It might be a month or more before the forms could be struck with any feeling of security.

The question of consistency is not altogether a laboratory question. The increased cost of materials due to the use of wet mixtures may be more than balanced by the saving in placing; but the engineer should bear in mind that consistency has a direct relation to strength, and if he permits a wet mixture he should provide for the same in his design. In any event he should control the details of the mixing.

LETTER TO THE EDITOR.

A Slide Rule for Sewer Calculations.

Sir,—The writer has had occasion to use the Crane rule in sewer calculations for a considerable time. Some of the changes that he has found it convenient to make in it may be of service to others.

The rule, as at present sold by one of our prominent instrument firms, is believed by the writer to have too many marks on it, and is too small. He had one made for his own use in which everything was doubled in size. The spaces were simply taken off the Crane rule with the dividers, and stepped twice on the new one. It was found necessary to insert marks for 14-in., 16-in. and 27-in. pipes in the third line. The confusing marks for n=.011 and n=.015 were omitted from that line, only those for n=.013 being retained. The McMath formula and the marks for egg-ended sewers were also omitted, the rule being made with only one face.

Another set of marks, in red, on the second line of the rule, shows the mean velocity with pipes flowing full, and has proved very useful in finding the time of concentration in a sewer system. As no mention has been noticed of their use by anyone else, the following description of them may be interesting.

Suppose the red velocity-mark for sewer pipes 15 inches diameter is required. The slide is set with 15 inches on the third line opposite, say, 2 per cent. grade on the fourth line. The mark "full" on the second line is then found standing opposite 8.8 cubic feet per second on the first line, showing that the 14-inch pipe, when flowing full, will deliver at that rate. Divide 8.8 by the sectional area of the pipe in square feet (the calculation of this by the ordinary slide rule is quite near enough): $8.8 \div 1.23 = 7.2$. The mean velocity of the water in the 15-inch pipe at 2 per cent. grade is thus 7.2 feet per second. The slide being retained in the last position, a red mark is made on the second line opposite 7.2 on the first line, and numbered 15 inches. If we wish to know the discharge and velocity at a grade of, say, 0.55 per cent., the 15-inch mark on the third line is shifted so as to be opposite 0.55 on the fourth line, when the black mark "full" on line 2 will stand opposite a discharge of 4.6 second-feet on line 1, and the red mark 15 inches will stand opposite a velocity of 3.8 feet per second on line 1, no other change being required in the position of the slide. A few minutes' work will give the set of red marks for all sizes of pipe.

J. PORTER, B.E.

Vancouver, B.C., April 6, 1915.

Portland cement was manufactured in the United States in 1914 to the extent of approximately 88,514,000 bbls., as compared with 92,097,131 bbls. in 1913. The estimated shipments during 1914 were 86,715,000 bbls., compared with 88,689,377 bbls. in 1913.

TAR MACADAM.

By Henry J. Scott, Toronto.

THIS material has been very much under discussion lately among road engineers and superintendents, particularly during the recent road conference in Toronto. It is now some years since it came into use in England, and considerable experience has been gained since its adoption. It was first sought after as a remedy for the dust nuisance due to the enormous increase of automobile traffic along the highways. Statistics soon showed that, in spite of the increased initial cost, it was economical to use tar macadam, and since then experience has dictated improvements which have rendered it still more desirable.

Sufficient attention was not at first given to the first or foundation layer. In consequence, water percolating through the interstices of the material rendered the substratum soft, with the result that the surface sank in places, making a very uneven road as the first sign of wear. This was particularly noticeable on roads which were, as at first, simply dressed with a coating of tar macadam 2½-in. mesh, and then top-dressed with a finer coating. The next improvement was the scarifying of the old macadam roads and crowning them to the necessary convexity, the water percolating through in this case being drained by the original macadam foundation layer.

This represented a great improvement, but a still better result is obtained by protecting the foundation from wet percolating through the interstices of the 2½-in. metal by first laying a coating of ¾-in. to ½-in. metal. This should be rolled and crowned to a slightly greater convexity than the finished surface is required to be. The 2½-in. metal should then be laid and finished off with another dressing of ¾-in. to ½-in. and rolled with a not too heavy roller.

If sufficient attention is paid to this first foundation layer so as to render it waterproof, a heavy foundation of large stone is not necessary in the case of ordinary highways, where the increasing traffic of a town has not to be dealt with.

Another point to consider is the material. This is divided into two classes: (1) the matrix, (2) the binder and its application.

The first can be again divided into two classes: natural stone and artificial material. Undoubtedly the best matrix is a hard natural stone of close texture, not easily friable with the action of traffic and not susceptible to changes of temperature. A good limestone or granite fills these conditions. Slag, however, from the nature of its production, is full of internal strains, and although a crushing test may show it actually stronger than a natural stone sample, it is always liable to be fractured by a blow, especially after changes of temperature.

A road, subject exclusively to ordinary horse-drawn traffic is subject to a pulverizing action similar to the blows of a hammer. A road subject exclusively to automobile traffic is subject to an entirely different action. There is little or no surface friction, but it is subject to the strain equal and opposite to the impulse required to propel the traffic. This creates attrition between the integral parts of the road. In the case of ordinary macadam roads, perhaps the greatest contributory destructive factor is the suction of the tires which draws out the dust. This is negligible in the case of tar macadam, unless the matrix itself breaks and becomes pulverized.

In the use of slag this contingency is more probable than in the use of natural stone on any road subject to