

will have much to do with the ultimate life of the pavement.

Sand.—The careful grading of the sand particles has received more study in recent years, with the result that the modern specifications are as follows:

200 mesh, 0 to 5%			
100 mesh and retained on	200 mesh,	10-25%	
80	"	100	" 6-20%
50	"	80	" 15-40%
40	"	50	" 10-30%
30	"	40	" 8-25%
20	"	30	" 5-15%
10	"	20	" 2-10%
8	"	10	" 0-5%

Particular attention is called to the large percentage of particles which must pass the 80-mesh sieve and the small amount which pass a 20, 10 and 8-mesh sieve.

It is unusual to find a sand which can comply with both the fine and the coarse requirements of these specifications. The writer is at present engaged in the laying of a considerable amount of sheet asphalt pavement under these specifications in the city of Norfolk, Va., and it has been found necessary to secure two sands in order to produce a blend which meets the requirements of the specifications. The fine grain sand is secured in North Carolina, and the coarse sand is secured by dredging in the Chesapeake Bay. A blend of three parts of the former to one part of the latter produces a mixture which complies in every respect to the requirements of the standard specifications.

The exact quantities of materials used in making a nine-cubic-foot box of our Norfolk paving mixture are as follows:

Sand	880 lbs.
Carbonate of lime	170 lbs.
Asphalt cement	127 lbs.
	1,177 lbs.

A nine-foot box of this mixture lays approximately 5.28 square yards of finished pavement two inches thick after compression with a steam roller weighing not less than two hundred pounds per inch width of tread.

Asphalt Cement.—The requirements of asphalt cement are that it shall be composed of refined asphalt or asphalt and flux prepared in the proper proportions and melted in such a manner that they shall be blended into a homogeneous mixture complying with the following requirements:

- It shall be thoroughly homogeneous and shall not be oily to the touch.
- It shall have a penetration between 40 and 75 at 77° F., depending upon the sand and asphalt used and traffic upon the street on which the pavement is to be laid.
- It shall not flash below 300° F. when tested in a New York State closed oil tester.
- When heated in an open tin at a temperature of 325° F. for five hours in a hot air oven, it must not show a loss by volatilization of over 5% and the penetration at 77° F. of the residue left after such heating must not be less than one-half of the penetration at 77° F. of the original sample before heating.
- When the pure bitumen of the asphalt cement is brought to a penetration of 77° F. of 50 and made into a briquette having a cross section of 1 sq. cm. it shall

have a ductility of not less than 20 cm. at 77° F., the two ends of the briquette to be pulled apart at the uniform rate of 5 cm. per minute.

When the asphalt cement as used has a penetration greater than 50 at 77° F., an increased ductility of 2 cm. shall be required for every 5 points in penetration above 50 penetration.

Binder and Laying.—The binder mixture shall be heated to a temperature of between 200 and 325° and shall be mixed with from five to eight per cent. bitumen. On reaching the street it shall immediately be dumped on the concrete and at once spread with hot shovels and rakes to the required thickness, after which it shall be thoroughly rolled. No more binder shall be laid at any one time than can be covered by two days' run of the paving plant on surface mixture.

Wearing Surface.—The sand and the asphalt cement shall be heated separately to such a temperature as will give, after mixing, a surface mixture of the proper temperature for the materials employed. The sand when used must be at a temperature of between 250° F. and 375° F. The asphalt cement when used must be at a temperature between 250° F. and 350° F. The filler shall be added to the hot sand in the required proportions, and the two thoroughly mixed. The asphalt cement in the proper portion shall then be added and the mixing continued for at least one minute.

Laying.—The surface mixture shall be brought to the street in wagons at a temperature between 230° F. and 350° F., and shall be covered with canvas covers while in transit. It shall then be dumped on a spot outside of the space on which it is to be spread. It shall then be deposited roughly in place by means of hot shovels, after which it shall be uniformly spread by means of hot iron rakes in such a manner that after having received its final compression by rolling, the finished pavement shall conform to the established grade and have a thickness generally of not less than two inches.

The modern sheet asphalt specifications generally require a binder course from one to one and one-half inches in thickness, and a surface course from one to one and one-half inches to two inches in thickness. I have never been able to discover to my satisfaction why it has been found necessary to have such a thick wearing course, as of 2 inches. It is a well-known fact that generally after a surface course has worn much over one-half to three-quarters of an inch that the remainder of the course disintegrates very rapidly. Would it therefore not be better to reduce the thickness of the surface course to one inch, and increase the quality and thickness of the binder course by having a very dense mixture of sand and stone mixed with the proper percentage of asphalt cement, and of a thickness approximately two inches? A pavement of this type laid under my direction more than three years ago has given very good results, and especially in view of the fact that it was laid on a macadam foundation.

The St. Thomas-Windsor extension of the Hydro-Electric power line has been decided upon to pass through St. Thomas, Ridgeway, Rodney, Dutton, and a number of other points. The route selected will allow easy construction, and will be in proximity to the Michigan Central right-of-way. It will serve the largest area and the most thickly-populated district of any route under consideration. The entire line is 112 miles in length, and the construction of it is being commenced.