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An Overturned 19,000-Ton Caisson Successfully Salvaged

Pier construction of Mid-Hudson Bridge delayed a year by remarkable accident in sinking largest open caissons ever used—Main span shortened to suit shift in pier locations

By GLENN B. WOODRUFF
Consulting Engineer, New York City

A 19,000-TON mass of reinforced concrete that was to become the base of one of the Mid-Hudson Bridge piers, at Poughkeepsie, N. Y., careened in the mud and clay of the river bottom, 60 ft. below water, when its sinking had just been begun. Fifteen months' persistent and skillful work was required to set it upright again. The remarkable operation is here recorded in compact engineering statement by an engineer closely connected with the work. Delay in publishing the article is due to an interesting lawsuit which developed from the mishap to the caisson and its restoration. The contractor sued to recover the cost of the salvage operation, claiming that the tipping was caused by instability inherent in the structure as designed, while the engineers claimed that it was caused by the contractor's excessive dredging below the cutting edge. The suit has been tried and a decision is pending. —EDITOR.

THE CENTRAL NEW ENGLAND Railway bridge across the Hudson River at Poughkeepsie, N. Y., built in 1888, was the first structure in America to be founded by deep open-dredged caissons. They are still among the largest and deepest that have ever been placed. Forty years later, the Mid-Hudson Bridge, less than a mile away, was founded by the largest open caissons ever used. Its construction was marked by a most unusual accident and an equally unusual salvage operation—righting a partly overturned caisson that weighed 19,000 tons. The salvage work is the central element of the present account, which records the main facts of the entire pier-construction work.

The Mid-Hudson Bridge is a suspension bridge with a center span of 1,495 ft., east-side span of 755 ft. and west-side span of 750 ft. Both piers stand in deep water in the river, while the anchorages are on land. The original design contemplated a center span of 1,500 ft. and two side spans of 750 ft. each, but a 5-ft. change became necessary because the east pier as finally sunk after the accident mentioned was out of position.

At the pier sites the water is about 60 ft. deep. Borings showed that the subsoil at the east pier site comprised 45 ft. of very stiff clay, then 30 ft. of softer material (which proved to be predominatingly sand) and then a stratum of gravel and boulders. It was decided to found the pier on this gravel stratum, 135 ft. below water level. At the west pier mud was found for 35 ft., boulders at 100 ft. below water, and rock along the west side of the caisson area at 115 ft. A tidal range of 5 ft. had to be reckoned with in constructing the foundations.

The conditions at the east pier resembled closely those found during the construction of the railway bridge, 40 years before, but at the west pier conditions were somewhat different, for the railway bridge record makes no mention of a boulder layer.

For comparison with the Mid-Hudson operations it may be of interest to note that the railway bridge caissons were of timber construction 60x100 ft. in plan, and that each caisson had fourteen dredging wells 10x12 ft. in plan, while the remainder of the horizontal section was occupied by loading pockets. In a paper by John F.

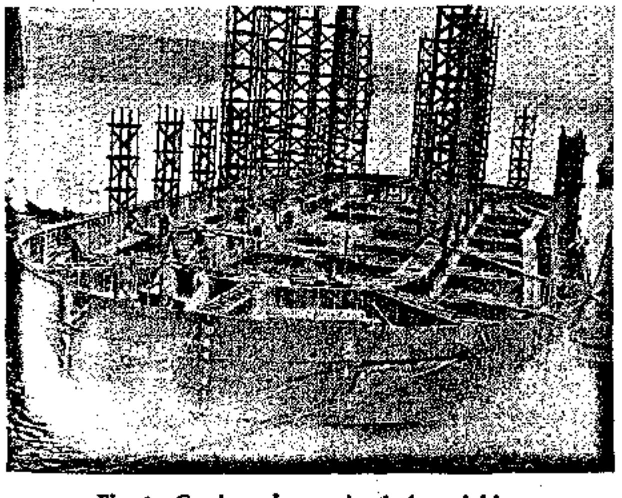


Fig. 1—Cutting edge section before sinking
This portion was built up as a core and formed the support for the upper concrete section.

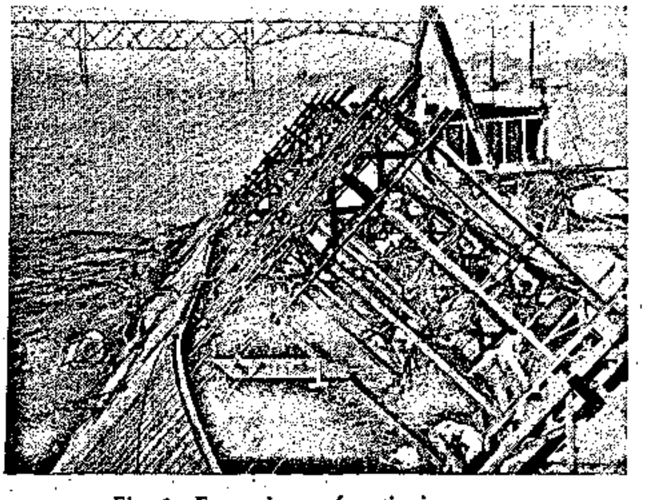


Fig. 2—East caisson after tipping
The entire movement through a 42-deg. arc occurred in about 1 min. One edge dropped 29 ft. The other rose 11 ft.

O'Rourke, "Construction of the Poughkeepsie Bridge," in *Transactions*, Am.Soc.C E., June, 1888, their action during sinking is described as follows:

When dredging begins there is no side friction. The material is soft, and the crib follows the dredging easily and evenly. When the crib has penetrated perhaps 20 ft. into the bottom, the material is more compact and side friction has become considerable. It no longer moves steadily, but by intermittent though gradual descents. Toward the end the crib hangs until the bottom is undermined, when it drops sometimes as much as 10 ft. at once, its motion being like that of a weight set free on the surface of a thick, soft cushion; and it comes to rest without jar. The dredge can only dig well holes, the areas of which are about one-fourth that of the bottom of the crib, and it must depend upon the material falling in from the sides for the greatest part of the excavation. These holes are often 30 ft. below the cutting edge when in hard material.

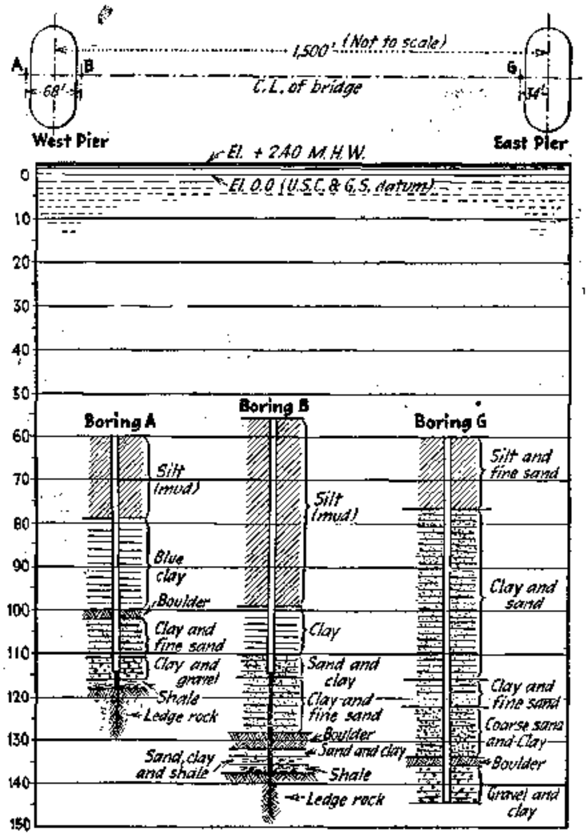


Fig. 3—Typical boring results

Deep soft ground led to use of open caissons for pier foundations of Mid-Hudson Bridge.

Large Concrete Caissons

As the depths necessary to secure a satisfactory foundation were beyond the limits of the pneumatic method, the open dredging method was selected for the Mid-Hudson pier bases. The usual type of timber caisson would have required loading pockets of large dimensions to provide the weight necessary to insure penetration, leaving correspondingly small dredging pockets; removal of the material from under the loading pockets and the wide exterior walls would therefore have been difficult. It was desired to obtain the necessary weight by constructing a cellular caisson of structural steel and reinforced concrete. For flotation prior to landing on the river bottom a removable bottom at the cutting-edge level became necessary.

Each caisson as designed and built consists of a concrete-filled steel cutting edge and truss system, 60x136 ft. and 20 ft. deep, with semicircular ends, composed of an outer shell of ½-in. steel plate and heavy bracing trusses. all filled and incased with concrete to form outer walls 3½ ft. thick and partition walls 2½ and 3 ft. thick. This lower section was proportioned to resist all stresses during launching and during the early part of the sinking. Above this the structure was of reinforced concrete jacketed with an exterior shell of 4-in. timber. The horizontal section of the concrete walls was made so that, at all times prior to landing, the concrete walls would be only a small distance above water level. A system of trussed steel columns at all wall intersections extended up through this section and carried 4x3-in. horizontal angles at 4-ft. spacing as supports for the outer planking and for the inner wall forms. This frame served to maintain the lines of the construction. The base area of each caisson is about 7,400 sq.ft.

The false bottoms designed by the contractor consisted of 14 in. floor timbers spanning from the cutting edges to a 24x28-in. strongback, which was supported by diagonal timber braces abutting against the walls. Horizontal braces at the top completed a truss system. The 14-in. timbers were deeper than necessary but were ordered for the east caisson before the details of the bracing system had been developed; 12-in. floor timbers were used for the west caisson. All joints in the floor were calked with white pine wedges.

The caisson was about 25 ft. wider than the masonry pier. In order that the underwater projection might not be a menace to navigation, the design provided that the top of the caisson in the final position should be 31 ft. below water. This necessitated a removable cofferdam on top of each caisson, which was placed before the cutting edge reached its final position, and which therefore had to be so braced as not to interfere with the dredge bucket operation. An interesting feature of this cofferdam was the use of the concrete walls to replace timber crossbracing that would otherwise have been necessary (Fig. 4). This obviated the necessity (for the lower portion of the dam) of cutting out braces and rebracing against the completed concrete walls.

Building and Floating the Caissons

The lower steel sections, with the false bottoms in place, were fabricated on ways at the yards of the Staten Island Shipbuilding Co. and towed to Poughkeepsie. Upon their arrival this bottom section was filled with concrete to about 4-ft. freeboard; then the work of building the successive 16-ft. lifts of the upper section was started. The sequence of build-up operations was: (1) Placing the structural-steel columns and girts. (2) Placing the 4-in. exterior planking, built on shore in panels 15x16 ft. and calked with oakum and pitch after placing. (3) Placing reinforcing steel. (4) Placing interior forms, made up in panels 8 ft. high. (5) Filling with concrete.

The mixing plant was built on a scow 40x120 ft. Sand and stone stored in bins 30 ft. above the deck flowed down into a measuring hopper and thence to the mixers. A movable horizontal belt transported cement from covered delivery barges to the cement house on the mixing scow, and a second belt carried it thence to the mixing platform. Two 1-yd. electric mixers dumped into a 1-yd. bucket.

At first the concrete was distributed to the walls of the caisson by a horizontal belt. This arrangement, adopted to meet a specification prohibition against chuting, proved unsatisfactory, principally because concrete was spilled by rocking of the mixing scow. The spilled concrete fell to the false bottoms and was a factor in the trouble later encountered in removing the bottoms. The engineers then permitted chuting, and the belt conveyor was replaced by chuting equipment, which proved satisfactory.

For each foot of height of caisson walls, 200 cu.yd. of concrete was required, or for the 16-ft. lift a total of 3,200 yd. With a force of 150 men the contractor was able to average 9 in. sinking per day.

Calculations by the engineers during the sinking indicated stability at all stages, but as a safeguard against unfavorable contingencies the engineers ordered, when caissons approached 60-ft. draft, about 500 tons of ballast to be placed in the pockets. The sand used by the contractor for this purpose proved a source of trouble later when the bottoms were to be removed.

In the construction of the caissons, provision was made for anchor attachments, two at the ends, two at the sides and one at each quarter point, or at eight points in all, around the perimeter of the caisson 19 ft. above the cutting edge. Similar provision was made at points 53 and 80 ft. above the cutting edge, but the upper attachments were not used. Eight concrete blocks, each of 15 cu.yd., were placed on the bottom of the river about 350 ft. from the caisson. A 1¾-in. plow steel cable from each block had, about 50 ft. from the caisson, a four-sheave purchase which led to the lower anchor attachments on the caisson, the lead line being tied to the top of the caisson. A second 1¼-in. line was later led from the 53-ft. fastenings and connected to the 1¾-in. line about 150 ft. from the caisson. These anchors were ample for their intended function of securing the caissons in correct horizontal position before they were landed on the river bottom.

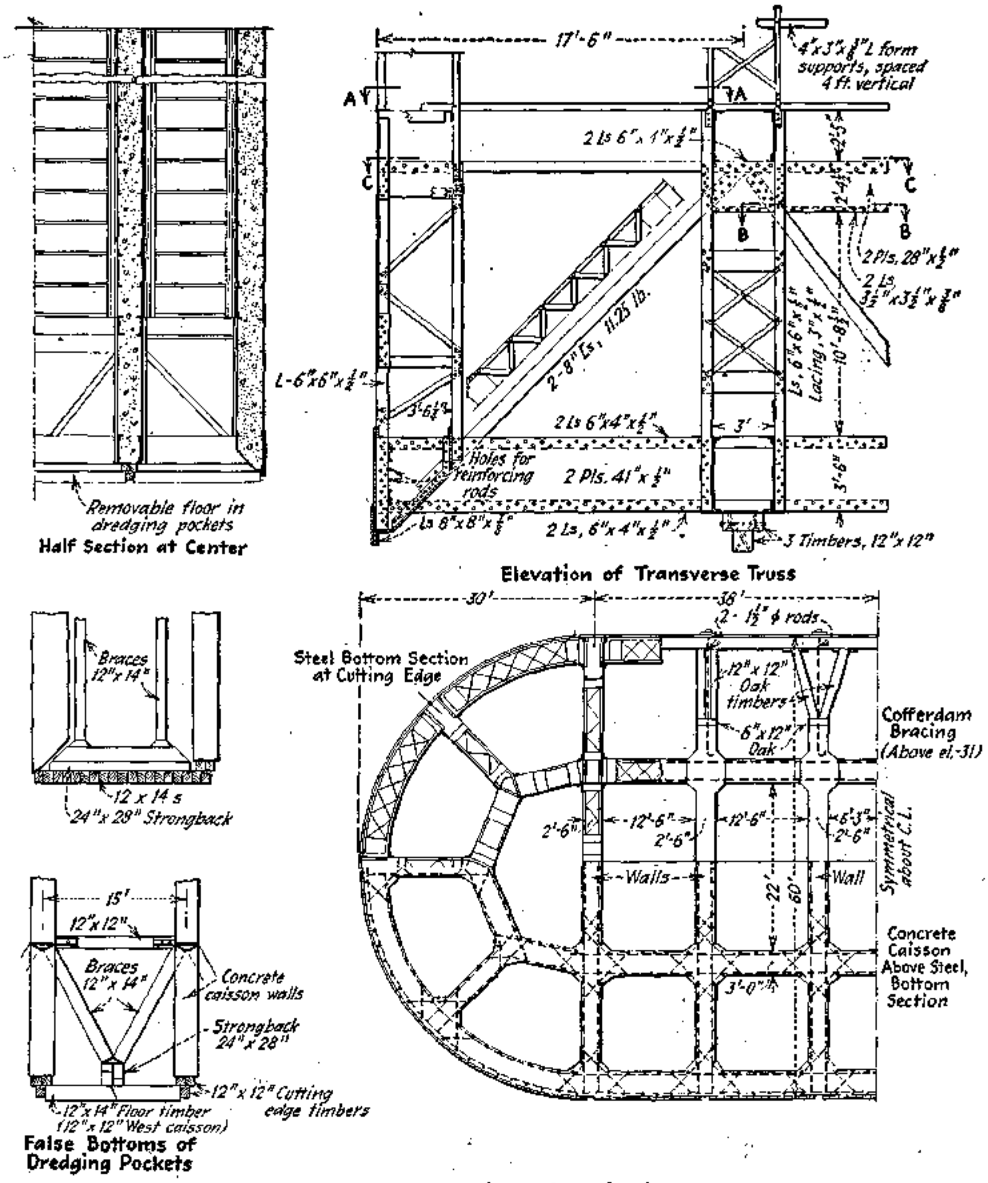


Fig. 4—Lower 20-ft. section of caissons

This section consisted of a concrete-filled steel shell braced by a heavy structural-steel frame; remainder of height is reinforced concrete. Collapsible false bottoms used in floating and sinking the caissons gave much trouble in removing.

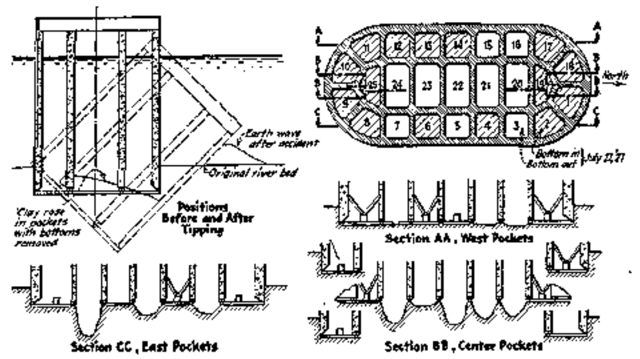
Sinking the West Caisson

The caisson for the west pier reached Poughkeepsie April 23, 1927. The work of building up the concrete walls proceeded without incident, and on July 1 the caisson was landed on bottom, at 57 ft. depth. By July 12 the outside walls had been raised to 69 ft. above the cutting edge, which then was at 60 ft. depth.

The braces in pocket 12 were dynamited and the bottoms came up suddenly, resulting in a decided settlement at the southwest corner. To level the caisson, the bottoms of pockets 3, 7 and 16 were shot in quick succession. This resulted in a level caisson, but during the operation, with a vertical settlement of 6 ft., the caisson moved 8.2 ft. west of correct location. The cause of this motion has never been completely understood. The most plausible explanation is that, when pocket 12 was opened, most of the material entering the pocket came from the west side of the caisson, leaving a void into which the caisson moved when the other pockets were opened.

To move the caisson eastward a surcharge of 1,500 tons of gravel was piled along the west side of the caisson. The effect was to produce a pressure toward the east, so that, in the subsequent vertical motion a movement to the east was obtained. The caisson in its final position is only 1½ ft. west of correct location.

At the west caisson the concrete walls were built up, and later the cofferdams placed. Practically all the sinkage was gained by removing the false bottoms, the



Date	Av. El. C.E.	East Side Dredging Wells									West Side Dredging Wells									Center Dredging Wells						
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
June 30	-61.6			K				K																		
July 1	-61.8																									
2	-62.5								K																	
3																										
4																										
5	-62.6																									
6	-62.8																									
7	-63.1		K					B																		
8	-63.3					K																				
9	-63.4																						K			
10																					K					
11	-63.9					B				K			K				K								K	
12	-64.2			B																						
13	-64.6														K								B			
14	-64.8																				B					
15	-65.0																B								B	
16	-65.7																									
17																										
18	-65.5			30 cu.yd.		40 cu.yd.		38 cu.yd.													26 cu.yd.		139 cu.yd.			
19	-65.5						K									K										
20	-65.5	K									K											K		K		
21	-66.0																6 cu.yd.					B				
22	-66.2																								16 cu.yd.	
23	-66.2																									
24				30 cu.yd. -4		16 cu.yd.																		B		
25	-66.3			-5		-4		-2									-1				-2	48 cu.yd. -4	0.0		-5	
26	-66.6			-5		-5		-2								B	-1				54 cu.yd. -7	-8	65 cu.yd. -5	22 cu.yd.	-5	
27				-5		-5		178 cu.yd. -5									-1				-7	-8	64 cu.yd. -11	31 cu.yd. -12	31 cu.yd. -11	

K = Braces removed   B = Bottom out   Figures denote either excavation in cubic yards or depth below cutting edge

Fig. 5—Condition of bottoms and of pocket excavation before tilting of east caisson and resulting position of structure

underlying material rising in the open wells. The last bottom was removed on Oct. 7, 1927, with the cutting edge at 102 ft. depth. The average rate of sinking from the time of landing, which was governed by the time required to build up the walls and erect the cofferdam, was about 6 in. per day.

The west cutting edge having reached the boulder formation on Oct. 7, all pockets were dredged to cutting-edge level and the slow work of removing the boulders started. This was accomplished mainly by excavating in the west pockets below the cutting edge, jetting away the clay surrounding the boulders so that they would fall into the excavation, and removing them by the bucket. It required over a month to sink the caisson 8 ft. to depth 110.

Borings had indicated that a satisfactory foundation would be secured at 115 ft., but additional exploration under the contract indicated soft material below this elevation under the east edge. It was therefore decided to carry the concrete foundation to rock over its entire area. To insure the stability of the caisson during the cleaning and refilling operations, pockets 5, 6 and 4 were successively excavated to rock at depth 126 ft. and refilled with concrete to depth 115 ft. This operation was started on Nov. 12, when the cutting edge was 110 ft. down. The work took a week, during which time there was practically no movement of the caisson. Excavation then proceeded, and by Nov. 30 the cutting edge was at 114.1 ft. depth, at which elevation ledge rock was encountered at the northwest corner of the caisson and the east edge was nearly in bearing on the concrete already placed. The center of the caisson was then cleaned out to rock and the center pockets concreted to 34 ft. below water, using a 2-yd. bottom-dump bucket. The north end of the caisson was next cleaned and concreted, and finally the south end.

There was no movement of the caisson after the concreting operations began. Measurements of the concrete placed indicate that the volume of material below the cutting edge was completely replaced by concrete.

The filling to El. —34 was completed on Dec. 23, 1927, at which time it became necessary to suspend operations for the winter. When work was resumed, March 8, 1928, the cofferdam showed little damage and could be unwatered after minor repairs. But a deposit of laitance over 20 ft. thick had to be removed from the top of the concrete, its lower layers requiring air hammers. The demarcation between the laitance and the concrete was distinct, and the concrete appeared to be of excellent quality. The west pier was completed June 12, 1928.

Work on East Caisson

The caisson for the east pier reached Poughkeepsie on March 26, 1927. Building up the walls proceeded as described, and on June 6 the structure was landed on the bottom, at 56 ft. depth. Soundings had disclosed that the riverbed was about 2 ft. higher under the east than under the west side of the caisson. It was anticipated that the material would be displaced when the caisson was landed, but this did not occur, and at all times before the accident the caison had a slight list to the west.

By June 30 the concrete walls had been built up to 72 ft. above the cutting edge, which was then 61.6 ft. down. On this date the braces were removed from pockets 1, 3 and 7 by exploding 3 lb. of dynamite at the foot of the diagonal braces. Contrary to expectation, the bottoms failed to give way when the braces were removed, and their removal proved difficult. They were slowly removed by first ramming them with a heavy concrete pile until the timbers were broken up and then chewing them out with a dredge bucket. The progress of the false-bottom removal is recorded in Fig. 5, which also shows, by dates, the material excavated from the various pockets. Prior to July 26 very little excavation had been done, except that incidental to removing the bottoms and cleaning out the material that had come up in the pockets above the cutting edge. All pockets were filled with water to river level.

Caisson Tips Over

On the night shift of July 25-26 the contractor removed 164 cu.yd. of material from the center pockets. On the following night shift, July 26-27, he excavated 254 cu.yd. of material from the center and east side pockets. At 4:30 a.m. on July 27 the caisson listed to an angle of 42½ deg. from the vertical (Fig. 5); from the estimate of a foreman on the caisson at the time the entire movement occurred in about a minute. The east edge dropped about 29 ft., the west edge rose 11 ft., and the center of gravity dropped 9 ft. After motion started it continued until resistance under the east edge and the building up of a bank or earth wave at the east side overcame the momentum.

It is the opinion of the engineers, the author included, that the sole cause of the accident was that the weakened walls of clay, which on the east side served as supports, were unable to withstand the comparatively high pressure of 2 tons per sq.ft. and failed. The lateral support of the material under the center and east walls had been removed, and this material had been also subjected to the softening effect of water from the sides. The excavation had created, in effect, a ditch into which the caisson overturned.

Steps were at once taken to prevent further overturning. Two lighters were placed along the east edge of the caisson with attachments to the steel frame. Two 150-ton crib anchors were sunk 600 ft. west of the caisson and connected by lines to the west top. Pontoons with a total capacity of 300 tons were attached to the east side of the caisson but were not in working condition until Aug. 13. About 400 cu.yd. of gravel was banked on the river bottom along the east side of the caisson.

This work took about a month. During this time the caisson settled vertically about 1 ft., at a decreasing rate, and the angle of list increased about 1 deg., but after Aug. 20 no further movement took place until the righting motion started.

Righting Operations

With the caisson secured against further overturning, attention was turned toward the problem of righting and restoring it, as nearly as possible, to its proper location.

The total weight of the caisson was 19,000 tons and its submerged weight 12,000 tons. A vertical line through its center of gravity passed slightly to the east of the east cutting edge, and there were two additional resistances which would oppose righting: the resistance of the material under the bottom and the adhesion between the east side of the caisson and the clay bank.

It was evident that the attack should be along two lines, supplying righting moments and excavating under the bottom. The greater the moment applied and the less the excavation, the nearer the caisson would be restored to its proper lateral position. Had it been practicable to apply moments of sufficient magnitude, the center of rotation might have been very near the same point as the center during the accident, and the caisson would have come to the vertical in true position. If, on the other hand, excavation had been the sole means employed, there would have been no tendency for the caisson to return to the vertical. The probable path of motion would have been for the caisson to slide along its east side, with the possibility that the cutting edge might move to the west even faster than the slope of the east bank would indicate. The engineers therefore insisted that no dredging be done before righting moments of a considerable magnitude had been applied.

It was very desirable that the righting motion be secured with as little settlement as possible. Any considerable additional vertical load applied to produce rotation would have probably caused additional vertical settlement; hence efforts were made to secure moments without adding vertical load. This could be done by using horizontal forces or, preferably, uplifts at the east side of the caisson.

Restoring Moments Applied

The various pulls applied to the caisson to produce this torque are shown diagrammatically in the sketch, Fig. 6. Their amounts and moments about the east cutting edge were as follows:

	Date Active	Force Tons Net	Moment Foot Tons
Loading in pockets 11, 12, 13, 14 and 17	Oct. 25, 1927	710	18,000
Cribs, west side	Sept. 10	210	9,000
Seven lines to west	Sept. 10	....	......
Twelve lines over carfloat	Nov. 26	1,000	99,000
Boom loads	May 20, 1928	250	......
	Increased June 1 to 5	282	26,000
Float east side	June 14	200	8,000

The lines to the west produced the greatest force toward righting the caisson. As first placed each line consisted of a $1\frac{3}{4}$-in. plow steel rope attached to rockfilled cribs placed about 600 ft. west of the caisson and attached to the caisson by a six-part tackle. To secure a greater leverage, a carfloat was placed at the west of the caisson and the lines carried over the float. As these lines were first rigged in the fall of 1927, they had to be tightened at low tide, and the full pull occurred only at high tide. Later, to give a steady pull regardless of the tide, the free end of the main tackle was connected to a six-part luff tackle, the free end of which passed over a pulley and carried a $2\frac{1}{2}$-ton weight.

The lines over the carfloat were so rigged as to keep the forces in play at all stages of the tide and were of prime value and effectiveness, without adding weight to the caisson.

Since all attachments had to be made by divers, the work was necessarily slow. The multiplicity of lines made it difficult to place additional rigging.

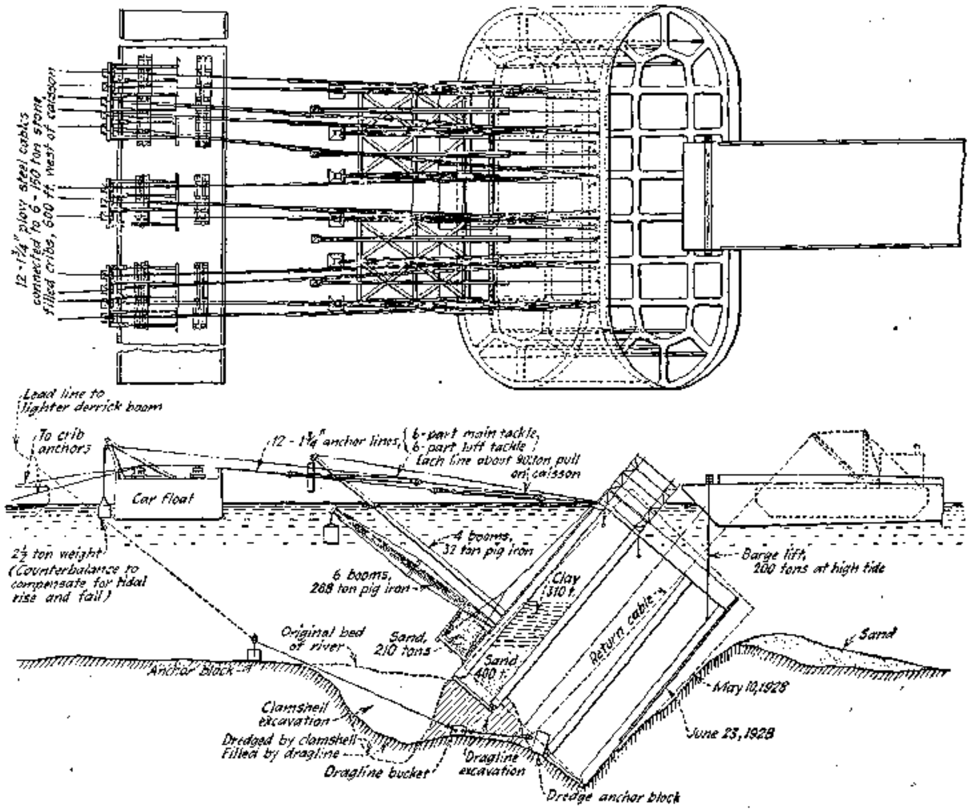


Fig. 6—To right the caisson, weighted booms and pulling tackles anchored to sunken cribs were rigged to apply 1,500 tons pull to the west at the top edge, while the soil was being dug away under the west half of the base

These methods of applying righting forces are only a few of those considered. Roofing over the east-side pockets and putting on air was seriously considered, and work on the plan was started. It was abandoned because the amount of water that could be safely displaced was limited by the strength of the vertical reinforcing steel, and there was doubt of making an effective air seal at the top of the pocket by placing concrete through a tremie. Another plan started was to build a cofferdam over the area of the caisson. This plan was abandoned, since it was not considered safe to depend on the watertightness of the seal of clay in those pockets in which the bottoms had been removed.

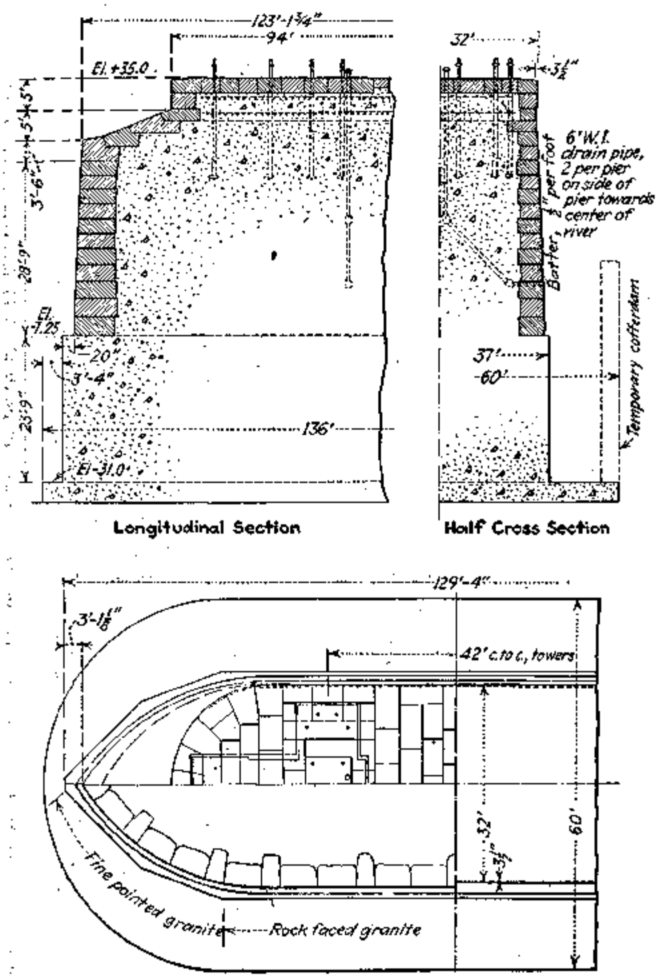


Fig. 7—Stone-faced concrete piers built on the caisson substructures within removable cofferdam inclosure

Excavating Under Bottom

The excavation of material from under the caisson presented unusual difficulties. Due to the inclination of the caisson, excavation by buckets through the pockets was extremely slow and, after the cutting edge was reached, became impossible, since the bucket swung under the edge. Several types of hydraulic ejectors and jets were tried without success. A self-propelling jet, developed by the United States Navy, proved very effective where small volumes were to be removed.

In the fall of 1927 a trench was excavated along the west side and around the ends of the caisson. In the spring of 1928 this trench was deepened to 85 ft. below water. A diver jetted a hole from pocket 22 to the west side and passed a line through this hole, to which was attached a crescent-shaped bucket. This device proved very successful, the material being dragged from under the caisson into the previously excavated trench.

On May 11, 1928, a slight righting motion of the caisson was noted. After this date a very steady motion of the caisson, averaging 30 min. of arc daily, was secured, until in early August the caisson was nearly vertical. This righting motion had been secured with no lowering of the east cutting edge and with the caisson about 12 ft. out of position instead of the 16 ft. that would have resulted had the rotation been about the east cutting edge.

At this time the righting appliances were removed. Some excavation was done at the east side and some gravel placed at the west side of the caisson in an effort to move the caisson eastward. The remaining false bottoms were removed and the cofferdams built on top of the structure.

On Nov. 20, 1928, the final sinking of the caisson was started, the cutting edge being at 112 ft. below water. In eighteen days the contractor sank the caisson to its final position, with cutting edge 134.4 ft. down and resting in a stratum of coarse gravel. By Dec. 26, 13,000 cu.yd. of concrete had been deposited in the upstream half of the caisson. The laitance was cleaned off this concrete and from the downstream pockets, and operations were closed for the winter. Work was resumed on March 19, 1929, and the pier completed on May 16. A total of 14,200 cu.yd. of concrete and 1,600 cu.yd. of stone were placed in less than two months.

Review of Design and Construction

At the end of such a project, especially when there has been a serious mishap, the question arises as to whether the design was faulty or could have been advantageously changed, and the construction procedure altered so that any hazards might be reduced. The author's conclusions are as follows:

In its general conception the design of the caissons was well adapted to their purpose and to the conditions encountered at the site.

The thin concrete walls of the caisson permitted the dredge buckets to get very close to the cutting edges. Had these walls been thicker or had loading pockets with permanent bottoms been used, it would have been most difficult to remove the material from under the cutting edges and loading pockets. Probably it would have been impossible to have sunk the west caisson to the desired elevation.

The weight of the walls was the maximum that would permit floating the caissons on false bottoms. This weight was more than sufficient to overcome all skin friction and other resistances to sinking. Hence there was no need of loading pockets.

The ratio of the width of the caisson to its height during the dredging operation (60 ft. wide to 60 ft. high at the start, and 60 to 135 ft. at the finish) was unusually large. The caissons were very easily controlled as to level at all stages of the sinking.

The use of the steel columns and girts proved valuable in permitting speedy erection of the exterior planking and the interior forms.

In regard to temporary parts and conduct of the work, the following may be noted:

Where the riverbed consists of a fairly stiff material, as was the case at the east caisson, the false bottoms should be constructed with more braces. In this way the shorter spans would permit lighter material for the floor.

All operations should be so conducted as to maintain symmetry as nearly as practicable. If the first pocket removed at the west caisson had been No. 22, the trouble with this caisson would probably have been avoided. Likewise, dredging should be done with the same regard to symmetry. As little dredging as possible should be done until the caisson is well embedded in firm material. All dredging should be done so as to keep the caisson rim-bearing, the sinkage being gained by the gradual failure of the cutting-edge support.

The Mid-Hudson Bridge was constructed by the department of public works, of the State of New York. Frederick Stuart Greene, superintendent of the department, and J. S. Bixby, division engineer, were in constant touch with the work. L. S. Hulburd, as senior resident engineer, was the state's representative on the ground. The contractor for the main piers was the Blakeslee Rollins Corp., of Boston, with W. G. Cheever as superintendent. The design and construction of the bridge was under the direction of Ralph Modjeski and Daniel E. Moran, of New York City, as consulting engineers. P. P. Angier served as resident engineer until Jan. 1, 1928, when he was succeeded by C. W. Hanson. The author was in direct charge of the design of the work and had general supervision of the fieldwork under the direction of the consulting engineers.

Estimating Fees—A Symposium

A presentation of both sides of the question of charging fees for bidding—Engineers view plan with suspicion—Contractors claim it lessens useless economic loss of excessive bidding.

IS THE practice of competitive bidders charging a fee for their proposals sound and justifiable? Engineers say it is not, contractors are divided in opinion and officials of organized contracting declare it is, according to many letters received by *Engineering News-Record* since the publication of an editorial on the subject in these pages Nov. 27, 1930. Some of the letters were replies to a request for an opinion, others were unsolicited. Consulting engineers, chief engineers of railoads and large industrial firms, officers of the U. S. Engineer Corps, and city, county and state officials represented the contract-awarding viewpoint. General and building contractors and secretaries of organized constructors' groups contributed opinions from the contracting industry. The *Constructor,* organ of the Associated General Contractors of America, also expressed its viewpoint on the subject.

Of all the engineers reporting, only one favored the plan, and he only partly. Quite a few viewed it with suspicion, pointing out possibilities of price-fixing or bidding solely for the purpose of collecting the fee. Two declared intentions of resorting to some means other than competitive contracting for carrying out construction projects if the system goes into effect in their territory. Organized contracting groups declare that the fee practice restricts the number of bidders and lessens a useless economic loss caused by excessive bidding lists. Some contractors claim the system puts the cost of bidding where it belongs. Other contractors were bitterly against the plan. They claim to know of fees collected on "complimentary" bids, and of false information being passed out to bidders regarding the approval of architects and engineers to the fee system on specific projects. They also allege that contractors unwilling to enter into bidding-fee agreements are intimidated through subcontractors and material supply interests.

Opinions of Engineers

Opposition to the practice of charging fees for bidding was expressed by Myers, Noyes & Forrest, consulting engineers, of Dallas, Tex. They further state:

> We recall very vividly the scandals which arose during the bidding on bridge work a few years back and feel that a renewal of the practice of making a charge for preparing bids will again bring up these old charges of contract pooling, probably with a great deal of justice. We have had no experience with bidding fees but at times we have felt that the system was being used to the disadvantage of the owner and without direct knowledge on the part of the owner or the engineer. We have felt that this has occurred on our work at times and naturally are very much opposed to it. We cannot see where the estimating fee plan is an equitable solution of the contractor's bidding problem.

Black & Veatch, consulting engineers, Kansas City, Mo., declared that they cannot discuss the question of estimating fees from the standpoint of any actual experience with such a plan since, as far as they know, it has never been practiced in the Kansas City territory. They expressed further opinion as follows:

> Our reaction to the scheme is decidedly adverse. There seems no more justice for such a procedure in submitting bids for construction work than in submitting proposals or bids in every other line of endeavor. Frankly, we think the engineering and architectural professions should do everything in their power to suppress such a practice. More real good can be done the contractors if the architects and engineers do everything within their power to see that the work on which bids are received has been clearly and fully explained in the plans and specifications and then assure the contractor of unprejudiced consideration and absolute open competition in the bidding.

Defeats System

J. E. Sirrine & Co., engineers, Greenville, S. C., told of actual experience with the plan and reported unethical practice in this connection:

> We have run into this situation in a few cases, and we invariably notified the contractors that such procedure would not be permitted. We know for a fact that an effort has been made among certain groups of contractors to try to "freeze out" or ostracize contractors who would not join in the practice. We are against the practice of charging an estimating fee, and feel that the cost of estimating is a part of the contractors' overhead, and it is our opinion that it will lead to the practice of contractors entering into competition merely to collect an estimating fee without any intention of submitting a bona fide bid. We further believe that the practice will lead to collusion and the fixing of bids and bidding, adding unnecessarily to the cost of the contracting work. We have never permitted the payment of a bidding fee, as we have always found it possible to break up the program by permitting independent contractors to bid, thereby giving them the advantage, compelling the other contractors to eliminate the bidding fee. We were advised that efforts were made to include a bidding fee on some of our work, but the interested contractors were unable to charge the fee