

this cost may be looked for as proficiency in practice and as mechanical appliances for the work are developed.

Bituminous Concrete (mixing method).—This type of construction has caused a great many disputes owing to the fact that there is a certain patent covering the use of stone and bitumen mixtures under certain specification. However, it has been pretty well established that if the maximum size of stone is not any greater than $\frac{1}{2}$ -in., and furthermore, if less than 10 per cent. is retained at $\frac{1}{4}$ -in. screen, regardless of the method of grading of mineral aggregate which will give the densest mixture there is no infringement of the above-mentioned patents.

This method of construction is well adapted to the improvement of an old macadam road where it is desired to introduce a better pavement at a minimum expense under moderately heavy traffic conditions. It is more expensive than the penetration method, but is more certain in its results, and more suitable for heavy traffic. This method involves a considerable expense for machinery, namely, heating and mixing plant, and with its first cost, as before stated, has led to the development of the penetration method.

Construction.—The mineral material composing the wearing surface is mixed with a sufficient quantity of bituminous material, approximately 15 gallons of tar to 1 cubic yard of material (stone). This mixing is usually done at a plant off the roadway itself and even some distance from the road, though it is preferred that mixing be done on the work.

One of the most common mixing and heating outfits is the Link-Belt portable plant. This machine is 27 ft. long and weighs about 17 tons. Practically all of the mechanism is housed in. This plant consists of melting kettles, a dryer, a dust blower and a mixer. The material is shovelled into one end of the machine, passes through the dryer and thence into the mixer, where it is mixed with the bitumen. The power for operating the machine is obtained by belting it to a tractor or road roller. The heat for the dryer, the melting kettles, etc., is obtained by means of fire boxes underneath the machine, in which coal is burned as fuel; the hot air passing around the various parts of the machine.

The mixture should be put on the road at a temperature of not less than 220° F. The prepared foundation should receive a slight sprinkling of the bituminous material as a binder coat. On this foundation the bituminous concrete is laid and raked into place and then thoroughly rolled with a 10-ton steam roller, until no further impressions occur, to desired thickness, usually $2\frac{1}{4}$ ins. Sometimes a lighter roller is used. This surface is then given a seal or flush coat of hot bituminous material, about $\frac{1}{4}$ gallon per square yard, and covered with fine stone screenings and again rolled. In places of this flush coat the surface is sometimes dusted with a coat of Portland cement to fill any surface pores.

With this method a maximum density is sought, using stone carefully graded from fine to large. The requirements of engineers vary to a considerable extent, due to different kinds of aggregate employed; in some cases, one size crusher-run stone is used; again, combinations of broken stone and sand are used. The following specification is adopted in many places in the United States:

Passing 10-mesh sieve....	1.0 per cent.
Passing $\frac{1}{4}$ -inch sieve....	5.5 per cent.
Passing $\frac{1}{2}$ -inch sieve....	30.8 per cent.
Passing $\frac{3}{4}$ -inch sieve....	34.2 per cent.
Passing 1-inch sieve....	23.4 per cent.
Passing $1\frac{1}{2}$ -inch sieve....	8.1 per cent.

Cost.—The average cost per square yard for this method is about 60 cents over and above waterbound macadam.

The advantages claimed for this method (mixing) are uniformity of surface and of composition of same, maximum value of surface for materials used, economy in use of materials, maximum life of surface and economy of results.

Carpet Coat (bituminous surface).—Surface treatments may be divided into two principal classes, based upon the material used, namely, (1) Those in which tar is used; and (2) treatment with oil.

The method of surface treatment is only applicable to road surfaces already finished by other methods—usually to old or new waterbound macadam.

Two classes of tar are commonly used, one a refined coal tar with a comparatively low melting point, but not fluid at ordinary summer temperatures; the other a refined coal tar which is fluid at ordinary temperatures.

The tar surfaces have the advantage of being much cleaner than oil surfaces in wet weather. The oil surface being softer and more adhesive, holds the dirt and dust upon the surface, while the tar hardens and nothing adheres to it.

The tar road for this reason maintains a better average condition throughout the year than an oiled road. On the other hand, a tar surface is more slippery than the oil, and will, in cold weather, harden and crumble to an extent depending on the season and the kind of traffic.

The use of the first class of tar is more suited to roads of fairly heavy traffic than the second class of tar. Two coats of the latter class give about the same service as one of the first class, and at about the same cost.

The method carried out in this treatment is to clean the old surface of road to be treated free from all dirt and fine material. After such cleaning and when surface is dry, the tar is applied at a temperature of about 180° F. from a tank wagon drawn by steam roller, in a manner described in penetration method. A steam pressure of about 10 lbs. per square inch is applied to the bituminous material. This also keeps the tar hot. This surface is immediately covered with stone screenings, or preferably pea gravel, and rolled. This forms a hard crust, is firmly bound to the surface, and resists all abrasion from motor cars. Where heavily loaded, iron-tired wagons use this type of surfacing, the crust has a tendency to break up, especially in cold weather, and an annual treatment is necessary and will maintain the road in excellent condition.

The amount of tar used is usually $\frac{1}{2}$ gallon per square yard.

The cost of this treatment varies from 8 cents to 14 cents per square yard; even as low as 6 cents per square yard has been recorded, including material and labor.

The advantages claimed for this method are simplicity of work, economy of first cost, and in many cases, economy in the long run, lack of serious interruption to use of road, ease of repairs and renewal.

Satisfactory results have been obtained under this method, and it is believed that it offers an easy and economical way of revivifying a macadam or gravel road otherwise about to need resurfacing at a far greater cost.

Snow removal this winter in New York City has cost \$1,150,000. The regular contractors' outfit engaged on the work totalled 2,500 men and 1,200 carts. The emergency gang was composed of 9,000 men, besides the 3,000 regular street cleaners. Motor snow plows to the number of 120 aided in the work. Wherever possible the snow was disposed of in sewers.