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[54] COATING REMOVAL METHOD

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[58] **Field of Search** ..... 134/6, 5, 38, 40, 42; 21/60.5 R, 60.5 A; 94/22, 23

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[57] **ABSTRACT**

A method of removing solid surface materials from a solid substrate which comprises applying to the surface materials, preferably as a mixture, water and a relatively volatile, heavier-than-water, water-immiscible solvent for the surface material, preferably in a volumetric ratio of about one part water per part solvent. Water forms an overlying layer above the solvent such that the solvent softens the surface material and there is little solvent loss by vaporization. Subsequently the surface material can be removed by conventional means from a foundation or solid substrate left fit for resurfacing. A preferred solvent is carbon tetrachloride.

10 Claims, No Drawings

COATING REMOVAL METHOD

This invention relates to a method of removing solid surface materials from their foundations or solid, supporting substrates.

Many solid substrates or supporting surfaces are coated with a material that subsequently needs to be removed from the substrate for replacement of the exposed surface coating, for example, road surfaces which typically contain natural or synthetic binders for holding together paving aggregates. As examples, the binder may be a natural asphaltic material or a synthetic resinous solid. Commonly in making a road surface, hot binder material is mixed with mineral aggregate such as crushed stone, gravel, etc. or sand or combinations thereof, and the mixture is placed while in a heated condition on the wearing surface of a pavement or other solid, supporting road bed. The surface is then rolled smooth and allowed to cool. Such paving compositions gradually harden over a period of years due for example to losses of volatile materials from and oxidation of the binder material. These losses cause the binder material to become dry, brittle and unsatisfactory as a binder and result in cracking, raveling and general deterioration of the pavement surface so that it becomes unfit for further use. When pavement surfaces are in this condition, it is customary to either apply an additional increment of new road over the old road and tack the two together with liquid asphalt or road oil, or remove the unsatisfactory dry and brittle asphaltic surface material from its foundation. If the surface is removed, it can be discarded and a fresh new surface relaid on the foundation, or the torn-up material can be reduced in size by mechanical grinders or crushers and blended with for example a binder cutback oil and relaid as a new surface.

Currently, removal of deteriorated road surface materials of the foregoing described types is often effected by softening the material by heat and removing it from its foundations by, for example, mechanical scraping. Such methods, however, are not wholly satisfactory because they require special equipment not always possessed by road contractors. Also the expense of heating and the necessity of maintaining the surface material heated until the time for removal by mechanical means is troublesome to accomplish and can give rise to costly and time-consuming reheating operations.

The method of the present invention provides for the efficient and relatively inexpensive removal from the supporting substrate of the foregoing described surface materials. According to the procedure, water and a relatively volatile solvent for the binder, which solvent is water-immiscible and has a specific gravity greater than water, are placed on the surface material to be removed. Preferably, the water and solvent are combined and then placed on the surface, and such mixture can be maintained under agitation until being placed on the surface in order that the solvent and water remain mixed. In any event the mixture must be unstable so that when placed on the surface material the solvent contacts the binder and the water forms a layer over the solvent which reduces solvent loss through volatilization that would otherwise occur under the ambient conditions of temperature and pressure normally used in the removal operation. The solvent and water can also be applied to the surface sequentially in either order, but the use of the solvent-water mixture is preferred. In any event, the solvent contacts and softens the binder and the overlying water layer serves to hold solvent losses and costs to a minimum. After the binder is softened the surface material can be mechanically removed as by cutting, scraping or combinations of such treatments, and it has been found that the mechanical removal operations are significantly enhanced by the use of the pre-softening procedure. After the removal, the substrate is ready to be re-surfaced. The method of the present invention is thus simple, effective and economical and the water and the heavier-than-water solvent can be applied to the surface by means of conventional equipment used for distributing asphalt cements, cutbacks and emulsions. Most paving contractors possess such equipment and the adoption of the method of this invention will require the purchase of little, if any, additional equipment.

The heavier-than-water, normally liquid solvent for the binder material can be a lower alkyl polychloride such as methylene chloride, chloroform, etc., but preferably is carbon tetrachloride and the specific gravity of the solvent is usually at least about 1.2, preferably at least about 1.4. The solvent is significantly more volatile than water and usually has a boiling point at atmospheric pressure of below about 90°F., often below about 80°F. The amount of solvent employed is sufficient to give the desired softening of the binder in the area of the surface treated, while the amount of water used is adequate to provide an essentially continuous layer over the solvent on the surface being treated. The volumetric ratio of the water to solvent, whether applied to the surface separately or as a mixture is often about 0.1 to 10 parts water per part solvent. Often the ratio is about 0.2 to 5 parts water per part solvent, preferably about 0.5 to 2 parts water per part solvent. Conveniently the mixture is applied to the surface in an amount of about 0.1 to 5 gallons, preferably about 0.5 to 2 gallons, per square yard of distribution area. Both the volumetric ratio and the rate of application of the mixture can vary depending on each other and on such factors as the area and type of material to be removed. The depth and amount of material to be softened for removal can be controlled by the volumetric ratio of the mixture, the rate of application and soaking time prior to removal. As noted above, removal can be by mechanical scraping and any underlying material softened but not desired to be removed can be restored to its original condition by allowing time for the solvent that has contacted the material to evaporate.

The surface materials which can be removed by the method of this invention are solids at ambient conditions and are for the most part soluble in the solvent employed. Asphalts used in surface materials for example as binders in paving compositions, are usually recovered as residua or as bottoms from the distillation of crude mineral oils. These asphalts often have a 100 gram, 5 second penetration value at 77°F. (ASTM D5) below about 300 and are usually applied as hot mix binders for mineral aggregates. Asphalts with these characteristics are often called asphalt cements. Their penetration values can be as low as about 40 and preferably up to about 200. The asphalts which can be removed according to the process of this invention are preferably at least about 99 weight percent soluble in carbon tetrachloride at ambient conditions.

Among the asphalt-like surface materials which can be removed according to the method of this invention, i.e., those having characteristics such as solubility in the solvent, e.g. carbon tetrachloride, and penetration and softening point values comparable to the previously mentioned asphalts, are for example, thermoplastic, petroleum-derived hydrocarbon resins, produced for example by polymerization of an unsaturated petroleum fraction in a relatively viscous plasticizing oil such as an aromatic or naphthenic lubricating oil or a mixture thereof. Such materials are described in U.S. Pat. No. 3,297,625, herein incorporated by reference. Other materials such as natural and synthetic rubbers can be added as desired to improve the properties of the surface coating. Asphalt-like binders can be prepared from a wide range of quantities of such ingredients. For example, the binders can comprise say from about 1 to 10, preferably about 1 to 6, parts by weight of a hydrocarbon rubber such as a styrene-butadiene rubber; from about 30 to 60 parts, preferably about 35 to 45 parts, by weight of a substantially completely polymerized, thermoplastic petroleum-derived hydrocarbon resin having a softening point (R&B) of about 220° to 300°F., preferably about 220° to 260°F., a mixed aniline point of about 20° to 60°C., preferably about 30° to 40°C., an iodine number of from about 70 to 160, an acid number up to about 4 and a molecular weight of about 600 to 1500 as determined by cryoscopic means; and from about 35 to 60 parts by weight of mineral oil of lubricating viscosity. A suitable mineral oil has about 8 to 10 parts by weight of a relatively viscous aromatic oil per part of naphthenic oil.

The following example serves to illustrate a specific use of the method of this invention.

The surface to which the solvent-water mixture was to be applied was a paving mix containing three-eighths inch top size, densely graded aggregate and 6.0–6.5 weight percent of an almost colorless synthetic petroleum-derived hydrocarbon resin of the type described above and quite similar to asphalt and soluble in carbon tetrachloride to the extent of at least 99.0 percent. The pavement surface was ¾ inches to 1 inch thick, very badly cracked and broken up and had been placed over an asphalt binder course. The surface had to be removed before resurfacing could be effected.

A distributor normally used for distributing asphalt cements, cutbacks, or emulsions was filled with an approximate 1 to 1 volumetric mixture of water and carbon tetrachloride. The distributor was equipped with conventional mixing equipment which was used during the distribution period. The mixture was applied at a rate of 0.75 gallons per square yard of surface with each distribution pass 10 feet wide. Forty-five minutes elapsed before scraping began with a scraper conventionally used for grading stone roads. Scraping to a depth of three-fourths inch proceeded at the same rate in feet/sec. as the distributor had traveled. Removal of the surface was satisfactorily and easily accomplished leaving a new surface acceptable for resurfacing. Some softening of this new surface (the asphalt binder course below the surface course) occurred, but in one hour after scraping, the carbon tetrachloride had evaporated thereby restoring the new surface to its original condition. Similar results can be obtained when removing a paving as described in the foregoing example, except that a paving grade petroleum asphalt is substituted for the hydrocarbon resin binder.

I claim:

1. A method of removing surface materials from a solid, supporting substrate, said surface material containing a binder soluble in a normally liquid solvent having a boiling point below 90°F. at atmospheric pressure, which comprises contacting said surface with a normally liquid, water-immiscible solvent having a boiling point below 90°F. at atmospheric pressure and a specific gravity greater than that of water, said solvent in contact with said surface being in an amount sufficient to soften said binder and overlain by water, holding the solvent and water on the surface to allow the solvent to soften the binder, and mechanically removing the surface material from said substrate.

2. The method of claim **1** wherein the solvent is a lower alkyl polychloride.

3. The method of claim **1** wherein the water and solvent are applied to the surface as a mixture.

4. The method of claim **3** wherein the mixture has about 0.5 to 2 parts of water per part of solvent.

5. The method of claim **4** wherein the solvent is a lower alkyl polychloride.

6. The method of claim **5** wherein the solvent is carbon tetrachloride.

7. The method of claim **3** wherein the surface material is a road surface comprised of aggregate and a binder selected from the group consisting of asphalt and normally solid, petroleum hydrocarbon resins.

8. The method of claim **7** wherein the solvent is a lower alkyl polychloride.

9. The method of claim **8** wherein the solvent is carbon tetrachloride.

10. The method of claim **9** wherein the mixture has about 0.5 to 2 parts of water per part of a solvent.

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