(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 356 066 A2**

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **89308088.7**

(22) Date of filing: **09.08.89**

(51) Int. Cl.[4]: **E01C 7/26 , E01C 7/35 , E01C 11/16 , E01C 11/12 , E01D 19/06**

(30) Priority: **26.08.88 GB 8820329**
28.12.88 GB 8830290

(43) Date of publication of application:
28.02.90 Bulletin 90/09

(84) Designated Contracting States:
AT BE CH DE ES FR IT LI LU NL

(71) Applicant: **FIBRESCREED LIMITED**
Bellbrook Estate
Uckfield East Sussex TN22 1QL(GB)

(72) Inventor: **McIntosh, James**
23 Keld Drive Uckfield
East Sussex(GB)
Inventor: **Goodenough, Ronald James**
Downside Stone Quarry Road Chelwood Gate
Nr Haywards Heath East Sussex(GB)

(74) Representative: **Williams, Trevor John et al**
J.A. KEMP & CO. 14 South Square Gray's Inn
London WC1R 5EU(GB)

(54) Improved material for bridge joints and for use in, and method of, repairing or surfacing roads and the like.

(57) A material for repairing roads and other areas comprises a bituminous binder, in most instances rubberised bitumen, which may be mixed with aggregate and chopped glass or other fibres. Rubber chips are bound by the binder and comprise substantially sized pieces of rubber having a dimension of at least 2 mm. Also bound in the binder are sections of metal wire or fibre. Suitably the rubber chips and metal reinforcement may be obtained by chopping up old metal reinforced vehicle tyres. This gives an appropriate proportion of metal to rubber. The material may be used for bridge or other expansion joints or for patching cracked areas, particularly in and around concrete joints, for subsequent treatment with an overlay, the resilient rubberised bitumen being load bearing and having sufficient tensile strength that reflective cracks are not transmitted to the overlay from underlying concrete having a large coefficient of thermal expansion. Also, the material may be used as a membrane layer covering a base layer or surface. Such a layer may be formed by spreading the binder, possibly also with the addition of strengthening glass fibres, distributing the rubber chips and metal over the binder, and rolling to consolidate.

EP 0 356 066 A2

IMPROVED MATERIAL FOR BRIDGE JOINTS AND FOR USE IN, AND METHOD OF, REPAIRING OR SURFACING ROADS AND THE LIKE

This invention relates to an improved material and process using this material to repair or surface roads, parking areas, aircraft pavements and other load bearing areas. For example, the method may be applied to aircraft pavements, roads, paths, motorways and footpaths. The material may also be used to provide a flexible bridge joint filler or expansion joint in a multistorey car park or other structure.

The present invention, in one aspect, is particularly concerned with providing repairs using a material which has some degree of resilience and which has a tensile strength and is thus especially useful where the surface to be repaired is jointed or cracked or spalled. This is particularly useful where one is endeavouring to repair concrete surfaces or surfaces with a concrete underlay in that the concrete expands and contracts greatly with changes of temperature and if one uses a conventional road surfacing material this is brittle and the movement of the concrete tends to provide reflective cracks from the joints or cracks in the concrete to the surface of the black top, Macadam or other conventional surfacing material. Thus, frequently with old concrete surfaces which have been laid in concrete with expansion joints between adjacent concrete areas, not only do the joints themselves cause difficulty but after a period of use the edges of the joints frequently will crack and one can end up with a substantial degree of cracking or enlargements of the joints and spalling of the concrete, that is the provision of localised crack holes and hollows in the concrete, which, if filled with conventional materials will permit the ready transference of cracks to the applied surfacing material after a relatively small period of use.

The present invention is concerned with the provision of a material which uses rubber to give the necessary resilience, which may have aggregate included to provide improved load bearing resistance and which also includes material to provide a tensile strength.

EP-A-0 202 966 discloses a material in accordance with the prior art portion of claim 1. While it is known to use rubber chips obtained from old rubber tyres for binding such bituminous material in the manufacture of road repairing material, in general it has been ensured that any wire reinforcing material is removed so that the material salvaged from the tyres is simply the rubber chips. Also, it has been proposed in GB-A-2 048 904 to provide wire reinforcements in a bituminous surfacing which is a substantially rigid mixture of aggregate and length wire bound with bituminous material. Surprisingly, the present invention, as specified in claim 1 has found it advantageous to use the wire reinforcement in a material which is inherently resilient without loss of resilience and with a considerable improvement in the strength and wear-resisting properties. The simple operation of chopping up the wire-reinforced rubber tyres, as well as forming the chips, unravels the wire reinforcement and cuts that down to lengths, substantially longer than the chip dimension, which are ideal for the required strengthening purposes, without unduly reducing the flexibility of the material.

Generally, when referring herein to rubber chips, we are concerned with rubber in the form of pieces having a maximum dimension greater than 2 mm, preferably in the range of 3 to 7 mm, conveniently about 5 mm. However, where the material is used to a substantial depth, for example to fill a groove at a bridge or other joint, the chips may have a greater maximum dimension, for example 15 mm or even 20 mm. Generally, also, the metal fibre or wire is very fine and is chopped to have a length greater than the rubber chip dimensions.

A further aspect of the invention provides a method of repairing or surfacing roads, parking areas and other load bearing areas in which the hot material of the invention is applied to the area. In most cases aggregate is mixed with the bituminous binder, which itself may be rubberised bitumen, and chopped glass or other fibres may in some circumstances also be mixed therewith although not normally required.

Where one is using the material of the present invention to repair localised areas of joints or cracking or spalling, the aggregate may be included up to as much as 25 mm in maximum dimension although preferably it will be from 3 to 5 mm in maximum dimension to ease application, especially where the depth of application in some areas is quite small. Once the sites of movement, for example expansion joints and cracks, have been covered with the material, possibly strengthened with aggregate, and reinforced with the metal fibre or wire a covering overlay may be applied to render the area fit for use. Typically, this overlay may be of glass fibre strengthened bitumen with a surface dressing as disclosed in our British Patent No 2 081 603. Alternatively, a conventional black top or Macadam surface may be applied to a thickness 30 mm, more usually in excess of 50 mm, frequently as much as 100 or 200 mm. Other alternative surface overlays or dressings which may be used include veneer surfacings of 3 mm upwards

in thickness.

Where one is using the material of the invention with the inclusion of aggregate to cover a surface area, the aggregate should have a maximum dimension of 5 mm, preferably approximately 3 mm, and generally no larger than the dimensions of the rubber chips in the material. Such a layer would be particularly suitable for spreading on more lightly loaded paths and the like, where the underlying surface may be crazed or lightly cracked or which has had more badly damaged areas already repaired and filled otherwise, for example with the material of the invention which contains a greater proportion of rubber in the bitumen and possibly larger sized aggregate.

The material of the invention may be mixed on site or may be supplied ready mixed for subsequent melting down and laying.

We will describe, by way of example, the use of material of the present invention for repairing joints and cracked or spalled surfaces or providing thin patches to badly worn localised areas. In doing this, the material may typically comprise approximately 50% of rubberised bitumen binder material. The rubberised bitumen binder will have added to it 5 to 50% by weight rubber chips and metal fibre or wire which has been formed by the coarse chopping of vehicle tyres. By chopping metal reinforced tyres an appropriate proportion of metal reinforcement wire or fibre is provided for the mix. During this chopping of the tyres the metal reinforcing strands in the tyre become untwisted and unravelled and are chopped but, because of their flexibility and fineness, the individual lengths of wire are left with a length several times the dimension of the rubber chips. For use in patching purposes one would expect at least 10%, preferably 15%, rubber in the rubberised bitumen. The aggregate could have a maximum dimension of preferably 3 to 5 mm although, depending upon the circumstances, a greater maximum dimension could be used, for example even as much as 20 to 25 mm. Where additional fibre, preferably glass, is added to the mixture it would not normally be more than 5% and in most cases 0.5 to 1.5%, say 1%, is adequate, in those unusual situations where tensile strength additional to that provided by the metal is required. The hot mixture is applied to the cracks or other surface areas requiring substantial repair and when set the additional covering surface is applied as required. Thus, as indicated previously, this additional surface may, for example, be a glass fibre reinforced bitumen provided with a dressing or a conventional black top Macadam surface. The resilience of the rubber chips in the bitumen with the tensile strength provided by the chopped metal fibre or wire prevents reflective cracks passing from the underlaying repaired surface to the top surface of the overlay and the substantial aggregate content of the material enables it to be load bearing and resistant to subsidence when passed over by heavy vehicles. A relatively thin layer of this material may be applied over localised areas for patching purposes as a membrane subsequently to be covered by an overlay.

In a situation where the material of the present invention is being used to form a bridge joint or an expansion joint in a large structure, for example a multistorey garage, in general no aggregate will be used in the mixture which will comprise a major proportion of the rubber chips bound, preferably, with a resilient bitumen material such as a polymer modified bitumen. When repairing such a joint, a groove will be provided spanning the joint and this groove will be filled with the material of the invention level to the surface on either side of the groove and a further surface layer for supporting the traffic will then be provided over the joint and over the structure on either side of the joint. In such a location where the depth of the groove may be quite substantial, the rubber chips may well have a maximum dimension as big as 15 mm, perhaps as much as 20 mm. The material can either be applied hot and rolled in situ or where the groove can be cut accurately, the material may be provided as preformed strips, insertable in the cut grooves. While, preferably, no aggregate is included in the material as used for repairing bridge or expansion joints, in some cases where the reduced flexibility can be tolerated, a proportion of aggregate may be used in the filling mixture.

Generally, above, we have been referring to the use of a material comprising the rubber chips and metal fibres mixed therein for localised patching purposes, normally prior to subsequent covering with a traffic bearing overlay surface. However, the present invention can also be used to provide an overall layer or membrane over an entire base area with that membrane layer including the rubber chips and the fine metal fibre or wire reinforcement. This can be achieved simply by spreading a layer of rubberised bitumen or rubberised polymer modified bitumen over the area, the rubberised bitumen preferably, although not necessarily, including a fine aggregate or sand filler. The rubber chips and metal reinforcement can either be mixed in that rubberised bitumenous layer prior to application of the material or may be distributed over the material after it has been laid and then rolled and compressed so as to become embedded in that material in the same manner that in a more conventional road surfacing aggregate would be spread over and compressed into an underlying binding layer. One disadvantage of using rubberised bitumen as the binder material, although adding to the resilience and quantity of rubber in the layer,

is that it cannot be applied easily by spraying. Thus, in an alternative method utilising the invention a less viscous, more liquid, bitumen emulsion or polymer modified bitumen emulsion may be sprayed over the surface prior to having the rubber chips and metal reinforcement distributed thereover for rolling in position. Aggregate may also be applied or included in the distributed bitumenous binder as required but normally in this situation would not have a dimension greater than that of the rubber chips and preferably would have a very much smaller dimension, more commonly being in the form of a fine grained aggregate or sand filler to the binder.

One particularly preferred method comprises distributing a layer of bitumenous binder with the addition of chopped glass fibre or other fibres and then distributing the rubber chips and metal reinforcement over that layer prior to rolling it in to cause it to be bound into a continuous rubberised layer. A further traffic bearing overlay can then be provided over the area to which the membrane has been applied.

A membrane layer as referred to above is particularly useful for applying as a thin repair layer to such surfaces as lightly loaded paths or other walk-on areas which are infrequently used by vehicles although even so the resilience of the rubber of the layer will give a resistance to cracking in conjunction with the tensile strength added by the included fibres of metal and possibly also of glass or the like.

In general, in most applications, the proportion of aggregate in the material may be from 40 to 60% although proportions outside this range may be used, depending upon the particular application and the amount of fine grained filler, if any, in the rubberised bitumen. Preferably, the proportion of aggregate in the material is approximately 50% by weight. However, in other applications no aggregate at all may be used. Thus a sandwich construction may be provided in which the sandwich "filling" comprises a membrane or layer of bitumen containing the chopped rubber pieces and metal fibre or wire. This "filling" may, or may not, contain aggregate depending upon the degree of resilience required, and provides for good non-cracking load transfer from an overlying top layer to the underlying support or base surface.

In all these applications, we have referred to glass fibres as being used when applied additionally to the metal fibres or wire. Usefully, the glass fibres may be chopped to a length of approximately 30 mm. While we have referred herein generally to the use of glass fibres, it will be appreciated that other materials may be used, for example polyamide or other metal fibres, although presently glass fibres are the preferred additional tensile-strength-imparting material when such is required.

Various advantages accrue from the use of the substantial sized pieces of rubber in the material of the present invention in conjunction with the longer lengths of fibre metal wire or fibre. Surprisingly, better wear resistance appears to be obtained than when using the simple conventional rubberised bitumen having a far smaller rubber particle size and also the incorporation of the metal wire provides very good tensile strength properties despite the relatively small proportion of metal wire present. While in some extreme cases it may be desirable to add additional longer fibres to increase tensile strength, in general it has been found that the use of the metal fibres or wires is very adequate and gives a better result than previous structure of the applicants as disclosed in GB-2 200 645-A where smaller rubber particle sizes are used with the longer glass or other fibres providing the tensile strength. Indeed, where extreme resilience is required, the present invention can use the bitumen and rubber with the chopped wire reinforcement with very little if any aggregate addition in order to provide a resilient waterproof membrane of substantial thickness between different layers of a road or other load bearing surface.

A particular advantage of the present material is that it can very readily be made simply by chopping up old wire reinforced vehicle tyres. Thus, modern radial tyres contain a substantial amount of metal reinforcement which conventionally is very difficult to separate reliably from the rubber in order to use the rubber for other purposes, for example broken down to a small particle-sized crumb for use in conventional rubberised bitumen. The material of the present invention requires far less breaking down of the tyres in view of the relatively large rubber chip size. The inclusion of the metal of the tyre reinforcement randomly bound to or, more usually, separated from the rubber chips provides what appears to be an ideal road construction material where it is important to prevent the transmission of reflective cracks. Thus, during the chopping up of the rubber tyres the twisted tensile cables are chopped and rapidly unravelled to the very fine and flexible constituents of the cable. Due to this fineness and flexibility most of the metal is not chopped as short as the dimensions of the rubber chips such that when the rubber is formed in 2 mm dimension chips the pieces of wire will normally have a length of from 20 to 30 mm; however due to the random nature of the chopping some of the metal lengths will be shorter, similar in length to the rubber chip dimensions or even shorter.

Claims

1. A material for use in repairing or servicing roads, parking areas, aircraft pavements and other load bearing areas, such material comprising rubber chips and a bituminous binder characterised in that the chips have a maximum dimension of at least 2 mm and mixed with the chips are lengths of metal fibre or wire longer than the maximum dimension of the chips, said rubber chips and lengths of metal fibre or wire being bound together with the binder.

2. A material according to claim 1, wherein the rubber chips are bound together with rubberised bitumen or a bitumen emulsion as the bituminous binder, the bitumen of the emulsion or of the rubberised bitumen preferably being a polymer modified bitumen.

3. A material according to claim 2, wherein the bituminous binder is rubberised biturnen material which includes 5 to 25% rubber.

4. A material according to any preceding claim, wherein the metal fibres are approximately 20 to 30 mm long.

5. A material according to any preceding claim, which also comprises up to 5%, preferably 0.5 to 1.5%, by weight of glass or other fibres.

6. A material according to any preceding claim, wherein the rubber chips have their maximum dimensions in the range of 3 to 7 mm, preferably about 5 mm.

7. A material according to any preceding claim, wherein the bituminous binder has aggregate mixed therewith, the aggregate being no larger than 25 mm and preferably no larger than 5 mm in maximum dimension.

8. A material according to claim 6, wherein the aggregate has dimensions similar to that of the rubber chips.

9. A method of repairing or surfacing roads, parking areas, aircraft pavements and other load bearing areas in which a hot material is applied to the area, such material being as claimed in any preceding claim.

10. A method according to claim 9, wherein the material is applied to localised damaged portions only of the area.

11. A method according to claim 9, wherein the material is applied as a continuous membrane layer over the whole area.

12. A method according to claim 10 or 11, wherein the area has sequentially applied to it a covering traffic bearing overlay.

13. A method of providing a bridge joint or expansion joint wherein material as claimed in any one of claims 1 to 6 is applied to a groove spanning the joint in the bridge or other structure.

14. A method according to claim 13, wherein the material is applied hot and rolled in situ.

15. A method according to claim 13, wherein the material is applied as a preformed strip into the groove, the groove having been cut to the required size to receive the strip.

16. A method according to any one of claims 13 to 15, wherein the rubber chips have a maximum dimension of up to 20 mm.

17. A method according to any one of claims 13 to 16, wherein a traffic bearing surface layer is provided over the material of the joint and over the structure on either side thereof in which the groove is formed.

18. A method according to claim 12 or 17, wherein said surface layer is applied as a mixture of said bituminous binder material, rubber chips and metal fibre or wire.

19. A method according to claim 12 or 17, wherein the surface layer is applied by spreading a layer of bituminous binder material over the filled groove and neighbouring surface, distributing a mixture of rubber chips and metal fibre or wire over the binder material and rolling the chips and metal into the binder material to be bound thereby.

20. A method according to claim 19, wherein the bituminous binder material itself has rubber chips and metal fibre or wire mixed therein before application to the area.

21. A method according to claim 19 or 20, wherein aggregate is added by being distributed over the bituminous binder material and rolled thereinto together with the rubber chips and metal.

22. A method according to claim 12 or 17, wherein the surface layer is a black top overlay of at least 30 mm thickness.

23. A method according to claim 12 or 17, wherein the surface overlay comprises a bituminous layer strengthened with glass or other fibres and provided with a surface layer of chippings or the like.

24. A material according to any one of claims 1 to 8, or a method of any one of claims 9 to 23, wherein the rubber chips and metal fibres or wire have been obtained by chopping up wire-reinforced vehicle tyres.