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(54) Wheel track repair on paved roads

(57) By a method for repairing wheel tracks on paved roads (2), initially a fraction of relatively large roadstones (3) are laid on the bottom of the track (1). Then a graduated amount of binder is laid across the track (1) and along the side edges of the track such that the greater amount of binder is laid on the areas where the track (1) is the deepest. Finally, a layer of roadstones (4) with lesser particle size is laid across the track (1) and along the side edges.

By the method there is achieved possibility of repairing deeper wheel tracks on road surfaces without having to cut the surface up and then lay hot asphalt. By the method according to the invention there is achieved an even surface with satisfactory drainage. The solution is more durable than by application of cold asphalt in wheel tracks since thicker binder films are achieved.

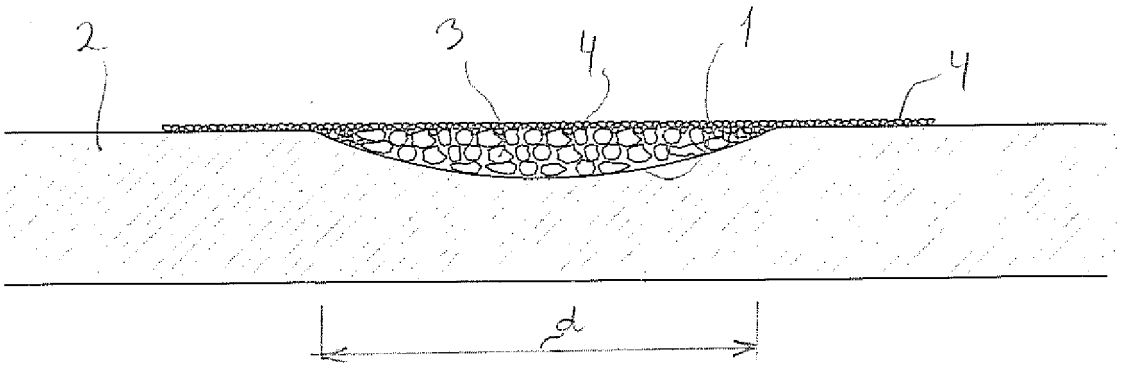

Fig. 2

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Description

Field of the Invention

[0001] The present invention relates to a method of repairing a road surface with longitudinal depressions in the shape of wheel tracks. The invention also concerns a road surface with a wheel track repaired and filled according to the method.

Background of the Invention

[0002] Surface dressing (SD) is a widely used surfacing method on roads with light to medium traffic load here and abroad. There are different types of surface dressing. Common to all is that a well-defined amount of bituminous binder (cutback or bitumen emulsion) is sprayed out and covered by stone materials having well-defined particle size or size fractions in one or more layers. The more layers of stone, the greater the amount of binder to be sprayed.

[0003] In the terminology of the industry, SD is found in several variants, as described below:

1 SD (single SD): Spraying a layer of binder which is subsequently covered by one layer of stones.

1½ SD (racked-in SD): Spraying of a layer of binder subsequently covered by two layers of stone, normally in two different screen fractions.

2 SD: Spraying a layer of binder followed by covering with a layer of stone, spraying of an additional layer of binder which is covered by an additional layer of stone.

2½ SD: Spraying a layer of binder followed by covering with two layers of stone, spraying of an additional layer of binder which is covered by an additional layer of stone.

Sandwich-SD: Laying of one layer of stone, followed by spraying of one layer of binder and finally laying a cover of an additional layer of stone.

SD is normally applied as a wearing surface in the entire width of the road. On roads with shallow wheel tracks, i.e. longitudinal depressions in the shape of wheel tracks, SD may also be used as partial filling of the formed tracks. If cracks are present at the bottom of the tracks, the SD surface will ensure sealing of these cracks.

By laying SD surfaces on roads with some traffic, spraying of binder is performed with a so-called transverse distribution. Here, a computer program and a special design of the spraying equipment ensure that less binder is dosed into the wheel tracks on the road compared with the areas between the wheel tracks. Hereby the risk of the stones "drowning" or being submerged in the binder under the action of traffic is minimised.

A method similar to the Sandwich-SD defined above is disclosed in AU 7642396 A. In this document, the method is applied to flushed areas of chip seal road surfacing occurring when bitumen migrates up through the chip to lie exposed on the surface of the road. The method is applied on the greater part of the shoulder-to-shoulder area of the road.

US 6,821,052 and EP 0 757 735 B1 both describe machines and methods for repairing road surfaces etc., where consideration is made to the shape and type of irregularities in the road surface.

GB 2 102 865 A and US 6,802,464 both describe laying of bitumen in a graded way across the road surface so that some areas are provided a thicker layer of bitumen.

[0004] However, it is not possible to repair deep wheel tracks by the prior art methods. Repairing and filling wheel tracks by the prior art methods often produce a distinct border between the filling and the remaining road surface which is felt by the vehicles as unevenness. Instead, one has to cut up or mill the road surface in its entire width and lay a new surface with hot asphalt.

Object of the Invention

[0005] The object of the invention is to provide a method for repairing wheel tracks on road surfaces whereby significantly deeper wheel tracks can be repaired as compared with the prior art. Furthermore it is the purpose to provide a road surface with a wheel track repaired and filled by the inventive method and by which a more even road surface is achieved after the repair work.

Description of the Invention

[0006] The object according to the invention is achieved by a method of the kind indicated in the introduction and including the steps of:

- laying a first layer of stone material with predetermined particle size fraction at the bottom of the wheel track, followed by
- spraying or laying a greater amount of binder per area unit in an area of the cross-section of the wheel track where the track is deepest than in the area of the cross-section of the wheel track lying at or close to the edges of the track, followed by
- laying a second layer of stone material with predetermined particle size fraction which is substantially less than the first particle size fraction at least across

the entire width of the wheel track.

[0007] By particle size fraction is meant the particle sizes within a certain range provided by screening the stone material. The invention provides that it becomes possible to repair appreciably deeper wheel tracks that hitherto possible by the prior art, and that a more even road surface is achieved. By re-programming an existing computer in the spraying equipment, more binder can be applied at the points where the wheel track is deepest, and less binder can be applied at the edges of the track (which are not so deep). Thereby it is possible to lay several layers of stone where the tracks are deepest. Relatively large stones are laid at the bottom of the wheel track after which spraying is performed at a width corresponding to the total width of the wheel track. Then a layer of smaller stones is laid in the whole width of the track. It may be said that by the invention a Sandwich-SD is provided at the bottom of the wheel track and a 1 SD at the edge. The laying of two layers of stone where the tracks are deepest requires a larger dose of binder which is provided by programming the existing spraying equipment. Moreover, possible cracks at the bottom of the wheel tracks are closed effectively, and an enhancement of the load capacity of the road is indirectly achieved thereby.

[0008] The method is cheap to perform, among others because it implies a much reduced consumption of material as compared with milling/cutting up and laying of hot asphalt. The extent of the repair work, which is limited to the wheel track itself, means minimal inconvenience to the traffic. Moreover, it is possible to adapt the colour to existing road surface.

[0009] By the invention is also provided a road surface with longitudinal depressions in the shape of a wheel track repaired and filled according to the inventive method, where a well-defined amount of bituminous binder, e.g. cutback or bitumen emulsion, has been sprayed or laid in a varying amount across the wheel track alternating with layers of stone materials. The peculiar feature of the road surface with wheel track repaired according to the invention is that the wheel track is filled with a first layer of stone material with predetermined particle size or particle size fraction at the bottom of the wheel track, that the amount of binder per area unit sprayed or laid in the deepest area of the cross-section of the wheel track is greater than the amount of binder sprayed or laid close to or at the edges of the wheel track, and that a second layer of stone material with predetermined particle size or particle size fraction which is substantially smaller than the particle size or fraction in the first layer is laid upon the first layer of stone material and the binder at least in the entire width of the wheel track.

[0010] By the filling and repair according to the invention is achieved an even surface that provides a satisfactory drainage, meaning less risk of aquaplaning. The solution is more durable that by using cold asphalt in wheel tracks since thicker binder films are achieved.

[0011] In a preferred embodiment of the inventive method, the amount of binder per area unit sprayed on the area of the cross-section of the wheel track where the track is deepest is between 35% and 50% greater than the amount per area unit sprayed on the area of the cross-section of the wheel track which is at or close to the edges of the wheel track.

[0012] By the laying, the particle size fraction in the first layer of stone material may overlap the particle size fraction in the second layer of stone material with up to 75%. Alternatively, the particles sizes in the two layers of stone material may be discrete and such that the particle size in the first layer of stone material is up to five times greater than the particle size in the second layer of stone material.

[0013] It is preferred that the amount of stone material or aggregate laid in the first layer of stone material is in the range 8 to 30 kg/m^2. Furthermore, it is preferred that the amount of stone material or aggregate in the second layer of stone material is in the range 10 to 17 kg/m^2.

[0014] In a further embodiment of the invention, the amount of binder per area unit sprayed close to or at the edges of the wheel track is in the range 0.5 to 2.0 kg/m^2, and the amount of binder per area unit sprayed on the bottom of the wheel track is in the range 1.5 to 3.5 kg/m^2.

[0015] The finished road surface provided by the invention may appear such that the road surface with a filled wheel track immediately after finishing appears with excess height in relation to the surrounding road surface. By this is achieved that the surface may get the same profile as the rest of the road when traffic has compacted the material filled into the wheel track.

Description of the Drawing

[0016] Examples of preferred embodiments of the invention will be described below with reference to the drawing, wherein:

Fig. 1 shows a curve representing the relative distribution of binder across a wheel track by applying the method according to the invention; and

Fig. 2 shows a cross-section of a road surface with a wheel track repaired and filled according to the invention.

Description of Example Embodiments

[0017] In an example of the method according to the invention, the case may be surface dressing and filling of a wheel track 1 with a width d, for example d = 60 cm, in a road surface 2.

[0018] At first, a lower layer of stone material 3 consisting of particles with relatively large particle size, e.g. size 8/11 (meaning screen fraction size 8-11 mm) is laid. This lower layer covers the deepest parts of the bottom of the wheel track 1 and almost to the edges, where the surface 1 of the wheel tracks continues into the road sur-

face 2 level. The lower layer 3 may e.g. consist of 12 kg/m^2 diabase. The material is applied with a aggregate spreader or sledge.

[0019] Subsequently is applied a layer of binder, e.g. bitumen, which is not shown on Fig. 2, but its cross-wise distribution appears on Fig. 1. In contrast to the prior art, a greater amount of binder is sprayed at the deepest point of the wheel track 1, i.e. with more around the centre of the wheel track 1 than at the areas close to the edges of the wheel track. The distributing is performed by programming existing and known spraying equipment which is computer-controlled. The increased amount of binder laid on the lower layer 3 of stone material in the wheel track 1 may be graduated as shown on the curve on Fig. 1. The binder may e.g. be Biostyrelf™ bitumen where 100% on the vertical axis in Fig. 1 corresponds to 1.4 kg/m^2. In the example it is preferred that the amount of binder at the deepest point of the track 1 is 2 kg/m^2, i.e. about 42% more than the amount of binder along the edges of the track.

[0020] It is preferred in the same operation to spray a layer of binder along both edges of the wheel track 1, see the extent of the curve along the horizontal axis on Fig. 1, e.g. in a strip 20 cm wide along each side of the track 1.

[0021] Then, with a aggregate spreader, is laid an upper layer of stone material 4 of particles with relatively small particle size, e.g. size 4/8 (screen fraction 4 - 8 mm). The upper layer 4 lies in an even layer across the entire width of the wheel track 1 right up to the edges. It is preferred that in the same operation, the layer 4 is also laid in a strip along each side of the track 1 in order thereby to achieve an even transition to the existing road surface 2. The upper layer 4 may e.g. consist of 14 kg/m^2 diabase.

[0022] By the laying of the layers 3 and 4, an excess height may be provided in relation to the level of the surrounding road surface 2 such that the filled wheel track may achieve the same profile as the road when the traffic has compacted the material.

[0023] It is possible to vary the composition and the amounts of the constituent parts within the scope of the invention. Examples of these variations are:

Binders may be all types of bituminous binders, for example:

- Bituminous emulsion (40 - 80 % bitumen)
- Bitumen fluxed with vegetable or animal oils (2 - 12 % flux, e.g. Biostyrelf)
- Bitumen fluxed with mineral oil (cutback bitumen, 2 - 12 % flux, e.g. CB6)
- Hot bitumen

[0024] The bitumen types used in the binders may be:

- 20/30 - 330/430 according to the standard EN 12591
- Modified bitumen (with polymers, wax, elastomers, rubber etc.)
- Latex modified emulsion

[0025] The stone materials may be:

- Crushed granite
- Crushed gravel material
- Steel slag

[0026] Typical combinations of particle sizes may be fractions in overlapping or discrete sizes, where bottom layer and top layer, respectively, consist of following fractions:

- 4/8 - 2/5
- 8/11 - 2/5
- 8/11 - 4/8
- 11/16 - 8/11
- 11/16 - 4/8
- 11/16 - 2/5

[0027] It is possible that aggregate including the same particle size is used in bottom layer and top layer within the scope of the invention.

[0028] Stone amounts per area unit (amounts of aggregate):

- Bottom aggregate: 8 - 30 kg/m^2
- Top aggregate: 10 - 17 kg/m^2

[0029] Amount of binder applied per area unit, counted as remaining amount:

- 0,5 kg/m^2 - 2,0 kg/m^2 at edges
- 1,5 kg/m^2 - 3,5 kg/m^2 at centre of track

Claims

1. A method of repairing a road surface with longitudinal depressions in the shape of one or more wheel tracks, wherein a well-defined amount of bituminous binder, e.g. cutback or bitumen emulsion, is sprayed or laid in varying amounts across a wheel track alternating with layers of stone materials, thus filling and evening the wheel track, the method including the following steps:

   - laying a first layer of stone material with predetermined particle size fraction at the bottom of the wheel track, followed by
   - spraying or laying a greater amount of binder per area unit in an area of the cross-section of the wheel track where the track is deepest than

in the area of the cross-section of the wheel track lying at or close to the edges of the track, followed by

- laying a second layer of stone material with predetermined particle size fraction which is substantially less than the first particle size fraction at least across the entire width of the wheel track.

2. A method according to claim 1, wherein the amount of binder per area unit sprayed on the area of the cross-section of the wheel track where the track is deepest is between 35% and 50% greater than the amount per area unit sprayed on the area of the cross-section of the wheel track which is at or close to the edges of the wheel track.

3. A method according to claim 1 or 2, wherein the particle size fraction in the first layer of stone material overlaps the particle size fraction in the second layer of stone material with up to 75%.

4. A method according to claim 1 or 2, wherein the particle size in the first layer of stone material is up to five times greater than the particle size in the second layer of stone material.

5. A method according to any preceding claim, wherein the amount of stone material in the first layer of stone material is in the range 8 to 30 kg/m^2.

6. A method according to any preceding claim, wherein the amount of stone material in the second layer of stone material is in the range 10 to 17 kg/m^2.

7. A method according to any preceding claim, wherein the amount of binder per area unit sprayed close to or at the edges of the wheel track is in the range 0.5 to 2.0 kg/m^2, and where the amount of binder per area unit sprayed on the bottom of the wheel track is in the range 1.5 to 3.5 kg/m^2.

8. A road surface with longitudinal depressions in the shape of a wheel track repaired and filled according to the method according to claim 1, where a well-defined amount of bituminous binder, e.g. cutback or bitumen emulsion, has been sprayed or laid in a varying amount across the wheel track alternating with layers of stone materials, **characterised in that** the wheel track is filled with a first layer of stone material with predetermined particle size or particle size fraction at the bottom of the wheel track, that the amount of binder per area unit sprayed or laid in the deepest area of the cross-section of the wheel track is greater than the amount of binder sprayed or laid close to or at the edges of the wheel track, and that a second layer of stone material with predetermined particle size or particle size fraction which is substantially smaller than the particle size or fraction in the first layer is laid upon the first layer of stone material and the binder at least in the entire width of the wheel track.

9. A road surface according to claim 8, wherein the filled wheel track immediately after finishing appears with excess height in relation to the surrounding road surface.

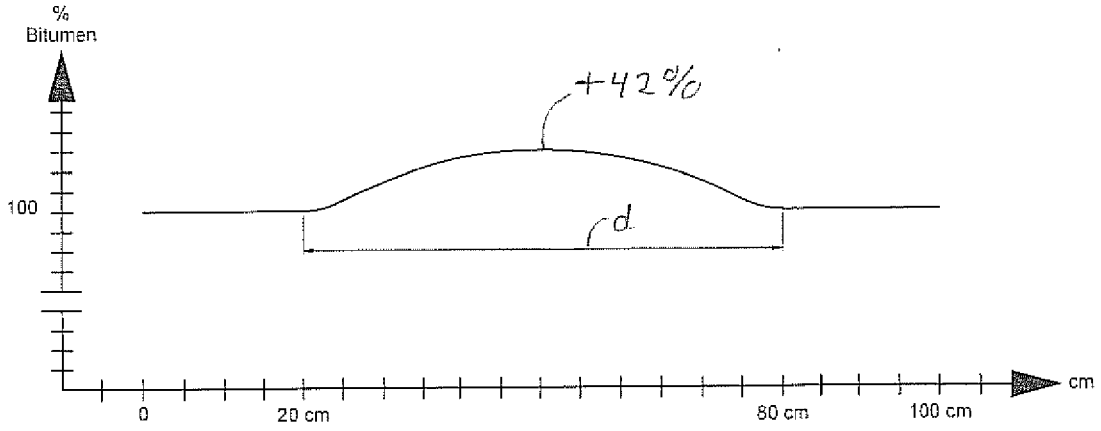

Fig. 1

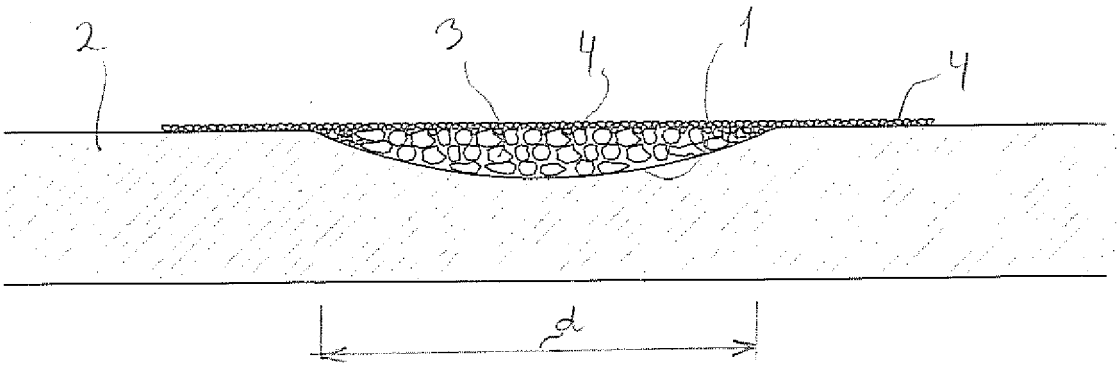

Fig. 2

REFERENCES CITED IN THE DESCRIPTION

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- US 6821052 B **[0003]**
- EP 0757735 B1 **[0003]**
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