

Pre-Assembled Plate Consisting of Reinforced Concrete

The invention relates to a pre-assembled plate of reinforced concrete and to a method of producing a compound plate construction.

A generic pre-assembled plate consisting of reinforced concrete is known from DE 197 33 909. The pre-assembled plate consisting of reinforced concrete is provided for constructing a compound plate construction, especially a solid roadway for high-speed rail traffic. At least two steel rods extending in the longitudinal direction of the plate and projecting over its two front sides are arranged in the pre-assembled plate consisting of reinforced concrete. Each steel rod is immovably anchored on only one position in the pre-assembled plate consisting of reinforced concrete and is otherwise freely expansible. This makes an extension stretch available that always has the length of each pre-assembled plate consisting of reinforced concrete and consequently exerts a great tensioning force on the concrete introduced into the butt joint. It turned out that this has the disadvantage that theoretical breaking points arranged at regular intervals in the pre-assembled plate consisting of reinforced concrete are bridged by the stress of the steel rods and thus lose their function. Unavoidable cracks in the pre-assembled plate consisting of reinforced concrete arise as a result at unpredictable locations, especially not in the area of the theoretical breaking points provided.

The method for producing a compound plate construction, especially a solid roadway for high-speed rail traffic that is also suggested in the DE 197 33 909 A1 consists in that at first the ends of the steel rods are tensionally connected to each other and that thereafter the two pre-assembled plates consisting of reinforced concrete adjacent to one another are pressed apart from one another with a defined force of the steel rods. The pre-assembled plates consisting of reinforced concrete are held in this position and the entire butt joint between the two front sides adjacent to one another of the pre-assembled plates consisting of reinforced concrete is filled with a solidified filling mass. The defined force is subsequently released and the filling mass stressed by the tensioning force of the steel rods that now occurs. This solution has the disadvantage that a positioning and exact adjusting of the pre-assembled plates consisting of reinforced concrete that took place prior to the application of the defined force is lost again since the complete plate must be moved for bracing. This results in a shifting of the plate on the foundation, as a result of which the adjusting screws standing on the foundation are shifted or even somewhat tilted. The positioning and aligning of the pre-assembled plate consisting of reinforced concrete previously performed is distorted again as a consequence. Therefore, a new alignment of the plates is necessary after the filling of the butt joint. This necessitates an additional work expense and problems in the area of the filled butt joint.

DE 26 21 793 teaches a method of producing a compound grate or plate construction of pre-tensioned pre-assembled concrete parts. In it the joints between the pre-assembled concrete parts are pre-tensioned after the joining together and aligning of the concrete pre-assembled parts. Tensioning member ends project from the concrete pre-assembled parts with which ends a connection is established between adjacent concrete pre-assembled parts. The joint produced is pressed apart with a pressing device, a mass is introduced into this joint as joint filling and the pressing device is not stress-relieved and removed until after the hardening or setting of the joint filling. After the setting of this mass, rod strainers that were arranged on the tensioning member ends were tightened with a controlled force, which places the filled joints under a pre-tension. The concrete plates are subsequently underfilled or underpressed. Lastly, the recesses for the rod strainers are closed and sealed. This method has the disadvantage that the pre-tension of the tensioning rod ends is altered by the underfilling or underpressing of the concrete plates. Moreover, the adjusting is possibly influenced by this method so that a subsequent check must take place. Even different temperatures during tensioning or filling of the butt joints and during the underfilling have a negative influence on the precision of the alignment of the concrete plates.

The present invention has the problem of avoiding the disadvantages of the state of the art and in particular of assuring a precise alignment of the pre-assembled plates consisting of reinforced concrete.

This problem is solved by the features of claims 1 and 32.

In a generic pre-assembled plate consisting of reinforced concrete each steel rod is anchored in the area between the front side of the pre-assembled plate and the first theoretical breaking point and is supported in a substantially freely movable manner, starting from this anchoring, in the direction of the particular front side in its longitudinal direction. This assures that the theoretical breaking point is not loaded with pressure, thus possibly loosing its effect. As a result of the fact that the steel rod is movably supported in a defined area directed away from the pre-assembled plate, traction forces in a plate segment limited by the theoretical breaking point are introduced onto the pre-assembled plate containing no theoretical breaking point. This produces cracks in the area of the theoretical breaking point. This is desired since as a consequence thereof the other plate parts remain substantially free of cracks. All theoretical breaking points introduced in the pre-assembled plate can thus fulfill their task.

If the theoretical breaking point is a dummy joint running transversely to the longitudinal direction of the pre-assembled plate the theoretical breaking point can be produced in a simple manner in the casting of the pre-assembled plate already. As a result of the dummy joint the thickness of the pre-assembled plate is reduced at this position. Cracks then arise in the immediate vicinity of this dummy joint and can thus be purposefully checked for their magnitude. The state of the pre-assembled plate can thus be readily monitored.

It proved to be especially advantageous if the anchoring of the steel rod is approximately 50 cm removed from the front side of the pre-assembled plate. This yields a sufficient length of the steel rod for extending it in accordance with the requirements in a permanent joining of several pre-assembled plates. As a result of the extension a pressure force is applied to the joint that can bring about a penetration of water and therewith a destruction of the joint or of the concrete.

In order to make possible an extension of the steel rod or to prevent the steel rod from being permanently connected in the corresponding area during the manufacture of the pre-assembled plate, it is provided that the steel rod is jacketed in the area between the front side of the pre-assembled plate and the anchoring by a tube or hose, especially by a shrinkdown plastic tubing. This can assure that the steel rod is arranged within the tube or hose or, if the shrinkdown plastic tubing was reduced from a greater diameter to a smaller diameter after the setting of the concrete, is movably arranged in its longitudinal direction in the pre-assembled plate. The anchor point of the steel rod is again located thereby in the first segment of the pre-assembled plate. The steel rod is to be extended from this anchor point to the end of the steel rod relative to the pre-assembled plate. A so-called tenso binding also yields a reliable corrosion protection in the non-concreted area.

A sliding of the steel rod within the jacketing is possible, in particular if the jacketing of the steel rod has a greater inside diameter than the outside diameter of the steel rod. The jacketing is permanently connected to the

concrete thereby whereas the steel rod can rotate within the jacketing. A sliding between the concrete and the shrinkdown plastic tubing is possible if a shrinkdown plastic tubing is used.

If the steel rod ends in a pocket of the pre-assembled plate, fastening means for joining the steel rod of the one pre-assembled plate to a steel rod of the adjacent pre-assembled plate can be introduced in a simple manner. The pocket also permits the tension path of the steel rod to be sufficiently large.

If the pocket is open toward the top of the pre-assembled plate the steel rod and the end of the steel rod and fastening means connected to them can be readily accessed. Tools for tensioning the steel rod can therefore be introduced in a simple manner.

If the pocket is closed in the direction of the bottom of the pre-assembled plate the substratum can be sealed off or encased in a simple manner. The bottom of the pre-assembled plate thus forms a substantially straight line along the front side of the pre-assembled plate so that appropriate sealing means are simple to apply. Moreover, it is more readily possible with this straight-line closure edge to seal off the substratum and less sealing material is required.

If the pocket has an back taper when viewed from the top, an additional clawing of the adjacent pre-assembled plates is produced during the filling up [grouting] of the pocket, e.g., with concrete. The pocket thus brings about a vertical fixing of the pre-assembled plates to each other so

that an additional reliability against an unintentional shifting of the pre-assembled plates toward each other is provided.

If the pocket of the one pre-assembled plate corresponds to a corresponding pocket of the adjacent pre-assembled plate, a wide joint is produced between the adjacent pre-assembled plates. This wide joint is for its part suited for receiving fastening means for the two pre-assembled plates and facilitates the accessibility to these fastening means during their mounting. In addition, a sufficient free space for the tensioning of the steel rods is achieved.

If a narrow joint is provided between two steel rods of the pre-assembled plate and/or toward the edge of the pre-assembled plate, a sealing compound can be introduced in a defined manner between the two pre-assembled plates.

If the bottom of the front side of the pre-assembled plate has a substantially straight-line course and/or the top has alternating narrow and wide joints, this yields on the one hand a good seal of the substratum below the pre-assembled plate and on the other hand a ready mounting of the tensioning device for the steel rods.

It is especially advantageous if a connecting means for connecting the steel rod of the one pre-assembled plate to the steel rod of the adjacent pre-assembled plate can be arranged inside the wide joint. This substantially facilitates the mounting of the pre-assembled plates. In addition, if a

disassembly of the pre-assembled plate is necessary, the connection means can be accessed in a relatively simple manner.

If adjusting devices, especially spindles, are arranged on the pre-assembled plate, the pre-assembled plate can be precisely adjusted in its height to the required degree. It is important, especially in the case of high-speed traffic means, that the pre-assembled plates and therewith the guide means for the high-speed vehicles are aligned very exactly with each other.

If the pre-assembled plate is manufactured from fiber concrete, a part of the traditional reinforcement can be dispensed with. Moreover, in addition to this advantage there is the further advantage of lesser crack widths.

If the narrow joint and/or the wide joint is/are filled up with a sealing compound, concrete in particular, between two pre-assembled plates, if a traction force is applied onto the steel rods a support of the two pre-assembled plates is assured via the filled-up narrow joint. This compresses the narrow joint, reliably preventing a penetration of water.

In order to fix the fine adjustment of the pre-assembled plate a substratum mass, in particular a bituminous cement mortar, is introduced between the pre-assembled plate and the foundation. This viscous substratum mass is introduced through fill openings in the pre-assembled plate from above or laterally from the plate edge into the hollow space between the pre-assembled plate and the substratum. The hardening of this substratum mass takes place in a substantially temperature-dependent

manner, that is, the pre-assembled plate hardens independently of the outdoor temperature in the position that had been precisely aligned previously. The fine adjustment of the pre-assembled plate thus remains substantially preserved.

If the substratum mass is encased in particular with a sealing element, especially with an elastic, preferably porous plastic, an expensive sealing elsewhere during the underpouring of the pre-assembled plate is avoided. The sealing element is on the one hand so elastic that it nevertheless still makes contact with the bottom of the pre-assembled plate and with the top of the foundation during an adjustment in height of the pre-assembled plate for aligning the pre-assembled plate. This prevents the substratum from running out. A reliable pouring out of the substratum is brought about even in the slopes of the roadway that are at times necessary with the aid of these especially advantageous sealing elements.

Sealing elements have proven to be especially advantageous that are a rubber mat, especially one consisting of neoprene or a sponge. The elements can either be left where they are after the hardening of the substratum or can be reused when underpouring another pre-assembled plate. Moreover, the use of a sponge makes it possible that air is forced through the sponge by the sealing compound and thus does not result in inclusions under the pre-assembled plate.

If spacers are arranged in the area of the joints a fixing of the adjacent pre-assembled plates can also take place therewith instead of the sealing in

order to be able to tension the steel rods. The spacers can be arranged in the area of the narrow joint or of the wide joint. It is especially advantageous if the joint is poured in one piece. The spacers serve to hold the pre-assembled plates in the finely adjusted position after the fine adjustment and before or after the tensioning of the steel rods. The spacers are advantageously wedges, that can be adjusted to the precise interval position.

In a method in accordance with the invention for producing a compound plate construction consisting of pre-assembled plates consisting of reinforced concrete with at least two steel rods extending in the longitudinal direction of the pre-assembled plate and projecting over its concrete surface on the front side and with a joint between adjacent pre-assembled plates the pre-assembled plate is first placed down and finely adjusted. The finely adjusted pre-assembled plate is then underpoured with a substratum mass and after the substratum has hardened, the pre-assembled plate is joined to the adjacent pre-assembled plate by filling up the joint and connecting the steel rods. This produces a compound plate construction that is very precise in its position in accordance with the invention. In distinction to the state of the art, the individual pre-assembled plate is first brought into its exact position and substantially fixed in this position. This prevents the pre-assembled plate, once it has been aligned, from being shifted out of its position by the joining with other pre-assembled plates of the compound plate construction and thus having to readjust. After the finely adjusted pre-assembled plate is fixed in this position it is first connected to the other pre-

assembled plate. This creates a compound plate construction that is very precise in its position and permanently fixed. During the connecting of the steel rods of adjacent pre-assembled plates the position of the pre-assembled plates that had been precisely adjusted previously was retained since the finely adjusted pre-assembled plates had been fixed with a hardened substratum mass. This achieves an especially precise and also rapid and therewith economical finishing of a compound plate construction that substantially renders a post-adjustment superfluous. Another substantial advantage is that if a pre-assembled plate is damaged, e.g., if a train derails, individual pre-assembled plates can be removed from a compound plate construction and replaced with a new pre-assembled plate. This achieves an assembly that is quite compatible with the method of production in accordance with the invention that has great advantages not only during the first assembly but also during repairs.

The steel rods are advantageously extended in order to connect adjacent pre-assembled plates. This creates a tension between the adjacent pre-assembled plates that assures an additional fixing in place and a water-tight connection of a joint between the pre-assembled plates.

If narrow joints and wide joints are provided at the plate joint, it is especially advantageous if the narrow joints are provided with a sealing compound at first, the steel rods are then tensioned and, finally, the wide joints are closed. This achieves a uniform loading of the pre-assembled plates and of the sealing compound.

If the steel rods are not tensioned until after the hardening of the sealing compound in the narrow joints, a pressing together of the joints between the pre-assembled plates is achieved in an advantageous manner. This shrinking of the sealing compound during setting is compensated by this and a watertight connection between the pre-assembled plates is obtained.

It is especially favorable for the assembly if the steel rods of adjacent pre-assembled plates are connected by rod strainers. They can be operated in a simple manner with a hand tool or with appropriate tool machines and impart a sufficient tension to the steel rods.

As an alternative to rod strainers, it is also advantageous in some instances to weld the steel rods to each other. The appropriate welding methods also effect an extension of the steel rods during the welding as a consequence and a tension is generated by the cooling off of the steel rods.

Spindles have proven to be advantageous for a fine adjustment of the pre-assembled plate. An especially sensitive adjustment of the pre-assembled plates, that must be precisely adjusted to the millimeter at times, can be achieved with the spindles.

If concrete, especially high-grade concrete, is used as sealing compound for the joints between the pre-assembled plates a good permanence of the joint is assured.

A bituminous cement mortar proved to be especially advantageous as substratum mass. Bituminous cement mortar is viscous and on the one hand

suitable for filling up the intermediate space between the pre-assembled plate and the foundation completely without bubble formation to the extent possible. On the other hand it effects a good connection to the pre-assembled plate and, moreover, to the foundation, which is frequently a hydraulically bound carrier layer or also an asphalt carrier layer. This bituminous cement mortar brings about an exact fixing of the pre-assembled plate on the foundation and fixes the pre-assembled plate, which had been adjusted prior to the introduction of the substratum mass, in its position.

If an elastic, especially a porous sealing element is used as casing [form] for the substratum, an especially simple, economical and efficient sealing of the intermediate space between the pre-assembled plate and the foundation is obtained. The sealing element prevents the substratum from flowing out of this intermediate space. The casing can be placed before the fine adjustment, in particular before the placing of the pre-assembled plate. On account of its elasticity, it adapts precisely to the intermediate space between the pre-assembled plate and the substratum even during the fine adjusting and brings about a sealing of the hollow space.

If the pre-assembled plate is used as a carrier for rails, it proved to be especially advantageous to brace the rails on the pre-assembled plate in rail fastenings before the fine adjustment of the pre-assembled plate. Since the rails are decisive for the alignment of the pre-assembled plate, this is especially advantageous since any imprecisions in the rail fastenings can be compensated by this.

After the pre-assembled plate has been aligned and the steel rods connected to each other the wide joints are closed and the rails joined to each other. After this concluding work the compound plate construction with rails is ready for high-speed rail traffic.

It is especially advantageous and an alternative to the filling up of the narrow joint before the bracing of the steel rods if the finely aligned pre-assembled plate is fixed to the adjacent pre-assembled plate with spacers, especially with wedges. The joint is subsequently filled up.

If the spacers are arranged in the area of the narrow joints and/or the wide joints a good support of the spacers on the two pre-assembled plates occurs.

After the filling up of the joints the spacers can be relieved or removed.

Other advantages of the invention are presented in the following description of the figures.

Figure 1 shows a top view of a part of a pre-assembled plate consisting of reinforced concrete.

Figure 2 shows a section transversal to the longitudinal direction of a pre-assembled plate consisting of reinforced concrete.

Figures 3a to 3d show different method steps in the joining of two pre-assembled plates consisting of reinforced concrete.

Figure 4 shows a detailed view in longitudinal section of a pre-assembled plate consisting of reinforced concrete in accordance with figure 3c.

Figure 5 shows a butt joint with spacers.

Figure 6 shows a spacer in a top view.

Figure 7 shows a spacer in a lateral view.

Figure 1 shows a part of a pre-assembled plate 10 consisting of reinforced concrete in a top view. Pre-assembled plate 10 consisting of reinforced concrete comprises a plurality of bumps [protuberances] 12 in this exemplary embodiment. Alternatively, a continuous band or a concrete conduit that is continuous or interrupted is also possible. Bumps 12 are arranged in two rows in the longitudinal direction of pre-assembled plate 10, as a result of which they can be used in the purpose shown here for fastening rails for, e.g., high-speed tracks. A rail 30 is fastened on each of the rows of bumps 12. Rail 30 is fastened on each bump 12 with fastenings by fastenings 31, shown here merely symbolically. Fastenings 31 can be fixed as needed in prefabricated sockets 32 or in appropriate holes.

Two bumps 12 each are arranged on one segment of pre-assembled plate 10 in the transversal direction of pre-assembled plate 10. The individual segments are separated from each other by dummy joints 15. Dummy joints 15 function as theoretical breaking points in which unavoidable small cracks of pre-assembled plate 10 consisting of reinforced

concrete are purposefully produced in pre-assembled plate 10. As a result of these cracks purposefully produced at these positions the remaining pre-assembled plate 10 consisting of reinforced concrete is substantially spared from cracks and can thus be made stable and its state can be readily checked. The design of pre-assembled plate 10 consisting of reinforced concrete must therefore be selected in such a manner that the cracks are actually produced in the area of the theoretical breaking points or dummy joints 15.

In addition to the usual reinforcement of pre-assembled plate 10, several traction or steel rods 19 are arranged in pre-assembled plate 10 that are placed in its longitudinal direction. Steel rods 19, acting as traction anchor in pre-assembled plate 10, extend from one end of the pre-assembled plate to the other end of pre-assembled plate 10. They project out of the concrete surface at front sides 17 of pre-assembled plate 10 and can be connected, as will be described in detail later, to the adjacent pre-assembled plate or to its steel rods.

Front side 17 comprises a substantially straight-line, continuous edge and two recesses or pockets 24 in this exemplary embodiment. Pockets 24 are setoffs in relation to straight-line front surface 17 in which setoffs steel rods 19 project out of the concrete surface. In addition, pockets 24 comprise undercuts (shown in dotted lines) that additionally improve the stability of the connection of pre-assembled plate 10 to the adjacent pre-assembled plate (not shown). Moreover, the subsequent filling up of the joints between two pre-assembled plates 10 can be achieved in a more permanent fashion since

the penetration of water, among other things, is prevented by these undercuts.

Pre-assembled plate 10 comprises several filling openings 13 (only one shown here). A substratum means is introduced under pre-assembled plate 10 in its completely aligned state through these filling openings 13.

Figure 2 shows a part of a section transversal to the longitudinal axis of pre-assembled plate 10 and its foundation. Bumps 12 are again arranged on pre-assembled plate 10 on which bumps rail 30 is arranged with fastenings 31. Fastenings 31 are fixed in sockets 32 formed in pre-assembled plate 10. The pre-assembled plate consisting of reinforced concrete can be designed in a traditional manner with the customary reinforcement. As an alternative, it is especially advantageous if pre-assembled plate 10 is produced with fiber concrete. Steel fibers that impart great strength to pre-assembled plate 10 are present in the fiber concrete. The steel fibers can be bent, wound or have some other shape with which they support the interlacing in the concrete. This makes it possible to obtain an extremely solid reinforced concrete for pre-assembled plates 10, which display an especially great strength and service life in particular in the edge areas or in the areas in which fastenings 31 are fixed.

Several spindles 37 are arranged on pre-assembled plate 10 for aligning pre-assembled plate 10 into the required position. Spindle 37 is supported on support plate 38 in order to find a solid and uniform foundation in order to achieve a fine adjustment of plate 10 in its height. Spindle 37

extends in this construction through a recess in pre-assembled plate 10 in order to permit a large adjustment path. Pre-assembled plate 10 is brought into its position by adjusting screw 39 on spindle 37. Before pre-assembled plate 10 is placed on a hydraulically bound carrier layer 45, elastic casing 41 is placed in the edge area of pre-assembled plate 10. This casing 41 serves to prevent underfilling 42 poured under pre-assembled plate 10 after it had been aligned from running out. The preferably viscous substratum 42 is held under pre-assembled plate 10 thereby by casing 41. Casing 41 is preferably an elastic plastic part. In particular, spongy materials with coarse pores or neoprene or similar plastics have proven to be advantageous. Casing 41 can either remain at this position after the substratum has hardened and thus effect a certain protection against moisture. If the casing is to be used for more substrata, it is also possible to draw this casing 41 under pre-assembled plate 10 out and reuse it.

The individual steps of the joining of two pre-assembled plates 10 is described in the following with reference made to figures 3a to 3d. At first, pre-assembled plates 10 are precisely aligned in their height by spindles 37 and nuts 39. Steel rods 19 of the two pre-assembled plates to be connected should be substantially aligned in their longitudinal axis (figure 3a). Substratum 42 is subsequently poured under pre-assembled plate 10 via filling openings 13. Substratum 42 preferably consists of a bituminous mortar concrete. Substratum 42 joins pre-assembled plate 10 to hydraulically bound carrier layer 45 prepared below it. When substratum 42

has completely hardened, narrow joints located between the two plates 10 are filled up with a sealing compound, preferably concrete (figure 3b). The pouring can take place solely in the area of joint abutments 21 of pre-assembled plate 10 or also fill up the lower area between pre-assembled plates 10 in which wide joints 27 following above are located. As soon as the sealing compound has hardened, steel rods 19 are connected to each other by tighteners 28 and extended. This produces a pressure on sealing mass 25 in narrow joints 26 and thus effectively prevents an entering of water. On the other hand, the precise alignment of pre-assembled plates 10 previously carried out during the tensioning of steel rods 19 is not changed again by this procedure since they are supported on sealing compounds 25 and are fixed as regards the foundation by substratum 42 (figure 3c).

After steel rods 19 have been connected to each other and extended, wide joint 27 can be closed in order to prevent corrosion (figure 3d). This closing can also take place by introducing a sealing compound 25, e.g., concrete. Alternatively, a removable covering can also be provided here. However, a firmer joining of the two pre-assembled plates 10 takes place by filling up wide joint 27 since this brings about an additional cogging of pre-assembled plates 10 given a corresponding shape of wide joint 27.

The procedure for the joining of the two pre-assembled plates 10 was presented in figures 3a to 3d without a built-on rail 30. If the pre-assembled plates are used for high-speed rail traffic, it is advantageous if rail 30 has

already been built on for the aligning of pre-assembled plates 10 since rail 30 is decisive for the aligning of pre-assembled plates 10.

Figure 4 shows the joint of two pre-assembled plates 10 prepared up to the work step of figure 3c in more detail. The pre-assembled plates 10 are cut lengthwise in the area of steel rods 19. Pre-assembled plates 10 are arranged on substratum 42 that is supported on a hydraulically bound carrier layer. Casing 41 prevents substratum from breaking out of the area of pre-assembled plate 10 during the underpouring or underpressing of pre-assembled plate 10.

Pre-assembled plate 10 comprises bumps 12 on which rail 30 is fastened with fastenings 31. Dummy joints 15 are arranged at regular intervals in pre-assembled plates 10 and represent theoretical breaking points for pre-assembled plate 10. Several steel rods 19 have been introduced into pre-assembled plate 10. Steel rods 19 are substantially firmly anchored in pre-assembled plate 10. Steel rod 19 is not connected to the concrete of the pre-assembled plate only in the area from dummy joint 15 to the end of the particular pre-assembled plate 10 and can thus be freely extended. To this end steel rod 19 is in a tube 20 that prevents a connection of steel rod 19 with a sealing compound 25. Narrow joints 26 are filled up with sealing compound 25. Steel rods 19 are connected to each other by tightener 28 and extended. The extension brings it about that the steel rods are extended in their freely movable area in the particular tube 20 and thus effect a pre-tensioning. Sealing compound 25 is pressed and the composite construction

stabilized by the pre-tension so that the penetration of water into the joints is prevented. In addition, pre-assembled plates 10 are pressed firmly against each other via sealing compound 25. The fact that steel rod 19 is movably supported only in the area between dummy joint 15 and the end of pre-assembled plate 10 brings it about in a reliable manner that dummy joint 15 is not bridged with a pressure force and loses its function therewith. The force on the concrete body is introduced only in the last segment, namely, between dummy joint 15 and the end of pre-assembled plate 10 via steel rods 19.

If pocket 24, in which tighteners 28 and the ends of steel rod 19 are located, is designed so that it has an undercut 29 in a top view onto the plate, an additional cogging of pre-assembled plates 10 with each other is achieved if wide joint 27 formed by pockets 24 is filled up with sealing compound 25'. Pre-assembled plates 10 are additionally hindered therewith from moving vertically.

Substratum 42 can be removed again in the instance in which the plate or the substratum lowers in the course of the using of the plate. This happens in that substratum 42 is bored through transversely to the longitudinal direction of the plate. A saw, especially a saw cable, is introduced into the borehole and saws through the substratum under the plate. The plate can then be precisely realigned, e.g., with spindles, and more matter can be poured under it again.

Figure 5 shows a top view onto a butt joint between two pre-assembled plates 10 and 10'. Spacers 50 are arranged for fixing pre-assembled plates 10 and 10'. Spacers 50 are located in the area of a narrow joint. Alternatively or additionally, two spacers 50' can be provided in the area of the wide joints. It is assured in each of the embodiments that the finely aligned state of pre-assembled plates 10 and 10' is retained during the tensioning of the steel rods.

Figure 6 shows a top view onto a spacer 50. Spacer 50 consists of base plate 51 fastened on pre-assembled plate 10 and 10'. This base plate 51 can either be cast in pre-assembled plate 10, 10' or have been subsequently applied. One of base plates 51 comprises guides 52 for a wedge 53. Wedge 53 is introduced into guides 52 between the two base plates 51 when pre-assembled plates 10 and 10' have been aligned. This fixes the interval of pre-assembled plates 10 and 10' so that during a tensioning of the steel rods the pre-assembled plates 10 and 10' can not move toward one another and the alignment of the plates is not changed.

Figure 7 shows a lateral view of spacer 50. Pre-assembled plates 10, 10' located on substratum 42 or carrier layer 45 are held at a defined interval by wedge 53. This interval is permanently fixed after the bracing of the steel rods in that the joint is filled up with sealing compound 25. After the hardening of sealing compound 25 the position of pre-assembled plates 10, 10' to one another is permanently determined. Wedge 53 can be removed as needed and used for the next butt joint. In a special embodiment sealing

compound 25 can also be hollowed out at least temporarily in the area of spacer 50. After the hardening of the rest of sealing compound 25 the complete spacer 50 can be removed from the butt joint together with wedge 53 and used for another connection position.

The use of the spacers permits an immediate application of tractive force on the steel rods and a subsequent common sealing of the wide and of the narrow joint. This is especially advantageous if unfavorable temperature and climate conditions for the sealing of the joint are present. A more favorable temperature and a suitable climate can be waited for for the final filling up of the wide and of the narrow joint so that an optimum processing of the material is given.

The present invention is not limited to the design presented. Pre-assembled plates 10 can also be used for applications other than the described ones. Steel rods 19 can also be prevented from joining with the concrete of pre-assembled plate 10 in the last segment in a different way. Combinations of the individual features are of course also within the protective scope of the invention.

CLAIMS:

1. A pre-assembled plate of reinforced concrete, with
at least two steel rods extending in the longitudinal direction of the pre-assembled plate and projecting over the concrete surface on a front side, with at least one theoretical breaking point of the pre-assembled plate running transversely to the steel rods, wherein at least one steel rod is anchored in the area between the front side of the pre-assembled plate and a first theoretical breaking point and is supported in a substantially freely movable manner in the direction of the particular front side in its longitudinal direction.
2. The pre-assembled plates according to claim 1, wherein the plates are suitable for use as structural components of a roadway for high-speed vehicles.
3. The pre-assembled plate according to claim 1 or 2, wherein the at least one theoretical breaking point comprises several theoretical breaking points.
4. The pre-assembled plate according to claim 1, 2 or 3, wherein the or a theoretical breaking point is a dummy joint extending transversely to the longitudinal direction of the pre-assembled plate.
5. The pre-assembled plate according to any one of the preceding claims, wherein the anchoring of the at least one steel rod is provided approximately 50 cm removed from the front side of the pre-assembled plate.

6. The pre-assembled plate according to any one of the preceding claims, wherein at least one steel rod is jacketed in the area between the front side of the pre-assembled plate and the anchoring by a tube or hose.
7. The pre-assembled plate according to claim 6, wherein the tube or hose comprises a shrinkdown plastic tubing or heat shrinkable sleeve.
8. The pre-assembled plate according claim 6 or 7, wherein the jacket of the steel rod has a greater inside diameter than the outside diameter of the steel rod.
9. The pre-assembled plate according to any one of the preceding claims, wherein at least one steel rod terminates in a pocket of the pre-assembled plate.
10. The pre-assembled plate according to claim 9, wherein the pocket is open toward the top of the pre-assembled plate.
11. The pre-assembled plate according to claim 9 or 10, wherein the pocket is closed toward the bottom of the pre-assembled plate.
12. The pre-assembled plate according to any one of claims 9, 10 or 11, wherein the pocket comprises an undercut when viewed from the top.
13. The pre-assembled plate according to any one of the preceding claims, wherein a bottom of the pre-assembled plate runs substantially in a straight line on the front side of the pre-assembled plate.
14. The pre-assembled plate according to any one of the preceding claims, wherein a joint abutment is provided between two steel rods of the pre-assembled plate and/or toward

the edge of the pre-assembled plate for forming a narrow joint with the adjacent pre-assembled plate.

15. The pre-assembled plate according to any one of claims 9-14, wherein the pocket forms a wide joint with the adjacent pre-assembled plate .

16. The pre-assembled plate according to any one of the preceding claims, wherein a top of the pre-assembled plate has alternating narrow and wide joints.

17. The pre-assembled plate according to claim 16, or according to claim 15 when dependent on claim 14, wherein the narrow joint and/or the wide joint between two pre-assembled plates is/are filled with a sealing compound.

18. The pre-assembled plate according to claim 17, wherein the sealing compound comprises concrete.

19. The pre-assembled plate according to any one of claims 15 to 17, wherein connecting means for connecting the steel rod of the one pre-assembled plate to the steel rod of the adjacent pre-assembled plate can be arranged in the wide joint.

20. The pre-assembled plate according to any one of the claims 14 to 19, wherein spacers are arranged in the area of the joints.

21. The pre-assembled plate according to any one of the preceding claims, wherein adjusting devices are arranged on the pre-assembled plate.

22. The pre-assembled plate according to claim 21, wherein the adjusting devices comprise spindles.

23. The pre-assembled plate according to any one of the preceding claims, wherein the pre-assembled plate is produced from fiber concrete.

24. The pre-assembled plate according to any one of the preceding claims, wherein a substratum mass, is introduced between the pre-assembled plate and a foundation.

25. The pre-assembled plate according to claim 24, wherein the substratum mass comprises a bituminous cement mortar.

26. The pre-assembled plate according to claim 24 or 25, wherein the substratum mass is encased with a sealing element.

27. The pre-assembled plate according to claim 26, wherein the sealing element comprises an elastic plastic.

28. The pre-assembled plate according to claim 26 or 27, wherein the sealing element comprises a porous plastic.

29. The pre-assembled plate according to any one of claims 26 to 28, wherein the sealing element comprises a rubber mat.

30. The pre-assembled plate according to claim 29, wherein the rubber mat comprises a neoprene material.

31. The pre-assembled plate according to any one of claims 26 to 30, wherein the sealing element comprises a sponge.

32. A method of producing a compound plate construction consisting of pre-assembled plates of reinforced concrete, with at least two pre-assembled plates, steel rods extending in the longitudinal direction of the pre-

assembled plate and projecting over the concrete surface on a front side, and with a joint between adjacent pre-assembled plates, the method comprising:

placing and finely aligning a first pre-assembled plate;

pouring a substratum mass under the finely aligned pre-assembled plate; and

after the hardening of the substratum, connecting the first pre-assembled plate to an adjacent pre-assembled plate by filling in the joint and connecting the steel rods.

33. The method according to claim 32, wherein connecting the steel rods comprises extending the steel rods .

34. The method according to claim 32 or 33, further comprising providing narrow joints and wide joints at the plate joint and providing a sealing compound in the narrow joints, tensioning the steel rods and, closing the wide joints .

35. The method according to claim 34, wherein providing a sealing compound comprises providing cement.

36. The method according to claim 34 or 35, wherein tensioning of the steel rods is not carried out until after the hardening of the sealing compound in the narrow joints.

37. The method according to any one of claims 32 to 36, wherein connecting the steel rods of adjacent pre-assembled plates comprises connecting them with tighteners.

38. The method according to any one of claims 32 to 36, wherein connecting the steel rods comprises welding them together.
39. The method according to any one of claims 32 to 38, wherein the finely aligning step comprises finely adjusting the first pre-assembled plate with spindles.
40. The method according to any one of claims 32 to 39, wherein a bituminous cement mortar is used as the substratum mass .
41. The method according to any one of claims 32-40, wherein an elastic, element is used as casing for the substratum .
42. The method according to claim 41, wherein the elastic element comprises an elastic porous sealing element.
43. The method according to claim 41 or 42, further comprising placing the casing is carried out before the fine adjusting step, .
44. The method according to claim 42, wherein placing the casing is carried out before the placing of the pre-assembled plate.
45. The method according to any one of claims 32 to 44, further comprising bracing rails in rail fastenings before the fine adjustment of the pre-assembled plate.
46. The method according to any one of claims 34 to 45, further comprising connecting rails on the pre-assembled plates to each other after connecting the pre-assembled plates to each other and after the closing of the wide joint.

47. The method according to any one of claims 32 to 46, wherein the finely aligned pre-assembled plate is fixed to the adjacent pre-assembled plate with spacers and further comprising tensioning the steel rods and subsequently filling up the joint.

48. The method according to claim 47, wherein the spacers comprise wedges.

49. The method according to claim 47 or 48, wherein the spacers are arranged in the area of the narrow joints and/or of the wide joints.

50. The method according to any one of claims 47 to 49, further comprising relieving or removing the spacers after the filling up of the joints.

51. The method as defined in any one of claims 32 to 50, wherein the plates are suitable for use as structural components of a roadway for high-speed vehicles.

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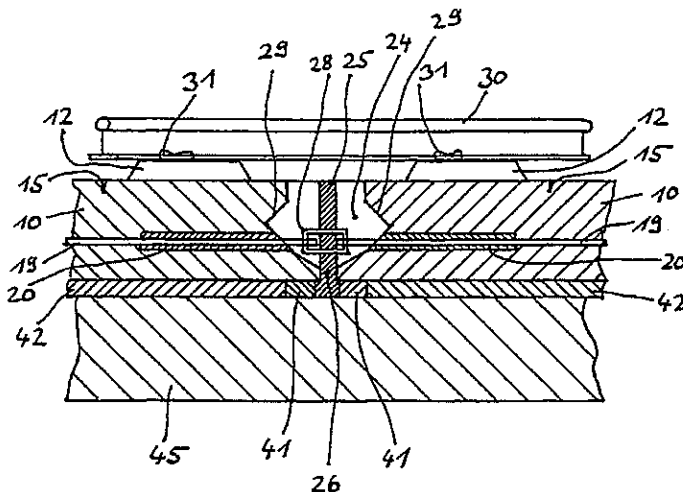
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(54) Title: PRE-ASSEMBLED PLATE CONSISTING OF ARMoured CONCRETE

(54) Bezeichnung: STAHLBETONFERTIGTEILPLATTE



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(57) Abstract: The invention relates to a pre-assembled plate consisting of armoured concrete, especially for the use as a component of a solid roadway for high-speed means of transport. At least two steel rods extending in the longitudinal direction of the pre-assembled plate of armoured concrete (10) and protruding over the concrete surface thereof on the front face (17) are provided. The pre-assembled plate (10) is provided with at least one, preferably several, predetermined breaking point/s (15) which extend/s crosswise in relation to the steel rods (19). The steel rod (19) is anchored in the area between the front face (17) of the pre-assembled plate (10) and the first predetermined breaking point (15) respectively and is mounted in the direction towards the respective front face (17) in the longitudinal direction thereof in an essentially freely moveable manner. According to a method for producing a plate composite structure of pre-assembled plates of armoured concrete (10), the pre-assembled plate (10) is placed and exactly positioned. A casting compound (42) is underpoured under the exactly positioned pre-assembled plate. The pre-assembled plate (10) is connected to the adjacent pre-assembled plate (10) by casting the joint and connecting the steel rods (19) after the casting compound (42) has hardened.

[Fortsetzung auf der nächsten Seite]