## ASPHALT PAVEMENTS\*

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HE broad subject assigned to me is far too comprehensive to fall within the scope of a single paper. We will therefore brief those parts which are of historical or general interest, and pass on as quickly as possible to the consideration of the phases of the subject that are of present-day interest to the modern roadbuilders of North America.

The sheet asphalt pavement is not a modern invention. This material was used for street covering purposes by the ancients, and sections of it have been dug up with the Other evidences of past civilizations. Having in mind the centuries that have elapsed since its first employment as a street pavement, the surprising thing is that so little progress has been made in its development, and practically none until recent years.

## American Asphalt Introduced About 1870

The European asphalt pavement is the rock asphalt, it being prepared from native bitumen-impregnated rocks. The natural substance is ground to a powder, heated, spread and then compacted by tamping or very slow rolling. To secure the best results, two or more rock Powders from different sources and having different characteristics are combined to produce a better grading of mineral aggregate and a more satisfactory bitumen content. Many very good asphalt pavements have been laid with this material in Europe, and some on this side of the

The American asphalt pavement was first produced by E. J. De Smedt about 1870, and may be considered as an attempt on his part to imitate, at a less cost in this country, the rock asphalt pavements of Europe. Europeans still term rock asphalt pavements as natural and the American product as an artificial asphalt pavement. As has happened in many other cases, the substitute leaves nothing to be desired of the original.

The first asphalt pavement of the American or artificial type to attract wide attention was that laid on Pennsyl-Vania Avenue in the city of Washington, D.C., about 1876. Congress provided that this national thoroughfare should be paved with sheet asphalt from the Capitol to the White House, that section east of Sixth Street to be rock asphalt and the section west thereof to be artificial asphalt. Previous sections of pavements laid in other cities had been of but small yardage and of an experimental nature.

# Mineral Aggregate Most Important

The modern asphalt pavement consists of a mineral aggregate of specially graded sand and impalpable dust, thoroughly mixed, and bound together with asphalt Cement. Roughly speaking, the mineral aggregate is 90 Per cent. by weight or 75 per cent. by volume, the specific gravity of the bitumen in the asphalt paving cement being but slightly more than that of water. The grit mixtures and the "stone-filled" sheet asphalts are the same with a small proportion of fine stone chips added, not usually

The asphalt paving cement is, of course, a vital over 30 per cent. matter, since we could not have an asphalt pavement with-Out it. More pavements fail to-day, however, because of the lack of an understanding of the necessary require-

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ments for the mineral aggregate, or carelessness or ignorance in the making of the paving mixture. Our public officials frequently go to great lengths to make sure that the materials furnished are what they should be, and then permit those materials to be spoiled at the asphalt mixing plant.

Many good asphalt cements are on the market to-day. They are manufactured from crudes found in Mexico, California, Trinidad, Bermudez in Venezuela, and elsewhere. All are of so nearly equal value that only the uniformed or specially interested will to-day pay a great difference per square yard for asphalt pavement in which one or the other has been properly used. The per square yard competitive basis, under carefully drawn specifications crude materials they are made nor by whom. Some public in wholesome communities.

### Penetrations of Asphalt Cements

Asphalt cements need testing no matter from what crude materials they are made nor by whom. Some public officials do not seem to think so; but could they know how well they are spotted by the supply houses, and how carefully this frame of mind is cultivated for them, they would very soon change these views. Doubtful material, or material that has been condemned by some careful official who does have his deliveries tested, is always shipped to the other man.

The consistency or penetration of the asphalt paving cement is the first point to which we look. In a material that is pure, and with a mineral aggregate that is properly graded, it is customary to use the following classes of material for the different conditions of traffic in this climate:-

Heavy traffic ...... 45 to 55 penetration 

Unless otherwise specified, all penetration tests are made with a No. 2 standard needle acting for five seconds under a load of one hundred grams at 77 deg. Fahr.

The ductility and other tests are of great importance in determining the quality of the asphalt cement, but they are more particularly the concern of the asphalt chemist, and must receive close attention at the laboratory. The field engineer should be in close touch with the chemist and know the general characteristics of the asphalt cement he is using, but we will pass these points for the present to discuss others that are of more immediate importance to the greater number of us:

#### Cut-Back Asphalts

Fluxed or cut-back asphalts are so little used to-day that they no longer present a serious problem,—at least, not in Canada. It is much easier to manufacture asphalt paving mixtures from cement that is delivered at the mixing plant at the desired consistency than when the cement must first be manufactured from crude or refined asphalt and flux oil. As a general proposition, the promiscuous cutting-back or fluxing of oil asphalts that have been refined to a hardness greater than that desired, should be discouraged. While it is not necessarily harmful, and might even be beneficial, it is always at least a subject for close question. The native asphalts are naturally so hard that they require fluxing with some other suitable material before they are usable in asphalt paving at all, so the foregoing remarks do not refer to these materials.

The inorganic dust or filler is a factor of prime importance. The material most commonly used is limestone dust pulverized in a grinding mill to such fineness that at least 75 per cent. will pass a standard 200-mesh testing