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Method for Preparation of Reciprocal Pressing Surfaces of Segments of a Construction



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This invention relates to a method for preparation of reciprocal pressing surfaces of segments of a construction, this construction being
5 achieved by juxtaposition and assembly of such segments comprising such reciprocal pressing surfaces.

The invention likewise concerns the constructions which are achieved through assembly of segments whose surfaces have been prepared according to the aforementioned method.

10 The invention concerns particularly, but not exclusively, the constructions which are achieved by juxtaposition of segments and by pressing these segments against one another with tension elements.

The invention applies particularly, but not exclusively, to constructions, such as bridges, achieved by assembly of segments made up of
15 concrete and the assembly being maintained through tensioning of tendons.

An object of the invention is a method of preparation of surfaces which at one and the same time facilitates adjustment of the position of the segments to be assembled and, once assembled, enables wedging of the said segments with respect to one another.

20 Another object of the invention is a method that makes it possible to guarantee these operations of adjustment and wedging with a large degree of reproducibility.

To this end, the invention has as its subject matter a method for preparation of pressing surfaces of segments of a construction, this
25 construction being achieved by juxtaposition and assembly of the segments.

The method is noteworthy in that, prior to the assembly of the segments, a layer of a connecting material is applied to at least one of the

reciprocal pressing surfaces, referred to as first and second surfaces, the function of which connecting material is to constitute a fluid-tight joint between these first and second surfaces, once they have been assembled.

The method is particularly characterised in that:

5 - to form a connecting material between a first surface and a second surface, a material is selected from among connecting materials which are, in order to obtain good connecting conditions between surfaces, currently recommended for use in making a thick layer, because of their duration of hardening which is inversely proportional to the value of the thickness of the
10 layer,

 - prior to the juxtaposition of one segment to another segment, at least one layer of the selected connecting material is applied, by spraying, on at least one of the said first and second surfaces intended to co-operate, and, during the application of this layer, a thickness of a maximal value is given to
15 this layer such that the hardening of the connecting material is delayed at least for the duration of the operations of juxtaposition and position adjustment of the segments, and this in such a way as to allow use of this connecting material as lubrication agent between the said first and second surfaces.

 The invention likewise concerns the constructions which are
20 achieved by assembly of segments whose surfaces have been prepared according to the aforementioned method.

 The invention applies particularly, but not exclusively, to the construction of bridges achieved by assembly of segments made up of concrete, and this assembly being maintained through tensioning of tendons.

25 The invention will be better understood from reading the description which follows, given by way of non-limiting example, with reference to the attached drawing:

Figure 1 is a lateral view of a construction comprising segments assembled according to the method of the invention in the course of construction,

Figure 2 is a view in perspective of a segment intended to be assembled according to the method of the invention,

Figure 3 is a lateral view, on an enlarged scale, of a segment treated according to the method of the invention,

Figure 4 is a diagram of an installation allowing the implementation of the method of the invention.

Referring to the figures, in particular Figures 1 and 2, a construction 1 can be seen, such as a bridge 1, this construction comprising at least two segments 2 which are held one against the other and, to this end, co-operate by reciprocal pressing surfaces 21, 22, which surfaces 21, 22 are referred to as first and second surfaces.

In the example of Figure 1, the construction 1 comprises a plurality of segments 2 assembled with respect to one another, and these segments are juxtaposed in the longitudinal direction 10 of the construction 1, and in particular above a surface 100, such as the surface 100 of the ground above which the said construction 1 rises.

As can be seen, each segment 2 includes at least one surface 21, referred to as first surface 21, intended to be placed pressing against another surface 22, referred to as second surface 22, borne by another segment 2, and this with a view to assembly of the said segments 2.

In the example of Figure 1, each segment 2 comprises a first surface 21 and a second surface 22, and these surfaces 21 and 22 are opposed and each substantially orthogonal to the longitudinal axis 23 of the segment 2.

As can be seen in the drawing, the said first surface 21 of a given segment 2 is intended to be pressed against the said second surface 22 of another segment 2.

The construction 1 is achieved by assembly of the segments 2, i.e.
5 by carrying out successive operations of juxtaposition of segments 2 then adjustment of position of these segments, and finally immobilisation of the said segments in juxtaposed position.

The immobilisation of the segments is carried out, for example, with tendons that are tensioned afterwards (post-tensioning tendons).

10 This technique of immobilisation is known per se, and thus will not be further described in the following.

To achieve the juxtaposition, then the assembly, at least one handling device 200 of at least one segment 2 is conventionally used, for example a crane.

15 A handling device 200 has been indicated symbolically in Figure 1, but this device is not described in further detail because it does not form part of the invention.

In the example shown in Figure 1, the construction 1 shown is a bridge constructed through juxtaposition of segments 2.

20 In Figure 1, in the upper part of the construction, a segment 2 has been represented in the course of assembly with another segment 2 already integral with the construction 1.

Likewise on the Figure 1, but at the base of the construction 1, an isolated segment 2 has been represented, this segment bearing a layer 3 of
25 connecting material 4.

Prior to the assembly of segments 2, a layer 3 of connecting material 4 is applied to at least one of the said first and second surfaces 21, 22 of the segments 2, the function of which connecting material is to form a fluid-tight seal between the first and second surfaces 21, 22 when they have been assembled.

In a noteworthy way:

- to form a connecting material 4, a material 4 is selected from among connecting materials which are, in order to obtain good connecting conditions between surfaces, currently recommended for use in making a thick layer, because of their duration of hardening which is inversely proportional to the value of the thickness of the layer,

- prior to the juxtaposition of one segment 1 to another segment 1, at least one layer 3 of the selected connecting material 4 is applied, by spraying, on at least one of the said first and second surfaces 21, 22 intended to cooperate, and, during the application of this layer 3, a thickness 5 of a maximal value is given to this layer 3 such that the hardening of the connecting material 4 is delayed at least for the duration of the operations of juxtaposition and position adjustment of the segments 1, and this in such a way as to allow use of this connecting material 4 as lubrication agent between the said first and second surfaces 21, 22.

When the hardening of the connecting material 4 is obtained, it causes a function referred to as wedging of the segments 2, i.e. a function of filling up the spaces of reduced thickness which remain between the first 21 and second surfaces 22 of these segments 2, between which this connecting material 4 has been placed beforehand.

The spaces of reduced thickness result from defects in flatness, for example.

Use of the connecting material as a lubrication agent allows facilitation of the adjustment in position of the said segments 2 through a possible sliding of the first 21 and second 22 surfaces, one against the other.

Admittedly the value for the sliding sought is relatively slight since a
5 displacement of some millimetres (usually 5 to 15 mm) generally takes place, but the application of such a connecting material 4 with a view to lubrication of surfaces of increased roughness is conventionally achieved with a layer of thickness ranging between two and three millimetres, indeed at times with a layer of thickness equal to, or greater than, five millimetres.

10 Use of a noteworthy thickness of material functioning as lubricant in the case of surfaces of high roughness is well known in the field mechanics, in the general sense of the term mechanics.

In this particular case, tests have shown that, in spite of the relative roughness of the first and second surfaces, such as the roughness of the
15 surfaces of concrete segments 2, the choice of a slight thickness for the connecting material makes it possible -- contrary to all expectations -- to ensure the first function of lubrication sought.

It is clear that there is great economic interest in this lesser use of connecting material.

20 Another advantage is that surfaces 21, 22 situated in the vertical planes can be prepared without fear that the material runs down these surfaces 21, 22.

In a noteworthy way, to make up the layer 3 of connecting material 4, the said material 4 is sprayed, and this after this material 4 has been prepared
25 in such a way as to make it fluid and able to be sprayed.

In a noteworthy way, selected is a connecting material 4 of the type able to be hardened through polymerisation.

In a noteworthy way the connecting material 4 consists of an epoxy resin without filler (such as particles or the like).

In a noteworthy way, when it turns out to be necessary to make up a layer 3 of connecting material 4 of a thickness 5 greater than the maximal
5 determined value 51 of thickness 5 necessary to achieve a function of lubrication, this layer is made up through stratification, i.e. by making up strata 31 each given a thickness at most equal to the predefined maximal value 51.

It is to be noted that the layer of connecting material 4 finally formed
by successive applications of layers of lesser thickness has different properties
10 from those of a single layer of connecting material of the same thickness formed at one time.

In particular, the polymerization time for the connecting material 4 is increased and the layer's 3 capacity for dripping is reduced.

An installation 6 for implementation of the method preferably
15 comprises:

at least one first reservoir 61 and a second reservoir 62 for each of the components 41, 42 of the connecting material 4,

an apparatus for mixing 63 of the said components 41, 42 of the connecting material 4, this mixing apparatus 63 having in particular an inlet
20 zone 630 for the components 41, 42, a zone for mixing 631 of the said components 41, 42 and an outlet zone 632 for the connecting material 4 formed through mixing of the aforementioned components 41, 42,

pumps 64, 65, each ensuring an operation of measured withdrawal of one of the components 41, 42 of the connecting material 4 from its reservoir
25 61, 62 and an operation of supplying the mixing apparatus 63 with the component withdrawn,

pipes for connection 640, 641, 650, 651 of each pump 64, 65 with, on the one hand, the reservoir 61, 62 of one of the components, and, on the other hand, with the inlet zone 630 of the mixing apparatus 63,

a compression apparatus 66 for a gas, such as air,

5 a spraying apparatus 67 for the connecting material 4 in the form of fine droplets supported in a flow of gas issued from the compression apparatus 66, this spraying apparatus 67 being of the controlled operation type, i.e. a type ensuring and interrupting the spray as a function of at least one binary
command emitted at least indirectly by a person (not shown) in charge of
10 supervision of the spraying of the connecting material 4,

pipes for connection 670, 671 of the spraying apparatus 67, on the one hand with the gas compression apparatus 66, and, on the other hand, with the outlet zone 632 of the mixing apparatus 63,

an operational control apparatus 68, in particular for the supply and
15 withdrawal pumps 64, 65 as well as for the gas compression apparatus 66, this control apparatus 68 being at least indirectly placed under the influence of the binary command issued by the person in charge of supervision of the spraying of the connecting material 4.

The pumps 64, 65 are preferably pumps of the jack type, i.e. pumps
20 which function like a syringe and are able, during a first phase of operation, to suction up in one of the reservoirs 61, 62 a certain volume of component 41, 42 of high viscosity, then, during a second phase of operation, deliver this component 41, 42 in a conduit 641, 651 to the mixing apparatus 63.

For example, a control valve 642, 652 controlled by the control
25 apparatus 68 makes it possible to obtain an operation ensuring the suction phase in each reservoir and the phase of delivery too the mixing apparatus 63.

So that the operational control apparatus 68 is able to be operated simply, reliably and efficiently:

the apparatus for spraying 67 the connecting material 4 consists of a spray gun 67 equipped with a control trigger 672, and this control trigger 672 activates a valve 673 controlling the passage of the gas under pressure,

5 the installation 6 comprises at least one element 680 for detection of a variation in pressure of predetermined value and for producing a signal 681 upon detection of such a variation in pressure, and this signal 681 is used by the operational control apparatus 68 to manage the operation of the said installation 1.

10 The mixing apparatus 63 preferably consists of a mixing tube 63 having a plurality of chambers for mixing of the components 41, 42, this tube being of the replaceable type.

Preferably the installation also comprises a part constituting a support for the segment at least one of the said first and second surfaces of which must be prepared.

15 The invention likewise concerns constructions 1 which are achieved through assembly of segments 2 whose surfaces 21, 22 have been prepared according to the aforementioned method.

More specifically, the invention concerns constructions 1 which are achieved through assembly of segments 2 made up of concrete and whose
20 surfaces 21, 22 have been prepared according to the aforementioned method.

Still more specifically, the invention concerns constructions 1 achieved through assembly of segments 2 made up of concrete and whose surfaces 21, 22 have been prepared according to the aforementioned method, the said segments 2 being intended to be kept assembled through tensioning of
25 tendons.

Claims

1. A method for preparation of reciprocal pressing surfaces (21, 22), of segments of a construction (1), this construction (1) being achieved by juxtaposition and assembly of such segments (2) comprising such reciprocal
5 pressing surfaces (21, 22), referred to as first and second surfaces (21, 22),

this method including a step according to which, prior to assembly of the segments (2), a layer (3) of a connecting material (4) is applied to at least one of the said first and second surfaces (21, 22), the function of which connecting material is to constitute a fluid-tight seal between these first and
10 second surfaces (21, 22), once assembled,

this method being characterised in that

- to form a connecting material (4), a material (4) is selected from among connecting materials which are, in order to obtain good connecting conditions between surfaces, currently recommended for use in making a thick
15 layer, because of their duration of hardening which is inversely proportional to the value of the thickness of the layer,

- prior to the juxtaposition of one segment (1) to another segment (1), at least one layer (3) of the selected connecting material (4) is applied, by spraying, on at least one of the said first and second surfaces (21, 22) intended
20 to co-operate, and, during the application of this layer (3), a thickness (5) of a maximal value is given to this layer (3) such that the hardening of the connecting material (4) is delayed at least for the duration of the operations of juxtaposition and position adjustment of the segments (1), and this in such a way as to allow use of this connecting material (4) as lubrication agent between
25 the said first and second surfaces (21, 22).

2. The method according to claim 1, characterised in that to make up the layer (3) of connecting material (4), the said material (4) is sprayed after it has been prepared in such a way as to make it fluid and able to be sprayed.

3. The method according to claim 1 or 2, characterised in that selected is a connecting material (4) of the type able to be hardened through polymerisation.

4. The method according to claim 3, characterised in that a
5 connecting material is used consisting of an epoxy resin without filler.

5. The method according to any one of the claims 1 to 4, characterised in that the connecting material (4) is applied in at least one layer (3) of thickness (5) ranging between 0.5 and 1.00 mm (half a millimetre and one millimetre).

10 6. The method according to any one of the claims 1 to 5, characterised in that a layer (3) of connecting material (4) is deposited on each of the said first and second surfaces (21, 22) intended to be assembled.

7. The method according to any one of the claims 1 to 6, characterised in that when it turns out to be necessary to make up a layer (3) of
15 connecting material (4) of a thickness (5) greater than the maximal determined value (51) of thickness (5) necessary to achieve a function of lubrication, this layer is made up through stratification, i.e. by making up strata (31) each given a thickness at most equal to the predefined maximal value (51).

8. Constructions (1) achieved through assembly of segments (2) the
20 surfaces (21, 22) of which have been prepared according to the method of any one of the claims 1 to 7.

9. Constructions (1) achieved through assembly of segments (2) composed of concrete and whose surfaces (21, 22) have been prepared according to the method of any one of the claims 1 to 7.

25 10. Constructions (1) achieved through assembly of segments (2) composed of concrete and whose surfaces (21, 22) have been prepared according to the method of any one of the claims 1 to 7, the said segments (2) being intended to be kept assembled through tensioning of tendons.