It is also true that in many cases the local materials are of such poor quality and would require such a large proportion of cement to fulfil the specifications, that it would be economical to bring in better material even from a considerable distance, the saving in cement paying the freight. Specifications of this kind might take some such form as the following, in which all figures are purely arbitrary and in no sense proposed as standard:

The materials used shall be of such quality and shall be used in such proportions as to produce a concrete which shall show a compressive strength of 2,500 lbs. (or 2,000 lbs. or 1,500 lbs.) per square inch at the age of 28 days when tested in accordance with the standard methods of testing.

This form of specification is obviously open to modification to cover varying conditions. For instance, to insure against concrete which sets or hardens slowly, and consequently requires forms being kept in place an unusual length of time, the specification may require a certain minimum strength to be attained in three days. Again, in sea wall or tunnel work, requirements as to permeability or density may be inserted either in place of, or in addition to, the strength requirement.

It would probably be desirable to add some further qualifying clauses, such as the limit of size of particles, the character of the materials composing the aggregates, freedom from constituents liable to cause deterioration, and the like.

The method at present most commonly employed is practically to ignore the quality of materials except the cement and arbitrarily to specify proportions that will give good results with almost any aggregates. Wherein lies the incentive to a contractor or builder to use any better materials than the cheapest if he is compelled by the specifications to use a certain arbitrary mixture, regardless of quality or material?

Any specifications for concrete aggregates which are to be used all over the country, must be so drawn that any material which will make concrete of the required quality will be included.

In operating under such specifications, it is of great importance that specimens of the concrete produced be regularly made and tested. It is also of the greatest importance that a close day-to-day check be maintained on the quality of the materials used, so as to insure a reasonable uniformity, and to know that these materials are at least equal in quality to the materials used in arriving at the proportions required to give the quality of concrete called for in the specifications.

Having once established by test the suitability of sand and stone for any grade of concrete and having determined the proper proportions in which to use them to attain a certain desired result, it is only necessary thereafter to see that the size, grading and proportions of these materials are reasonably constant to insure uniform quality of concrete. Such a check on size and grading should be had on each and every shipment of material and is easily obtained with a small set of sieves, or in the case of sand, which is by far the more important material, by means of a self-contained sand tester.

The regular and systematic testing of the size of the aggregates gives data which will permit the engineer to tell without further tests, whether the aggregates will produce a better or poorer concrete than that produced by the original or standard sample. This fact is based on the well-established principle that, other things being equal, the aggregate whose granulometric-analysis curve most nearly approaches the line of maximum density will produce the best concrete. This makes it possible to determine with reasonable certainty which two sands of the same kind and from the same source, but differing only in fineness, will make the better concrete.

NEW LOCOMOTIVES ON THE T. & N. O. RY.

The Temiskaming and Northern Ontario Railway has recently purchased from the Canadian Locomotive Co., Kingston, six Mikado locomotives. These are the first engines of this type to go into service on this road, up to the present time the ten-wheel and Pacific type having been used in handling their passenger trains, and ten-wheel and Consolidation type being used for freight service.

In purchasing these locomotives, the commission, after careful consideration of the question, decided to secure a type equally adapted to both freight and passenger service, the latter having recently become somewhat too heavy at times for their previous heaviest type of passenger engine.

In arranging the design care was taken to have as many parts as possible interchangeable with the railway's standard Consolidation type engine.

The boiler is of the extended wagon-top type with sloping throat and back head and fire-box roof sheet, outside diameter at the front end 71 inches, and at the dome course 78 inches. There are 202 two-inch tubes and 32 superheater flues, the length being 20 feet over tube sheets, and the bridges between the tubes are 7/8 inch wide. The fire-box is 96 ins. long by 75 1/4 ins. wide inside the sheets and the back tube sheet is 5/8 in. thick. Water space at the front of fire-box is 5 1/2 ins. wide and at the sides and back 4 1/2 ins. The total heating surface, including superheater, is 3,981 sq. ft., and the grate area 50 sq. ft. The smoke boxes of four of the engines are equipped with the usual Master Mechanic's standard arrangement for front end, while the remaining two are fitted with the Mudge Slater arrangement, these latter being for test purposes. On account of the line of the T. & N. O Railway running for the greater part through forest country, it is the endeavor of the railway to provide the most modern devices obtainable for the elimination of danger of fires from engines throwing sparks.

The main frames are of vanadium steel 5 ins. wide throughout, spaced 43-in. centres, the front extensions being cast integral with the main frames. The equalization system divides between the second and third pair of driving wheels and the springs throughout are of vanadium steel, the driving springs being composed of 5-in. 7/16-in. plates.

The cabs of these engines are of a type new on the T. & N. O. Railway, and are an adaptation of the design used by the Russian government on the engines built at the Canadian Locomotive Co.'s works for the Siberian railways. This design provides considerably more protection for the engine crew in winter, which is very necessary in this climate and although enclosed all round should not be uncomfortably warm in summer as provision has been made for ample ventilation.

The principal dimensions of these locomotives are as follow: Gauge, 4 ft. 8 1/2 ins. Cylinders, 25 ins. by 30 ins.; driving wheels, 63 ins. diameter; working steam pressure, 180 lbs. Weight on driving wheels in working order, 197,000 lbs.; on front truck, 29,550 lbs.; on trailing truck, 31,500 lbs.; total, 258,050 lbs. Weight of tender loaded, 145,000 lbs. Driving wheel base, 16 ft. 6 ins.; total engine wheel base, 34 ft. 8 ins.