	8	0.11	—	—	1	0.07	—	—	229.58	0.46	"	—	—	16	
8	1	6.00	1	3.23	6	19.50	2	5.00	63	157.50	2	3.00	5	1.28	10	0.63	3	0.04	—	—	—	—	—	—	—	—	2	7.60	1	3.30	2	4.80	2	4.20	2	4.80	11^{4}	19.44	5	17.00	—	—	8	0.10	—	—	1	0.07	—	—	257.49	0.35	"	—	—	23	
9	1	6.00	1	3.23	6	19.50	2	5.00	65	102.50	2	3.00	4	1.02	6	0.37	3	0.04	—	—	—	—	1	0.34	—	—	2	7.60	1	3.30	2	4.80	2	4.20	2	4.80	9^{6}	16.32	4^{9}	16.66	8	0.34	8	0.11	—	—	1	0.07	—	—	259.20	0.04	"	—	—	22	
10	1	6.00	1	3.23	6	19.50	2	5.00	60^{5}	151.25	2	3.00	5	1.27	8	0.50	1	0.01	—	—	—	—	—	—	—	—	2	7.60	1	3.30	2	4.80	2	4.20	2	4.80	9^{6}	16.32	5	17.00	—	—	8	0.10	—	—	1	0.07	—	—	247.95	1.53	"	—	—	25	
11	1	6.00	1	3.23	6	19.50	2	5.00	59	147.50	2	3.00	4	1.02	8	0.50	—	—	—	—	—	—	—	—	—	—	2	7.60	1	3.30	2	4.80	2	4.20	2	4.80	9^{6}	16.32	5	17.00	—	—	8	0.11	—	—	1	0.07	—	—	243.95	0.25	"	—	—	31	
12	1	6.00	1	3.23	5^{5}	17.87	2	5.00	59	147.50	2	3.00	5	1.28	8	0.50	—	—	—	—	—	—	—	—	—	—	2	7.60	1	3.30	2	4.80	2	4.20	2	4.80	9^{6}	16.32	5	17.00	—	—	8	0.10	—	—	1	0.07	8	0.11	242.68	0.11	"	—	—	21	
13	1	6.00	1	3.23	6	19.50	2	5.00	60^{5}	151.25	2	3.00	6	1.53	6	0.38	6	0.08	—	—	—	—	1	0.34	—	—	2	7.60	1	3.30	2	4.80	2	4.20	2	4.80	9^{6}	16.32	4^{9}	16.66	8	0.34	8	0.11	—	—	1	0.07	—	—	248.51	0.44	"	—	—	21	
14	1	6.00	1	3.23	6	19.50	2	5.00	60	150.00	2	3.00	6	1.53	10	0.62	6	0.07	—	—	—	—	—	—	—	—	2	7.60	1	3.30	2	4.80	2	4.20	2	4.80	10^{3}	17.51	5	17.00	—	—	8	0.10	—	—	1	0.07	—	—	248.33	1.69	"	—	—	26	
15	1	6.00	1	3.23	6	19.50	2	5.00	62	155.00	2	3.00	7	1.78	10	0.63	3	0.04	—	—	—	—	1	0.34	—	—	2	7.60	1	3.30	2	4.80	2	4.22	2	4.80	10^{8}	18.36	4^{9}	16.66	—	—	8	0.11	—	—	1	0.07	—	—	254.42	0.05	"	—	—	32	
16	1	6.00	1	3.23	6	19.50	2	5.00	61^{5}	153.75	2	3.00	5	1.27	6	0.37	2	0.03	—	—	—	—	1	0.34	—	—	2	7.60	1	3.30	2	4.80	2	4.20	2	4.80	10^{8}	18.36	4^{9}	16.66	—	—	8	0.10	—	—	1	0.07	—	—	252.38	0.01	"	—	—	29	
17	1	6.00	1	3.23	6	19.50	2	5.00	63	157.50	2	3.00	7	1.78	8	0.50	8	0.10	—	—	—	—	—	—	—	—	2	7.60	1	3.30	2	4.80	2	4.20	2	4.80	10^{8}	18.36	5	17.00	8	0.34	8	0.11	—	—	1	0.07	—	—	257.19	1.79	"	—	—	28	
18	1	6.00	1	3.23	6	19.50	2	5.00	62^{5}	156.25	2	3.25	5	1.27	6	0.38	3	0.04	—	—	—	—	4	1.36	—	—	2	7.60	1	3.30	2	4.80	2	4.20	2	4.80	11^{1}	18.87	4^{6}	15.64	16	0.68	8	0.10	—	—	1	0.07	—	—	256.34	0.32	"	—	—	26	
19	1	6.00	1	3.22	6	19.50	2	5.00	61^{5}	153.75	2	3.25	4	1.02	8	0.50	6	0.07	—	—	—	—	—	—	—	—	2	7.60	1	3.30	2	4.80	2	4.20	2	4.80	10^{8}	18.36	5	17.00	—	—	8	0.11	—	—	1	0.07	—	—	252.55	0.13	"	—	—	28	
20	1	6.00	1	3.22	6	19.50	1	2.50	57^{5}	143.75	2	3.25	4	1.02	6	0.37	6	0.08	—	—	—	—	3	1.02	—	—	2	7.60	1^{2}	3.85	2	4.80	2	4.20	2	4.80	10	17.16	4^{7}	15.98	—	—	8	0.12	—	—	1	0.07	—	—	239.29	0.23	"	—	—	28	
21	1	6.00	1	3.22	4^{5}	14.63	2	5.00	55^{5}	138.75	2	3.25	4	1.02	4	0.25	6	0.07	4	0.24	¼	0.05	1	0.34	2	0.12	2	7.60	1	3.30	2	4.80	2	4.20	2	4.80	9^{6}	16.32	4^{9}	16.66	—	—	8	0.12	—	—	1	0.07	—	—	230.81	1.50	"	—	—	22	
22	1	6.00	1	3.22	4	13.00	2	5.00	60^{5}	151.25	2	3.25	6	1.53	8	0.50	3	0.04	—	—	—	—	1	0.34	—	—	2	7.60	1	3.30	2	4.80	2	4.20	2	4.80	9	15.30	4^{9}	16.66	—	—	8	0.12	—	—	1	0.07	8	0.11	241.09	0.84	"	—	—	25	
23	1	6.00	1	3.22	5	16.25	2	5.00	64	160.00	2	3.25	5	1.28	6	0.38	6	0.08	—	—	—	—	—	—	—	—	2	7.60	1	3.30	2	4.80	2	4.20	2	4.80	11	18.42	5	17.00	8	0.34	8	0.12	—	—	1	0.07	—	—	256.11	0.11	"	—	—	24	
24	1	6.00	1	3.22	6	19.50	2	5.00	63^{5}	158.75	2	3.25	6	1.53	8	0.50	2	0.03	—	—	—	—	—	—	—	—	2	7.60	1	3.30	2	4.80	2	4.20	2	4.80	11^{5}	19.54	5	17.00	—	—	8	0.12	—	—	1	0.07	—	—	259.21	0.55	"	—	—	22	
25	1	6.00	1	3.22	6	19.50	2	5.00	61	152.50	2	3.25	4	1.00	8	0.50	8	0.10	3	0.18	¼	0.05	1	0.34	1	0.06	2	7.60	1	3.30	2	4.80	2	4.20	2	4.80	10^{9}	18.39	4^{9}	16.66	—	—	8	0.12	—	—	1	0.07	—	—	251.66	0.92	"	—	—	21	
26	1	6.00	1	3.22	6	19.50	2	5.00	61^{5}	153.75	2	3.25	6	1.65	8	0.50	2	0.02	—	—	—	—	—	—	—	—	2	7.60	1	3.30	2	4.80	2	4.20	2	4.80	12^{6}	20.43	5	17.00	—	—	8	0.12	—	—	1	0.07	8	0.11	255.32	0.39	gravel	—	—	25	
27	1	6.00	1	3.22	6	19.50	2	5.00	61^{5}	153.75	2	3.25	6	1.65	8	0.50	19	0.24	—	—	—	—	1	0.34	—	—	2	7.60	1	3.30	2	4.80	2	4.20	2	4.80	11	18.18	4^{9}	16.66	8	0.34	8	0.12	—	—	1	0.07	—	—	253.52	1.25	and	—	—	22	
28	1	6.00	1	3.22	6	19.50	2	5.00	60	150.00	2	3.25	4	1.10	6	0.38	—	—	—	—	—	—	5	1.70	—	—	2	7.60	1	3.30	2	4.80	2	4.20	2	4.80	11^{2}	18.48	4^{6}	15.30	—	—	8	0.12	—	—	1	0.07	—	—	248.82	1.15	sand.	—	—	27	
29	1	6.00	1	3.22	6	19.50	2	5.00	61	152.50	2	3.25	5	1.37	4	0.25	—	—	—	—	—	—	—	—	—	—	2	7.60	1	3.30	2	4.80	2	4.20	2	4.80	13^{2}	22.16	5	17.00	—	—	8	0.12	—	—	1	0.07	—	—	255.14	0.23	"	—	—	29	
30	1	6.00	1	3.22	5^{5}	17.87	2	5.00	60	150.00	2	3.25	5	1.38	6	0.37	—	—	—	—	—	—	—	—	—	—	2	7.60	1	3.30	2	4.80	2	4.20	2	4.80	12^{3}	21.46	5	17.00	—	—	8	0.12	—	—	1	0.07	—	—	250.44	1.68	"	—	—	32	
31	1	6.00	1	3.22	5^{5}	17.88	2	5.00	60	150.00	2	3.25	5	1.37	7	0.44	—	—	—	—	—	—	—	—	—	—	2	7.60	1	3.30	2	4.80	2	4.20	2	4.80	14^{5}	24.39	5	17.00	—	—	8	0.12	—	—	1	0.07	8	.11	253.55	0.01	"	—	—	28	
June.																																																									
1	1	6.00	1	3.33	5	16.25	2	5.00	63	157.50	2	3.25	6	1.65	8	0.50	—	—	—	—	—	—	4	1.36	—	—	2	7.60	1	3.30	2	4.80	2	4.20	2	4.80	14^{4}	24.48	4^{6}	15.64	8	0.34	8	0.12	—	—	1	0.07	—	—	260.19	1.68	"	—	—	33	
2	1	6.00	1	3.33	5	16.25	2	5.00	59^{5}	148.75	2	3.25	4	1.10	6	0.37	—	—	—	—	—	—	—	—	—	—	2	7.60	1	3.30	2	4.80	2	4.20	2	4.80	14^{4}	24.48	5	17.00	—	—	8	0.22	—	—	1	0.07	—	—	250.42	0.55	"	—	—	33	
3	1	6.00	1	3.34	5	16.25	2	5.00	57^{5}	143.75	2	3.25	5	1.38	6	0.38	10	0.13	4	0.24	¼	0.05	—	—	2	0.12	2	7.60	1	3.30	2	4.80	2	4.20	2	4.80	14^{4}	24.48	5	17.00	—	—	8	0.12	—	—	1	0.07	—	—	246.26	0.34	"	—	—	34	
4	1	6.00	1	3.33	5	16.25	2	5.00	56	140.00	2	3.25	5	1.37	8	0.50	16	0.20	—	—	—	—	—	—	—	—	2	7.60	1	3.30	2	4.80	2	4.20	1	2.40	14^{4}	24.48	5	17.00	—	—	8	0.12	—	—	1	0.07	8	0.11	239.98	1.16	clay,	—	—	33	
5	1	6.00	1	3.33	5	16.25	2	5.00	54^{5}	136.25	2	3.25	4	1.10	6	0.38	3	0.04	—	—	—	—	—	—	—	—	2	7.60	1	3.30	2	4.80	2	4.20	1	2.40	14^{4}	24.48	5	17.00	8	0.34	8	0.12	—	—	1	0.07	—	—	235.91	0.07	"	—	—	26	
6	1	6.00	1	3.34	6	19.50	2	5.00	54	135.00	2	3.25	4	1.10	6	0.37	—	—	—	—	—	—	4	1.36	—	—	2	7.60	1	3.30	2	4080	2	4.20	2	4.80	13^{2}	22.44	4^{6}	15.64	—	—	8	0.12	—	—	1	0.07	—	—	237.89	0.47	"	—	—	27	
7	1	6.00	1	3.33	6	19.50	2	5.00	57^{5}	143.75	2	3.25	5	1.38	6	0.38	8	0.10	—	—	—	—	—	—	—	—	2	7.60	1	3.30	2	4.80	2	4.20	2	4.80	9^{6}	16.32	5	17.00	—	—	8	0.12	—	—	1	0.07	—	—	240.90	0.16	"	—	—	26	
8	1	6.00	1	3.33	5	16.25	2	5.00	56^{5}	141.25	2	3.25	5	1.37	6	0.37	—	—	—	—	—	—	—	—	—	—	2	7.60	1	3.30	2	4.80	2	4.20	2	4.80	7^{2}	12.24	5	17.00	—	—	8	0.12	—	—	1	0.07	—	—	230.95	0.30	"	—	—	24	
9	1	6.00	1	3.34	5^{5}	17.87	2	5.00	54^{5}	136.25	2	3.25	4	1.10	6	0.38	13	0.16	—	—	—	—	—	—	—	—	2	7.60	1	3.30	2	4.80	2	4.20	2	4.80	7^{2}	12.24	5	17.00	8	0.34	8	0.12	—	—	1	0.07	8	0.11	227.93	0.17	"	—	—	18	
10	1	6.00	1	3.33	6	19.50	2	5.00	57	142.50	2	3.25	5	1.38	8	0.50	17	0.21	—	—	—	—	—	—	—	—	2	7.60	1	3.30	2	4.80	2	4.20	1	2.40	7^{2}	12.24	5	17.00	—	—	8	0.12	—	—	1	0.07	—	—	233.40	0.02	"	—	—	27	Began sealing caisson.
11	1	6.00	1	3.33	6	19.50	2	5.00	58	145.00	2	3.25	3	0.82	8	0.50	—	—	—	—	—	—	—	—	—	—	2	7.60	1	3.30	2	4.80	2	4.20	1	2.40	—	—	5	17.00	—	—	8	0.12	—	—	1	0.07	—	—	222.89	—	—	—	—	29	
12	1	6.00	1	3.34	6	19.50	2	5.00	57^{5}	143.75	2	3.25	3	0.83	4	0.25	3	0.04	—	—	—	—	—	—	—	—	2	7.60	1	3.30	2	4.80	2	4.20	1	2.40	—	—	5	17.00	—	—	8	0.12	—	—	1	0.07	—	—	221.45	—	—	—	—	25	
13	1	6.00	1	3.33	6	19.50	2	5.00	55	137.50	2	3.25	11	3.02	6	0.37	3	0.04	—	—	—	—	—	—	—	—	2	7.60	1	3.30	2	4.80	2	4.20	1	2.40	—	—	5	17.00	—	—	8	0.12	—	—	1	0.07	—	—	217.50	—	—	—	—	23	
14	1	6.00	1	3.33	6	19.50	2	5.00	54	135.00	2	3.25	7	1.78	8	0.50	8	0.10	—	—	—	—	—	—	—	—	2	7.60	1	3.30	2	4.80	2	4.20	1	2.40	—	—	5	17.00	8	0.34	8	0.12	—	—	1	0.07	—	—	214.29	—	—	—	—	25	
15	1	6.00	1	3.34	6	19.50	2	5.00	52	130.00	2	3.15	4	0.80	4	0.25	1	0.01	—	—	—	—	—	—	—	—	2	7.60	1	3.30	2	4.80	2	4.20	—	—	—	—	5	17.00	—	—	8	0.12	—	—	1	0.07	—	—	205 24	—	—	—	—	23	
16	1	6.00	1	3.33	6	19.50	2	5.00	54^{5}	136.25	2	3.25	3	0.60	4	0.25	9	0.11	—	—	—	—	—	—	—	—	2	7.60	1	3.30	2	4.80	2	4.20	—	—	—	—	5	17.00	—	—	8	0.12	—	—	1	0.07	—	—	211.38	—	—	—	—	21	
17	1	6.00	1	3.33	6	19.50	2	5.00	55^{5}	138.75	2	3.25	3	0.60	4	0.25	3	0.04	—	—	—	—	3	1.02	—	—	2	7.60	1	3.30	2	4.80	2	4.20	1	2.40	—	—	4^{7}	15.98	—	—	8	0.12	—	—	1	0.07	—	—	216.21	—	—	—	—	22	
18	1	6.00	1	3.33	6	19.50	2	5.00	54	135.00	2	3.25	2	0.40	2	0.12	13	0.16	—	—	—	—	—	—	—	—	2	7.60	1	3.30	2	4.80	2	4.20	1	2.40	—	—	5	17.00	8	0.34	8	0.12	—	—	1	0.07	—	—	212.59	—	—	—	—	23	
19	½	3.00	1	3.34	3	9.75	1^{5}	3.75	30^{5}	76.25	2	3.25	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2	7.60	1	3.30	2	4.80	2	4.20	1	2.40	—	—	—	—	—	—	—	—	—	—	—	—	—	—	121.64	—	—	—	—	—	Took off air at 7:05 a. m.
		505.41		276.39		1131.85		403.37		9152.17		258.25		86.37		34.70		6.57		4.56		0.60		24.12		1.88		625.75		279.40		399.00		349.65		334.80		819.06		1533.25		8.84		10.29		6.30		6.02		1.10	16259.70						

Other expenses charged to smking . . $2127.14

$18386.84

APPENDIX E.—Continued.

TIME, COST AND MATERIALS USED IN FOUNDATIONS. PIER III.

Date 1886	Principal Foreman Days	Principal Foreman Amount	Night Foreman Days	Night Foreman Amount	Sub Foremen Days	Sub Foremen Amount	Lock Tenders Days	Lock Tenders Amount	Pressure Men Days	Pressure Men Amount	Coffeehouse Men Days	Coffeehouse Men Amount	Coffee Lbs.	Coffee Amount	Sugar Lbs.	Sugar Amount	Candles No.	Candles Amount	Red Lead Lbs.	Red Lead Amount	Wick Lbs.	Wick Amount	Coal for Heating, 200 lbs. Boxes	Coal for Heating Amount	Linseed Oil Pints	Linseed Oil Amount
Nov.																										
23	1	6.00	1	3.33	2	6.00	—	—	47^{6}	91.87	—	—	—	—	—	—	—	—	40	2.40	—	—	—	—	16	1.00
24	0^{8}	4.80	0^{8}	2.67	2^{4}	7.20	—	—	47^{5}	90.27	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
25	1	6.00	1	3.33	1	3.00	—	—	35	67.50	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
26	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
27	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
28	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
29	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
30	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Dec.																										
1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
4	1	6.00	1	3.23	1^{6}	5.25	1	2.25	18	40.50	2	3.25	3	0.50	4	0.26	20	0.25	—	—	—	—	4	1.36	—	—
5	1	6.00	1	3.23	3	9.00	2	4.50	33	74.25	2	3.25	3	0.50	4	0.26	11	0.14	—	—	—	—	—	—	—	—
6	1	6.00	1	3.23	1	3.00	2	4.50	10^{6}	23.63	2	3.25	2	0.33	—	—	6	0.08	2	0.12	¼	0.05	—	—	½	0.04
7	1	6.00	1	3.23	1	3.00	2	4.50	4	9.00	2	3.25	2	0.34	4	0.26	2	0.03	—	—	—	—	2	0.68	—	—
8	1	6.00	1	3.23	2	6.00	2	4.50	25	56.25	2	3.25	3	0.50	—	—	3	0.04	—	—	—	—	—	—	—	—
9	1	6.00	1	3.23	^{6}	1.50	2	4.50	16	36.00	2	3.25	2	0.33	6^{6}	0.41	4	0.05	2	0.12	¼	0.05	4	1.36	½	0.04
10	1	6.00	1	3.23	1	3.00	2	4.50	4^{6}	10.12	2	3.25	2	0.34	4	0.24	4	0.05	—	—	—	—	—	—	—	—
11	1	6.00	1	3.23	3	9.00	3	6.75	33	74.25	3	4.75	5	0.84	4	0.24	6	0.07	—	—	—	—	—	—	—	—
12	1	6.00	1	3.23	3	9.00	2	4.50	30	67.50	2	3.25	4	0.67	4	0.24	7	0.08	—	—	—	—	4	1.36	—	—
13	1	6.00	1	3.23	3	9.00	2	4.50	30	67.50	2	3.25	5	0.84	9	0.54	3	0.04	—	—	—	—	—	—	—	—
14	1	6.00	1	3.23	1	3.00	2	4.50	16	36.00	1	1.50	4	0.67	4	0.24	1	0.01	—	—	—	—	—	—	—	—
15	1	6.00	1	3.23	1^{6}	4.50	2	4.50	6	13.50	2	3.25	3	0.51	5	0.30	3	0.04	—	—	—	—	2	0.68	—	—
16	1	6.00	1	3.23	2	6.00	2	4.50	9	20.25	2	3.25	2	0.33	—	—	2	0.02	—	—	—	—	—	—	—	—
17	1	6.00	1	3.33	—	—	1	2.25	5	11.25	1	1.75	2	0.34	4	0.24	—	—	—	—	—	—	5	1.70	—	—
18	1	6.00	1	3.23	2	6.00	2	4.50	15	33.75	1^{6}	2.38	2	0.33	5	0.30	11	0.14	—	—	—	—	—	—	—	—
19	1	6.00	1	3.22	1	3.00	2	4.50	6	13.50	2	3.25	2	0.34	5	0.30	2	0.03	—	—	—	—	—	—	—	—
20	1	6.00	1	3.22	1	3.00	2	4.50	4	9.00	2	3.25	3	0.50	—	—	—	—	—	—	—	—	2	0.68	—	—
21	1	6.00	1	3.22	3	9.00	2	4.50	25	56.25	2	3.25	3	0.50	5	0.30	2	0.02	—	—	—	—	—	—	—	—
22	1	6.00	1	3.22	2	6.00	2	4.50	32	72.00	2	3.25	5	0.84	4	0.24	—	—	4	0.24	¼	0.05	4	1.36	2	0.13
23	1	6.00	1	3.22	1	3.00	2	4.50	11	24.75	2	3.25	3	0.51	5	0.30	—	—	—	—	—	—	—	—	—	—
24	1	6.00	1	3.22	2	6.00	2	4.50	18	40.50	2	3.25	3	0.50	5	0.30	—	—	—	—	—	—	—	—	—	—
25	1	6.00	1	3.22	—	—	1	2.25	4	9.00	1	1.75	2	0.33	—	—	—	—	—	—	—	—	—	—	—	—
26	1	6.00	1	3.22	1	3.00	2	4.50	6	13.50	2	3.25	2	0.40	—	—	—	—	—	—	—	—	—	—	—	—
27	1	6.00	1	3.22	1	3.00	2	4.50	19	42.75	2	3.25	4	0.80	5	0.30	6	0.08	—	—	—	—	4	1.36	—	—
28	1	6.00	1	3.22	2	6.00	2	4.50	31	69.75	2	3.25	3	0.60	5	0.30	—	—	—	—	—	—	—	—	—	—
29	1	6.00	1	3.22	1	3.00	2	4.50	20^{6}	46.13	1^{6}	2.37	3	0.60	5	0.30	17	0.21	—	—	—	—	4	1.36	—	—
30	1	6.00	1	3.22	2^{6}	7.50	2	4.50	20^{6}	46.12	2	3.25	4	0.80	5	0.30	—	—	4	0.24	¼	0.05	—	—	2	0.12
31	1	6.00	1	3.22	3	9.00	2	4.50	33	74.25	2	3.25	4	0.80	5	0.30	—	—	—	—	—	—	2	0.68	—	—
1887 Jan.																										
1	1	6.00	1	3.23	1^{6}	4.88	2	5.00	13^{6}	33.75	2	3.25	1	0.20	4	0.24	—	—	—	—	—	—	—	—	—	—
2	1	6.00	1	3.23	3	9.75	2	5.00	8	20.00	2	3.25	2	0.40	4	0.24	2	0.03	—	—	—	—	3	1.02	—	—
3	1	6.00	1	3.23	3	9.75	2	5.00	17^{6}	43.75	2	3.25	2	0.40	4	0.24	—	—	2	0.12	¼	0.05	—	—	½	0.04
4	1	6.00	1	3.23	4	13.00	2	5.00	42	105.00	2	3.25	3	0.60	4	0.24	6	0.07	—	—	—	—	—	—	—	—
5	1	6.00	1	3.23	4	13.00	2	5.00	44^{6}	111.25	2	3.25	3	0.60	5	0.30	6	0.08	—	—	—	—	—	—	—	—
6	1	6.00	1	3.23	4	13.00	2	5.00	44^{6}	111.25	2	3.25	3	0.60	3	0.18	3	0.04	—	—	—	—	—	—	—	—
7	1	6.00	1	3.23	4	13.00	2	5.00	43^{6}	108.75	2	3.25	2	0.40	5	0.30	—	—	—	—	—	—	—	—	—	—
8	1	6.00	1	3.23	4	13.00	2	5.00	43^{6}	108.75	2	3.25	6	1.20	8	0.48	2	0.02	—	—	—	—	4	1.36	—	—
9	1	6.00	1	3.23	4	13.00	2	5.00	42^{6}	106.25	2	3.25	4	0.80	5	0.30	10	0.13	—	—	—	—	—	—	—	—
10	1	6.00	1	3.23	4	13.00	2	5.00	39	97.50	2	3.25	4	0.80	5	0.30	—	—	—	—	—	—	4	1.36	—	—
11	1	6.00	1	3.23	4	13.00	2	5.00	41^{6}	103.75	1	1.50	2	0.40	5	0.30	3	0.04	—	—	—	—	3	1.02	—	—
12	1	6.00	1	3.23	4	13.00	2	5.00	40^{6}	101.25	2	3.25	6	1.20	4	0.24	2	0.03	—	—	—	—	—	—	—	—
13	1	6.00	1	3.23	4	13.00	2	5.00	40	100.00	2	3.25	3	0.60	8	0.60	6	0.07	2	0.12	¼	0.05	—	—	½	0.04
14	1	6.00	1	3.23	4	13.00	2	5.00	41^{6}	103.75	2	3.25	3	0.60	4	0.24	6	0.08	—	—	—	—	3	1.02	—	—
15	1	6.00	1	3.23	4	13.00	2	5.00	41	102.50	2	3.25	3	0.60	4	0.24	—	—	—	—	—	—	—	—	—	—
16	1	6.00	1	3.23	4	13.00	2	5.00	42	105.00	2	3.25	4	0.80	4	0.24	6	0.07	5	0.30	¼	0.05	3	1.02	2	0.13
17	1	6.00	1	3.23	4	13.00	2	5.00	40	100.00	2	3.25	3	0.60	4	0.24	10	0.12	—	—	—	—	—	—	—	—
18	1	6.00	1	3.23	4	13.00	2	5.00	35¾	89.37	2	3.25	3	0.60	4	0.24	—	—	—	—	—	—	4	1.36	—	—
19	1	6.00	1	3.22	4	13.00	2	5.00	34	85.00	2	3.25	4	0.80	4	0.24	3	0.04	—	—	—	—	—	—	—	—
20	1	6.00	1	3.22	5	16.25	2	5.00	47^{6}	118.75	2	3.00	3	0.60	5	0.30	6	0.08	—	—	—	—	—	—	—	—
21	1	6.00	1	3.22	6	19.50	2	5.00	54	135.00	2	3.00	4	0.80	5	0.30	—	—	3	0.18	¼	0.05	4	1.36	1	0.06
22	1	6.00	1	3.22	6	19.50	2	5.00	56^{6}	141.25	2	3.00	5	1.00	10	0.60	2	0.02	—	—	—	—	—	—	—	—
23	1	6.00	1	3.22	6	19.50	2	5.00	59^{6}	148.75	2	3.00	5	1.00	10	0.60	—	—	—	—	—	—	4	1.36	—	—
24	1	6.00	1	3.22	6	19.50	2	5.00	61^{6}	153.75	2	3.00	4	0.93	10	0.60	4	0.05	—	—	—	—	—	—	—	—
25	1	6.00	1	3.22	6	19.50	2	5.00	60^{6}	151.25	2	3.00	8	1.82	10	0.60	—	—	—	—	—	—	4	1.36	—	—
26	1	6.00	1	3.22	6	19.50	2	5.00	58	145.00	2	3.00	5	1.12	10	0.60	6	0.07	—	—	—	—	—	—	—	—
27	1	6.00	1	3.22	6	19.50	2	5.00	61	152.50	2	3.00	5	1.12	10	0.60	3	0.04	—	—	—	—	2	0.68	—	—
28	1	6.00	1	3.22	6	19.50	2	5.00	57^{6}	143.75	2	3.00	4	0.90	5	0.30	3	0.04	—	—	—	—	—	—	—	—
29	1	6.00	1	3.22	6	19.50	2	5.00	61^{6}	153.75	2	3.00	4	0.90	9	0.54	2	0.02	—	—	—	—	5	1.70	—	—
30	1	6.00	1	3.22	6	19.50	2	5.00	63^{6}	158.75	2	3.00	4	0.90	9	0.54	3	0.04	—	—	—	—	—	—	—	—
31	1	6.00	1	3.22	6	19.50	2	5.00	62^{6}	156.25	2	3.00	4	0.90	5	0.30	3	0.04	—	—	—	—	4	1.36	—	—
Feb.																										
1	1	6.00	1	3.57	5^{6}	17.88	2	5.00	62^{6}	156.25	2	3.00	5	1.13	10	0.60	2	0.03	—	—	—	—	3	1.02	—	—
2	1	6.00	1	3.57	4	13.00	2	5.00	61^{6}	153.75	2	3.00	5	1.13	10	0.60	—	—	—	—	—	—	—	—	—	—
3	1	6.00	1	3.57	6	19.50	2	5.00	61^{6}	153.75	2	3.00	3	0.67	6	0.30	4	0.05	—	—	—	—	4	1.36	—	—
4	1	6.00	1	3.57	6	19.50	2	5.00	61^{6}	153.75	2	3.00	5	1.12	10	0.60	4	0.05	—	—	—	—	4	1.36	—	—
5	1	6.00	1	3.57	5^{6}	17.87	2	5.00	62	155.00	2	3.00	5	1.13	10	0.60	4	0.05	2	0.12	¼	0.05	—	—	½	0.04
6	1	6.00	1	3.57	6	19.50	2	5.00	58	145.00	2	3.00	4	0.90	5	0.30	2	0.03	—	—	—	—	—	—	—	—
7	1	6.00	1	3.85	6	19.50	2	5.00	61	152.50	2	3.00	5	1.12	10	0.62	3	0.04	—	—	—	—	3	1.02	—	—
8	1	6.00	1	3.57	6	19.50	2	5.00	58^{6}	146.25	2	3.00	5	1.13	10	0.63	1	0.01	—	—	—	—	—	—	—	—
9	1	6.00	1	3.57	6	19.50	2	5.00	60^{6}	151.25	2	3.00	4	0.90	10	0.63	—	—	—	—	—	—	3	1.02	—	—
10	1	6.00	1	3.57	6	19.50	2	5.00	59^{6}	148.75	2	3.00	6	1.35	10	0.64	2	0.02	3	0.18	¼	0.05	2	0.68	1	0.06

Date 1886	Day Engineer Days	Day Engineer Amount	Night Engineer Days	Night Engineer Amount	Firemen Days	Firemen Amount	Coal Passers Days	Coal Passers Amount	Pump Men Days	Pump Men Amount	Laborers on Hoist Days	Laborers on Hoist Amount	Coal for Boilers Tons	Coal for Boilers Amount	Signal Oil Pints	Signal Oil Amount	Black Oil Pints	Black Oil Amount	Tallow Lbs.	Tallow Amount	Waste Lbs.	Waste Amount	Coal Oil Pints	Coal Oil Amount	Totals for Each Day	Feet Sunk per day	Material	Water Pumps Hrs. Run	Water Pumps No. of revo-l'ns	Air Pumps No. of revolutions	Remarks
Nov.																															
23	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	16	0.20	—	—	—	—	—	—	110.80	4.70	—	—	—	—	Lowering caisson.
24	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	16	0.20	—	—	—	—	—	—	105.14	8.80	—	—	—	—	
25	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	16	0.20	—	—	—	—	—	—	80.03	2.60	—	—	—	—	Began concreting in a. m.
26	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		0.28	—	—	—	—	
27	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		0.32	—	—	—	—	
28	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		0.00	—	—	—	—	
29	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		0.00	—	—	—	—	
30	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		0.60	—	—	—	—	
Dec.																															
1	—	—	—	—	—	—	—	—	—	—	—	—	15	36.75	—	—	—	—	—	—	—	—	—	—	36.75	0.08		—	—	—	
2	—	—	—	—	—	—	—	—	—	—	—	—	15	36.75	—	—	—	—	—	—	—	—	—	—	36.75	0.00	—	—	—	—	
3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.57	—	—	—	—	
4	2^{6}	8.95	—	—	2	4.60	1	1.93	1	2.40	—	—	—	—	—	—	—	—	8	0.50	1	0.07	—	—	81.30	1.15	—	10	38	—	
5	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	—	—	7	17.15	8	0.34	8	0.10	—	—	1	0.07	—	—	143.19	0.98	sand.	13¼	35	16	
6	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	—	—	8	19.60	—	—	8	0.10	8	0.50	1	0.07	—	—	88.90	0.22	"	—	—	13	
7	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	—	—	—	—	—	—	8	0.10	—	—	1	0.07	—	—	54.86	0.80	"	—	—	18	
8	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	—	—	11^{1}	37.74	8	0.34	8	0.10	8	0.50	1	0.07	—	—	142.92	3.09	"	$22\frac{1}{12}$	35	16	
9	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	—	—	11	37.40	8	0.34	8	0.10	—	—	1	0.07	—	—	119.15	0.23	"	—	—	27	
10	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	—	—	5^{7}	19.38	—	—	4	0.05	8	0.50	1	0.07	—	—	75.13	0.48	"	—	—	22	
11	2^{6}	8.95	1^{6}	4.95	2	4.80	2	4.20	2	4.80	—	—	5^{9}	20.06	8	0.34	8	0.10	—	—	1	0.07	—	—	153.40	0.07	"	—	—	—	
12	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	—	—	5^{7}	19.38	—	—	8	0.10	8	0.52	1	0.07	—	—	140.30	2.78	"	19	35	30	
13	2	7.30	1	3.30	2	4.80	2	4.20	1^{2}	2.80	—	—	5^{7}	19.38	8	0.34	8	0.10	—	—	1	0.07	—	—	137.19	2.33	"	$14\frac{5}{6}$	33	21	
14	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	—	—	6^{1}	20.74	—	—	8	0.10	—	—	1	0.07	—	—	100.46	0.00	"	—	—	16	
15	2	7.30	1	3.30	2^{6}	5.80	2^{6}	5.08	2^{6}	5.80	—	—	5^{9}	20.06	—	—	8	0.10	—	—	1	0.07	—	—	84.02	0.00	"	—	—	27	
16	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	—	—	6^{1}	20.74	—	—	8	0.10	—	—	1	0.07	—	—	88.89	0.01	"	—	—	25	
17	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	—	—	5^{8}	19.04	—	—	8	0.10	—	—	1	0.07	—	—	70.37	0.45	"	—	—	26	
18	2	7.30	1	3.30	2	4.80	2	4.20	1^{6}	3.60	—	—	6^{1}	20.74	—	—	8	0.10	—	—	1	0.07	—	—	100.74	1.97	"	—	—	25	
19	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	—	—	6^{1}	20.74	—	—	4	0.05	—	—	1	0.07	—	—	79.40	0.00	"	—	—	23	
20	2	7.30	1	3.30	2	4.80	2	4.20	1^{6}	3.60	—	—	5^{9}	20.06	—	—	8	0.10	—	—	1	0.07	—	—	73.58	0.02	"	—	—	22	
21	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	—	—	6^{1}	20.74	8	0.34	8	0.10	8	0.50	1	0.07	—	—	129.19	2.37	"	24	38	28	
22	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	—	—	5^{7}	19.38	—	—	8	0.10	—	—	1	0.07	—	—	141.78	2.16	"	$13\frac{11}{12}$	35	25	
23	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	—	—	6^{1}	20.74	—	—	8	0.10	8	0.50	1	0.07	—	—	91.34	1.56	"	8	35	25	
24	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	—	—	6^{1}	20.74	—	—	8	0.10	—	—	1	0.07	—	—	109.58	0.73	"	4⅔	35	26	
25	2	7.30	1	3.30	2	4.80	2	4.20	1	2.40	—	—	6^{1}	20.74	—	—	4	0.05	—	—	1	0.07	—	—	65.41	0.00	"	—	—	22	
26	2	7.30	1	3.30	2	4.80	2	4.20	1	2.40	—	—	6^{1}	20.74	—	—	4	0.05	—	—	1	0.07	—	—	76.73	0.13	"	—	—	24	
27	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	—	—	5^{7}	19.38	8	0.34	8	0.10	8	0.50	1	0.07	—	—	110.05	2.27	"	19¾	32	26	
28	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	—	—	6^{1}	20.74	—	—	8	0.10	—	—	1	0.07	—	—	138.93	1.62	"	17⅙	33	36	
29	2	7.30	1	3.30	2	4.80	2	4.20	1^{6}	3.60	—	—	5^{7}	19.38	—	—	4	0.05	8	0.50	1	0.07	—	—	110.89	1.12	"	—	—	26	
30	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	—	—	6^{1}	20.74	8	0.34	8	0.10	8	0.50	1	0.07	—	—	118.25	2.07	"	$19\frac{5}{12}$	36	21	
31	2	7.30	1	3.30	2	4.80	2	4.20	2	4.40	—	—	5^{9}	20.06	—	—	8	0.10	—	—	1	0.07	—	—	146.63	2.51	"	$21\frac{11}{12}$	37	25	
1887 Jan.																															
1	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	—	—	6^{1}	20.74	—	—	8	0.10	8	0.52	1	0.07	—	—	102.38	0.26	"	$2\frac{7}{12}$	45	24	
2	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	—	—	5^{7}	19.72	8	0.34	8	0.10	—	—	1	0.07	8	0.11	93.66	0.01	"	—	—	21	
3	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	—	—	6^{1}	20.74	—	—	8	0.10	4	0.25	1	0.07	—	—	117.39	2.05	"	16½	36	23	
4	2	7.30	1	3.30	2	4.80	2	4.20	2	3.80	—	—	6^{1}	20.74	—	—	8	0.10	8	0.50	1	0.07	—	—	181.20	1.16	sand &	$23\frac{7}{12}$	36	21	
5	2	7.30	1	3.30	2	4.80	2	4.20	2	3.80	—	—	6^{1}	20.74	—	—	8	0.10	—	—	1	0.07	—	—	187.22	1.16	mud.	16¾	34	22	
6	2	7.30	1	3.30	2	4.80	2	4.20	2	4.20	8^{4}	11.76	6^{1}	20.74	8	0.34	8	0.10	—	—	1	0.07	—	—	199.36	1.00	clay.	—	—	24	
7	2	7.30	1	3.30	2	4.80	2	4.20	1	2.40	10^{6}	18.36	6^{1}	20.74	—	—	8	0.10	—	—	1	0.07	—	—	201.20	0.03	"	—	—	25	
8	2	7.30	1	3.30	2	4.80	2	4.20	1	2.40	12	20.40	5^{1}	19.33	—	—	8	0.10	—	—	1	0.07	—	—	204.24	0.07	"	—	—	23	
9	2	7.30	1	3.30	2	4.80	2	4.20	1	2.40	12	20.40	6^{1}	20.74	—	—	8	0.10	—	—	1	0.07	—	—	201.27	1.03	"	—	—	24	
10	2	7.30	1	3.30	2	4.80	2	4.20	1	2.40	12	20.40	5^{7}	19.38	8	0.34	8	0.10	—	—	1	0.07	—	—	192.73	0.09	"	—	—	19	
11	2	7.30	1	3.30	2	4.80	2	4.20	1	2.40	10	27.00	5^{8}	19.72	—	—	8	0.10	—	—	1	0.07	—	—	193.13	1.89	"	—	—	14	
12	2	7.30	1	3.30	2	4.80	2	4.20	1	2.40	12	20.40	6^{1}	20.74	—	—	8	0.10	—	—	1	0.07	—	—	196.51	0.02	"	—	—	12	
13	2	7.30	1	3.30	2	4.80	2	4.20	1	2.40	12	20.40	6^{1}	20.74	—	—	8	0.10	—	—	1	0.07	—	—	195.27	0.02	"	—	—	13	
14	2	7.30	1	3.30	2	4.80	2	4.20	1	2.40	12	20.40	5^{8}	19.72	8	0.34	8	0.10	—	—	1	0.07	8	0.11	198.91	0.00	"	—	—	14	
15	1	3.30	1	3.30	2	4.80	2	4.20	1	2.40	12	20.40	6^{1}	20.74	—	—	8	0.10	—	—	1	0.07	—	—	193.13	1.00	"	—	—	18	
16	2	7.30	1	3.30	2	4.80	2	4.20	1	2.40	12	20.40	5^{8}	19.72	—	—	8	0.10	—	—	1	0.07	—	—	200.38	0.93	"	—	—	28	
17	2	7.30	1	3.30	2	4.80	2	4.20	1	2.40	10^{6}	18.36	6^{1}	20.74	—	—	8	0.10	—	—	1	0.07	—	—	192.71	0.12	"	—	—	19	
18	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	10^{6}	18.36	5^{7}	19.38	—	—	8	0.10	—	—	1	0.07	—	—	184.36	0.10	"	—	—	18	Pump men running clay hoist.
19	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	13^{2}	22.44	6^{1}	20.74	—	—	8	0.10	—	—	1	0.07	—	—	184.30	0.10	"	—	—	21	
20	2	7.30	1	3.30	2	4.80	2	4.20	1	2.40	13^{2}	22.44	6^{1}	20.74	8	0.34	8	0.10	—	—	1	0.07	—	—	218.89	0.12	"	—	—	18	
21	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	12	20.40	5^{7}	19.38	—	—	8	0.10	—	—	1	0.07	—	—	238.82	0.37	"	—	—	21	
22	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	12	20.40	6^{1}	20.74	—	—	8	0.10	—	—	1	0.07	—	—	245.30	1.13	"	—	—	20	
23	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	12	20.40	5^{7}	19.38	—	—	8	0.12	—	—	1	0.07	—	—	252.80	0.10	"	—	—	20	
24	2	7.30	1	3.30	2	4.80	2	4.20	1	2.40	12	20.40	6^{1}	20.74	8	0.34	8	0.12	—	—	1	0.07	—	—	255.72	0.09	"	—	—	20	
25	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	12	20.40	5^{7}	19.38	—	—	8	0.12	—	—	1	0.07	8	0.11	256.23	0.53	"	—	—	20	
26	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	12	20.40	6^{1}	20.74	—	—	8	0.12	—	—	1	0.07	—	—	249.24	0.78	"	—	—	21	
27	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	10^{6}	18.36	5^{9}	20.06	—	—	8	0.12	—	—	1	0.07	—	—	254.67	1.17	"	—	—	21	
28	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	12	20.40	6^{1}	20.74	8	0.34	8	0.12	—	—	1	0.07	—	—	247.78	0.05	"	—	—	21	
29	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	12	20.40	5^{8}	19.04	—	—	8	0.12	—	—	1	0.07	—	—	257.66	0.13	"	—	—	21	
30	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	12	20.40	6	20.40	—	—	8	0.12	—	—	1	0.07	—	—	262.34	0.58	"	—	—	20	
31	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	10^{6}	18.36	5^{1}	19.33	—	—	8	0.12	—	—	1	0.07	—	—	257.90	1.27	"	—	—	19	
Feb.																															
1	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	9^{6}	16.32	5^{8}	19.72	8	0.34	8	0.12	—	—	1	0.07	8	0.11	255.56	0.12	"	—	—	21	
2	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	10^{6}	18.36	6^{1}	20.74	—	—	8	0.12	—	—	1	0.07	—	—	249.74	0.06	"	—	—	22	
3	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	12	20.40	5^{7}	19.38	—	—	8	0.12	—	—	1	0.07	—	—	257.57	0.32	"	—	—	23	
4	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	12	20.40	5^{7}	19.38	—	—	8	0.12	—	—	1	0.07	—	—	258.32	2.15	"	—	—	24	
5	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	12	20.40	6^{1}	20.74	8	0.34	8	0.12	—	—	1	0.07	—	—	258.50	0.09	"	—	—	23	
6	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	12	20.40	6^{1}	20.74	—	—	8	0.12	—	—	1	0.07	—	—	249.03	0.22	"	—	—	23	
7	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	12^{5}	20.46	5^{8}	19.72	—	—	8	0.12	—	—	1	0.07	—	—	257.15	0.19	"	—	—	23	
8	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	8^{4}	14.28	6^{1}	20.74	—	—	8	0.12	—	—	1	0.07	16	0.22	244.92	1.25	"	—	—	24	
9	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	13^{4}	22.36	5^{8}	19.72	8	0.34	8	0.12	—	—	1	0.07	—	—	257.58	0.08	clay.	—	—	24	
10	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	12	20.40	5^{9}	20.06	—	—	8	0.12	—	—	1	0.07	—	—	253.85	1.16	coarse sand	—	—	24	

PIER III.—Continued.

Date. 1887.	Principal Foreman. Days.	Amount.	Night Foreman. Days.	Amount.	Sub Foremen. Days.	Amount.	Lock Tenders. Days.	Amount.	Pressure Men. Days.	Amount.	Coffee house Men. Days.	Amount.	Coffee. Lbs.	Amount.	Sugar. Lbs.	Amount.	Candles. No.	Amount.
Feb.																		
11	1	6.00	1	3.57	5^6	17.88	2	5.00	56^6	141.25	2	3.00	5	1.12	10	0.63	2	0.03
12	1	6.00	1	3.57	6	19.50	2	5.00	61	152.50	2	3.00	4	0.90	5	0.32	—	—
13	1	6.00	1	3.57	6	19.50	2	5.00	57^6	143.75	2	3.00	5	1.13	10	0.63	6	0.08
14	1	6.00	1	3.58	5^6	17.87	2	5.00	53^6	133.75	2	3.00	4	0.90	5	0.32	2	0.02
15	1	6.00	1	3.57	5	16.25	2	5.00	57	142.50	2	3.00	5	1.12	10	0.63	2	0.03
16	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
17	1	6.00	—	—	3	9.75	1	2.50	30^6	76.25	1	1.50	2	0.45	5	0.32	—	—
18	1	6.00	1	3.57	6	19.50	2	5.00	54	135.00	2	3.00	5	1.13	10	0.63	3	0.04
19	1	6.00	1	3.57	6	19.50	2	5.00	52^6	131.25	2	3.00	4	0.90	10	0.63	1	0.02
20	—	—	1	3.57	3	9.75	1	2.50	24^6	61.25	1	1.50	3	0.68	5	0.32	—	—
21	—	—	—	—	^{6}	1.63	—	—	4	10.00	—	—	—	—	—	—	—	—
22	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
23	1	6.00	—	—	2^6	8.12	1	2.50	28^6	71.25	—	—	2	0.45	5	0.32	3	0.04
24	1	6.00	1	3.57	6	19.50	2	5.00	62^6	156.25	2	3.00	4	0.90	5	0.32	—	—
25	1	6.00	1	3.57	5^6	17.88	2	5.00	62	155.00	2	3.00	4	0.90	10	0.63	5	0.06
26	1	6.00	1	3.57	5	16.25	2	5.00	60^6	151.25	2	3.00	5	1.12	10	0.63	2	0.02
27	1	6.00	1	3.57	5	16.25	2	5.00	64	160.00	2	3.00	4	0.90	5	0.32	2	0.03
28	1	6.00	1	3.58	5	16.25	2	5.00	60	150.00	2	3.00	3	0.67	10	0.63	3	0.04
Mar.																		
1	1	6.00	1	3.23	6	19.50	2	5.00	66^6	166.25	2	3.00	3	0.68	5	0.32	12	0.15
2	—	—	—	—	—	—	—	—	—	—	—	—	1	0.23	5	0.32	7	0.09
3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
6	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
7	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
8	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
9	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
10	1	6.00	1	3.23	4^6	14.62	1	2.50	45	112.50	2	3.00	4	0.90	6	0.39	2	0.02
11	1	6.00	1	3.23	6	19.50	2	5.00	63	157.50	2	3.00	5	1.13	6	0.39	10	0.12
12	1	6.00	1	3.23	6	19.50	2	5.00	58	145.00	2	3.00	3	0.67	4	0.25	3	0.04
13	1	6.00	1	3.23	4^6	14.63	2	5.00	44^6	111.25	2	3.00	3	0.68	5	0.34	12	0.15
14	1	6.00	1	3.23	—	—	1	2.50	—	—	2	3.00	5	1.12	7	0.50	2	0.03
15	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
16	1	6.00	1	3.23	5	16.25	2	5.00	58^6	146.25	2	3.00	5	1.13	11	0.79	3	0.04
17	1	6.00	1	3.23	6	19.50	2	5.00	60^6	151.25	2	3.00	5	1.12	7	0.50	9	0.11
18	½	3.00	1	3.23	1^6	4.87	1^6	3.75	29	72.50	1^6	2.25	—	—	—	—	—	—
19	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
20	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
21	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
22	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
23	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
24	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
25	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
26	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
27	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
28	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
29	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
30	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
31	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Apr.																		
1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
6	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
7	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
8	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
9	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
10	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
11	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
12	1	6.00	—	—	1^6	4.88	1	2.50	17^6	43.75	1	1.50	1	0.22	4	0.26	6	0.07
13	1	6.00	1	3.33	6	19.50	2	5.00	58	145.00	2	3.00	2	0.45	4	0.26	11	0.14
14	1	6.00	1	3.33	6	19.50	2	5.00	58	145.00	2	3.00	4	0.90	8	0.52	3	0.04
15	1	6.00	1	3.34	6	19.50	2	5.00	60^6	151.25	2	3.00	3	0.67	8	0.52	12	0.15
16	1	6.00	1	3.33	6	19.50	2	5.00	59	147.50	2	3.00	3	0.68	6	0.39	3	0.04
17	1	6.00	1	3.33	6	19.50	2	5.00	55^6	138.75	2	3.00	3	0.60	10	0.65	12	0.15
18	1	6.00	1	3.34	6	19.50	2	5.00	55	137.50	2	3.00	3	0.60	8	0.52	36	0.45
19	1	6.00	1	3.33	6	19.50	2	5.00	54^6	136.25	2	3.00	3	0.60	6	0.39	20	0.25
20	1	6.00	1	3.33	5^6	17.87	2	5.00	49	122.50	2	3.00	4	0.80	10	0.65	10	0.13
21	1	6.00	1	3.34	5	16.25	2	5.00	46^6	116.25	2	3.00	2	0.40	4	0.26	4	0.05
22	1	6.00	1	3.33	6	19.50	2	5.00	54^6	136.35	2	3.00	4	0.80	10	0.65	4	0.05
23	1	6.00	1	3.33	7	22.75	2	5.00	63^6	158.75	2	3.00	2	0.40	8	0.52	6	0.08
24	1	6.00	1	3.34	6	19.50	2	5.00	55^6	138.75	2	3.00	4	0.80	10	0.65	4	0.05
25	1	6.00	1	3.33	6	19.50	2	5.00	56	140.00	2	3.00	4	0.80	8	0.52	9	0.11
26	1	6.00	1	3.33	4	13.00	2	5.00	34	85.00	2	3.00	3	0.60	6	0.39	11	0.14
27	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		655.80		357.51		1446.83		505.25		11329.01		320.75		80.11		41.50		5.94

Date. 1887.	Red Lead. Lbs.	Amount.	Wick. Lbs.	Amount.	Coal for heating, 200 lbs. Boxes.	Amount.	Linseed Oil. Pints.	Amount.	Day Engineers. Days.	Amount.	Night Engineer. Days.	Amount.	Firemen. Days.	Amount.	Coal Passers. Days.	Amount.	Pump Men. Days.	Amount.	Laborers on Hoist. Days.	Amount.
Feb.																				
11	—	—	—	—	—	—	—	—	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	12	20.40
12	—	—	—	—	—	—	—	—	2	7.30	1	3.30	2	4.80	2	4.20	1^2	2.80	10^8	18.36
13	—	—	—	—	3	1.02	—	—	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	12	20.40
14	2	0.12	¼	0.05	2	0.68	½	0.04	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	12	20.40
15	—	—	—	—	—	—	—	—	1	3.30	1	3.30	2	4.80	2	4.20	2	4.80	12	20.40
16	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
17	—	—	—	—	—	—	—	—	2	7.30	—	—	1	2.40	1	2.10	1	2.40	6	10.20
18	—	—	—	—	1	0.34	—	—	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	10^1	17.17
19	—	—	—	—	—	—	—	—	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	12	20.40
20	—	—	—	—	4	1.36	—	—	—	—	1	3.30	1	2.40	1	2.10	1	2.40	6	10.20
21	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
22	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
23	—	—	—	—	—	—	—	—	2	7.30	—	—	1	2.40	1	2.10	1	2.40	5^6	9.35
24	—	—	—	—	3	1.02	—	—	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	12^8	20.52
25	—	—	—	—	2	0.68	—	—	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	12^3	20.32
26	—	—	—	—	2	0.68	—	—	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	12	20.40
27	—	—	—	—	3	1.02	—	—	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	12	20.40
28	—	—	—	—	—	—	—	—	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	12	20.40
Mar.																				
1	—	—	—	—	4	1.36	—	—	2^1	7.58	1^3	4.12	2^1	5.00	2^1	4.37	2	4.80	12^6	20.97
2	—	—	—	—	—	—	—	—	2	7.30	1	3.30	2	4.80	2	4.20	—	—	—	—
3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
6	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
7	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
8	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
9	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
10	—	—	—	—	—	—	—	—	2	7.30	1	3.30	2	4.80	2	4.20	1	2.00	6^8	10.33
11	—	—	—	—	—	—	—	—	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	6^6	11.56
12	—	—	—	—	—	—	—	—	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	5^4	9.18
13	—	—	—	—	—	—	—	—	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	5^8	9.14
14	—	—	—	—	1	0.34	—	—	2	7.30	1	3.30	2	4.80	2	4.20	—	—	2	3.40
15	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
16	—	—	—	—	4	1.36	—	—	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	5^4	9.18
17	—	—	—	—	—	—	—	—	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	5^4	9.18
18	—	—	—	—	—	—	—	—	1	3.65	1	3.30	1^6	3.60	1^6	3.15	1	2.40	2^6	4.59
19	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
20	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
21	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
22	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
23	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
24	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
25	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
26	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
27	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
28	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
29	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
30	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
31	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Apr.																				
1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
6	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
7	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
8	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
9	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
10	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
11	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
12	5	0.30	¼	0.05	3	1.02	2	0.12	3	11.25	—	—	1	2.40	1	2.10	1	2.40	—	—
13	—	—	—	—	1	0.34	—	—	2	7.60	1	3.30	2	4.80	2	4.20	1	2.40	5^4	9.18
14	—	—	—	—	—	—	—	—	2	7.60	1	3.30	2	4.80	2	4.20	2	4.80	5^4	9.18
15	—	—	—	—	3	1.02	—	—	2	7.60	1	3.30	2	4.80	2	4.20	2	4.80	5^5	9.21
16	—	—	—	—	—	—	—	—	2	7.60	1	3.30	2	4.80	2	4.20	2	4.80	5^5	9.21
17	—	—	—	—	—	—	—	—	2	7.60	1	3.30	2	4.80	2	4.20	2	4.80	5^3	9.12
18	—	—	—	—	—	—	—	—	2	7.60	1	3.30	2	4.80	2	4.20	2	4.80	5^5	9.24
19	—	—	—	—	3	1.02	—	—	2	7.60	1	3.30	2	4.80	2	4.20	2	4.80	1^4	2.40
20	—	—	—	—	—	—	—	—	2	7.60	1	3.30	2	4.80	2	4.20	1	2.40	—	—
21	—	—	—	—	—	—	—	—	2	7.60	1	3.30	2	4.80	2	4.20	1	2.40	—	—
22	—	—	—	—	4	1.36	—	—	2	7.60	1	3.30	2	4.80	2	4.20	1	2.40	—	—
23	—	—	—	—	—	—	—	—	2	7.60	1	3.30	2	4.80	2	4.20	—	—	—	—
24	—	—	—	—	—	—	—	—	2	7.60	1	3.30	2	4.80	2	4.20	—	—	—	—
25	—	—	—	—	4	1.36	—	—	2	7.60	1	3.30	2	4.80	2	4.20	—	2.40	—	—
26	—	—	—	—	—	—	—	—	2	7.60	1^3	4.95	2	4.80	2	4.20	—	—	—	—
27	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		4.56		0.60		51.00		1.86		788.48		350.62		513.40		447.13		424.80		1120.41

Date. 1887.	Coal for Boilers. Tons.	Amount.	Signal Oil. Pints.	Amount.	Black Oil. Pints.	Amount.	Tallow. Lbs.	Amount.	Waste. Lbs.	Amount.	Coal Oil. Pints.	Amount.	Totals for Each Day.	Feet Sunk per day.	Material.	Water Pumps. Hours run.	No. of revolutions.	Air Pumps. No. of revolutions.	Remarks.
Feb.															and				
11	6^1	20.74	—	—	8	0.12	—	—	1	0.07	—	—	244.21	0.01	gravel	—	—	27	
12	6^1	20.74	—	—	8	0.12	—	—	1	0.07	—	—	252.48	0.00	"	—	—	24	
13	5^8	19.72	8	0.34	8	0.12	—	—	1	0.07	—	—	248.73	1.11	"	—	—	26	
14	5^7	20.06	—	—	8	0.12	—	—	1	0.07	—	—	236.38	0.19	"	—	—	25	
15	6^1	20.74	—	—	8	0.12	—	—	1	0.07	—	—	239.83	1.30	"	—	—	21	
16	1^6	4.60	—	—	8	0.12	—	—	1	0.07	—	—	4.79	0.00	"	—	—	—	Working in Pier II.
17	6^1	20.74	8	0.34	8	0.12	—	—	1	0.07	—	—	142.44	0.05	"	—	—	25	
18	6	20.40	—	—	8	0.12	—	—	1	0.07	—	—	236.37	0.04	"	—	—	25	
19	6^1	20.74	—	—	8	0.12	—	—	1	0.07	—	—	235.60	0.08	"	—	—	26	
20	5^7	19.38	—	—	8	0.12	—	—	1	0.07	—	—	120.90	1.23	"	—	—	24	
21	1^6	4.60	—	—	—	—	—	—	—	—	—	—	16.23	0.00	"	—	—	—	Working in Pier II.
22	1^6	4.60	—	—	—	—	—	—	—	—	—	—	4.60	0.00	"	—	—	—	" "
23	6^1	20.74	8	0.34	8	0.12	—	—	1	0.07	—	—	133.50	0.00	"	—	—	23	
24	5^8	19.72	—	—	8	0.12	—	—	1	0.07	—	—	260.39	1.33	"	—	—	26	
25	5^7	22.10	—	—	8	0.12	—	—	1	0.07	—	—	259.73	0.15	"	—	—	25	
26	5^6	22.10	8	0.34	8	0.12	—	—	1	0.07	—	—	254.95	0.59	"	—	—	25	
27	6^4	21.76	—	—	8	0.12	—	—	1	0.07	—	—	262.84	0.36	"	—	—	26	
28	6^7	22.78	—	—	8	0.12	—	—	1	0.07	—	—	252.94	0.24	clay	—	—	26	
Mar.																			
1	6^8	21.42	—	—	8	0.12	—	—	1	0.07	—	—	273.94	0.50	"	—	—	24	Work suspended. River breaking up.
2	6^7	22.78	—	—	—	—	—	—	—	—	—	—	43.02	0.01	"	—	—	21	" "
3	—	—	—	—	—	—	—	—	—	—	—	—		—	—	—	—	—	" "
4	—	—	—	—	—	—	—	—	—	—	—	—		—	—	—	—	—	" "
5	—	—	—	—	—	—	—	—	—	—	—	—		—	—	—	—	—	" "
6	—	—	—	—	—	—	—	—	—	—	—	—		—	—	—	—	—	" "
7	—	—	—	—	—	—	—	—	—	—	—	—		—	—	—	—	—	" "
8	—	—	—	—	—	—	—	—	—	—	—	—		—	—	—	—	—	" "
9	—	—	—	—	—	—	—	—	—	—	—	—		—	—	—	—	—	
10	6^7	22.78	8	0.34	—	—	—	—	—	—	—	—	198.21	0.02	clay	—	—	21	
11	6^7	22.78	—	—	8	0.12	—	—	1	0.07	—	—	254.80	0.25	"	—	—	23	
12	6^7	22.78	—	—	8	0.12	—	—	1	0.07	—	—	239.24	—	"	—	—	23	
13	6^7	22.78	—	—	8	0.12	—	—	1	0.07	—	—	200.79	—	"	—	—	20	
14	6^6	22.44	8	0.34	4	0.06	—	—	1	0.07	—	—	62.63	—	"	—	—	13	
15	—	—	—	—	—	—	—	—	—	—	—	—		—	—	—	—	—	
16	6^8	21.42	—	—	8	0.12	—	—	1	0.07	—	—	238.24	0.07	"	—	—	23	
17	6^7	22.78	—	—	8	0.12	—	—	1	0.07	—	—	246.26	—	"	—	—	34	
18	6^7	22.78	—	—	4	0.06	—	—	1	0.07	—	—	133.20	—	"	—	—	33	Working in Pier II.
19	—	—	—	—	—	—	—	—	—	—	—	—		—	—	—	—	—	" "
20	—	—	—	—	—	—	—	—	—	—	—	—		—	—	—	—	—	" "
21	—	—	—	—	—	—	—	—	—	—	—	—		—	—	—	—	—	" "
22	—	—	—	—	—	—	—	—	—	—	—	—		—	—	—	—	—	" "
23	—	—	—	—	—	—	—	—	—	—	—	—		—	—	—	—	—	" "
24	—	—	—	—	—	—	—	—	—	—	—	—		—	—	—	—	—	" "
25	—	—	—	—	—	—	—	—	—	—	—	—		—	—	—	—	—	" "
26	—	—	—	—	—	—	—	—	—	—	—	—		—	—	—	—	—	" "
27	—	—	—	—	—	—	—	—	—	—	—	—		—	—	—	—	—	" "
28	—	—	—	—	—	—	—	—	—	—	—	—		—	—	—	—	—	" "
29	—	—	—	—	—	—	—	—	—	—	—	—		—	—	—	—	—	" "
30	—	—	—	—	—	—	—	—	—	—	—	—		—	—	—	—	—	" "
31	—	—	—	—	—	—	—	—	—	—	—	—		—	—	—	—	—	
Apr.																			
1	—	—	—	—	—	—	—	—	—	—	—	—		—	—	—	—	—	" "
2	—	—	—	—	—	—	—	—	—	—	—	—		—	—	—	—	—	" "
3	—	—	—	—	—	—	—	—	—	—	—	—		—	—	—	—	—	" "
4	—	—	—	—	—	—	—	—	—	—	—	—		—	—	—	—	—	" "
5	—	—	—	—	—	—	—	—	—	—	—	—		—	—	—	—	—	" "
6	—	—	—	—	—	—	—	—	—	—	—	—		—	—	—	—	—	" "
7	—	—	—	—	—	—	—	—	—	—	—	—		—	—	—	—	—	" "
8	—	—	—	—	—	—	—	—	—	—	—	—		—	—	—	—	—	" "
9	—	—	—	—	—	—	—	—	—	—	—	—		—	—	—	—	—	" "
10	—	—	—	—	—	—	—	—	—	—	—	—		—	—	—	—	—	" "
11	—	—	—	—	—	—	—	—	—	—	—	—		—	—	—	—	—	" "
12	6^6	22.10	—	—	4	0.06	—	—	1	0.07	—	—	101.05	—	clay	—	—	22	
13	6^6	22.10	—	—	8	0.12	—	—	1	0.07	—	—	236.79	—	"	—	—	25	
14	6^7	22.78	8	0.34	8	0.12	—	—	1	0.07	—	—	240.48	0.01	"	—	—	23	
15	6^4	21.76	—	—	8	0.12	—	—	1	0.07	8	0.11	246.42	0.00	"	—	—	24	
16	6^7	22.78	—	—	8	0.12	—	—	1	0.07	—	—	242.32	0.12	"	—	—	22	
17	6^7	22.78	—	—	8	0.12	—	—	1	0.07	—	—	233.77	0.52	"	—	—	20	
18	6^7	22.78	8	0.34	8	0.12	—	—	1	0.07	—	—	233.16	0.38	"	—	—	19	
19	6^4	21.76	—	—	8	0.12	—	—	1	0.07	8	0.11	224.50	—	"	—	—	17	Began sealing caisson.
20	6^7	22.78	—	—	8	0.12	—	—	1	0.07	—	—	204.55	—	"	—	—	18	
21	6^7	22.78	—	—	8	0.12	—	—	1	0.07	—	—	195.82	—	"	—	—	19	
22	6^8	21.42	8	0.34	8	0.12	—	—	1	0.07	—	—	220.19	—	"	—	—	17	
23	6^7	22.78	—	—	8	0.12	—	—	1	0.07	—	—	242.70	—	"	—	—	14	
24	6^7	22.78	—	—	8	0.12	—	—	1	0.07	—	—	219.96	—	"	—	—	14	
25	6^8	21.42	—	—	8	0.12	—	—	1	0.07	—	—	223.53	—	"	—	—	16	
26	6^7	22.78	8	0.34	4	0.06	—	—	1	0.07	8	0.11	161.37	—	"	—	—	—	
27													—	0.04	—	—	—	—	Took off air at 8:10 a. m.
		2343.23		9.52		11.97		6.29		7.56		0.99	20825.12						

Other expenses charged to sinking . . $1633.86

$22458.98

TIME, COST AND MATERIALS USED IN FOUNDATIONS. PIER IV.

Date 1886.	Principal Foreman Days	Principal Foreman Amount	Night Foreman Days	Night Foreman Amount	Sub Foremen Days	Sub Foremen Amount	Lock Tenders Days	Lock Tenders Amount	Pressure Men Days	Pressure Men Amount	Coffee house Men Days	Coffee house Men Amount	Coffee Lbs.	Coffee Amount	Sugar Lbs.	Sugar Amount	Candles No.	Candles Amount	Red Lead Lbs.	Red Lead Amount	Wick Lbs.	Wick Amount	Coal for heating 200 lbs. Boxes	Coal for heating Amount	Linseed Oil Pints	Linseed Oil Amount
Aug.																										
22	1	6.00	1	3.23	3	9.00	1	2.25	32^{5}	73.12	2	3.25	2	0.28	3¼	0.20	13	0.16	40	2.40	—	—	—	—	16	1.00
23	1	6.00	1	3.23	3	9.00	2	4.50	32	72.00	2	3.25	4	0.56	5	0.31	4	0.05	—	—	—	—	—	—	—	—
24	1	6.00	1	3.23	3	9.00	2	4.50	29	65.75	2	3.25	4	0.56	5	0.31	—	—	—	—	—	—	2	0.63	—	—
25	1	6.00	1	3.23	3	9.00	2	4.50	31^{5}	70.88	2	3.25	3	0.42	4	0.25	6	0.07	—	—	—	—	—	—	—	—
26	1	6.00	1	3.23	3	9.00	2	4.50	34	76.50	2	3.25	4	0.56	5	0.31	6	0.08	—	—	—	—	—	—	—	—
27	1	6.00	1	3.23	3	9.00	2	4.50	34	76.50	2	3.25	3	0.42	5	0.31	3	0.04	—	—	—	—	—	—	—	—
28	1	6.00	1	3.23	3	9.00	2	4.50	34	76.50	2	3.25	6	0.84	8	0.50	8	0.10	—	—	—	—	2	0.63	—	—
29	1	6.00	1	3.23	3	9.00	2	4.50	33^{5}	75.37	2	3.25	3	0.42	3½	0.22	6	0.07	—	—	—	—	—	—	—	—
30	1	6.00	1	3.23	3	9.00	2	4.50	36	81.00	2	3.25	3	0.42	8	0.50	3	0.04	—	—	—	—	2	0.63	—	—
31	1	6.00	1	3.23	2	6.00	2	4.20	33^{5}	75.38	2	3.25	4	0.56	4	0.25	4	0.05	—	—	—	—	—	—	—	—
Sept.																										
1	1	6.00	1	3.33	3	9.00	2	4.50	34^{5}	77.62	2	3.25	3	0.42	7	0.44	12	0.15	—	—	—	—	3	0.94	—	—
2	1	6.00	1	3.33	3	9.00	2	4.50	34^{5}	77.63	2	3.25	3	0.42	4	0.25	4	0.05	5	0.30	½	0.09	—	—	2	0.12
3	1	6.00	1	3.34	1	3.00	2	4.50	11^{5}	25.87	2	3.25	1	0.14	4	0.25	3	0.04	—	—	—	—	—	—	—	—
4	1	6.00	1	3.33	—	—	2	4.50	—	—	2	3.25	2	0.28	4	0.25	8	0.10	5	0.30	½	0.10	—	—	2	0.13
5	1	6.00	1	3.33	2	6.00	2	4.50	24	54.00	2	3.25	3	0.42	3	0.19	10	0.12	—	—	—	—	3	0.95	—	—
6	1	6.00	1	3.34	3	9.00	2	4.50	33	74.25	2	3.25	3	0.42	8	0.50	—	—	—	—	—	—	—	—	—	—
7	1	6.00	1	3.33	3	9.50	2	4.75	34	82.00	2	3.25	3	0.42	4	0.25	13	0.16	5	0.30	½	0.09	—	—	2	0.12
8	1	6.00	1	3.33	4	13.00	2	5.00	39^{5}	98.76	2	3.25	4	0.56	4	0.25	3	0.04	—	—	—	—	2	1.63	—	—
9	1	6.00	1	3.34	4	13.00	2	5.00	40	100.00	2	3.25	4	0.56	8	0.50	2	0.02	—	—	—	—	—	—	—	—
10	1	6.00	1	3.33	4	13.00	2	5.00	36	90.00	2	3.25	3	0.42	4	0.25	6	0.08	5	0.30	¼	0.05	—	—	2	0.13
11	1	6.00	1	3.33	4	13.00	2	5.00	38^{5}	96.25	2	3.25	3	0.42	4	0.25	6	0.07	—	—	—	—	3	0.94	—	—
12	1	6.00	1	3.34	4	13.00	2	5.00	41^{5}	103.75	2	3.25	3	0.42	8⅓	0.53	—	—	—	—	—	—	—	—	—	—
13	1	6.00	1	3.33	4	13.00	2	5.00	42	105.00	2	3.25	2	0.28	4	0.25	8	0.10	—	—	—	—	—	—	—	—
14	1	6.00	1	3.33	4	13.00	2	5.00	40	100.00	2	3.25	4	0.56	4	0.25	6	0.08	—	—	—	—	3	0.95	—	—
15	1	6.00	1	3.34	4	13.00	2	5.00	43	107.50	1	1.75	5	0.70	2½	0.16	6	0.07	—	—	—	—	—	—	—	—
16	1	6.00	1	3.33	4	13.00	2	5.00	41	102.50	1	1.75	4	0.56	9	0.56	3	0.04	—	—	—	—	1	0.31	—	—
17	1	6.00	1	3.33	3	9.75	2	5.00	40^{5}	101.25	2	3.25	5	0.70	9	0.56	4	0.05	—	—	—	—	3	0.95	—	—
18	1	6.00	1	3.34	4	13.00	2	5.00	36	90.00	2	3.25	4	0.56	4	0.25	6	0.08	—	—	—	—	—	—	—	—
19	1	6.00	1	3.33	3	9.75	2	5.00	37	92.50	2	3.25	3	0.42	3	0.19	—	—	—	—	—	—	—	—	—	—
20	1	6.00	1	3.33	4	13.00	2	5.00	41	102.50	2	3.25	3	0.44	4	0.25	14	0.17	—	—	—	—	3	0.94	—	—
21	1	6.00	1	3.34	4	13.00	2	5.00	40	100.00	2	3.25	3	0.50	7	0.44	3	0.04	—	—	—	—	—	—	—	—
22	1	6.00	1	3.33	4	13.06	2	5.00	40	100.00	2	3.25	3	0.49	4	0.25	—	—	—	—	—	—	3	0.95	—	—
23	1	6.00	1	3.33	4	13.00	2	5.00	38	95.00	2	3.25	3	0.50	4	0.25	5	0.06	—	—	—	—	—	—	—	—
24	1	6.00	1	3.34	4	13.00	2	5.00	41	102.50	2	3.25	3	0.49	8	0.50	6	0.08	—	—	—	—	—	—	—	—
25	1	6.00	1	3.33	4	13.00	2	5.00	40^{5}	101.25	2	3.25	3	0.50	4	0.25	6	0.07	—	—	—	—	2	0.63	—	—
26	1	6.00	1	3.33	4	13.00	2	5.00	40	100.00	2	3.25	3	0.49	4	0.25	6	0.08	3½	0.21	¼	0.05	—	—	2	0.12
27	1	6.00	1	3.34	5	16.25	2	5.00	41	102.50	2	3.00	3	0.50	8	0.50	19	0.24	—	—	—	—	3	0.94	—	—
28	1	6.00	1	3.33	5½	17.87	2	5.00	53	132.50	2	3.00	4	0.66	8	0.50	2	0.02	—	—	—	—	—	—	—	—
29	1	6.00	1	3.33	5½	17.88	2	5.00	60	150.00	2	3.00	4	0.66	4	0.25	6	0.07	—	—	—	—	3	1.95	—	—
30	1	6.00	1	3.34	6	19.50	2	5.00	60	150.00	2	3.00	4	0.66	4	0.25	10	0.13	—	—	—	—	—	—	—	—
Oct.																										
1	1	6.00	1	3.23	6	19.50	2	5.00	56^{5}	141.25	2	3.00	4	0.66	8	0.50	6	0.07	5	0.30	½	0.09	3	0.94	3	0.19
2	1	6.00	1	3.23	6	19.50	2	5.00	55	137.50	2	3.00	6	0.99	8	0.50	10	0.13	—	—	—	—	3	0.95	—	—
3	1	6.00	1	3.23	6	19.50	2	5.00	58^{5}	146.25	2	3.00	6	0.99	8	0.50	—	—	—	—	—	—	—	—	—	—
4	1	6.00	1	3.23	6	19.50	2	5.00	59	147.50	2	3.00	5	0.82	8	0.50	5	0.06	—	—	—	—	3	0.94	—	—
5	1	6.00	1	3.23	6	19.50	2	5.00	58	145.00	2	3.00	5	0.83	8	0.50	5	0.07	—	—	—	—	—	—	—	—
6	1	6.00	1	3.23	6	19.50	2	5.00	63	157.50	2	3.00	6	0.99	4	0.25	10	0.13	—	—	—	—	3	0.95	—	—
7	1	6.00	1	3.23	6	19.50	2	5.00	63^{5}	158.75	2	3.00	6	0.99	8	0.50	—	—	—	—	—	—	—	—	—	—
8	1	6.00	1	3.23	6	19.50	2	5.00	57^{5}	143.75	2	3.00	4	0.66	8	0.50	7	0.09	—	—	—	—	3	0.94	—	—
9	1	6.00	1	3.23	4	13.00	2	5.00	61	152.50	2	3.00	6	0.99	8	0.50	1	0.01	—	—	—	—	—	—	—	—
10	1	6.00	1	3.23	6	19.50	2	5.00	65	162.50	2	3.00	6	0.99	8	0.50	7	0.09	—	—	—	—	3	0.95	—	—
11	1	6.00	1	3.23	6	19.50	2	5.00	63	157.50	2	3.00	6	0.99	8	0.50	18	0.23	—	—	—	—	—	—	—	—
12	1	6.00	1	3.23	6	19.50	2	5.00	61	152.50	2	3.00	5	0.82	8	0.50	9	0.11	5	0.30	½	0.10	3	0.94	3	0.19
13	1	6.00	1	3.23	6	19.50	2	5.00	57^{5}	143.75	2	3.00	6	1.00	8	0.50	3	0.04	—	—	—	—	—	—	—	—
14	1	6.00	1	3.23	6	19.50	2	5.00	60^{5}	151.25	2	3.00	6	1.00	8	0.50	9	0.12	—	—	—	—	3	0.95	—	—
15	1	6.00	1	3.23	6	19.50	2	5.00	55^{5}	138.75	2	3.00	5	0.84	2½	0.16	6	0.07	—	—	—	—	—	—	—	—
16	1	6.00	1	3.23	5	16.25	2	5.00	55^{5}	138.75	2	3.00	4	0.67	9	0.56	3	0.04	—	—	—	—	3	0.94	—	—
17	1	6.00	1	3.23	5^{5}	17.87	2	5.00	55	137.50	2	3.00	5	0.84	9	0.56	4	0.05	—	—	—	—	—	—	—	—
18	1	6.00	1	3.23	6	19.50	2	5.00	53^{5}	133.75	2	3.00	4	0.67	4	0.25	6	0.08	—	—	—	—	—	—	—	—
19	1	6.00	1	3.22	6	19.50	2	5.00	53^{5}	133.75	2	3.00	3	0.50	3	0.19	—	—	—	—	—	—	3	0.95	—	—
20	1	6.00	1	3.22	6	19.50	2	5.00	55	137.50	2	3.00	3	0.50	4	0.25	14	0.17	—	—	—	—	—	—	—	—
21	1	6.00	1	3.22	5	16.25	2	5.00	53^{5}	133.75	2	3.00	3	0.50	7	0.44	3	0.04	—	—	—	—	3	0.94	—	—
22	1	6.00	1	3.22	6	19.50	2	5.00	43^{5}	108.75	2	3.00	3	0.51	4	0.25	—	—	—	—	—	—	—	—	—	—
23	1	6.00	1	3.22	6	19.50	2	5.00	30^{5}	76.25	2	3.00	3	0.50	4	0.26	5	0.06	—	—	—	—	3	0.95	—	—
24	1	6.00	1	3.22	6	19.50	2	5.00	45^{5}	113.75	2	3.00	3	0.50	8	0.51	6	0.07	—	—	—	—	—	—	—	—
25	1	6.00	1	3.22	6	19.50	2	5.00	59^{5}	148.75	2	3.00	3	0.50	4	0.25	6	0.08	—	—	—	—	3	0.94	—	—
26	1	6.00	1	3.22	5	16.25	2	5.00	57	142.50	2	3.00	3	0.51	4	0.25	6	0.07	—	—	—	—	—	—	—	—
27	1	6.00	1	3.22	5	16.25	2	5.00	49^{5}	123.75	2	3.00	3	0.50	8	0.51	19	0.25	—	—	—	—	3	0.95	—	—
28	1	6.00	1	3.22	5	16.25	2	5.00	55	137.50	2	3.00	4	0.67	8	0.51	2	0.02	—	—	—	—	3	0.94	—	—
29	1	6.00	1	3.22	6	19.50	2	5.00	58	145.00	2	3.00	4	0.67	4	0.26	6	0.08	—	—	—	—	3	0.95	—	—
30	1	6.00	1	3.22	6	19.50	2	5.00	58	145.00	2	3.00	4	0.67	4	0.25	10	0.12	—	—	—	—	—	—	—	—
31	1	6.00	1	3.22	6	19.50	2	5.00	55^{5}	138.75	2	3.00	4	0.67	8	0.51	6	0.08	—	—	—	—	—	—	—	—
Nov.																										
1	1	6.00	1	3.33	6	19.50	2	5.00	56	140.00	2	3.00	4	0.67	8	0.51	6	0.07	—	—	—	—	3	0.94	—	—
2	1	6.00	1	3.33	5^{5}	17.88	2	5.00	53^{5}	133.75	2	3.00	6	1.00	8	0.51	10	0.13	—	—	—	—	—	—	—	—
3	1	6.00	1	3.34	5	16.25	2	5.00	54^{5}	136.25	2	3.00	6	1.00	8	0.51	—	—	—	—	—	—	—	—	—	—
4	1	6.00	1	3.33	6	19.50	2	5.00	54^{5}	136.25	2	3.00	5	0.84	8	0.51	5	0.06	—	—	—	—	3	0.95	—	—
5	1	6.00	1	3.33	4^{5}	14.62	2	5.00	56^{5}	141.25	2	3.00	5	0.84	8	0.51	5	0.07	—	—	—	—	—	—	—	—
6	1	6.00	1	3.34	6	19.50	2	5.00	56^{5}	141.25	2	3.00	6	1.00	4	0.26	10	0.12	—	—	—	—	3	0.94	—	—
7	1	6.00	1	3.33	5	16.25	2	5.00	54^{5}	136.25	2	3.00	6	1.00	8	0.51	—	—	—	—	—	—	3	0.95	—	—
8	1	6.00	1	3.33	6	19.50	2	5.00	52^{5}	131.25	2	3.00	4	0.67	8	0.51	7	0.09	—	—	—	—	—	—	—	—
9	1	6.00	1	3.34	3	9.75	2	4.25	13	32.50	2	3.00	6	1.00	8	0.51	1	0.01	—	—	—	—	—	—	—	—
		480.00		262.30		1177.37		388.75		9018.13		246.00		50.57		30.04		5.85		4.41		0.57		30.87		2.00

Date 1886.	Day Engineers Days	Day Engineers Amount	Night Engineer Days	Night Engineer Amount	Firemen Days	Firemen Amount	Coal Passers Days	Coal Passers Amount	Pump Men Days	Pump Men Amount	Laborers on hoist Days	Laborers on hoist Amount	Coal for Boilers Tons	Coal for Boilers Amount	Signal Oil Pints	Signal Oil Amount	Black Oil Pints	Black Oil Amount	Tallow Lbs.	Tallow Amount	Waste Lbs.	Waste Amount	Coal Oil Pints	Coal Oil Amount	Totals for each day	Feet sunk per day	Material	Cameron Pumps Hours run	Cameron Pumps No. of revolutions	Air Pumps No. of revolutions	Remarks
Aug.																															
22	2	7.30	1	3.30	1	2.40	1	2.10	1	2.40	—	—	3^{5}	11.90	8	0.34	12	0.17	—	—	1	0.07	—	—	130.87	—	gumbo	20 16/60	32	30	
23	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	—	—	3	10.20	—	—	8	0.11	10	0.65	1	0.07	—	—	134.33	1.15	"	22¾	33	24	Started air pumps at 7:05 a. m.
24	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	—	—	6^{5}	22.10	—	—	8	0.11	—	—	1	0.07	—	—	139.91	1.51	"	23⅓	37	23	Started Cameron pumps at 7:30 a. m.
25	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	—	—	7	23.80	—	—	8	0.11	10	0.65	1	0.07	—	—	146.63	1.48	"	22 5/6	41	20	
26	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	—	—	7	23.80	8	0.34	8	0.11	—	—	1	0.07	8	0.11	152.26	1.77	"	23 1/12	40	18	
27	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	—	—	7^{5}	25.50	—	—	8	0.11	10	0.63	1	0.07	—	—	153.96	0.17	"	21¼	38	16	
28	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	—	—	7^{3}	24.82	—	—	8	0.11	—	—	1	0.07	—	—	153.95	3.21	"	23¾	40	13	
29	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	—	—	7	23.80	—	—	8	0.11	10	0.63	1	0.07	—	—	151.07	0.32	"	23	41	14	
30	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	—	—	7	23.80	8	0.34	8	0.11	—	—	1	0.07	—	—	157.29	2.34	"	24	39	10	
31	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	—	—	7	23.80	—	—	8	0.11	10	0.63	1	0.07	—	—	148.23	2.79	"	22 1/60	37	13	
Sept.																															
1	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	—	—	6^{2}	21.08	—	—	8	0.11	—	—	1	0.07	—	—	151.31	6.31	sand.	24	39	16	
2	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	—	—	2^{3}	7.82	—	—	8	0.11	10	0.64	1	0.07	—	—	137.98	4.25	"	19⅔	39	15	
3	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	—	—	2	6.80	8	0.34	8	0.11	—	—	1	0.07	—	—	78.11	0.02	"	1	35	14	
4	2	7.30	1	3.30	2	4.80	2	4.20	1	2.40	—	—	6^{5}	22.10	—	—	8	0.11	10	0.64	1	0.07	—	—	63.16	0.00	"	—	—	10	
5	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	—	—	7^{5}	25.50	—	—	8	0.11	—	—	1	0.07	—	—	128.84	7.29	"	23¼	39	20	
6	2	7.30	1	3.30	2	4.80	1	2.10	2	4.80	—	—	7^{7}	26.18	—	—	8	0.11	10	0.63	1	0.07	—	—	150.55	4.92	"	23½	41	21	
7	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	—	—	7^{8}	26.52	8	0.34	8	0.11	—	—	1	0.07	—	—	161.61	2.78	"	21¾	40	21	
8	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	—	—	4^{6}	15.64	—	—	8	0.10	10	0.63	1	0.07	—	—	171.66	2.46	"	23	41	19	
9	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	—	—	4^{5}	15.30	—	—	8	0.10	—	—	1	0.07	—	—	171.54	1.09	"	6⅓	43	20	
10	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	—	—	3^{9}	13.26	—	—	8	0.10	10	0.63	1	0.07	8	0.11	160.38	0.20	clay.	5 5/6	43	14	
11	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	8^{4}	11.76	2^{2}	7.48	8	0.34	8	0.10	—	—	1	0.07	—	—	172.66	0.35	"	23 1/12	37	21	
12	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	10^{6}	14.84	2^{7}	9.18	—	—	8	0.10	—	—	1	0.07	—	—	183.88	0.41	"	—	—	24	Pump men running clay hoist.
13	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	9^{6}	13.44	2^{7}	9.18	—	—	8	0.10	—	—	1	0.07	—	—	183.40	1.06	"	—	—	25	
14	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	9^{6}	13.44	3	10.20	—	—	8	0.10	—	—	1	0.07	—	—	180.63	0.00	"	—	—	28	
15	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	9^{6}	13.44	3	10.20	8	0.34	8	0.10	—	—	1	0.07	—	—	186.07	1.39	"	—	—	28	
16	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	9^{6}	13.44	3^{1}	10.54	—	—	8	0.10	—	—	1	0.07	—	—	181.60	0.00	"	—	—	31	
17	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	9^{6}	13.44	3^{4}	11.56	—	—	8	0.10	—	—	1	0.07	—	—	180.41	1.24	"	—	—	27	
18	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	9^{6}	13.44	3^{8}	12.92	—	—	8	0.10	—	—	1	0.07	—	—	172.41	0.11	"	—	—	32	
19	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	9^{6}	13.44	4	9.80	8	0.34	8	0.10	—	—	1	0.07	—	—	168.59	0.17	"	—	—	29	
20	2	7.30	1	3.85	2	4.80	2	4.20	2	4.80	9^{6}	13.44	4	9.80	—	—	8	0.10	—	—	1	0.07	—	—	182.69	1.12	"	—	—	32	
21	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	10^{8}	15.12	3^{9}	13.26	—	—	8	0.10	—	—	1	0.07	—	—	184.52	0.01	"	—	—	35	
22	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	9^{6}	13.44	2^{7}	9.18	—	—	8	0.10	—	—	1	0.07	—	—	179.46	1.76	"	—	—	34	
23	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	12^{8}	17.92	3^{5}	11.90	8	0.34	8	0.10	—	—	1	0.07	—	—	181.12	0.03	"	—	—	22	
24	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	12	16.80	3^{4}	11.56	—	—	8	0.10	—	—	1	0.07	—	—	187.09	0.03	"	—	—	31	
25	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	12	16.80	3^{5}	11.90	—	—	8	0.10	—	—	1	0.07	—	—	186.55	0.00	"	—	—	39	
26	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	12	16.80	3	10.20	—	—	8	0.10	—	—	1	0.07	—	—	183.35	1.47	"	—	—	35	
27	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	12	16.80	3	10.20	8	0.34	8	0.10	—	—	1	0.07	—	—	190.18	0.00	"	—	—	35	
28	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	12	16.80	4	13.60	8	0.34	8	0.10	—	—	1	0.07	—	—	224.19	1.78	"	—	—	30	
29	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	12	16.80	4	13.60	—	—	8	0.10	—	—	1	0.07	—	—	242.11	0.02	"	—	—	31	
30	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	12	16.80	3	10.20	—	—	8	0.10	—	—	1	0.07	—	—	239.45	0.01	"	—	—	29	
Oct.																															
1	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	12	16.80	3^{6}	12.24	8	0.34	8	0.10	—	—	1	0.07	—	—	234.68	1.32	"	—	—	25	
2	2	7.50	1	3.30	2	4.80	2	4.20	2	4.80	12	16.80	3^{6}	12.24	—	—	8	0.10	—	—	1	0.07	—	—	230.41	0.01	"	—	—	33	
3	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	12	16.80	3^{1}	10.54	8	0.34	8	0.10	—	—	1	0.07	—	—	236.72	0.02	"	—	—	36	
4	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	12	16.80	3^{1}	10.54	—	—	8	0.10	—	—	1	0.07	—	—	238.46	1.65	"	—	—	34	
5	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	12	16.80	3^{2}	10.88	—	—	8	0.10	—	—	1	0.07	—	—	235.38	0.03	"	—	—	37	
6	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	12	16.80	3^{6}	12.24	—	—	8	0.10	—	—	1	0.07	—	—	250.16	1.79	"	—	—	27	
7	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	12	16.80	4	13.60	8	0.34	8	0.10	—	—	1	0.07	—	—	252.28	0.03	"	—	—	25	
8	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	12	16.80	4^{1}	13.94	—	—	8	0.10	—	—	1	0.07	—	—	237.98	1.71	"	—	—	30	
9	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	12	16.80	4^{5}	15.30	16	0.68	8	0.10	—	—	1	0.07	—	—	241.58	0.01	"	—	—	29	
10	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	11^{9}	16.66	6^{4}	21.76	—	—	8	0.10	—	—	1	0.07	—	—	264.75	1.22	"	—	—	25	
11	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	[illegible]	.70	5^{4}	18.36	—	—	8	0.10	—	—	1	0.07	—	—	239.58	1.97	gravel	—	—	26	
12	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	6	8.40	5^{4}	18.36	—	—	8	0.10	—	—	1	0.07	—	—	243.52	0.05	"	—	—	25	
13	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	12	16.80	4	13.60	8	0.34	8	0.10	—	—	1	0.07	—	—	237.33	1.98	"	—	—	27	
14	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	11^{7}	16.38	3^{8}	12.92	—	—	8	0.10	—	—	1	0.07	—	—	244.42	0.01	"	—	—	27	
15	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	11^{6}	16.24	4^{5}	15.30	—	—	8	0.10	—	—	1	0.07	—	—	232.66	2.12	"	—	—	27	
16	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	12	16.80	3^{7}	12.58	—	—	8	0.10	—	—	1	0.07	—	—	228.39	0.00	"	—	—	29	
17	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	12	16.80	4^{1}	13.94	8	0.34	8	0.10	—	—	1	0.07	—	—	229.70	0.01	"	—	—	31	
18	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	12	16.80	3^{1}	10.54	—	—	8	0.10	—	—	1	0.07	—	—	223.39	2.14	"	—	—	30	
19	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	8^{7}	12.18	3^{6}	12.24	8	0.34	8	0.10	—	—	1	0.07	—	—	221.44	0.00	"	—	—	31	
20	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	7^{2}	10.08	2^{9}	9.86	—	—	8	0.10	—	—	1	0.07	—	—	219.65	0.01	"	—	—	31	
21	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	15^{6}	21.84	2	6.80	8	0.34	8	0.10	—	—	1	0.07	—	—	222.69	1.27	"	—	—	26	
22	2	7.30	1	3.30	2	4.80	2	4.20	1	2.40	3^{6}	5.04	1^{8}	6.12	8	0.34	8	0.10	—	—	1	0.07	—	—	179.90	0.05	"	—	—	16	
23	2	7.30	1	3.30	2	4.80	2	4.20	—	—	7	9.80	4^{2}	14.28	—	—	8	0.10	—	—	1	0.07	—	—	158.59	0.01	"	—	—	18	
24	2	7.30	1	3.30	2	4.80	2	4.20	1	2.40	7^{2}	10.08	4^{5}	15.30	—	—	8	0.10	—	—	1	0.07	—	—	199.10	0.00	"	—	—	28	
25	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	15^{6}	21.84	4^{5}	15.30	—	—	8	0.10	—	—	1	0.07	—	—	248.95	0.53	"	—	—	34	
26	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	15^{6}	21.84	4^{8}	16.32	8	0.34	8	0.10	—	—	1	0.07	—	—	239.87	1.55	"	—	—	33	
27	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	13^{2}	18.48	4	13.60	—	—	8	0.10	—	—	1	0.07	—	—	216.08	0.01	"	—	—	33	
28	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	12	16.80	3^{5}	11.90	—	—	8	0.10	—	—	1	0.07	—	—	226.38	0.78	"	—	—	28	
29	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	10^{2}	14.28	3^{8}	12.92	8	0.34	8	0.10	—	—	1	0.07	—	—	235.79	0.08	clay	—	—	29	
30	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	10^{2}	14.28	3^{6}	12.24	—	—	8	0.10	—	—	1	0.07	—	—	233.85	0.34	"	—	—	31	
31	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	10^{8}	15.12	3^{6}	12.24	8	0.34	8	0.10	—	—	1	0.07	—	—	229.00	0.21	"	—	—	32	
Nov.																															
1	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	10^{2}	14.28	3^{3}	11.22	—	—	8	0.10	—	—	1	0.07	—	—	229.09	0.64	"	—	—	32	
2	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	8^{4}	11.76	3^{1}	10.54	—	—	8	0.10	—	—	1	0.07	—	—	217.47	0.01	"	—	—	30	
3	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	9^{6}	13.44	3^{2}	10.88	8	0.34	8	0.10	—	—	1	0.07	—	—	220.58	0.12	"	—	—	30	
4	2	7.30	1	3.30	2	4.80	2	4.20	2	4.80	10^{2}	14.28	4^{1}	13.94	—	—	8	0.10	—	—	1	0.07	—	—	228.23	0.93	"	—	—	33	
5	2	7.30	1	3.30	2	4.80	2	4.20	1	2.40	3^{2}	4.48	3^{9}	13.26	—	—	8	0.10	—	—	1	0.07	—	—	214.53		"	—	—	30	
6	2	7.30	1	3.30	2	4.80	2	4.20	—	—	—	—	3^{8}	12.92	8	0.34	8	0.10	—	—	1	0.07	—	—	213.44		"	—	—	29	Began filling caisson at 11:25 a. m.
7	1	3.30	1	3.30	2	4.80	2	4.20	—	—	—	—	2^{7}	9.18	—	—	8	0.10	—	—	1	0.07	—	—	197.24		"	—	—	29	
8	2	7.30	1	3.30	2	4.80	2	4.20	—	—	—	—	0^{8}	2.72	—	—	8	0.10	—	—	1	0.07	—	—	191.84	0.04	"	—	—	24	
9	2	7.30	1	3.30	2	4.80	2	4.20	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	79.96		"	—	—	—	Took off air at 7:20 a. m.
		580.00		264.00		381.60		331.80		348.00		824.88		1102.84		8.84		8.13		6.36		5.53		0.22	15559.06						

Other expenses charged to sinking . . $1595.93

$17154.99

APPENDIX F.

SPECIFICATIONS FOR SUPERSTRUCTURE.

GENERAL DESCRIPTION.

The superstructure will consist of three main through spans and six deck spans three of which will be at each end of the structure.

Each through span will be 375 feet long between centers of end pins, divided into fifteen panels of 25 feet each. The trusses will be 50 feet deep and placed 22 feet apart between centers. The top chord, end posts, bolsters, rollers, bearing plates, pins and all eye-bars except counters and vertical suspenders, will be of steel; all other parts will be of wrought iron except the wall plate pedestals and ornamental work, which will be cast. Each span will contain approximately 486,000 pounds of steel, 484,000 pounds of wrought iron and 21,000 pounds of cast iron.

Each deck span will be 125 feet long between centers of end pins, divided into five panels of 25 feet each. The trusses will be 17 feet 6 inches deep and placed 12 feet apart between centers. The intermediate ends of each set of three spans will rest on iron towers measuring 25 feet long in the direction of the bridge, making a total length of iron work in each group of three deck spans of 425 feet. The pins, rollers, bearing plates and eye-bars, excepting counters, will be of steel; all other parts will be of wrought iron except the wall plate pedestals, which will be of cast iron. Each span will contain approximately 102,000 pounds of wrought iron and 31,000 pounds of steel. Each group of three spans including the towers will contain approximately 93,000 pounds of steel, 398,000 pounds of wrought iron and 16,000 pounds of cast iron.

The total estimated weight of the entire structure is approximately 4,000,000 pounds.

PLANS.

Full detail plans, showing all dimensions, will be furnished by the engineer. The work shall be built in all respects according to these plans. The contractor, however, will be expected to verify the correctness of the plans, and will be required to make any changes in the work which are necessitated by errors in these plans, without extra charge, where such errors could be discovered by an inspection of the plans.

MATERIALS.

All materials shall be subject to inspection at all times during their manufacture, and the engineer and his inspectors shall be allowed free access to any of the works in which any portion of the material is made. Timely notice shall be given to the engineer so that his inspectors may be on hand.

Steel.—The Steel used will be of two classes, viz.: High Steel, which will be used in compression members, bolsters, bearing plates, pins and rollers, and Low Steel, which will be used for tension members and rivets.

Steel may be made by the open hearth or by the Bessemer process, but no steel shall be made at works which have not been in successful operation for at least one year; steel made by the Clapp-Griffiths process will not be accepted. All melts shall be made from uniform stock low in phosphorus, and the manufacturer shall furnish satisfactory evidence to the engineer that this class of material is being employed, it being understood that the furnished product is to be one in which the phosphorus does not average more than 8-100 of one per cent., and never exceeds 1-10 of one per cent.

A sample bar ¾ of an inch in diameter shall be rolled from every melt, the method of obtaining the piece from which this sample bar is rolled shall be the same for all samples, and the amount of work on this sample bar shall be as nearly as practicable the same as on the finished product. The laboratory tests shall be made on this sample bar in its natural state without annealing.

The laboratory test of High Steel made on the sample bar shall show an elastic limit of not less than 50,000 pounds per square inch, an ultimate strength of not less than 80,000 pounds nor more than 90,000 pounds, an elongation of at least 15 per cent. in eight inches and a reduced area of at least 35 per cent. at the point of fracture. The sample bars shall bend 180° around its own diameter without showing crack or flaw.

The laboratory tests of Low Steel made on the sample bar shall show an elastic limit of not less than 40,000 pounds per square inch, an ultimate strength of not less than 70,000 pounds nor more than 80,000 pounds, an elongation of at least 18 per cent. in a length of eight inches, and a reduction of at least 42 per cent. at the point of fracture. In a bending test the sample bar shall bend 180° and close back against itself without showing crack or flaw on the outside of the curve.

The softest melts shall be selected for rivets, the only requirement as to elastic limit and ultimate strength will be that the ultimate strength shall be at least 60,000 pounds per square inch.

Facilities for testing sample bars shall be furnished by the contractor at a point convenient to the steel works, and the tests shall be made at the expense of the contractor and under the direction of the Engineer. Tests may also be made from time to time on samples cut from finished plates, shapes and bars which shall show results substantially conforming to those shown by the sample tests of the same melts.

All sheared edges or punched holes in steel work shall be subsequently planed or drilled out, so that none of the rough surface is ever left upon the work. Steel for pins shall be sound and entirely free from piping.

Wrought Iron.—The iron used in tension members shall be double refined (high test) iron; muck bars may be used at the center of the pile, but shall not constitute more than one-third of the total pile. Small samples having a minimum length of eight inches, shall be furnished by the contractor for testing, as directed by the engineer; these samples shall show an elastic limit of at least 26,000 pounds, and an ultimate strength of at least 50,000 pounds per square inch, shall elongate at least 15 per cent. and show a reduced area of at least 25 per cent. at the point of fracture. The fracture shall be of uniform fibrous character, free from crystalline appearances.

Small samples, having a minimum length of eight inches, shall be furnished by the contractor from the iron used in shapes, plates and other miscellaneous forms as directed by the Engineer; these samples will show an elastic limit of at least 24,000 pounds, and an ultimate strength of at least 47,000 pounds per square inch, shall elongate at least 10 per cent. before breaking, and show a reduction of area of at least 15 per cent. at the point of fracture. In plates more than thirty inches wide an elongation of 8 per cent. and a reduction of 12 per cent. at the point of fracture will be considered satisfactory.

Cast iron shall be of the best quality of tough, grey iron.

RIVETED WORK.

All plates, angles and channels shall be carefully straightened before they are laid out; the rivet holes shall be carefully spaced in truly straight lines; the rivet heads shall be of hemispherical pattern and the work shall be finished in a neat and workman-like manner. Surfaces in contact shall be painted before they are put together. The dimensions given for rivets on the plans are the diameters of the rivets before driving.

Power riveters shall be direct acting machines, capable of exerting a yielding pressure and holding on to the rivet when the upsetting is completed.

Steel.—The several parts of each steel member shall be assembled and the holes shall be drilled, the sharp edge of the drilled hole shall be trimmed so as to make a slight fillet under the rivet head, and the pieces shall be riveted together without taking apart. Should the contractors desire, the parts may be punched with holes not exceeding 4-5 the diameter of the finished hole, and this punching shall be so ac-

APPENDIX F.—Continued.

curate that at least 1/16 of an inch of metal is taken out all around in drilling the hole. All rivets in steel members shall be of steel; the rivet holes shall be of such size that they will fill the hole before driving, and whenever possible the rivets shall be driven by power. All bearing surfaces shall be truly faced. The chord pieces shall be fitted together in the shop in lengths of at least five panels and marked; when so fitted there shall be no perceptible wind in the length laid out. The pin-holes shall be bored truly so as to be at exact distances, parallel with one another, and at right angles to the axis of the member.

Wrought Iron.—All wrought-iron shall be punched accurately with holes 1/16 of an inch larger than the size of the rivet, and when put together a cold rivet shall pass through every hole without reaming. So far as possible all rivets shall be driven by power. The holes for the rivets connecting the floor-beams with the posts and bolsters and the stringers with the floor-beams, and, in general, the holes for all rivets which must be driven after erection, shall be accurately drilled to an iron templet. The holes for the rivets connecting the floor-beams with the posts shall be 1 inch in diameter, and the rivets of corresponding diameter. The pin holes in the vertical posts shall be truly parallel with one another, and at right angles to the axis of the posts. The posts shall be straight and free from wind.

FORGED WORK.

The heads of the steel eye-bars shall be formed by upsetting and forging into shape by such process as may be accepted by the Engineer. No welds will be allowed. After the working is completed, the bars shall be annealed by heating them to a uniform dark red heat throughout their entire length and allowing them to cool slowly. The form of the heads of steel eye-bars may be modified to suit the process in use at the contractor's works, but the form of head adopted must be such as to meet the requirements of the tests of full sized bars.

The heads and the enlarged ends for screws in laterals, suspenders and counters shall be formed by upsetting or by an upsetting and welding process acceptable to the engineer. Welds in the body of the bar will not be allowed.

TESTS OF FULL-SIZED BARS.

Ten full-sized steel eye-bars of sections and lengths used in the actual work shall be selected by the inspector for testing; each of these full-sized bars shall be strained till an elongation of 10 per cent. is obtained, and if possible broken; if broken, the fracture shall occur in the body of the bar and shall show a uniform and ductile quality of material.

The contractor will be required to furnish facilities for testing the full-sized bars within a reasonable distance of his works. Should the contractor be unable to furnish such facilities, he shall be required to furnish bars at 20 per cent. larger section than those called for, without charge for the increased weight.

The full-sized bars shall be selected from time to time as the work proceeds, the last bar not to be selected till all the eye-bars are manufactured. The tests shall be made from time to time as the bars are selected. When three bars have been tested, the bars manufactured up to the time of the selection of these three test bars shall be accepted or rejected as the results of such tests, and the same shall be done again when three more bars are tested. In the tests, the failure of one bar to develop a stretch of 10 per cent. before breaking, shall be sufficient reason for rejecting the whole lot; but a failure to break in the body of the bar shall not be a sufficient ground for condemnation if it does not occur in more than one-third of the bars tested. Should the contractor on the first attempt fail to make bars coming up to the required specifications, the engineer may order bars of 20 per cent. larger section than the plans called for, to be furnished by the contractor without charge for the increased weight.

MACHINE WORK.

The bearing surfaces in the top chord shall be truly faced. The ends of the stringers and of the floor-beams shall be squared in a rotary facer. All surfaces so designated on the plans shall be planed.

All pins shall be accurately turned to a gauge, and shall be of full size throughout; pin holes shall be bored to fit the pins with a play not exceeding 1·50 of an inch. These clauses apply to all lateral connections as well as those of the main trusses. Pins shall be supplied with pilot nuts for use during erection, four for each size of pin.

All screws shall have a truncated V thread, United States standard sizes.

MISCELLANEOUS.

All workmanship and material, whether particularly specified or not, must be of the best kind now in use in first-class bridge work. Flaws, ragged edges, surface imperfections, or irregular shapes, will be sufficient ground for rejection; rough and irregularly finished work will not be accepted.

Machine-finished surfaces shall be coated with white lead and tallow before shipment; all other parts shall be given a coat of hot boiled linseed oil.

TERMS.

Monthly estimates will be made at the end of each month for the work done during that month. In these monthly estimates, the material delivered at the contractor's shop, but not manufactured, shall be estimated at 50 per cent. of the contract price for finished material in Chicago, and manufactured material at 75 per cent. of the contract price for finished material in Chicago. Payments will be made on or about the 15th day of the following month, according to these estimates, deducting from the amount of the same ten per cent. as security, to be held until the completion of the entire contract.

No material will be paid for which does not form a part of the permanent structure.

All expense of testing shall be borne by the contractor.

TIME.

The deck spans and towers shall be completed and shipped not later than January 1st, 1887. The three through spans shall be completed and shipped in February, March and June, 1887, respectively.

The railroad company may exact a penalty not exceeding $150 per day for failure to complete the work within these specified times.

PROPOSALS.

Separate proposals should be made for the deck spans (including towers) and the through spans.

The prices should be by the pound at separate rates for steel, wrought iron and cast iron. The prices shall include material, and all patterns and other work of every description, and are to be on the basis of finished material delivered on cars at Chicago. Separate proposals shall also be made for erection on the basis of a single gross sum for the erection of the six deck spans (including towers), and a single gross sum for the erection of the three through spans. Erection will include setting wall plates and drilling the necessary holes for anchor bolts. The contractors will be required to furnish all false work and tools of every description, and the plans of such false work shall be subject to the approval of the engineer.

The right is reserved to accept separate proposals for the deck spans and the through spans, to accept proposals for material without erection and to award the contract to other than the lowest bidder.

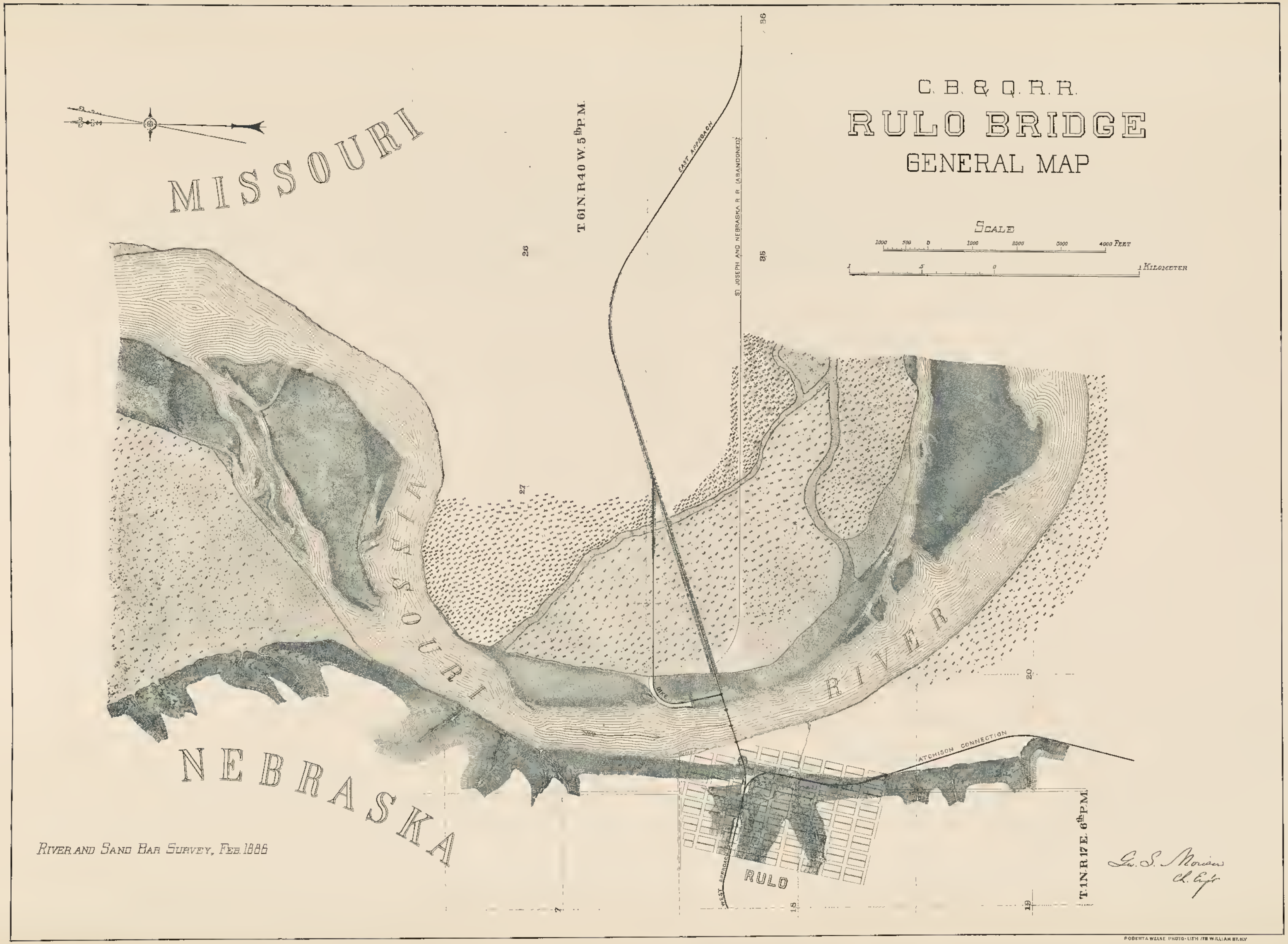
GEO. S. MORISON,
Chief Engineer Rulo Bridge.

NEW YORK, JULY 20, 1886.

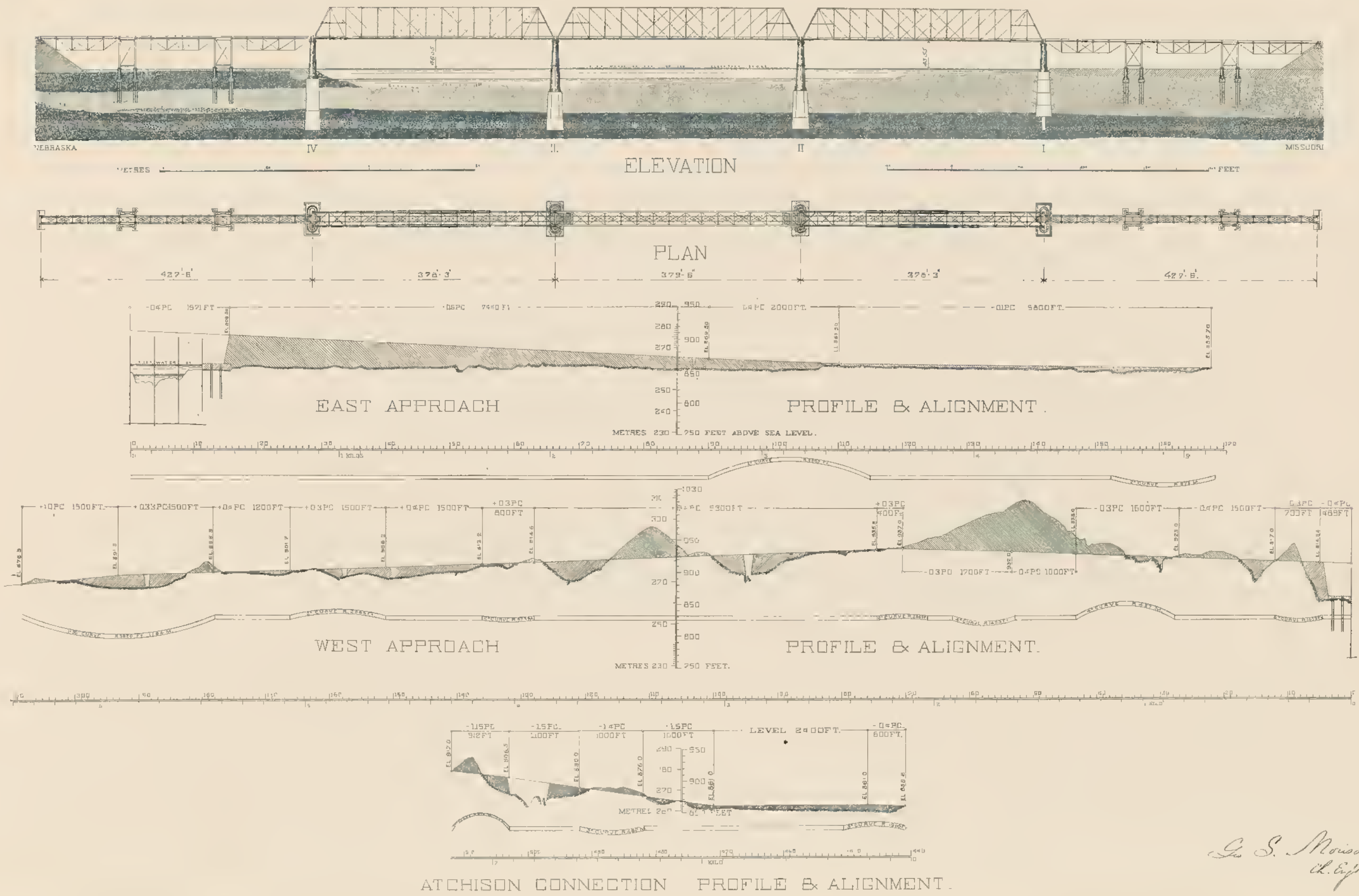
APPENDIX G.

TESTS OF STEEL EYE BARS.

TESTS ON FULL-SIZED EYE-BARS. — Dimensions,—Inches. — Original — Nominal — Width.	Nominal — Thickness.	Actual — Length c. to c.	Actual — Width.	Actual — Thickness.	After Testing — Width.	After Testing — Thickness.	Results of Mechanical Tests. — Reduction of Area Per Cent.	Extension — Guaged Length. Inches.	Extension — Per cent.	Elastic Limit. Lbs. per sq. in.	Maximum Load. Lbs. per sq. in	Place of Fracture.	TESTS ON SAMPLE BARS FROM SAME MELTS. — Diameters — Original. Inches.	Diameters — After Testing Inches	Reduction Per cent.	Extension in 8 in. Per cent.	Elastic Limit. Lbs. per sq. in.	Maximum Load Lbs. per sq. in.	Per cent. of Phosphorus	Melt Number.
7	¾	300.03	6.97	0.76	—	—	—	264	—	34270	60450	Head	.739	.545	45.6	22.80	47790	74840	.090	8485
7	1	300.03	6.97	1.01	5.51	0.74	42.08	264	13.77	35350	67220	Body	.750	.535	49.1	25.30	44140	73330	.090	8847
7	1½	300.03	6.97	1.52	5.37	0.87	55.90	264	14.75	31570	65262	"	.750	.530	50.1	26.75	47980	75140	.051	8415
7	1¾	300.03	6.97	1.76	—	—	—	264	—	30925	60020	Head	.743	.475	59.1	26.30	45210	71040	.086	8345
7	1	300.03	6.97	1.01	5.46	0.64	50.36	264	13.67	35350	67800	Body	.750	.535	49.1	25.30	44140	73330	.090	8847
7	1½	300.03	6.97	1.50	6.60	1.39	12.25	264	9.01	35120	67110	"	.739	.510	52.4	24.70	47570	74610	.068	8352
7	1⅝	424.10	6.98	1.62	5.23	0.98	54.67	396	12.11	36070	67100	"	.740	.545	45.8	23.00	46040	75340	.076	8339
7	1⅝	424.10	7.00	1.61	5.57	1.22	39.70	396	11.43	33120	63340	"	.741	.486	57.0	24.60	45460	74210	.075	8330
7	1¼	424.09	6.98	1.26	5.85	1.02	33.15	396	11.24	32930	64240	"	.749	.550	46.1	22.00	45170	75800	.048	8419
5	¾	422.97	5.01	0.76	4.00	0.54	43.27	396	8.65	38940	61340	"	.748	.510	53.5	24.37	48240	76690	.062	8367
5	¾	422.72	5.00	0.77	3.70	0.48	53.87	396	9.78	42365	69325	"	.746	.510	53.3	24.80	44390	71380	.076	8223
7	1¾	300.03	7.00	1.75	5.20	1.23	47.62	264	13.37	33300	63270	"	.758	.560	45.4	24.10	45200	72680	—	9303
7	¾	299.61	6.97	.78	5.41	0.53	47.51	264	13.32	40140	67530	"	.755	.535	49.8	23.30	46680	74370	.086	9046

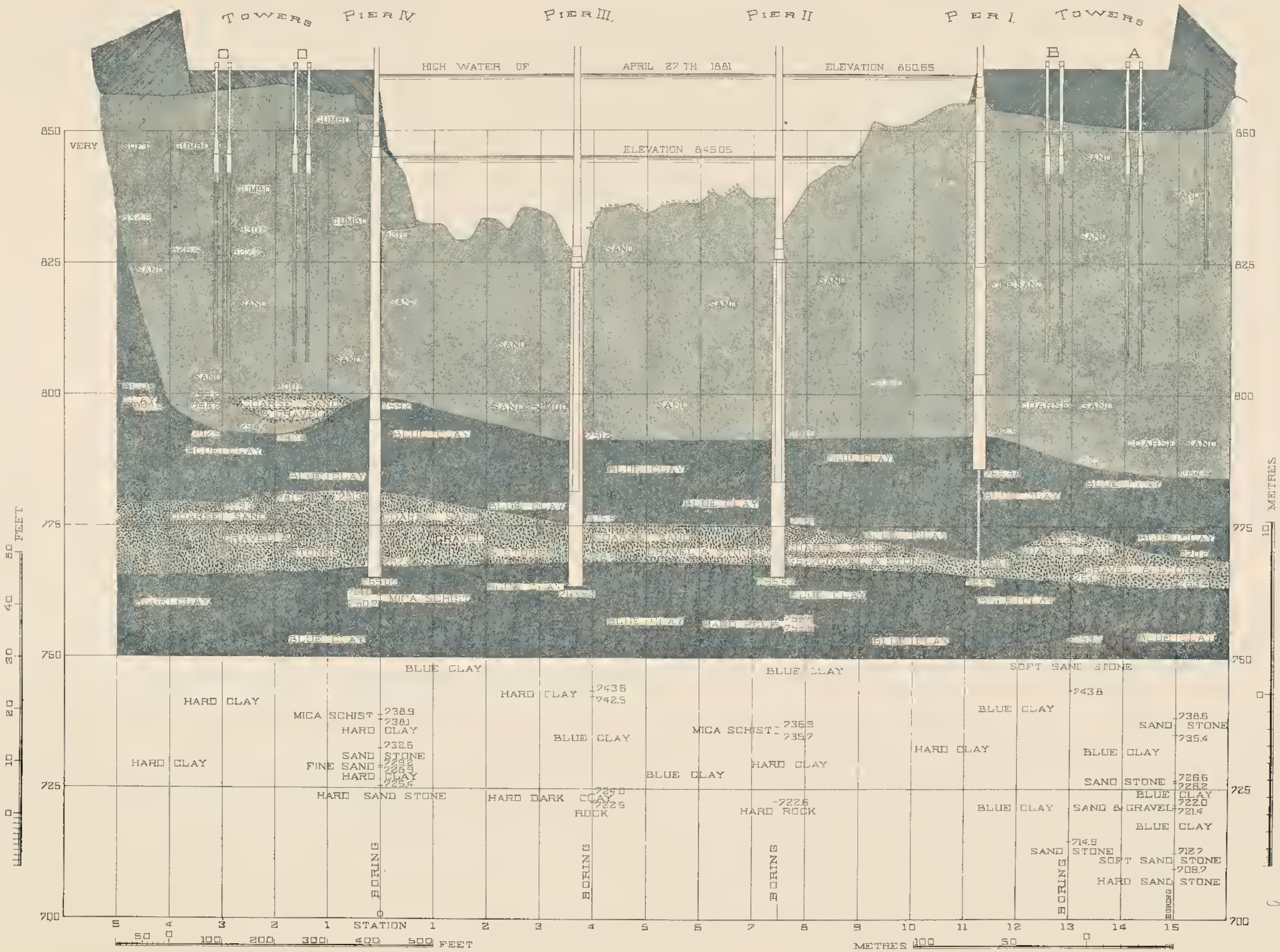

C. B. & Q. R. R.
RULO BRIDGE
GENERAL MAP
SCALE
1000 500 0 1000 2000 3000 4000 FEET
1 .5 0 1 KILOMETER
MISSOURI
NEBRASKA
MISSOURI
RIVER
T. 61 N. R. 40 W. 5th P. M.
EAST APPROACH
ST. JOSEPH AND NEBRASKA R. R. (ABANDONED)
36
35
26
27
20
19
18
7
DIKE
ATCHISON CONNECTION
WEST APPROACH
RULO
T. 1 N. R. 17 E. 6th P. M.
RIVER AND SAND BAR SURVEY, FEB. 1886

C. B. & Q. R. R.
RULO BRIDGE
GENERAL ELEVATION, PLAN, PROFILE & ALIGNMENT

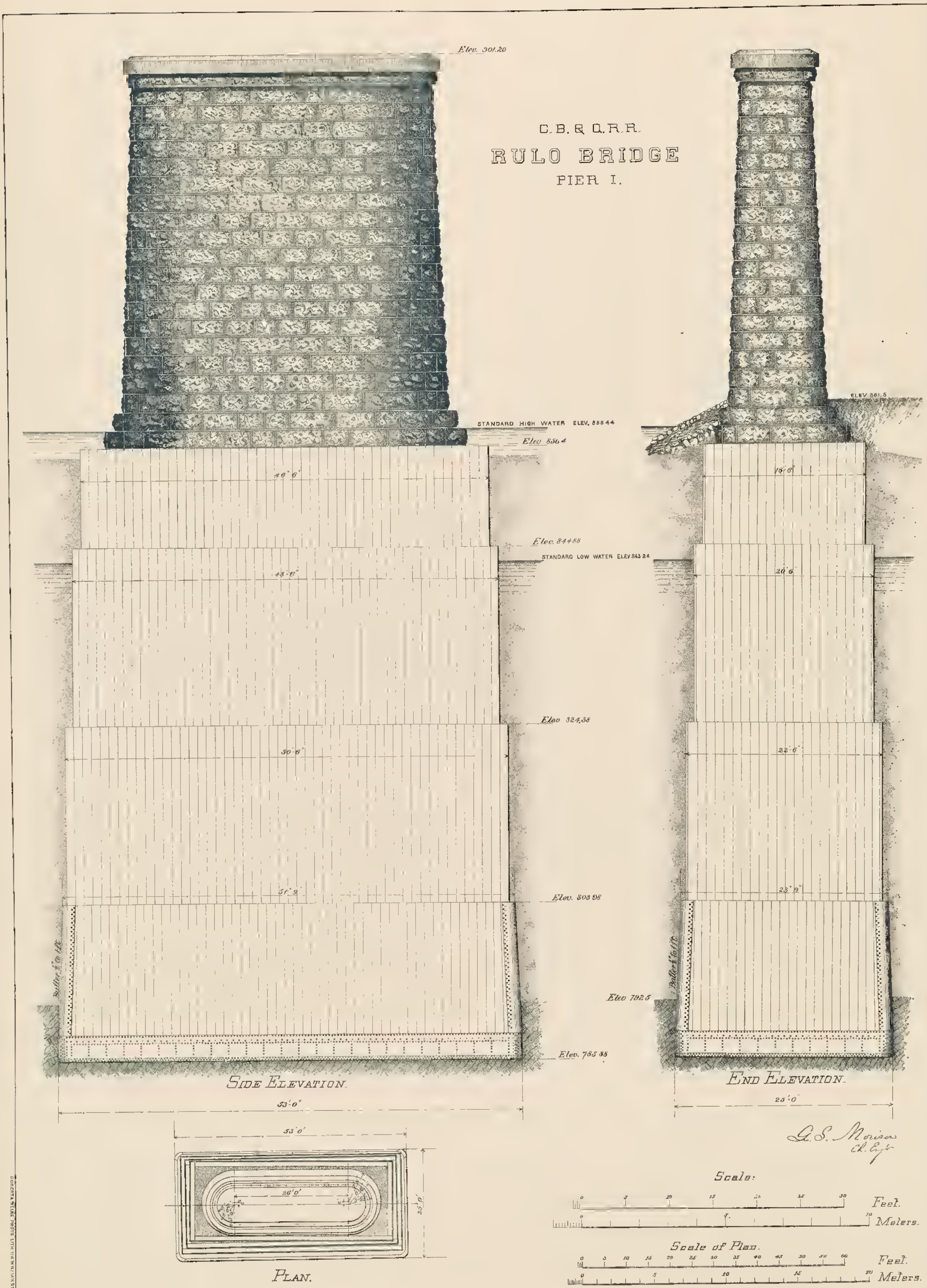


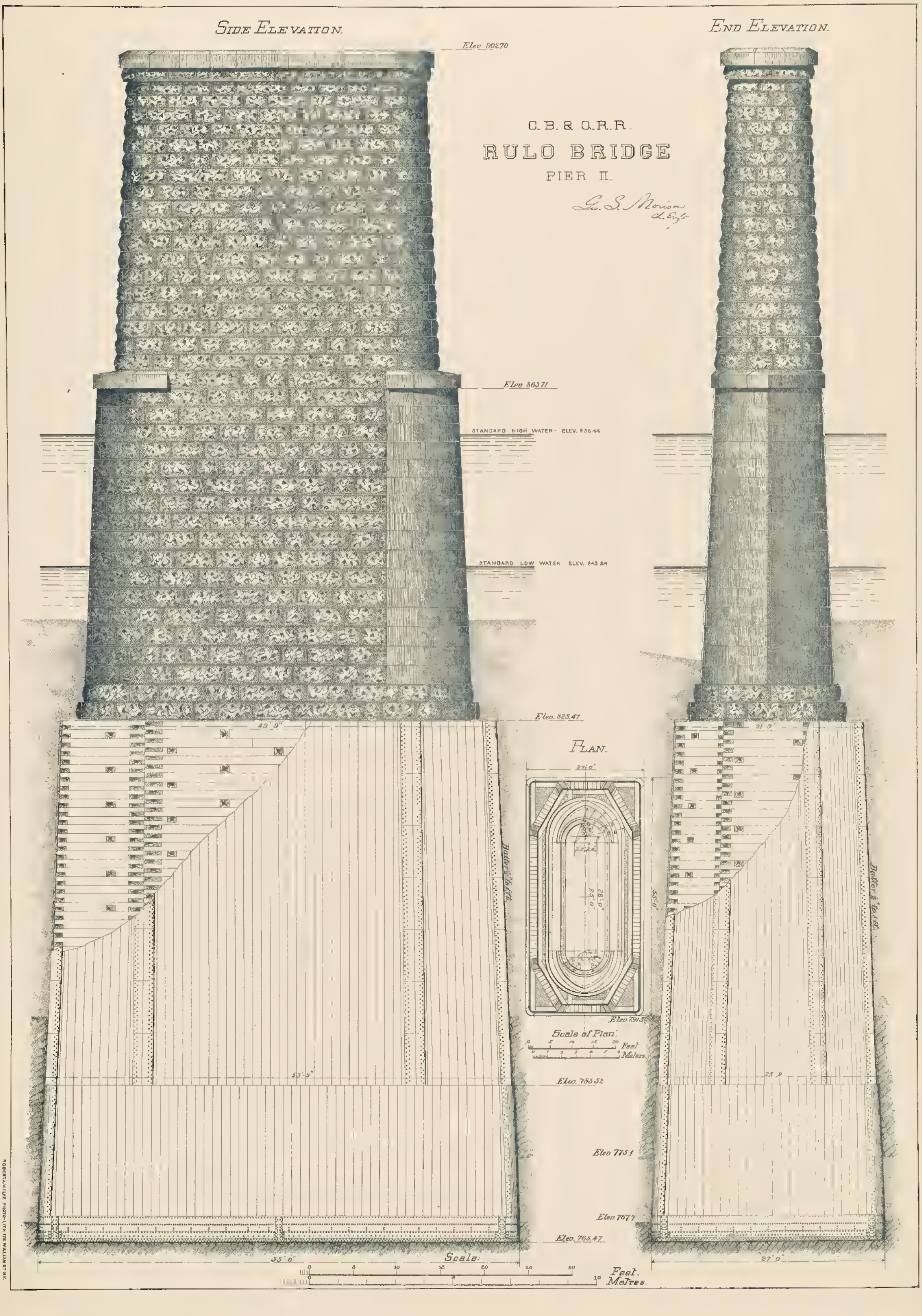
ROBERTA WELKE PHOTO LITH 178 WILLIAM ST NY

C. B. & Q. R. R.
RULO BRIDGE
PROFILE SHOWING STRATIFICATION ON BRIDGE LINE.

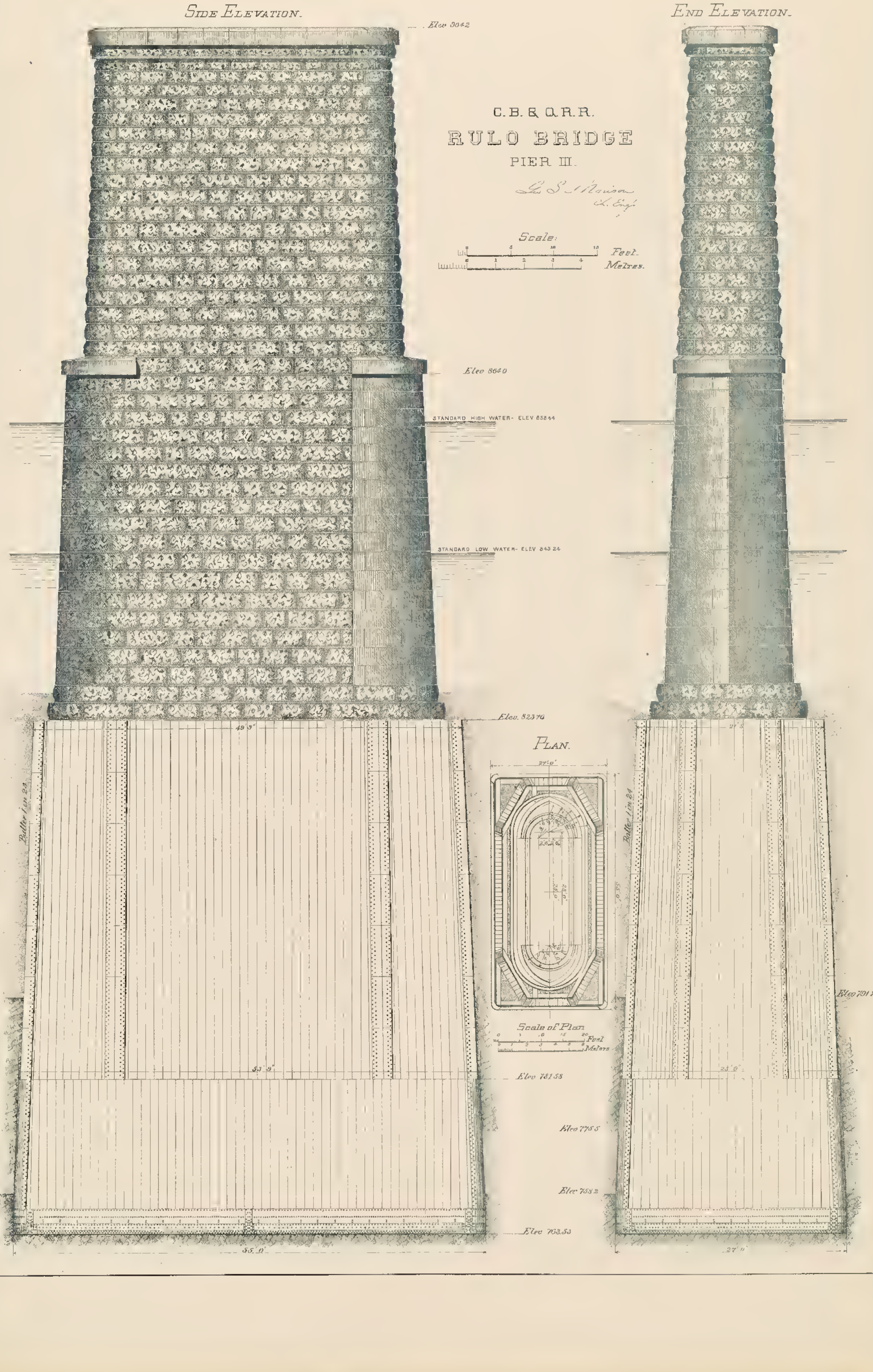


G. S. Morison
Ch. Eng.


C. B. & Q. R. R.
RULO BRIDGE
PIER I.
Elev. 301.20
STANDARD HIGH WATER ELEV. 855.44
Elev. 856.4
Elev. 844.88
STANDARD LOW WATER ELEV. 843.24
Elev. 824.38
Elev. 803.98
Elev. 792.5
Elev. 785.88
ELEV. 861.5
46' 6"
48' 6"
50' 6"
51' 9"
18' 6"
20' 6"
22' 6"
23' 9"
SIDE ELEVATION.
53' 0"
END ELEVATION.
25' 0"
PLAN.
53' 0"
25' 0"
26' 0"
G. S. Morison
Ch. Eng.
Scale:
Feet.
Meters.
Scale of Plan.
Feet.
Meters.



ROBERT A. WELKE PHOTO-LITH. 178 WILLIAM ST. N.Y.



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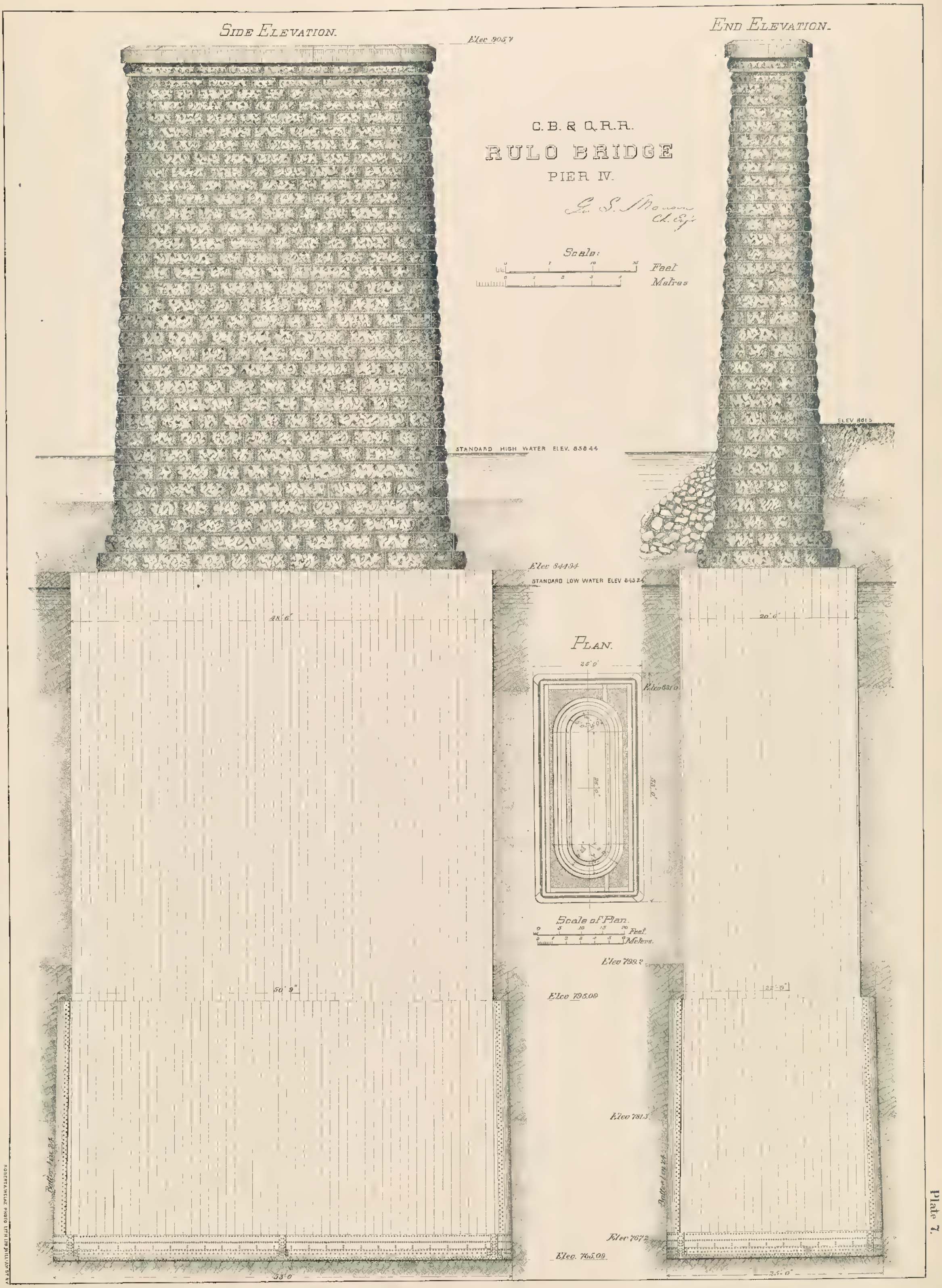
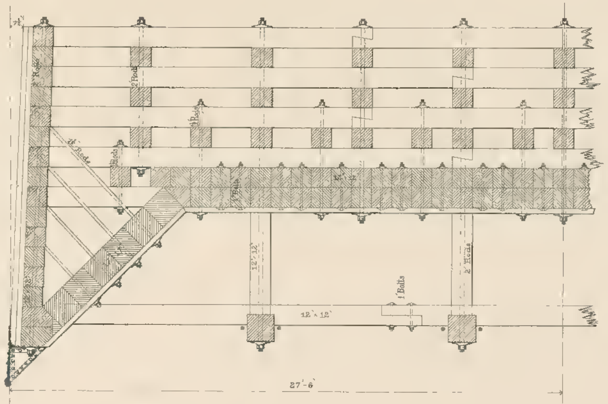
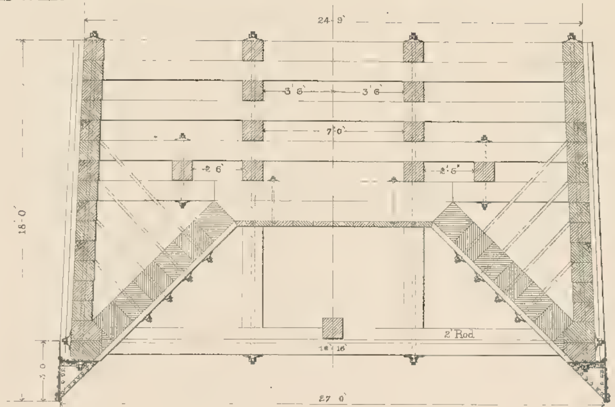

Side Elevation.
End Elevation.
C. B. & Q. R. R.
RULO BRIDGE
PIER IV.
Scale:
Feet
Metres
STANDARD HIGH WATER ELEV. 858.44
STANDARD LOW WATER ELEV 843.24
Elev 844.94
Plan.
Scale of Plan.
Feet.
Metres.
Elev 795.09
Elev 765.09

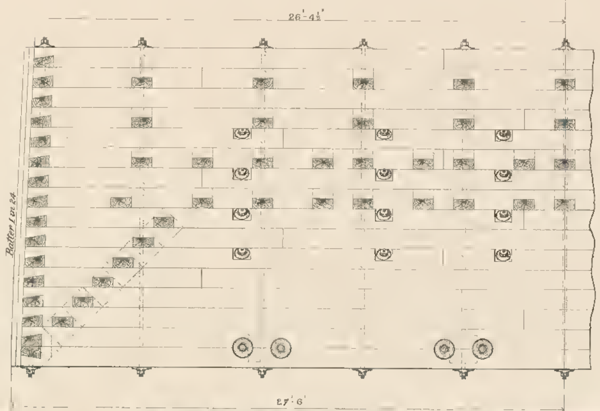
C. B. & Q. R. R.
RULO BRIDGE
CAISSONS II & III.



HALF LONGITUDINAL SECTION.

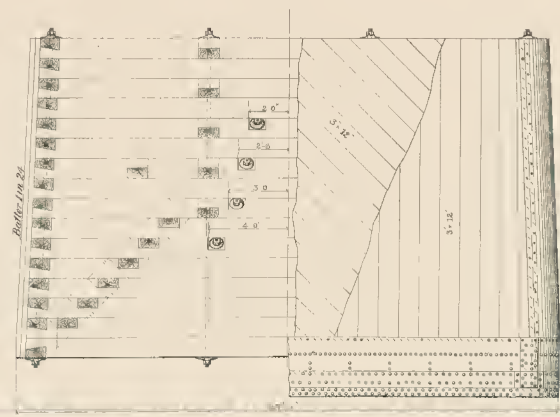


CROSS SECTION.



Cutting edge and planking removed.

HALF SIDE ELEVATION.



END ELEVATION.

Scale.

Feet

Metres

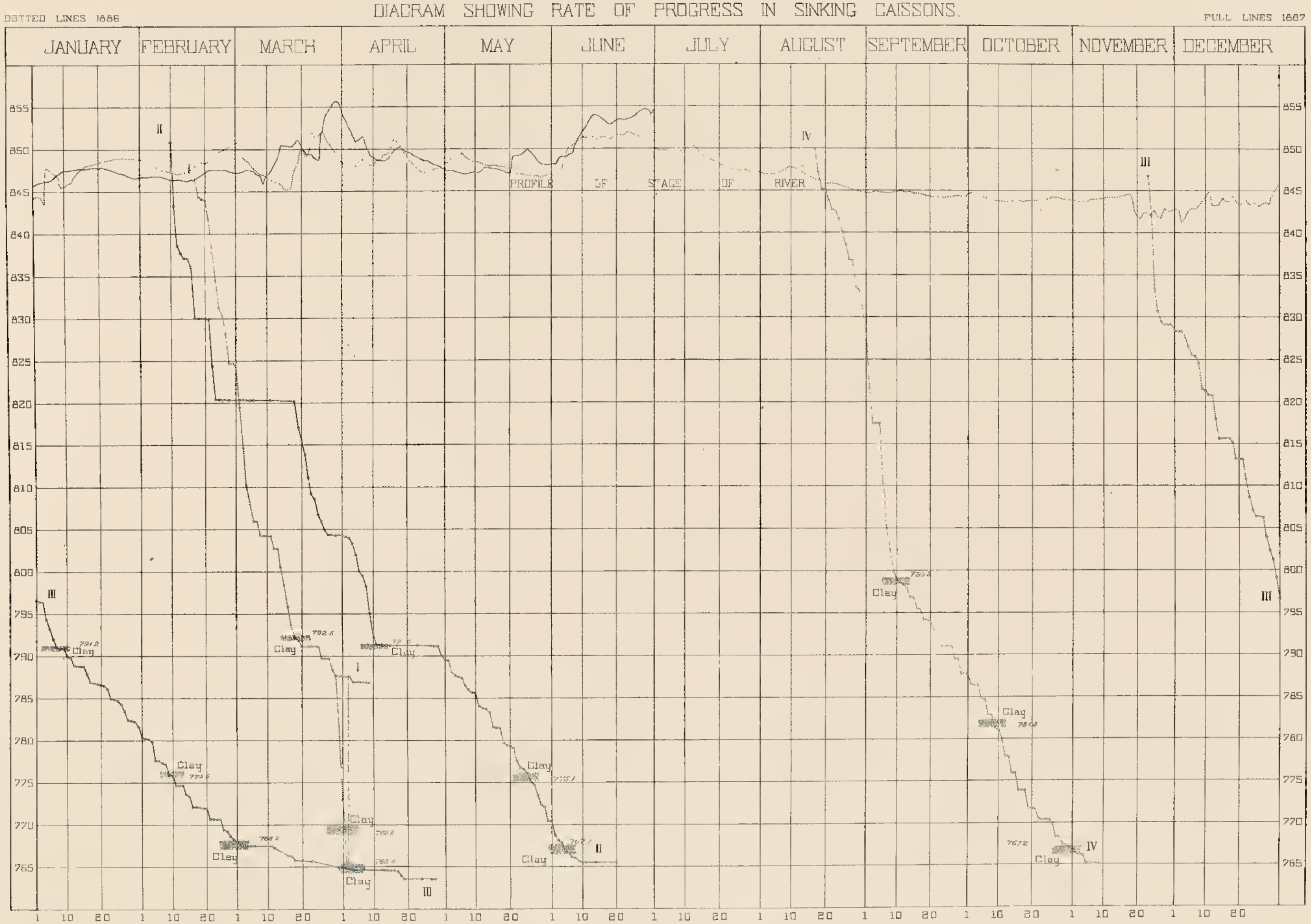
G. S. Morison
C. Engr.

ROBERT A. WELCKE PHOTO-LITH 129 WILLIAM ST N.Y.

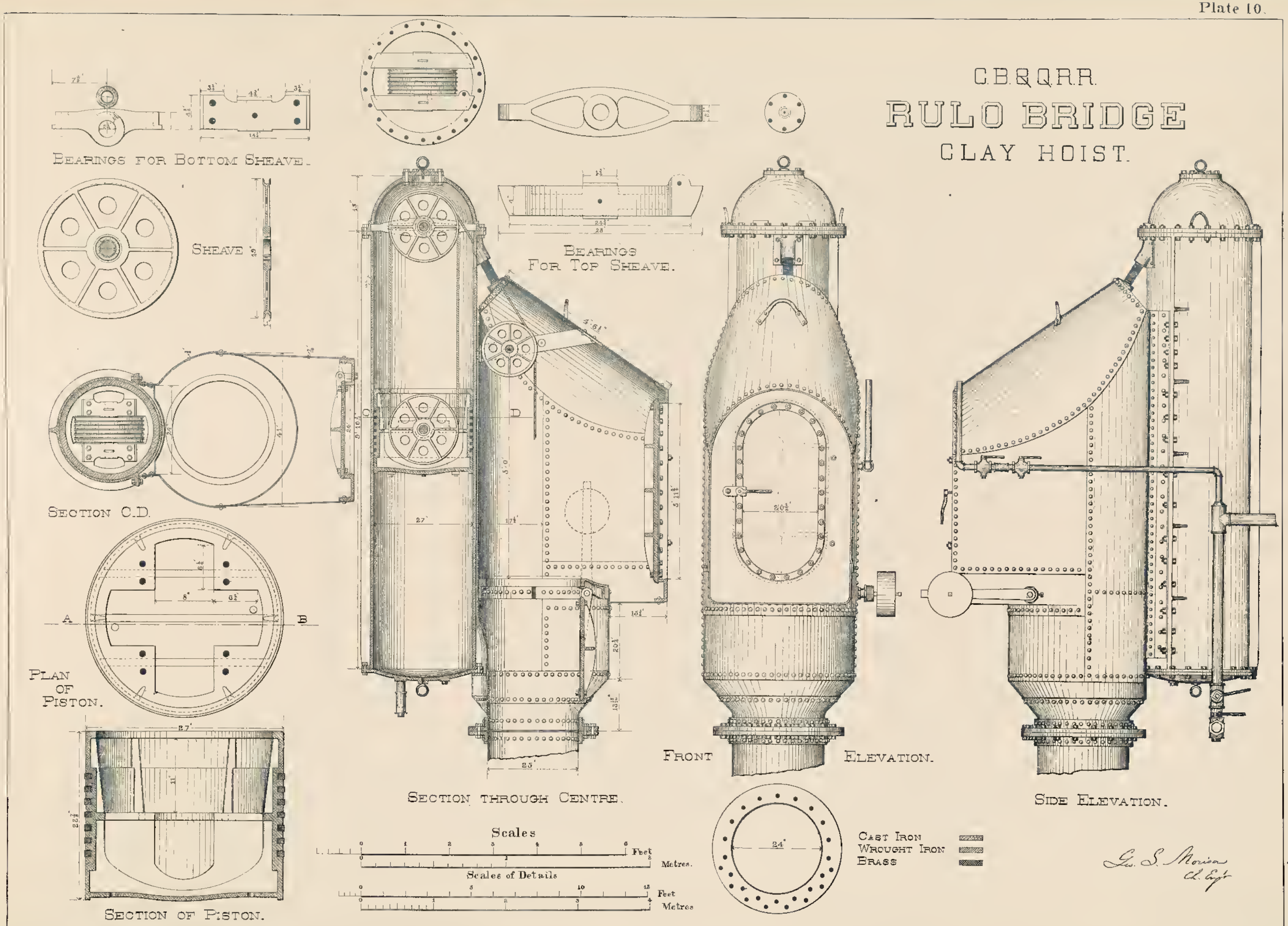
C. B. & Q. R.R.

RULO BRIDGE

DIAGRAM SHOWING RATE OF PROGRESS IN SINKING CAISSONS.



G. S. Morison
Ch. Eng'r

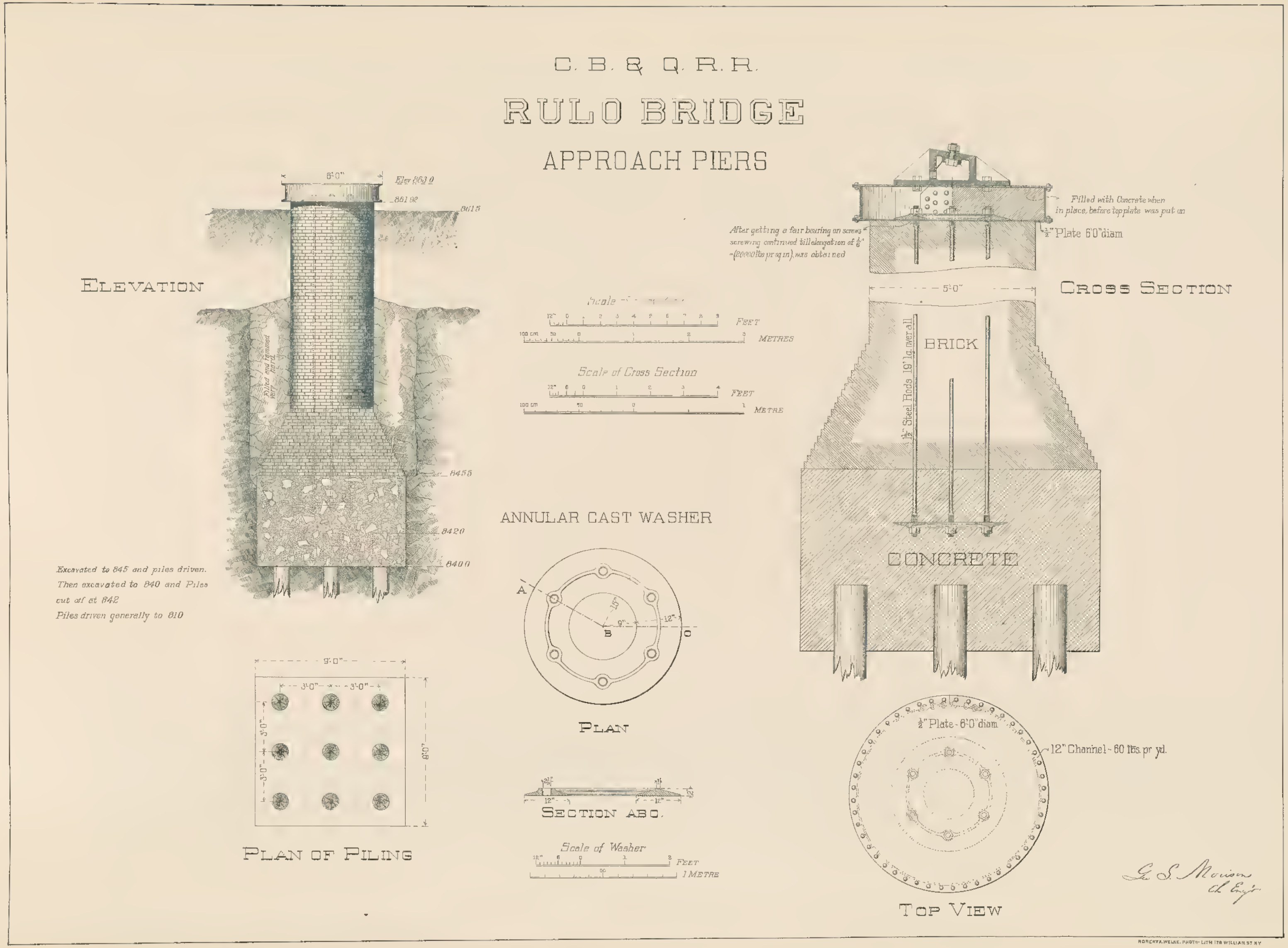


ROBERT A. WELCKE PHOTO LITH 178 WILLIAM ST N.Y.

C. B. & Q. R. R.

RULO BRIDGE

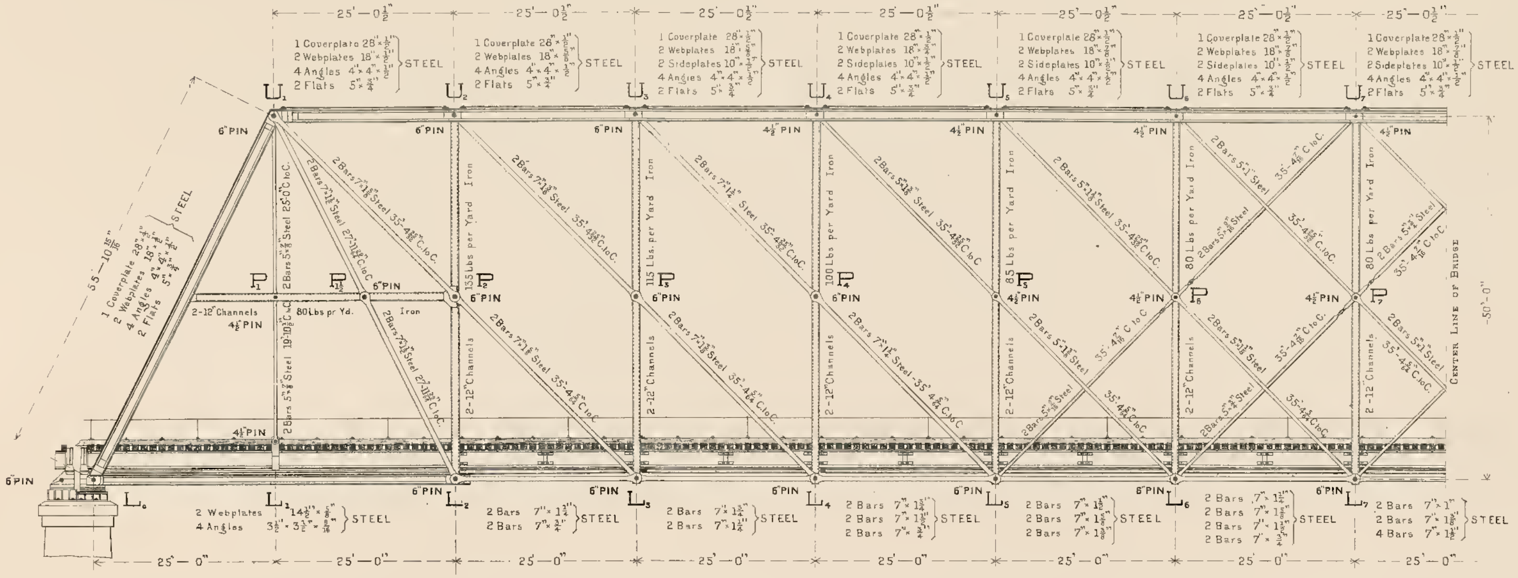
RECORD OF WATER STAGE OF THE MISSOURI RIVER AT RULO NEBRASKA.



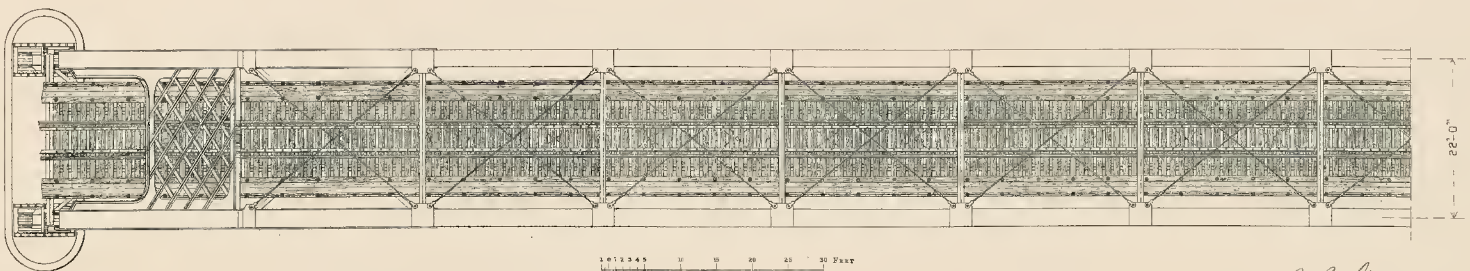
ROBERT A. WELKE, PHOTO-LITH 178 WILLIAM ST NY

C. B. & Q. R. R. RULO BRIDGE THROUGH SPAN

General Elevation of 375'-0" Span



General Plan of 375'-0" Span



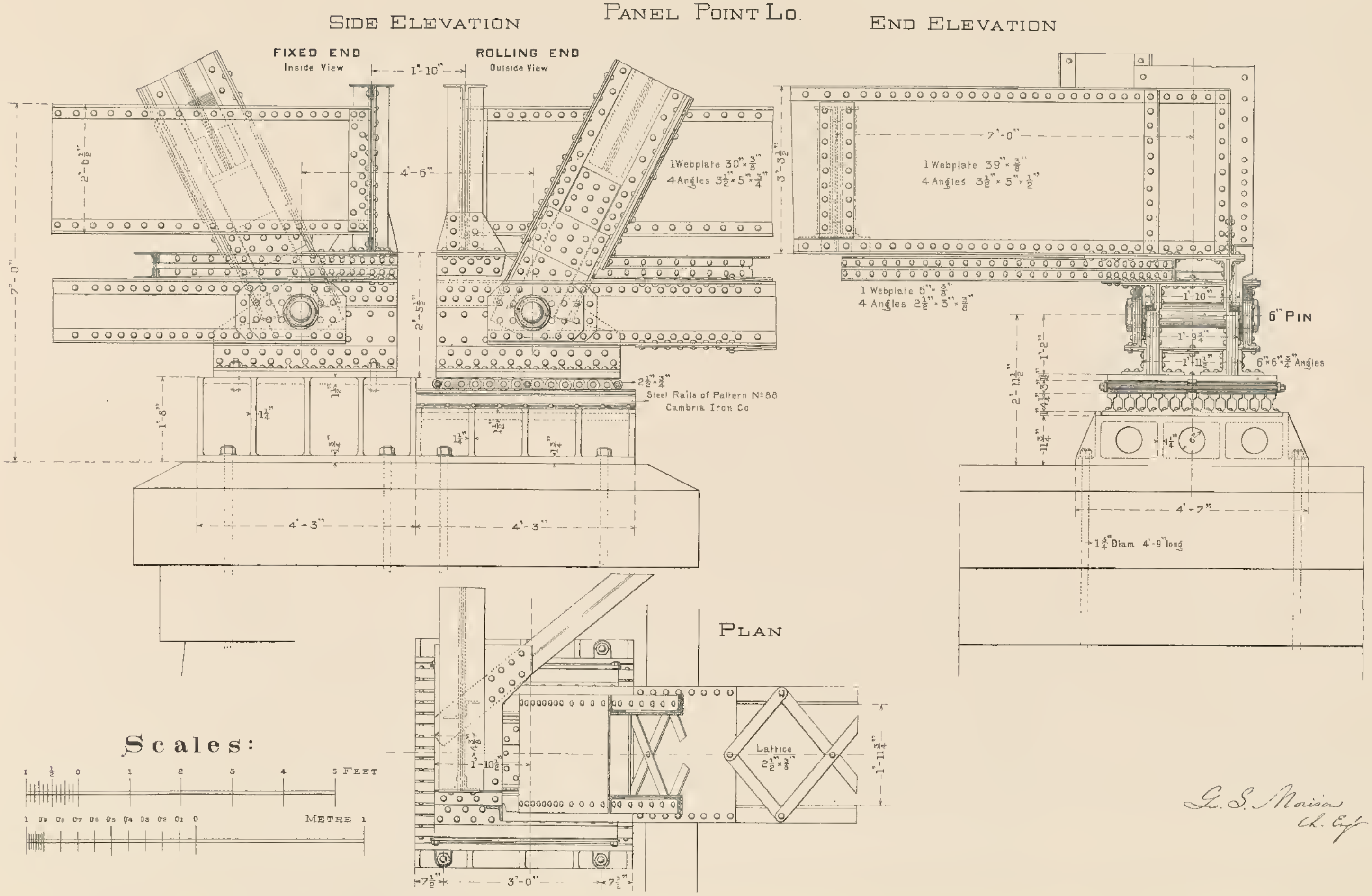
Scales: 10 1 2 3 4 5 10 15 20 25 30 Feet; 1 0 1 2 3 4 5 10 Metres

Geo. S. Morison
Ch. Engr.

C. B. & Q. R. R. RULO BRIDGE THROUGH SPAN

DETAILS OF 375'-0" SPAN

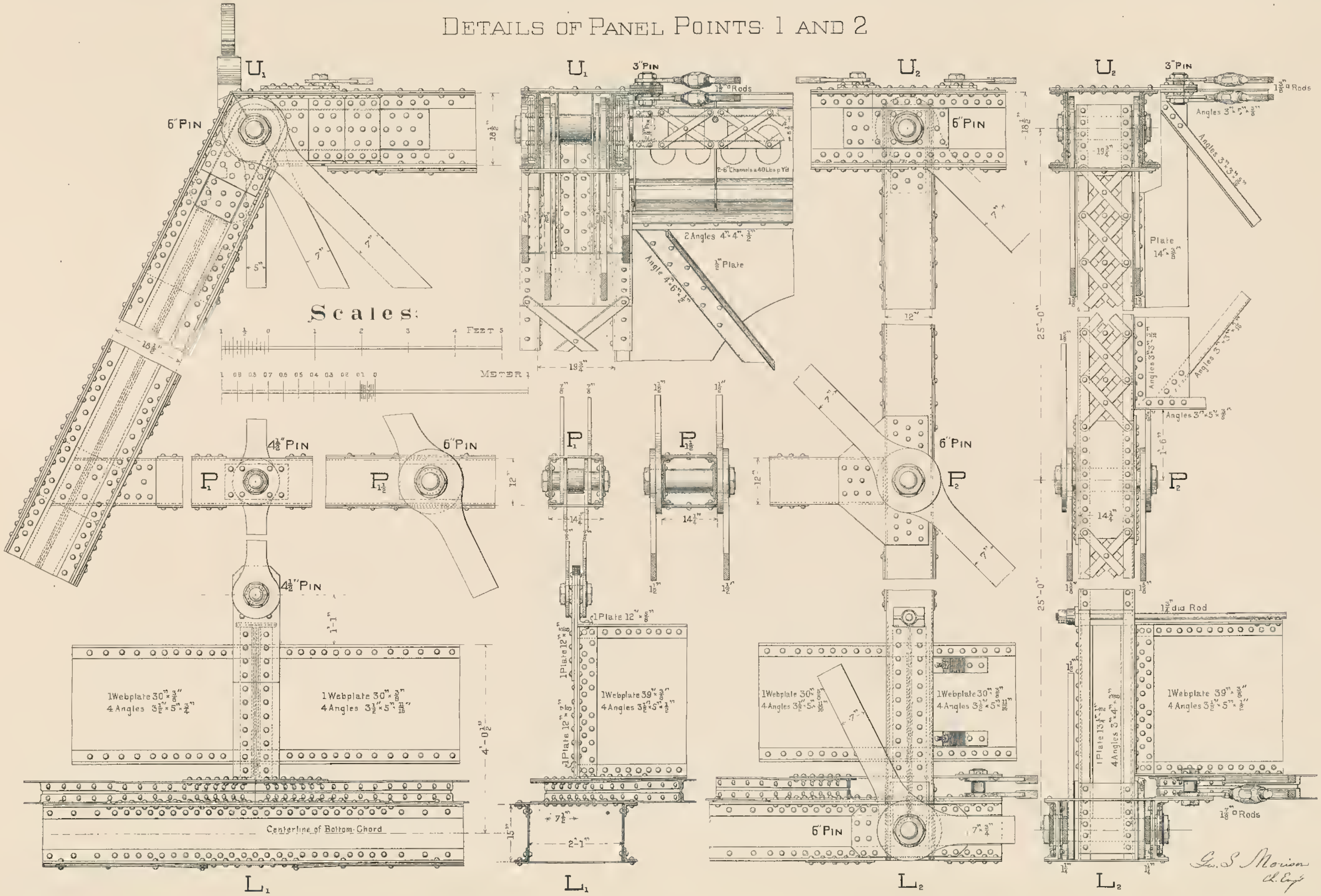
PANEL POINT Lo.



ROBERT A WELKE PHOTO-LITH 176 WILLIAM ST. N.Y.

C. B. & Q. R. R. RULO BRIDGE THROUGH SPAN

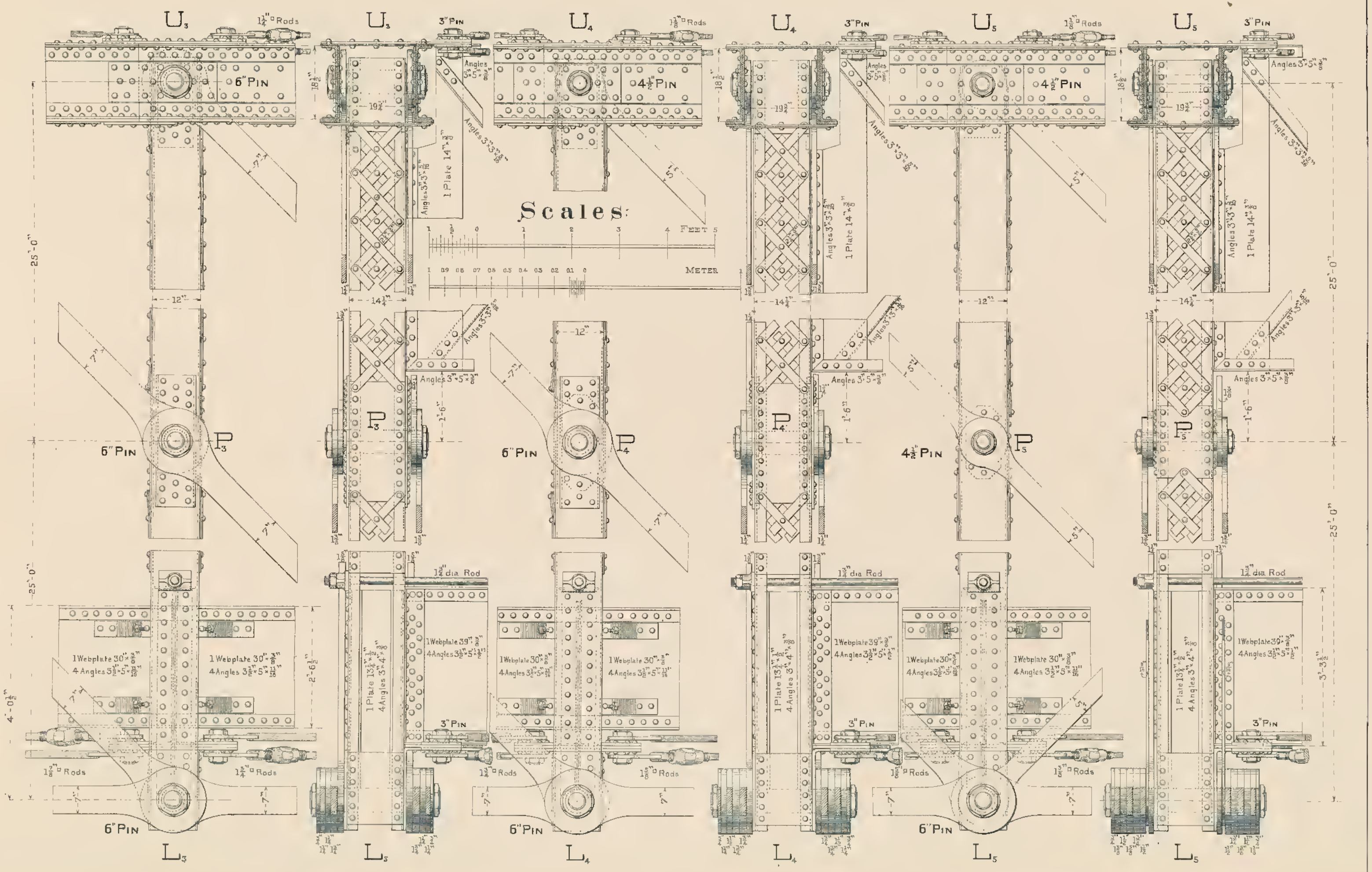
Details of Panel Points 1 and 2



Geo. S. Morison
Ch. Engr.

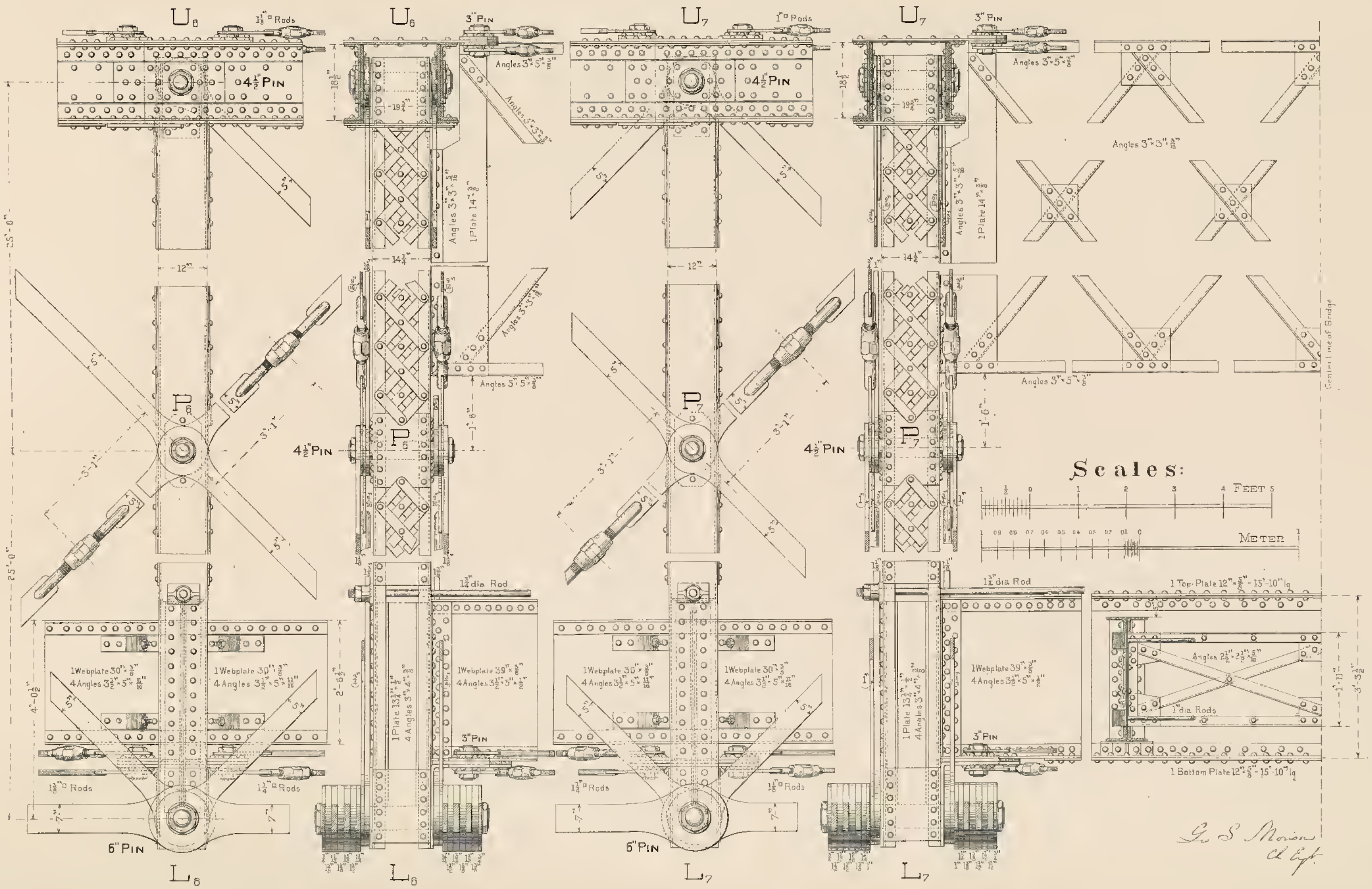
C. B. & Q. R. R. RULO BRIDGE THROUGH SPAN

DETAILS OF PANEL POINTS 3, 4 AND 5.



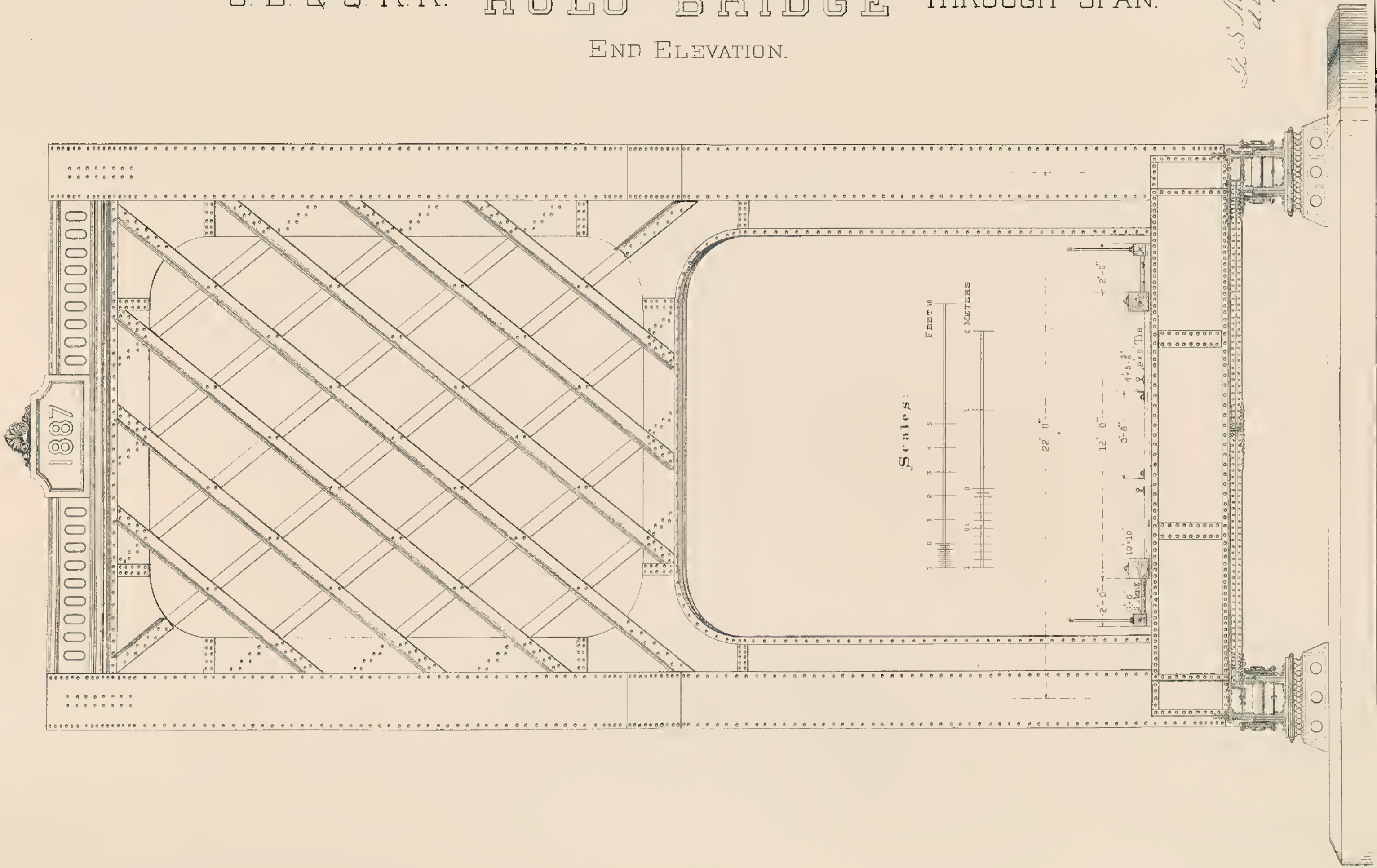
C. B. & Q. R. R. RULO BRIDGE THROUGH SPAN

Details of Panel Points 6 and 7



C. B. & Q. R.R. RULO BRIDGE THROUGH SPAN.

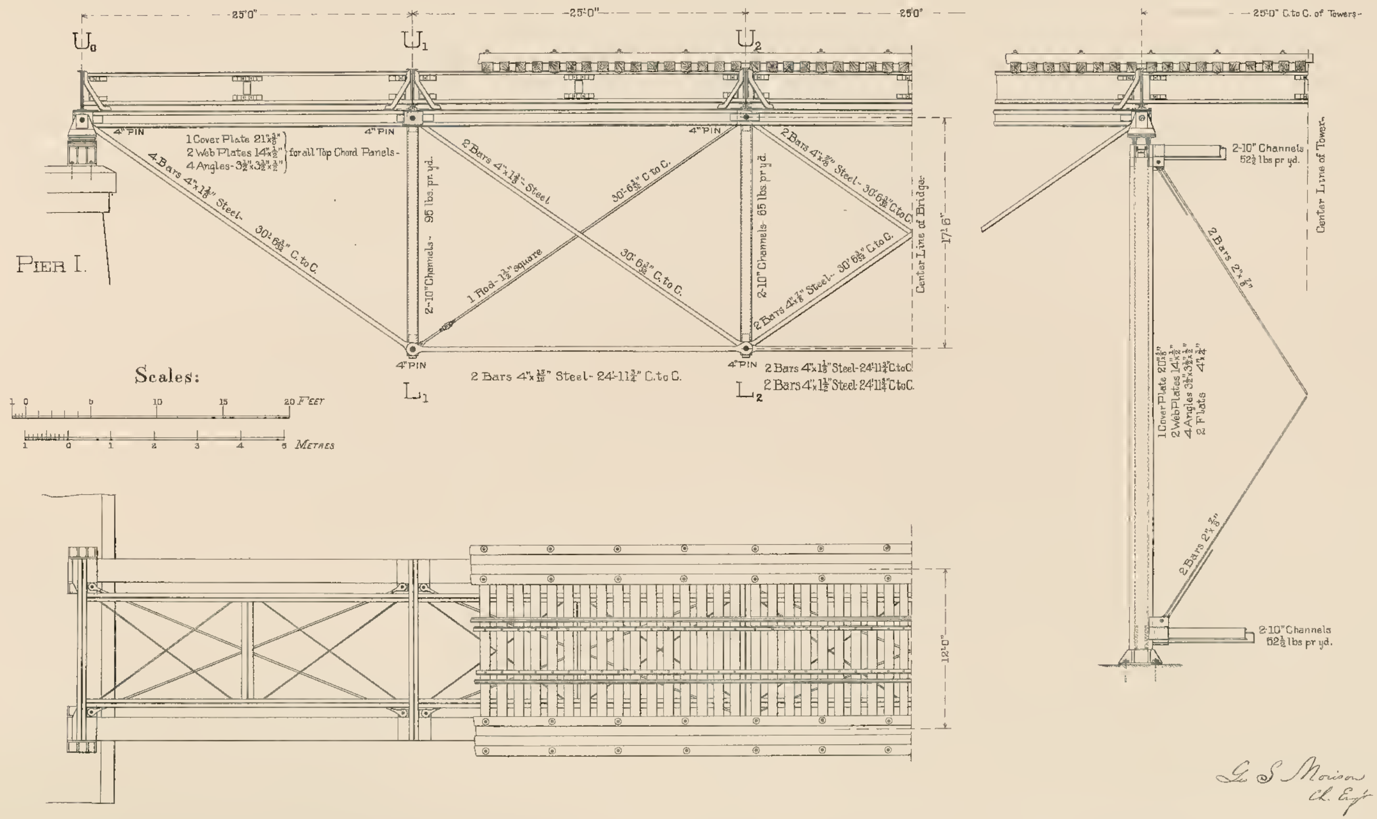
END ELEVATION.



ROBERTS & WELBE PHOTO-LITH 170 WILLIAM ST NY

C. B. & Q. R. R. RULO BRIDGE 125 FT DECK SPAN

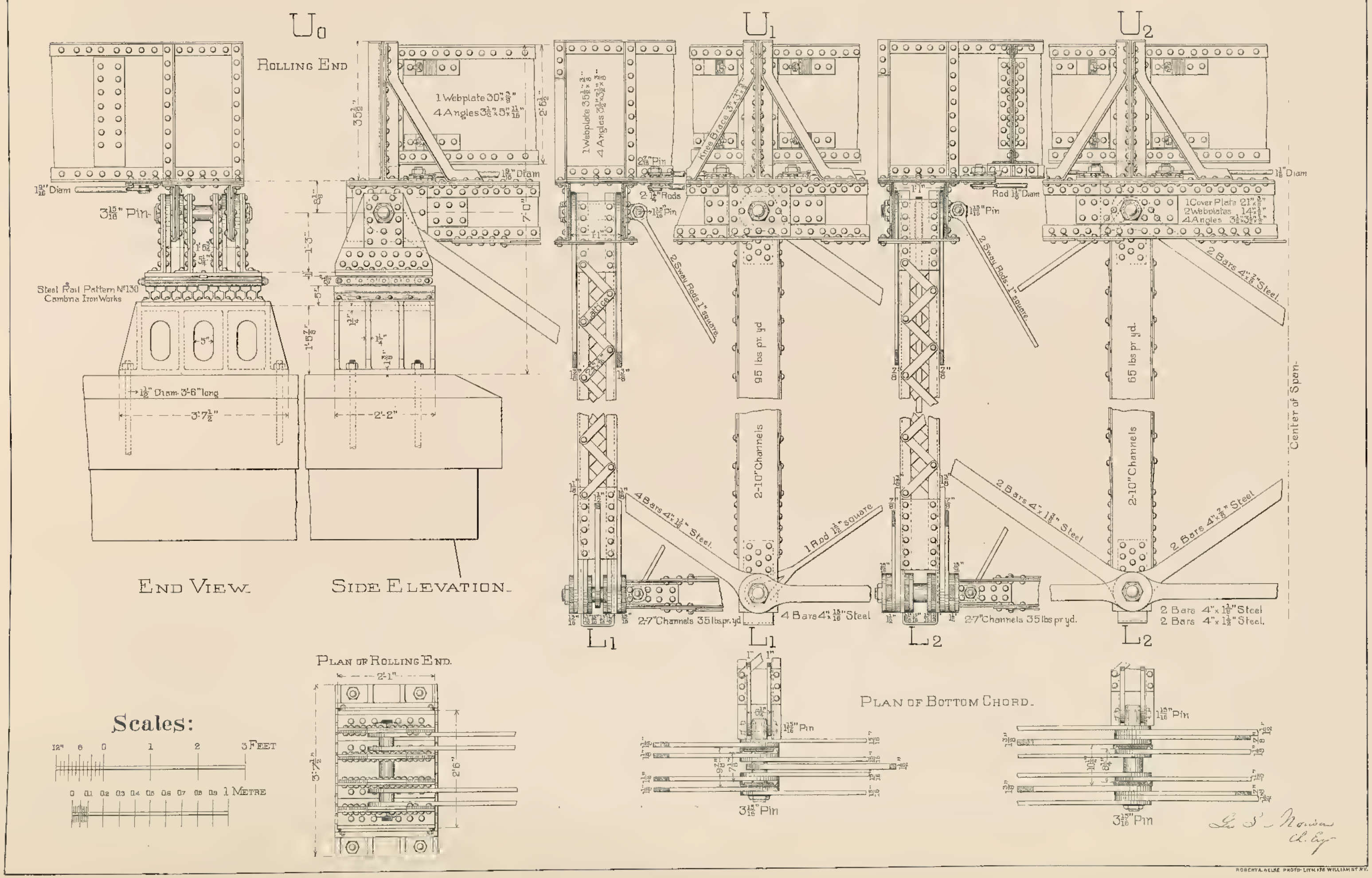
GENERAL ELEVATION AND PLAN



G. S. Morison
Ch. Engr.

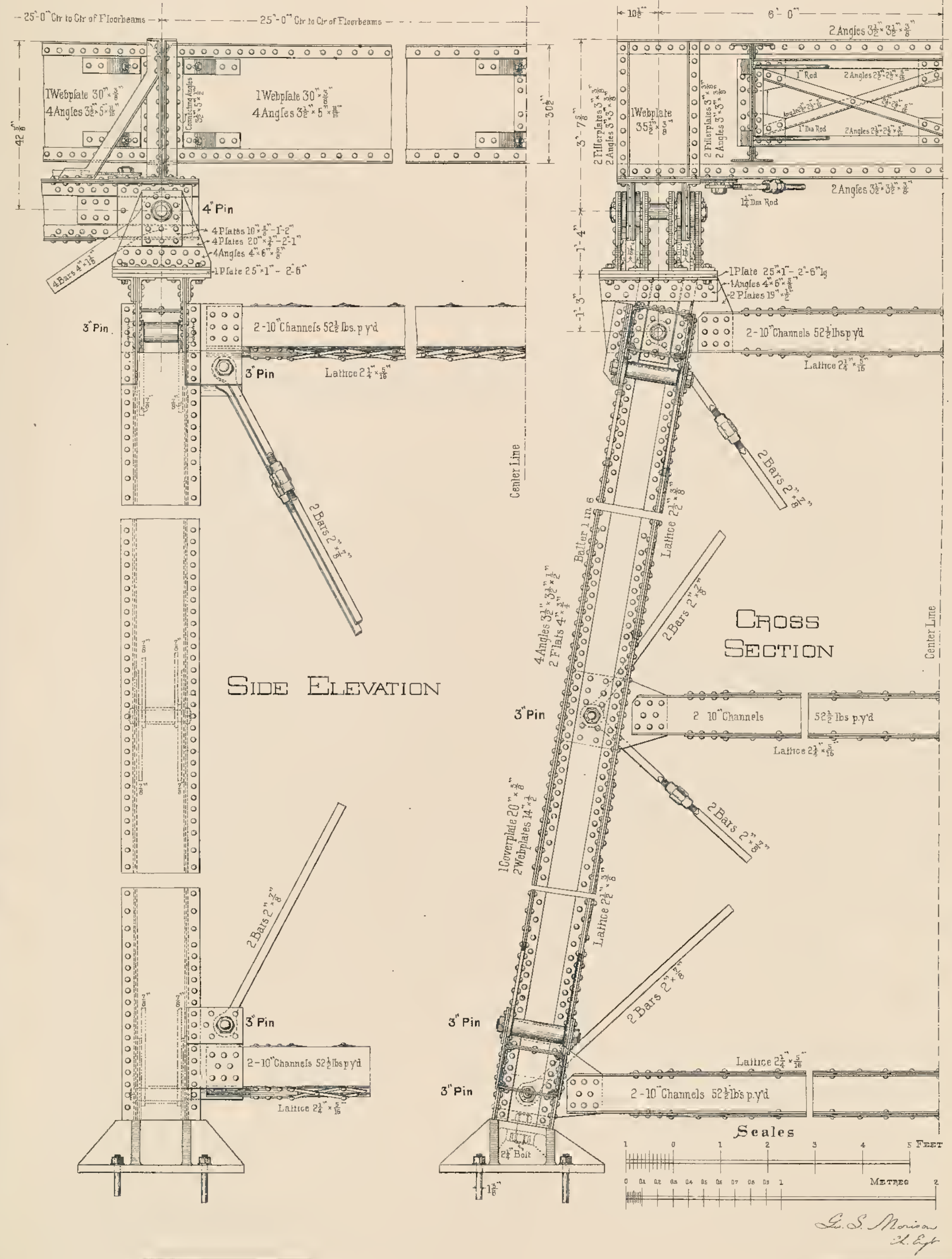
C. B. & Q. R.R. RULO BRIDGE 125 FT DECK SPAN

Details of Panel Points 0, 1 and 2



C.B.&Q.R.R. RULO BRIDGE 125FT. DECK SPAN

SUPPORTING TOWER



G. S. Morison
Ch. Engr.

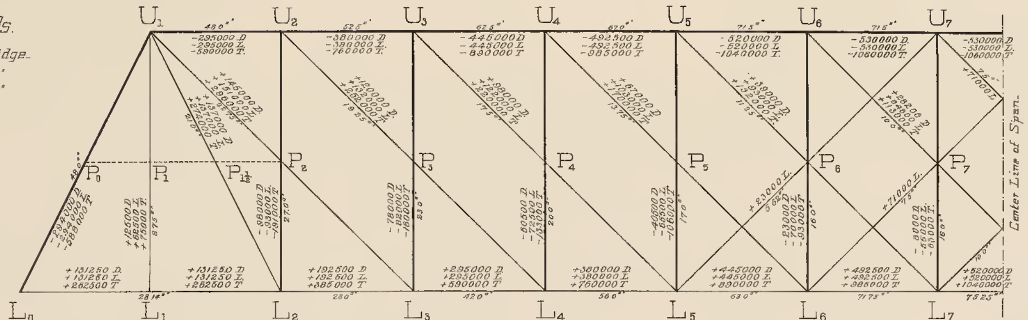
ROMEYN & WILKE PHOTO-LITH. 176 WILLIAM ST. N.Y.

C. B. & Q. R.R. RULO BRIDGE STRAIN SHEET

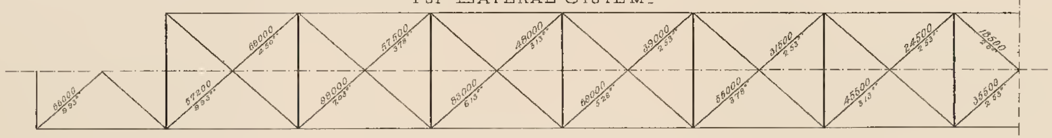
375FT. THROUGH SPAN

Assumed Loads.

D.L. 3000 lbs. pr. ft. of Bridge.
L.L. 3000 " " " "
E.L. 5000 " " " "



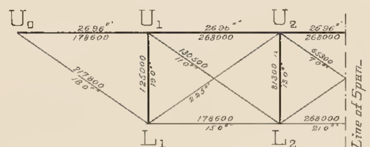
TOP LATERAL SYSTEM.



BOTTOM LATERAL SYSTEM.

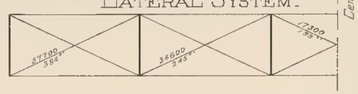
125FT. DECK SPAN

5000 lbs pr. ft. all moving load.



LATERAL SYSTEM.

500 lbs pr. ft. wind pressure



Geo. S. Morison
Ch. Eng'r

ROBERT A. WELCKE PHOTO-LITH 178 WILLIAM ST. N.Y.