SAND AND GRAVEL.

By R. W. Stone.

ROAD MATERIAL.

Military preparedness includes in time of peace the construction of permanent trunk highways and in time of war the hasty improvement of roads that lead from military bases to the line of action. Improvement of roads under war conditions would in most places mean surfacing with a mixture of sand and clay or of sand, clay, and gravel. This material is abundant; in fact, there are few areas in the United States where a good supply can not be had within a reasonable distance. The United States Geological Survey is in touch with thousands of producers of sand and gravel, and many of its detailed geologic maps show the distribution of the deposits.

GLASS SAND.

The glass-making industry is in no way dependent on foreign supplies for its sand, salt cake, soda ash, and limestone. Our resources in these materials are ample. Most of the output of glass sand comes from a belt of States extending from New Jersey to Missouri. Illinois, Pennsylvania, and West Virginia are the largest producers, and Illinois leads, producing well over 500,000 tons, largely by disintegration of the friable St. Peter sandstone. California is the only State west of Oklahoma that produced glass sand in 1915.

Glass sand has formerly been brought to this country in ballast from European ports, but the present conflict cut off this small importation. The war, by unsettling general business conditions, for a number of months put a damper on the glass industry in this country. Later, however, business has increased, building operations are active, demanding large quantities of window glass, and furthermore glassware is now being exported in quantity to Europe and to the countries which the European glass industry formerly supplied. Consequently the glass industry is booming, and as a corollary the production of glass sand has increased. The output in 1916 approxi-

mated 2,000,000 tons and was thus larger than it has ever been. On account of the higher wages and the increased cost of machinery and of all supplies, particularly coal, the price of glass sand, which has been decreasing in the last few years, showed an upward tendency in 1916.

The glass-sand deposits in this country are very extensive and are found in many States. Many deposits of high-grade material are undeveloped. Quartz sand suitable for making cheap glass occurs in great quantity in the white dunes on the coast of California and along the shores of the Gulf of Mexico and in the white quartzite and sandstone in many parts of the country. Most of the glass factories in this country are located with relation to large supplies of the cheap fuel—natural gas—so that West Virginia, Pennsylvania, and the Ohio Valley contain most of them.

MOLDING SAND.

The new requirements of armament and munitions have caused foundries and machine shops to increase their output, and this activity is in turn reflected in the molding-sand industry. The total production in 1915 was 3,500,000 tons, more than two-thirds of which came from New Jersey, New York, Pennsylvania, and Ohio. This was 750,000 tons more than the output of 1914. The statistics for 1916 are not yet available (April, 1917), but it is confidently expected that they will show 4,500,000 tons produced in that year. This country has unknown quantities of molding sand of different kinds, such as that required for light and heavy iron and steel castings. The developed deposits are very largely in the Eastern States, because that is where most of the foundries are situated. As freight rates practically prohibit long-distance shipping of this heavy and cheap commodity, little search has been made for deposits in the Western States, where the demand for molding sand is small.

Up to 1914 molding sand was annually imported from France for use in casting bronze. The French sand is used for facing the molds, and as most of the casting done in it is art work, the curtailment would not seem to be serious in a time of national stress. In response to requests from importers of the French sand and from bronze molders the United States Geological Survey has sought for a domestic substitute and is now able to announce that sands which on preliminary tests prove to be satisfactory substitutes for the French molding sand have been found near Albany, N. Y., and Zanesville, Ohio. Bronze and brass castings made at Government arsenals and navy yards for many years have been poured in sand from the Albany district; commercial foundries and manufacturers use sand from Albany, N. Y., Windsor Locks, Conn., and several localities in Ohio for fac-

ing molds for brass and bronze castings that do not require the extremely fine finish of art work. The supply at these places is abundant, and the country seems able to meet any requirement in quality and quantity of molding sand.

ABRASIVE SAND.

Sand suitable for grinding and polishing, ranging from small gravel for use in sand-blast work on heavy castings to the fine material used for giving a polish, is abundant, and the country produces about 1,000,000 tons annually. Pennsylvania is the leading producer and in some years furnishes one-half of the output. The present activity in the production of armament will call for an increased production of this material, for it is the practice in large foundries to clean castings by sand-blast.

GENERAL CONDITIONS.

The sand industry in all its branches grows normally with increase of population. Severe business depression decreases the production of building sand more than that of sand for some other uses, such as engine sand, which is used wherever trains and trolley cars run. Business acceleration increases the output and use of all kinds of sand. The value of all the sand and gravel produced in 1915 of which the United States Geological Survey has a record was over $23,000,000. The statistics for 1916 are not yet available (April, 1917).

AID BY GEOLOGICAL SURVEY.

An important part that the United States Geological Survey plays in the sand and gravel industry, aside from collecting and publishing statistical data, consists in answering questions regarding the usefulness of samples submitted for examination and directing inquirers to a source of supply of sands for special use. For example, within a few days after this country declared its participation in the war the Geological Survey directed an important laboratory to sources of glass sand for optical purposes, for which it was specified that the sand must contain less than 0.05 per cent of iron and over 99 per cent of silica; an importer of bronze molding sand was informed of localities in this country that can furnish a satisfactory substitute; and a maker of egg-boiling timers who can no longer procure the customary foreign sand was furnished with samples made by the Survey from domestic sand which fill the specifications calling for round grains passing 150 mesh.

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