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THE PONT DU GARD, NIMES, FRANCE.
THE COFFER-DAM PROCESS FOR PIERS.

FOWLER.
THE COFFER-DAM PROCESS FOR PIERS.

PRACTICAL EXAMPLES FROM ACTUAL WORK.

BY

CHARLES EVAN FOWLER,
Member American Society of Civil Engineers,
Bridge Engineer.

"Much of the success of any one in any kind of work, and especially in work subject to the peculiar difficulties of that we are considering, depends upon the spirit in which it is undertaken."—ARTHUR MELLEN WELLINGTON.

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INTRODUCTION.

The greater part of foundation work is of an ordinary character. And while difficult foundations have been quite fully treated by engineering writers, ordinary ones have too often been passed over with mere mention, or treated in such a general way that the information proves of little value in actual practice.

Many valuable examples of work of this character have been described in current engineering literature, and it is hoped that by bringing them together a real service will be rendered the profession, as well as much valuable time be saved for considering other and equally important problems.

The history of the coffer-dam process would seem to indicate that engineers of nearly a century ago gave more consideration to the smaller problems than the engineer of to-day, who has apparently passed to the consideration of the larger and of course more interesting ones.

That this is deplorable, is proven by the many cases where money has been wasted in the after effort to make good the mistakes that have become apparent where cheap construction of coffer-dams has been resorted to. The saving in original cost, as between an indefensible method and a defensible one, is often so small as to seem absurd when it has become necessary to make large expenditures to rectify the errors.

Errors of judgment are more easily excusable with regard to foundations than with any other class of construction, but when definite limits can be set, economy will result by keeping as closely as possible within them.

Reference is made in the following pages to the splendid construction of foundations by the Romans, where they could be built outside the water. The Pont du Gard, illustrated in the frontispiece, is the most notable example of this extant. It is interesting also as indicating their knowledge of the better form of piers and methods of arch construction.

Although constructed during the reign of the Emperor Augustus, at the beginning of the Christian era, it is in a remarkable state of preservation, aside from repairs that have been made from time to time.

Probably the earliest recorded examples of the use of coffer-dams which give details of construction are those constructed under the engineers of the Ponts et Chaussées.
Those built under Perronnet at the bridge of Orleans were large and extensive, and references made to the pile drivers and the pumps used on the work, serve to illustrate the great amount of attention paid to planning the details of construction.

The same engineer completed the piers of the bridge at Mantes, where the coffer-dams were constructed to enclose both the abutment and the nearest pier within one dam, making the dimensions about 150 feet by 200 feet in the extreme!

Hardly less notable were the coffer-dams at Neuilly, where the interiors were so large, that the excavation did not approach near the inside wall of the dam.

All of these were constructed prior to the year 1775, and the details as shown in the elaborate drawings are of much interest to the engineer engaged on similar works.

The coffer-dams constructed about 1825 by Rennie on the new London bridge were the prototypes of those used at Buda-Pesth, but were elliptical in form. They were designed with as much care, apparently, as any other feature of the bridge, and from the fact that the water was pumped to twenty-nine feet below low water and the work found tight, the details must have been very carefully executed.

However great the amount of care bestowed, there will be cases undoubtedly where the difficulties cannot be foreseen, and it will become necessary to adopt some of the many expedients cited to overcome them; or they might better be employed from the start, where any suspicion is had that trouble may ensue.

The question as to whether it will be best to use a crib or a sheet-pile coffer-dam will most always be decided by the character of the bottom, the location, and the character of the foundation to be built. It is advisable, whichever type is selected, to make the size large enough, so that the excavation may be completed without approaching too close to the inside wall of the dam, and so that plenty of room may be had for the laying of the foundation courses.

The unit stress adopted for timber construction is believed to be as large as will give good results in the majority of cases, both on account of the possibility of the construction having to undergo more severe usage than is expected, and on account of the grade of timber which is most often made use of for temporary works.

Where it is permissible from the standpoint of true economy, it is believed that steel construction will commend itself for use. In most localities it will not be long until metal construction will be found cheaper than timber for building coffer-dams, and in many places this is already true.

A great mistake is made, in nearly nine cases out of ten, by trying to use old machinery, such as hoisting engines, pumps, and the like, which are ill adapted to the purposes for which they are intended, on account of lack of capacity and only too often on account of having outgrown their usefulness.
The engineer would avoid many unpleasant situations by demanding that a proper outfit be provided, and in the end gain the thanks of the contractor for increased profits.

Extended acquaintance with Portland cement is increasing the use of concrete in construction, and this is a great gain for the engineer, as it is not only superior to much stone that is used, but is better adapted to use in difficult situations. It also lends itself more readily to use for ornamental details in pier construction. That truly ornamental piers are not, however, those with needless and frivolous details, has been clearly set forth in the last article. Simplicity and beauty are near relatives.

The best locations cannot always be chosen for piers, but careful examination will often be the means by which bad locations may be avoided.

The methods for determining the economic division of a given crossing of a river, have not come into general use, probably on account of lack of easy application. The method given is an accurate one and very simple to use, especially if the results are tabulated for a given loading.