

joints, backfilling, finishing the surface, moldings, and the furnishing, placing and removing of all necessary forms.

Piling for sub-foundation work, gravel, waterproofing and extra sewer pipe will be paid for at the rates bid for the same.

Reinforcing Steel.—All steel used in reinforced concrete shall be deformed steel bars or rods of the dimensions shown on the plans. They shall be rolled from billets of either open-hearth or Bessemer steel, and shall have an ultimate strength of not less than 80,000 lbs. per sq. in. and a yield point of not less than 50,000 lbs. per sq. in. The minimum percentage of elongation in eight inches shall be $1,000,000 \div T. S.$ It shall be capable of being bent cold, without fracture, 180° around a diameter equal to 3 times the thickness of the bar. All steel bars shall be carefully bent to the form required as shown on the plan.

Payment.—Payment for reinforcing steel will be in full for furnishing, bending, fitting and placing the same in the work as called for on the plan. The measurement of steel will be for the length called for on the plan or as the City Engineer may direct to be placed in the completed work.

Wooden Bulkheads.

Lumber.—All lumber in bulkheads shall be well fitted, bedded and nailed. All posts shall be set on blocks, laid in

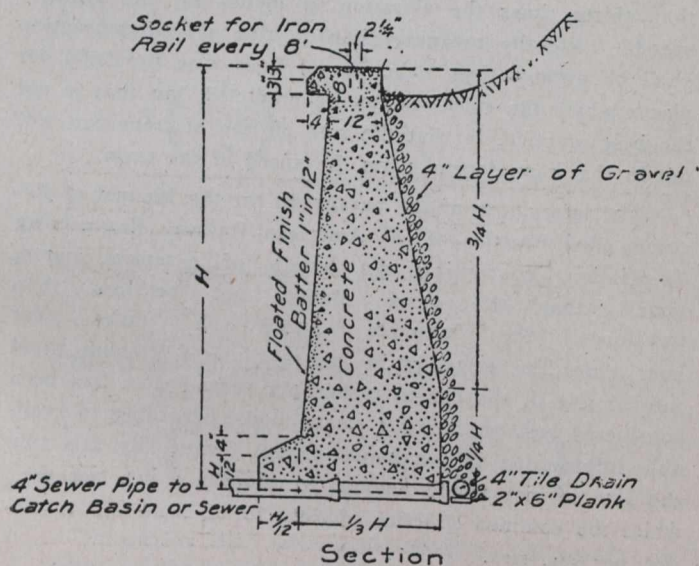


Fig. 30.—Section of Concrete Retaining Wall.

holes, excavated to the depth as shown on the plans, or as directed by the City Engineer. In refilling such holes, the earth shall be thoroughly tamped. "Deadmen" shall be bedded to the depth shown. No excavations, such as trenches for "deadmen" and holes for posts and other unexposed work in bulkheads shall be filled or covered until the same have been fully inspected. All lumber used for bulkheads not exposed, except ends of timbers (unless otherwise specified) shall be painted with two coats of hot coal tar or some other preparation approved by the City Engineer. The lagging shall be well nailed to the posts using 8 in. wire nails for 4 in. lagging and 9 in. wire nails for 5 in. lagging. There shall be two nails to each post. Where directed by the City Engineer, concrete of standard mixture shall be placed at the foot of the posts. Payment for concrete will be as listed on the proposal.

Payment for bulkhead lumber will include the cost of digging and refilling of post holes and painting of the lumber.

Iron.—Rods used in bulkheads shall be of good quality of steel and shall be of the dimensions shown on the plans. Threads at each end shall be 8 ins. in length. All rods shall have welded ends 2 ft. long, $\frac{3}{8}$ in. larger than main rod. Each rod shall be provided with the standard size nuts and 6 in. washers. All shall be thoroughly painted with two coats of "P. & B." or other preparation approved by the City Engineer. Blocks of the dimensions shown on the plans shall be used under each washer and will be included in the measurement of lumber used.

ECONOMICAL COAL PURCHASING.

How the "best" coal must be most surely and cheaply obtained, the word "best" being interpreted in the light of the conditions of a particular power plant, is stated in a recent paper by Dwight T. Randall, of Arthur D. Little, Inc., Chemists and Engineers of Boston.

There is a wide difference says Mr. Randall, in the character of the various coals on the market and a considerable variation in the quality of the coals sold under the same general trade name. These differences make it difficult to secure the most economical coal for a given plant without an intimate knowledge of the coals and of the engineering problems connected with their combustion.

Careful investigations have shown that if coals are suited for use in the furnaces installed, they may be burned with practically the same efficiency and are of value in proportion to their heating values. Investigations have also shown that almost any fuel may be burned in suitably designed special furnaces so as to give results which are nearly proportional to their available heating value. In many cases it has been found advisable to change furnaces to utilize a low-grade fuel rather than to purchase an expensive coal for the existing equipment.

The management of any plant should know the quality of the coal in use and be able to locate the cause of variations in the boiler room economy. Poor results are not always chargeable to the coal. Operating conditions are frequently at fault. An analysis of a representative sample of coal which is suitable for the furnaces is a more accurate measure of the value of the coal than the performance of the boilers.

This method of purchasing coal has already been adopted by many of the larger and most progressive consumers of coal. Its advantages are so clearly demonstrated to engineers thoroughly experienced in power house practice that few who are in a position to purchase large quantities of coal are willing to do so without a guarantee as to its quality. With information as to the coal bed, the district and the mine from which the coal will be furnished and the guaranteed analysis, an experienced engineer can select a coal for the plant which is both suitable and cheap when quality and price are considered.

A contract based on a guaranteed analysis provides for a definite procedure in settling for variations in the quality of the coal delivered and avoids the necessity of devoting much time to personal arguments and correspondence regarding poor coal. If both the consumer and the seller are familiar with the technical points involved in the sale of coal on a guaranteed analysis, it will prove a fair method by which the purchaser pays according to the value of the coal delivered to him and the dealer is reimbursed for any expense due to better preparation of the coal.