Bituminous Materials for Road Construction

Standards for Their Test and Use.

At a recent meeting of the American Society of Civil Engineers a special committee was formed to report on Bituminous Materials for Road Construction, and the following extracts taken from its findings should be of interest to our readers.

For more than fifty years (the committee observe) the use of bituminous materials of various kinds has prevailed in highway work to a greater or less extent in the United States, and for a longer period in some other countries. Except in the cases of a few materials, this use, until within ten years or less, had been marked by the variety of materials used, the variety of methods of use, the variety of results secured, the lack of standards for materials, methods and results, and the lack of appreciable advance in the science and art underlying the results.

In the exceptions referred to, which are meant to include the sheet asphalt and certain bituminous concrete pavements, it may be said that progress had been steadily, if somewhat slowly, made in the sheet asphalt work, and that the development of the bituminous concrete pavement rapidly advanced the science and art of bituminous pavements generally.

Howover, even including both these cases, as late as six years ago (1909) standards for materials were lamentably lacking. It was then customary, even where the specifications were otherwise all that could be expected, to describe the bituminous material by its trade name or as "equal to" Higha particular brand of fairly well-known character. way authorities generally knew little or nothing as regards means of identification of bituminous materials-even the asphalts coming under this statement-and no considerable agreement existed among engineers or chemists connected with highway work as to the analyses and tests desirable to be made on either the better-known asphalts or on the newer materials offered for use. A suggestion then madeto the effect tha tbituminous materials could and should be purchased under specifications which would describe their essential characteristics-met with discouragement and even ridicule from many quarters.

At the present time it may be said that a number of important questions concerning the use of bituminous materials in highway work are desirable of investigation or of solution. Some investigations have been begun, but as yet have not been concluded successfully, mainly because of lack of sufficient time for the proof of certain principles. Other investigations should be begun and pursued under such a variety of conditions as will render the conclusions of general value. As the committee has before stated (in its report dated January, 1912), it believes "that, in order to solve many of the problems of construction and maintenance, it is more necessary to have at hand physical data recorded along uniform lines for a relatively short period than to prove the correctness of certain fine theoretical and therefore it again urges resistance to a tenpoints,' dency, apparent in some instances, to ignore the opportunity offered by the committee for collaboration, which would result in mutual benefit, and depreciates any tendency to return to the former chaotic conditions which would ensue from individual, non-current effort.

General—The Committee deplores the tendency, apparent in some quarters, to devote time and energy for the discovery of "the most satisfactory road surface," and expresses its conviction that there is no such thing as a "panacea" for all highway ills. It believes that, with the development of highway work, it should be constantly more apparent that one of the greatest problems to be solved by highway engineers is the proper selection of the particular material and form of construction to be used, which most efficiently meet the conditions of any particular case, and that progress will be hastened by complete recognition of this fact.

Most materials and methods of use of bituminous materials have their values, and the real problems are the determination of these values and of their adaptability or fitness to meet the conditions of any case properly.

A bituminous surface or pavement properly designed for carrying light motor vehicles may not be the one best adopted to horse-drawn vehicles, and one which is efficient to horse-drawn vehicles may be most seriously injured by motor vehicles. A solution of the problem of the proper design and construction of a roadway for mixed traffic is, under any local conditions on which the solution ultimately depends, difficult, though facts are accumulating which may finally permit this solution.

It is still desirable to record the characteristics and details

(including cost figures) of use of bituminous materials and great concordance in so doing is most necessary.

Construction—Materials—Your committee is agreed that: For the present, at least, whenever comprehensive specifications are to be prepared so as to admit a variety of types of bituminous materials, separate specifications as may be necessary should be prepared for each type.

Where bituminous pavements are laid, the edges should be protected and a sudden transition from the pavement to any softer shoulder material avoided by means of cement concrete or other edgings, and such reinforcement of the shoulder material as may be necessary.

Whatever method may be used, in any case it is essential, as in water-bound construction, that a suitable quality of road metal be used.

By proper selection and use of the bituminous material, injury to property and deleterious effects upon animal and vegetable life may be avoided, and also considerable hygienic advantage may result from the use of such materials on the highways.

The quantity of bituminous material to be used in any case will depend on the peculiar conditions of that case, such as the kind of road metal and of bituminous material, the character of the aggregate, the climatic conditions, etc.

The fluidity of the bituminous materials used should be sufficient to ensure a proper coating of the mineral particles, and such fluidity may be obtained by heating, provided the degree of heat is not excessive or sufficient to injure the bituminous materials, and is reached through proper methods.

The bituminous material should possess adhesive and cohesive qualities sufficient to enable it to perform its purposes properly under the conditions of any case, and it should not be of a greasy character.

The adhesiveness, cohesiveness, resiliency, and elasticity of the material should have the greatest possible permanence.

The success of results depends largely on the use of proper sizes of the particles, and on securing a proper density of the mixture for the local conditions.

The character of the mineral aggregate to be used may be controlled by local conditions, but the best results can only be obtained by the use of the best materials. Excessive sizes, or excessive variations in the size of the mineral particles, should be avoided, and the utmost care must be taken to avoid the segregation of particles of different sizes.

Mixing machines should be used, and hand-mixing methods should be avoided wherever practicable.

The success of results is greatly dependent on the degree of uniformity obtained in spreading the mixture, and on the proper rolling and compacting of the mixture. Too heavy a roller should not be used.

Care should be taken in prescribing or laying any seal coat that invication or excuse is not given for inferior prior work and its concealment by such a seal coat.

The use of fine sand on top of bituminous concrete is open to grave objections, and the use of clean stone chips or small gravel free from particles that will pass through a tenmesh sieve seems preferable.

Trap rock in sizes greater than that passing a 2-in screen should be used with caution in the construction of the upper course.

Construction—General.—Your committee is agreed that: The use of any form of a bituminous pavement or bituminous surface does not preclude the necessity for the construction of a well-drained, thoroughly compacted, and adequate foundation. In fact, such improvement of the highway frequently attracts heavier traffic, and thus increases the stresses on the sub-grade.

The proper treatment of a broken stone, gravel, shell or slag roadway with bituminous material for the purpose of eliminating the so-called dust nuisance will at the same time render even the best of such roadways more efficient for sustaining traffic, and such treatment with bituminous materials is usually preferable and more economical than sprinkling with water or the use of hygroscopic salts.

An objectionable slipperiness of bituminous pavements or bituminous surfaces may be decreased or prevented by proper precautions during construction or by proper treatment thereafter.

The crown generally used in the construction of broken stone roadways is excessive when bituminous materials are used, and a crown of even $\frac{1}{2}$ in. per foot should be avoided when a lesser crown can be secured without detriment to the surface drainage.