

missions were also examined. The experience with metal posts in a settled community is that the metal proves tempting and the posts or caps do not remain in the original position very long.

Concrete survey monuments have been used with success in southern Ontario for some time and several satisfactory designs are in existence. After careful search of all existing information on such monuments, the design shown in the accompanying drawing was prepared. The length of this monument is $4\frac{1}{2}$ feet, with the base 8 inches square and top 5 inches square, giving a taper of $1\frac{1}{2}$ inches to the sides, with a 1-inch chamfer at each corner. Steel reinforcing bars are placed in the corners of the monument, the bars being $\frac{3}{8}$ -in. round, with the ends hooked. To prevent splitting of the concrete, the bars are wound at four places with No. 10 annealed steel wire. A centre point is provided by placing a piece of No. 10 copper wire in the top of the monument. This piece of wire is 6 inches long and bent so as to anchor to the concrete. After the concrete in the monument is set, the wire is cut off flush with the surface, and the top of the monument rubbed down with a carborundum stone.

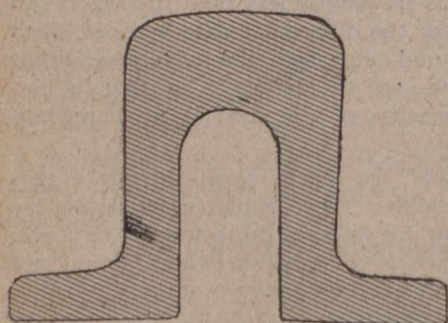
In February, 1918, the department made tests east of Toronto to determine the depth of frost penetration, and in one exposed location it was found that the frost had gone down three feet eight inches. Short square monuments are sometimes heaved by the frost, but the taper given this design and the depth of slightly over four feet to which they are planted, give sufficient assurance against displacement.

These monuments contain $1\frac{1}{3}$ cubic feet of concrete and weigh approximately 200 pounds. During the past winter, when outside work could not be carried on to advantage, farm buildings convenient to the roads to be marked were secured and a number of the monuments cast ready for the construction season. Only a sufficient number to monument a road across one township were cast at one location, and they are being distributed on short hauls by teams or steam tractors as occasion requires. Ordinary post-hole digging tools have been found satisfactory for opening an excavation of the proper dimensions.

LETTER TO THE EDITOR

Old Grand Trunk Rail

Sir,—Enclosed please find section of Grand Trunk Railway 1856 rail, which may be of interest. We received



a short piece of this recently for the Waterloo Historical Society, which is accumulating something of a transportation museum. Our specimen is considerably rust-pitted. It weighs, as it is, about 59 lbs. per yard; probably the original weight was 60 lbs. per yard. You will note that the base is not quite a plane and that the top surface shows apparent slight wear.

W. H. BREITHAUPT, C.E.

Kitchener, Ont., June 3rd, 1918.

SOME ASPECTS OF CHEMICAL TREATMENT AT ST. LOUIS WATERWORKS*

By A. V. Graf,

Chief Chemist, St. Louis Waterworks

THE principal streams contributing to the water supply of the city of St. Louis are the Mississippi, Illinois and Missouri Rivers. The Illinois River enters the Mississippi thirty-three miles north of the intakes at the Chain of Rocks, and in traversing this distance a more or less intimate mixture of the two waters is effected. The Missouri River enters the Mississippi five and a half miles north of the intakes, and causes a pressing of the Mississippi River water upon the east bank of the river, and in this way, as a rule, very little mixing of the two waters occurs by the time the water reaches our intakes. At times the turbidity of the water on the west side of the river is ten times as great as that of the water on the east side, and at other times the color of the east water is 25 parts per million greater than that of the west water, showing the incompleteness of the mixing of the two waters. With a high stage in either river and a low stage in the other, the mixing of the waters is more complete.

Mississippi, Missouri and Illinois Rivers

The waters in each of these rivers have certain characteristics which become of greater or less interest as the stages of the rivers vary. The Mississippi River drainage area being covered with swamps, the water in this river becomes highly colored at times of heavy run-off, while the Illinois River, carrying a large amount of sewage, contains colloidal organic matter, which seems to act as a protective colloid on the turbidity carried by this river. The water in the Missouri River, always turbid, becomes much more so at times of heavy run-off. The dissolved solids in these waters vary considerably, but dissolved solids offer no difficulty in the treatment of the water, and are, therefore, of less interest.

The river water enters our plant through two intakes, one, the old, or west, intake, 1,500 feet east of the west bank of the river, and connected to the wet well by a 7-foot circular, brick-lined tunnel, 2,197 feet long. The other, or east intake, is 700 feet east and 200 feet north of the west intake, and is connected to the wet well by an 8-foot circular, concrete-lined tunnel, 2,747 feet long.

The water drawn through the west intake is principally Missouri River water for the greater part of the year, while the water drawn through the east intake is that of the mixture of the Mississippi and Illinois River waters, although at times the water at both intakes is practically the same, both chemically and physically.

150,000,000 Gallons a Day

The east intake was in service only ninety-seven days during the past year, whereas the west intake was used for three hundred and fifty days. Because of the greater difficulty of treating the water from the east intake, this is not used unless low stages of the river or anchor ice, or both, are affecting the pumping.

The water entering the tunnels flows by gravity to the wet well, whence it is pumped, against a dynamic head of 58.3 feet, into the delivery well, and flows from there to the grit chamber, where the average velocity of flow, at a rate of pumping of 150,000,000 gallons per

*One of a series of four papers on St. Louis Waterworks presented before the convention of the American Waterworks Association, held recently in that city.