A MODERATE-COST STONE DAM.

The design of a masonry dam sometimes has to be adapted to the expenditure which can be afforded in view of the benefits to be derived from the works, just as is true of manufacturing plants, although when one looks at the monumental structures built, and justified, in some locations, he almost forgets that the more modest examples are also worthy an engineer's attention. In a recent issue of "Indian Engineering," there are reproduced the drawings for a small masonry dam built in New Zealand to form a reservoir with a capacity sufficient to irrigate about 10,000 acres of farm land. The dam closes the mouth of a gorge, known as the Idaburn gorge, being built on schist rock between steep rock slopes, and is about 50 feet high above the floor of the gorge, which at the level of the top of the dam is only about 100 feet wide. Disintegrated and loose rock was removed and the structure was bonded into the sound ledge.

The dam is of the gravity type, the crest being straight in plan. A spillway forms the central portion; its crest is 46 feet long and its sides have slopes of 1:1 rising 10 feet to the tops of the portions of the dam built into the sides of the gorge. The top of the spillway is rounded and is about 9 feet wide; the other portions of the dam are flat on top, 6 feet wide. The upstream face is battered 1 in 24, and the downstream face is a vertical curve, the cross-section resembling the Rankine type. The maximum thickness at the bottom is 42 feet, and the thicknesses at 10 foot intervals above are successively 27, 19, 13, 8¾ and 6 feet.

The unusual feature of the construction is the use of cement only in a comparatively thin outside and bottom shell of the masonry, the heart of the dam apparently being of dry rubble containing many large stones. The bottom and upstream face for a thickness of 2 to 4 feet approximately, and the toe are of roughly squared blocks of stone laid in cement mortar. The crest and the downstream face are of concrete having a minimum thickness of 2 feet. To protect the toe of the spillway and the adjacent rock in the bottom of the stream from erosion by the water overflowing from the reservoir, an apron of heavy stones was placed so as to cover the rock for a number of feet, and extend up 12 or 15 feet on to the face of the dam.

For the purpose of scouring sedimentary deposits from the bottom of the reservoir, a 3x3-foot concrete conduit was built through the bottom of the dam under one end of the spillway. This conduit is controlled by a sluice gate at its upstream end operated by rods and chains led over pulleys to a screw-stand on top of the dam set several feet to one side of the gate because of the slope of the end wall of the spillway. For the regular supply water is drawn through a 24-inch cast-iron pipe laid through the opposite end of the dam and about 10 feet above the scour conduit. This pipe is encased in a mass of concrete.

COST OF CONCRETE WALLS.

The Central Railroad of New Jersey has built car shops at Elizabethport, N. J., and the most noticeable feature in the construction of these buildings was the liberal use of concrete, with but one exception all the walls being of that material. From an article in a recent issue of the Railroad Gazette on this plant we take the following items in regard to the proportions of the concrete and the cost per cubic yard:

The concrete use in this work was in some cases made with an aggregate of engine cinders, in general with the proportion of one part of cement, three of Edison sand and six of cinders. Gravel aggregate was also used, composed of gravel as it came from the bank, mixed with sand and unscreened. About one per cent was in cobble-stones two inches in diameter and over, the balance all sizes of gravel and sand to the smallest. When this was employed it was mixed with cement only, the amount of cement used being determined by experiment. In all cases the concrete was mixed very wet, so that no ramming was required. After being deposited it was pulled with a light wooden rammer to secure an even distribution. No attention was paid to the weather, concrete being mixed and deposited in any weather in which the men could work.

When the temperature dropped below 25 degrees all water used was brought nearly to the boiling point and salted; using one pound of salt for eighteen gallons of water. When the work stopped at night it was covered with canvas between the forms and sprinkled with salt. The forms for the work below ground were of rough hemlock; above ground, of yellow pine painted with soft soap, which gave a smooth surface. No provision was made for expansion and contraction from temperature changes with cinder concrete. This is good practice, but in gravel concrete a joint should be made about once in 150 feet. Some of the concrete was mixed by hand, some of it in mixing machines. Wherever the walls were less than eighteen inches thick it was found that hand mixing was more economical, the labor cost for mixing and depositing the concrete being frequently as low as 50 cents per cubic yard. Where the machines were used the cost of mixing was reduced; but the cost for handling and depositing was so much increased as to overbalance it. In general, it may be said for building work that no machine mixer is economical that can not be transported as easily as a wheelbarrow. — National Builder.

The value of water meters in checking water waste in a city where the capacity of the works is reached and any unusual draft produces unpleasant consequences, was well indicated at the recent convention of the American Water Works Association by Mr. Jerry O'Shaughnessy, superintendent of the Columbus, Ohio, water department. The same facts are mentioned as follows in the last annual report of Mr. Charles E. Bolling, superintendent of the Richmond, Va., water department: "Had we not adopted the meter system, Richmond would undoubtedly have experienced a water famine this winter, due to the constant stoppage of the water-power pumps from ice and the excessive waste in fixtures to pevent bursting of pipes. For comparison, in 1893, during a long cold spell, the average pumpage per day was 17,000,000 gallons. Our reservoirs were nearly empty, and there was little or no pressure along some of our principal streets. During this long cold season the daily pumpage has been 14,000,000 gallons, at no time a scarcity of water in the reservoirs, and the pressure on the mains has been ten times greater than in 1893."

The Best Sand to withstand **Fire** is the Sand that is all Sand, namely,

Water Washed Sand.

It is the Best. It is the Cheapest.

SAND & DREDGING, Limited

Tel. M. 4507 John Street Dock, TORONTO

JOHN S. FIELDING
Mem. Soc. C. E. West Penn. '87.
CONSULTING ENGINEER.
Dams, Mills, Bridges, Machinery.
Room 41, National Trust Building,
20 King Street East, TORONTO, ONT.
Telephone Main 3488.

J. A. L. WADDELL, Mem. Can. Soc. C. E., Mem. Inst. C. E., Mem. Am. Soc. C. E.
IRA G. HEDRICK, Mem. Can. Soc. C. E., Mem. Inst. C. E., Mem. Am. Soc. C. E.

Waddell & Hedrick
Consulting Bridge Engineers
KANSAS CITY, MO.
Canadian Head Office:
Manning Chambers, TORONTO, ONT.
Montreal Office: 185 St. James Street.

PALMERSTON BOULEVARDE, Toronto
Is to be paved with the Bitulithic pavement.
It has been laid in London, Chatham, Montreal and Glace Bay and contracts have been awarded to us for 16,000 sq. yds. in Walkerville, Ont., also for the Driveways around the Dominion Parliament Buildings in Ottawa. Write for particulars and estimates to
The Warren Bituminous Paving Co., Limited
Head Office: 164 Bay Street, TORONTO.

THE LAKEFIELD PORTLAND CEMENT CO., LIMITED
Manufacturers and Sales Agents of
MONARCH BRAND PORTLAND CEMENT
One grade only—Straight Portland. Unexcelled for Strength, Color and Uniformity.
The Recognized Standard Canadian Brand
Used by the Dominion Government, large Corporations and leading Contractors throughout Canada
'Phone, wire or write for prices to
THE LAKEFIELD PORTLAND CEMENT CO. Limited, - Lakefield, Ont.
Long distance 'phone No. 29.