

BALLASTLESS TRACK BASE PLATE CONNECTING STRUCTURE AND BALLASTLESS TRACK HAVING SAME

TECHNICAL FIELD

[0001] The disclosure relates to the technical field of ballastless track, and more particularly to a connection structure of a base slab for ballastless track, and a ballastless track comprising the same.

BACKGROUND

[0002] Ballastless track refers to a track structure in which concrete or asphalt mixture is used instead of a track bed composed of scattered gravel. Compared with ballast track, ballastless track has been widely applied to high-speed rail because it prevents any ballast splashing on people or other areas, and has the advantages of giving good ride, good stability, long service life, good durability and less maintenance.

[0003] The main structure of slab ballastless track involves a track slab, an asphalt mortar or a self-compacting concrete-filled layers, a base or a support layer, etc. The base or the supporting layer adopts a concrete structure. The asphalt mortar or self-compacting concrete-filled layer laid on the base or the supporting layer is a structural layer for structure adjustment and supporting force transmission of ballastless track.

[0004] In the existing ballastless track structure of unit slab type, each track slab is independent after laying and installation. However, the disadvantage is that the track slab will be separated from the filling layer after the line runs for a period of time, easily causing the longitudinal end of the track slab to warp and bend. This undoubtedly adversely affects the smoothness, comfort, and service life of the track structure.

[0005] A slab ballastless track structure of longitudinally connection style has been disclosed in the prior art, such as a longitudinal connection tension lock of a ballastless track slab disclosed in patent document 201695285U. This patent utilizes steel bars extending longitudinally from the track slab for connection and locking to achieve

longitudinal connection. However, this connection method, whose connection structure is complicated, is basically equivalent to the method of longitudinal prestressed steel bars, leading to the construction is cumbersome. The rigidly connected track slab will arc upward in the case of excessive temperature force. This will adversely affect the service life of the track structure, and the smoothness and comfort of the traveling train.

[0006] To overcome the above deficient, there are currently methods for directly connecting the longitudinal ends of two base slabs by bolts. For example, patent document CN201495454U discloses a longitudinal connection structure of the slab ballastless track provided for a high-speed railway. The connection structure comprises a track slab lying longitudinally along the line. The longitudinal end of the track slab is provided with at least two sets of dents and arc-shaped through holes at intervals. The two ends of the arc-shaped through hole communicate with the longitudinal end faces of the pit and the track slab, respectively. The arc-shaped bolts disposed in the dent and the arc-shaped through holes longitudinally connect two adjacent track slabs. This connection structure can overcome the problem of arching upward of rigidly connected track slab under the condition of excessive temperature force. However, this connection method must form a dent having a certain depth at two ends of the track slab, and then a bolt hole is disposed in the groove that penetrates the connecting ends. On the one hand, additional dents on the slab complicate the process, increasing manufacturing difficulty and cost. In addition, the size and shape of the inner wall have higher requirements to meet the opening of the bolt holes and the connection and fixing of the bolts, making the manufacturing process more difficult. In particular, the dent will cause the precipitation of rainwater and dirt, etc., which will cause the bolts to be corroded or difficult to disassemble and repair, increasing the difficulty of subsequent maintenance.

[0007] At present, China Railway Track System (CRTS) can be divided into three types: CRTS I, II and III slab ballastless track. The CRTS I slab ballastless track adopts a unit slab that has no vertical connection between them, without horizontal blocks. The unit slab is disposed on a cast-in-situ reinforced concrete base with a convex block, and then positioned by convex blocks. The slabs of CRTS II slab ballastless track are connected vertically. A longitudinal connection structure is formed by longitudinal finely-threaded

concrete and tension locks, with horizontal blocks. The CRTS III slab ballastless track adopts a positioning method in which square convex blocks (or grooves) are disposed on both sides of the self-compacting concrete filling layer. For example, patent document CN105200868A discloses a precast slab ballastless track structure and a positioning structure involved. The track slab is in the form of an intermediate hollow frame (through hole), and a positioning convex block corresponding to the through hole is provided between the base and the prefabricated track slab. There is at least one positioning convex block which are used to prevent the displacement of the track slab in the horizontal and vertical directions.

[0008] The positioning method for slab ballastless track has poor removability and the subsequent maintenance is inconvenient when the track slab is damaged. This positioning structure also has disadvantages in terms of stress and deformation requirements. It is necessary to design an assembled positioning structure for ballastless track to solve the problem of inconvenient maintenance of the positioning structure of slab ballastless track, improving the current load and deformation requirements of the positioning structure.

[0009] The existing slab ballastless track structure has many special-shaped slabs due to the complexity of the horizontal and vertical sections of the line and the underlying structure of the railway, which reduces the production efficiency of the factory. Moreover, the structure and size of the standard slab are completely different from that of special-shaped slab, which is not convenient for stacking, transportation, and on-site assembly of the track slabs, and the maintenance task will be complicated when the track slab is damaged at the site.

[0010] For the existing unit slab ballastless track structure, each track slab is independent after laying and installation. However, the disadvantage is that the track board track slab will be separated from the filling layer after the line runs for a period of time, causing the longitudinal end of the track slab to easily warp and bend. This undoubtedly adversely affects the smoothness, comfort, and service life of the track structure. It is still difficult to meet the problems of stress and deformation between the slabs and the complex manufacturing process although there are corresponding solutions to improve the connection method. Moreover, it is impossible to overcome the problem

that the current ballastless track has too many special-shaped slabs, which leads to the difficulty in assembly and maintenance of the ballastless track.

SUMMARY

[0011] The disclosure provides a connection structure of a base slab for ballastless track and a ballastless track comprising the same. A base slab of ballastless track is provided with an optimized and improved connection structure, which overcomes the deformation question that the base slabs tend to arc upward due to stress when they are connected to each other. The provided base slab has a simple structure and is convenient for construction, thus facilitating subsequent assembly and disassembly and also ensuring an easy and reliable maintenance.

[0012] According to an aspect of the disclosure, there is provided a connection structure of the base slabs for ballastless track. The connection structure comprises a first connector disposed on the first base slab of ballastless track, and a second connector disposed on the second base slab of ballastless track;

[0013] the first connector is disposed on one end of the first base slab, and comprises a protrusion extending in the longitudinal direction. The longitudinal end surface of the protrusion is provided with a bolt hole penetrating the upper surface of the connector;

[0014] the second connector is disposed on one end of the second base slab connected to the first base slab, and comprises a longitudinal dent that matches the protrusion. The longitudinal end surface of the dent is provided with a bot hole penetrating the upper surface of the second connector. The protrusion and the dent can be matched and spliced to form a mortise-and-tenon joint when the ends of the two base slabs are connected to each other. The two bolt holes are exactly aligned and spliced to form a complete channel. A bolt then passes through the channel to connect and fix the two base slabs.

[0015] The upper surfaces of both the first connector and the second connector are higher than that of the first base slab and the second base slab. The upper surface of the connector is connected to the upper surface of the corresponding base slab via an inclined

slope. The opening on one end of the bolt hole is disposed on the inclined slope, thus the opening is higher than the upper surface of the base slab.

[0016] The central axis of the opening on the inclined slope is perpendicular to the plane where the inclined slope is located.

[0017] The bolt hole separately disposed on the first connector and the second connector is an arc-shaped hole. The two arc-shaped holes can be exactly aligned and connected to form a channel that allows an arc-shaped bolt to pass through.

[0018] At least one arc-shaped bolt hole is disposed on the first connector and the second connector, respectively.

[0019] At least one first connector is disposed on one end of the first base slab for ballastless track, and at least one second connector is disposed on one end of the second base slab for ballastless track.

[0020] An embedded sleeve is disposed in the arc-shaped bolt hole.

[0021] According to another aspect of the disclosure, there is also provided a ballastless track having the connection structure.

[0022] According to another aspect of the disclosure, there is also provided an assembled positioning structure disposed between a track slab and a base for positioning the track slab and the base, the assembled positioning structure comprising:

[0023] a positioning body comprising a through hole penetrating through two opposite end surfaces of the positioning body; and one of the two opposite end surfaces of the positioning body being provided with a groove having a certain depth;

[0024] a first positioning hole disposed on the track slab and matching the positioning body in shape, so that one end of the positioning body can be inserted therein;

[0025] a second positioning hole disposed on the base and matching the positioning body in shape, so that another end of the positioning body can be inserted therein;

[0026] a positioning tooth disposed at the bottom of the second positioning hole, and matching the groove on the positioning body, so that the positioning tooth can be in

engagement with the corresponding dent when one end of the positioning body is inserted in the second positioning hole; the positioning tooth comprises a bolt hole that can be aligned with the through hole penetrating through the positioning body when the positioning body is inserted in the second positioning hole; a bolt passes through the through hole and through the bolt hole to detachably fix the positioning body to the base; the positioning body matches the first positioning hole to limit the track slabs.

[0027] The positioning body can be a cylinder, a cuboid, an oblong, or an ellipsoid.

[0028] The first positioning hole is disposed at the connecting end of the track slab outside the steel rails; the first positioning hole is a quarter-hole partially matched to a peripheral contour of the positioning body; the two positioning holes form a half-hole structure that matches the peripheral contour of the positioning body after being spliced together, to limit the two track slabs after the positioning body is inserted in the first positioning hole.

[0029] Two first positioning holes are disposed on each end of the track slab.

[0030] The positioning tooth having a strip shape is disposed at and protrudes upward from the bottom of the second positioning hole.

[0031] The number of the bolt holes of the positioning tooth is the same as that of the through hole of the positioning body.

[0032] An embedded sleeve is disposed in the bolt hole of the positioning tooth.

[0033] The positioning body comprises precast concrete or steel block.

[0034] According to another aspect of the disclosure, there is also provided an assembled ballastless track comprising the positioning structure.

[0035] According to another aspect of the disclosure, there is also provided an assembled ballastless track. The assembled ballastless track comprises a plurality of unit slabs; each unit slab comprises at least one precast base slab, and each precast base slab comprises a certain number of bearing track platforms.

[0036] Every two precast base slabs are connected in pairs, one of which comprises a protrusion on the end and the other one comprises a dent; the protrusion comprises a bolt hole disposed on the longitudinal end surface thereof and penetrating the upper surface of the base slab; the dent matches the protrusion, and comprises a bolt hole disposed on the longitudinal end surface thereof and penetrating the upper surface of the base slab; the protrusion is connected to the corresponding dent with mortise-and-tenon joint, and then a bolt passes through the two bolt holes to fasten the joint.

[0037] The unit slab has a length that satisfies the requirement of on-site construction, and comprises a plurality of different combination of the base slabs; the number and/or the length of the base slabs in different groups can be different from each other.

[0038] At least three bearing track platforms are disposed on the precast base slab.

[0039] The bolt hole disposed on the longitudinal end surface of the protrusion comprises an opening, and the opening communicates with the upper surface of the base slab and is higher than the upper surface of the base slab.

[0040] The bolt hole disposed on the longitudinal end surface of the dent comprises an opening, and the opening communicates with the upper surface of the base slab and is higher than the upper surface of the base slab.

[0041] The central axis of the opening on the inclined slope is perpendicular to the plane where the inclined slope is located.

[0042] The bolt hole separately disposed on the first connector and the second connector is an arc-shaped hole. The two arc-shaped holes can be exactly aligned and connected to form a channel that allows an arc-shaped bolt to pass through.

[0043] At least one bolt hole is corresponding to the protrusion or the dent.

[0044] At least one first connector is disposed on one end of the first base slab for ballastless track, and accordingly, at least one second connector is disposed on one end of the second base slab for ballastless track.

[0045] The disclosure has the following advantages as compared with the prior art:

[0046] (1) the connection structure of the disclosure comprises a protrusion and a dent separately disposed on the opposite ends of two base slabs. The protrusion is connected to the dent with mortise-and-tenon joint, and the joint is further fastened with a bolt. The design is convenient for reliably anchoring of two base slabs. In this case the anchoring force can be reasonably transmitted, which effectively solves the problem that the track slabs easily deformed by force;

[0047] (2) the connection structure also comprises an arc-shaped bolt hole whose opening on the upper surface of the track slab is higher than the upper surface of the base slab. This design prevents the erosion of the connectors due to the accumulation of water and dust in the bolt hole;

[0048] (3) the base slab provided in the disclosure for ballastless track has a longitudinal connection structure, facilitating the construction and subsequent maintenance. And it provides the possibility to splice and combine different kinds of unit slabs of different length specifications, effectively satisfying the requirements of ballastless track for stability and comfort, and facilitating the construction and subsequent maintenance;

[0049] (4) the positioning structure of the disclosure comprises a detachable positioning connection structure that is formed by connecting the positioning body with the bolt of the base, thereby facilitating the disassembly and assembly of the positioning structure to realize the detachable maintenance or replacement of the track slab;

[0050] (5) the positioning structure of the disclosure comprises a positioning hole disposed on the track slab, and the cross section of the positioning hole matches the peripheral contour of the positioning body. The positioning body can be thus inserted in the positioning hole and fixed on the base, preventing the lateral and/or longitudinal displacement of the track slab along the tracks;

[0051] (6) the positioning structure of the disclosure can realize the detachable positioning of the track slab, which meets the requirements of deformation by positioning force, and facilitates the subsequent disassembly, assembly and maintenance of the track slab.

[0052] (7) the ballastless track of the disclosure can be flexibly configured and combined by using a plurality of base slabs of different specifications, which can be combined into unit slabs of different sizes according to the requirements at the site, and the combination forms are more diverse. The miniaturized and lightweight precast base slabs are more convenient for production, stacking and transportation and on-site assembly, reducing the use of existing special-shaped slabs. The small modular precast base slab is easier to replace in the case of on-site damage, which effectively reduces the workload of maintenance and improves production efficiency;

[0053] (8) the ballastless track of the disclosure adopts the connection method based on the optimized and improved base slab. That is, a protrusion and a corresponding dent are separately disposed on the opposite connecting ends of two base slabs. The protrusion is connected to the dent with mortise-and-tenon joint, and the joint is further fastened with an arc-shaped bolt passing through an arc-shaped through hole. The process can first realize the precast production of different kinds of assembled base slabs for ballastless track, and then combine these base slabs into unit plates of certain sizes on-site through the connection device. Therefore, the precast base slabs can be flexibly matched and combined to form a unit slab whose length is more suitable for the on-site needs.

BRIEF DESCRIPTION OF THE DRAWINGS

[0054] FIG. 1 is a schematic diagram of a connection structure of a base slab for ballastless track according to one embodiment of the disclosure;

[0055] FIG. 2 is a sectional view taken along line A-A in FIG. 1;

[0056] FIG. 3 is a perspective view of the connection structure of base slab of the ballastless track;

[0057] FIG. 4 is a partial structural schematic diagram of a positioning component according to one embodiment of the disclosure;

[0058] FIG. 5 is a structural schematic diagram of a first positioning hole of the positioning component;

[0059] FIG. 6 is a perspective view of a three-dimensional structure of the second positioning hole of the positioning component;

[0060] FIG. 7 is an exploded view of an assembly application of the positioning structure of ballastless track according to one embodiment of the disclosure;

[0061] FIG. 8 is a structural schematic diagram of the precast base slab comprising three bearing track platforms according to one embodiment of the disclosure;

[0062] FIG. 9 is a structural schematic diagram of the precast base slab comprising four bearing track platforms according to one embodiment of the disclosure;

[0063] FIG. 10 is a structural schematic diagram of the precast base slab comprising five bearing track platforms according to one embodiment of the disclosure;

[0064] FIG. 11 is a structural schematic diagram of the precast base slab comprising six bearing track platforms according to one embodiment of the disclosure;

[0065] FIG. 12 is a schematic diagram of the connection structure of the precast base slab according to one embodiment of the disclosure.

[0066] the description of reference numerals in the figures is as follows: **10**. Base slab; **11**. Connector; **12**. Arc-shaped through hole; **13**. Embedded bolt sleeve; **20**. Positioning body; **21**. Through hole; **22**. Positioning groove; **30**. First positioning hole; **40**. First positioning hole; **41**. Positioning tooth; **42**. Bolt hole; **43**. Embedded bolt sleeve; **50**. Fastener; **60**. Precast base slab; **61**. Upper surface of base slab; **62**. Bolt hole; **63**. Embedded bolt sleeve;

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0067] To further illustrate, embodiments detailing the disclosure are described below. It should be noted that the following embodiments are intended to describe and not to limit the disclosure.

[0068] The technical features in the embodiments of the invention described below can be combined with each other so long as no conflict occurs.

[0069] FIG. 1 is a schematic diagram of the connection structure of the base slab of the ballastless track in Example of the disclosure. FIG. 2 is a sectional view taken along line A-A in FIG. 1. FIG. 3 is a perspective view of the connection structure of base slab of the ballastless track.

[0070] As shown in FIG. 1, the connection structure of the base slab of the ballastless track as described in the disclosure, comprising a first connector **11** and a second connector **11**.

[0071] The first connector **11** and the second connector **11** is disposed at the end of the base slab of the ballastless track. Preferably, the two connectors are disposed on the base slab between two steel rails, or disposed at the connecting end of the base slab outside the steel rails. There is least one connector on each base slab. Preferably, the surface of the connectors protrudes above the upper surface of the base slab. The upper surface of the connector and the surface of the base slab are connected with an inclined plane that is flat or curved.

[0072] As shown in FIGS. 1-3, the upper surface of the first connector **11** is higher than the surface of the base slab **10**, that is, the first connector **11** protrudes above the base slab **10**. The upper surface of the first connector **11** and the upper surface of the base slab **10** are connected with an inclined slope that is flat or curved, which is convenient for processing and subsequent construction.

[0073] As shown in FIG. 2, the first connector **11** comprises a protrusion protruding laterally from the longitudinal end of the base slab **10**. In an example of a preferred embodiment of the disclosure, the protrusion is disposed on the lower section of the first connector **11**, and a dent being in engagement with the protrusion is disposed at the longitudinal end of the second connector **11** of another base slab. The longitudinal end of the dent is flush with that of the base slab. The dent is preferably disposed on the lower section of the second connector **11**. The longitudinal end of the protrusion is preferably a plane, accordingly, the longitudinal end of the dent is a plane. The dent is required to be in engagement with the protrusion. There is no particular limit on shapes for the longitudinal ends of the protrusion and the dent that can be arbitrary shapes matched to each other.

[0074] As shown in FIG. 3, the longitudinal end of the dent is preferably flush with that of the base slab. The longitudinal end of the protrusion protrudes from that of the corresponding base slab, which is convenient to extend into the dent and guarantees fast and reliable splicing results.

[0075] The protrusion of the first connector **11** is provided with an arc-shaped through hole, wherein the one end of the through hole is disposed on the longitudinal end of the protrusion, and another end of the through hole is disposed on the inclined plane between the upper surface of the first connector **11** and the upper surface of the base slab **10**. This design is convenient for processing and subsequent construction, and more importantly, it can avoid the accumulation of water and dust that may lead to the erosion of the connectors. The two through holes communicate with each other to form a complete channel when they are aligned, thereby the two base slabs can be connected and fixed by a bolt passing through the two through holes.

[0076] The arc of through hole on the protrusion matches to that of the through hole on the corresponding dent, thus forming a complete arc-shaped hole when the two through holes are aligned, and further connecting and fixing the arc-shaped hole by an arc-shaped bolt passing through them.

[0077] In an Example of the disclosure, an embedded sleeve **13** is provided in the arc-shaped through hole **12**, which is convenient for the prefabricated construction and the full penetration of the arc-shaped bolts.

[0078] In a preferred embodiment of the disclosure, there is at least one arc-shaped through hole on each base slab.

[0079] The connection between the base slabs of the ballastless track has a great impact on the mechanical properties, stability and reliability of ballastless track and the convenience in construction and maintenance. The disclosure adopts such a newly designed connection structure, in which a connector is disposed on one end of each track slab. The connectors are divided into two types of protrusions and dents. A protrusion is connected to a corresponding dent with mortise-and-tenon joint, and the protrusion and the dent configured in pairs are further fixed by an arc-shaped bolt, thus being convenient

for anchoring two base slabs. The protrusion and its corresponding dent are reliably spliced by matching and engaging, and then anchored and locked by bolts. An anchoring force are first transmitted via the protrusion and the dent and then transmitted by the connectors, so that the whole track slabs are reasonably transmitted in force, the stability is good, and the problem that the track slabs easily deformed by force is overcome. In addition, the opening disposed on the upper surface of the base slabs is higher than the upper surface of the track slab, thereby the processing and subsequent construction are convenient and simple. More importantly, this design can prevent the erosion of the connectors due to the accumulation of water and dust in the through holes.

[0080] FIG. 4 is a partial structural schematic diagram of a positioning component in Example of the disclosure; FIG. 5 is a structural schematic diagram of a first positioning hole of the positioning component; FIG. 6 is a perspective view of the three-dimensional structure of the second positioning hole of the positioning component; FIG. 7 is an exploded view of an assembly application of the positioning structure in a ballastless track in Example of the disclosure.

[0081] As shown in FIG. 4, the disclosure provides a positioning component that can be applied in assembled ballastless track. The positioning component is disposed between the track slab and the base to prevent these two slabs movement. The precast positioning component is inserted into the positioning space between the track slab and the base after the track slabs are finely adjusted, thus preventing the horizontal and/or longitudinal displacement of the track slab along the tracks.

[0082] As shown in FIGS. 4-7, the positioning component comprising a positioning body **20**, a first positioning hole **30**, a second positioning hole **40** and a positioning tooth **41**. As shown in FIG. 4, the shape of the positioning body **20** can be a cylinder, a cuboid, an oblong, or an ellipsoid. That is, the positioning body **20** has an elongated structure with a certain thickness, whose cross section can be rectangle, oblong, oval, or any other structure that can be easily processed or assembled. The positioning body **20** comprises precast concrete or metal materials such as steel.

[0083] As shown in FIG. 4, the positioning body **20** comprises two through holes penetrating the upper and lower end surfaces which are located opposite to each other,

and this design permits complete penetration of fastening bolts **50**. A groove penetrating to a certain depth is formed on one end surface of the positioning body **20** (as shown in FIG. 4, the groove is formed on the lower end surface of the positioning body **20**).

[0084] As shown in FIG. 5, the first positioning hole **30** is matched to the size of the peripheral contour of the positioning body **20**, so that the positioning body **20** can be just inserted therein and limits the displacement of the track slabs on the tracks.

[0085] The positioning hole **30** is disposed on one end surface of the track slab without the connectors **11**, **12**. As shown in FIG. 5, the first positioning hole **30** is a quarter-hole partially matched to the peripheral contour of the positioning body, that is, the cross section of the first positioning hole **30** is 1/4 of the entire peripheral contour thereof. The two positioning holes can form a half-hole structure after being spliced together. The cross section of the first positioning hole **30** is a partial, not complete shape, preferably, it can be 1/4 of the entire cross-sectional shape, and two such positioning holes can be symmetrically combined into 1/2 holes, and two such 1/2 holes can be symmetrically combined into a complete cross-sectional hole. The cross-sectional shape can be 1/4 of a circle, 1/4 of a rectangle, 1/4 of an oval, or 1/4 of a semi-oval. Two first positioning holes configured in pairs can be pieced together to a half cross-sectional hole. In other words the two half cross-sectional holes can be pieced together to a complete cross-sectional hole.

[0086] The first positioning hole **30** of this Example can be any other reasonable sizes, for example, 1/3, 2/3, etc. of the entire peripheral contours of a positioning body **20**, or other sizes ensuring the positioning body secured therein. Each end surface of the track slabs having at least one and preferably two first positioning holes, thus achieving the best positioning effect. But the specific quantity can be determined according to the actual requirements of the construction.

[0087] As shown in FIG. 5, the first positioning hole **30** is preferably provided at the longitudinal end surface of the track slabs, that is, the side close to the longitudinal end face. For example, a hole having 1/4 of an entire peripheral contours are disposed on one end of the track slabs, which can be combined with another same hole in the same position of another track slab to form a 1/2 hole. The contour of the hole disposed on the

end surface also can be other sizes to form a larger or smaller contour after the two unit slabs are spliced. The contour of the hole must have a positioning effect on the positioning body, regardless of its size. More preferably, the partial contour of the positioning hole is at least matched to the peripheral contour of the positioning body.

[0088] In this example, the unit slabs spliced together to form a connecting track, comprise a plurality of precast base slabs connected to each other. For two base slabs connected to each other, one comprises a protrusion on the end surface, and the other comprises a dent on the end surface. The protrusion is connected to the corresponding dent with mortise-and-tenon joint. The upper surface of the protrusion and the dent are preferably higher than that of the track slabs. A hole is provided on the upper surface of the protrusion and the dent, or on the inclined slope between the upper surface of the protrusion and the dent and the surface of the track slabs. The hole, which is preferably bolt hole, penetrate the longitudinal end surface of the protrusion and the dent. Two track slabs can be connected and fixed by the bolt passing through the hole. The hole on the protrusion and the dent is higher than the surface of the track slab, which can prevent the accumulation of water and dust in the through hole, and is convenient for subsequent disassembly, assembly and maintenance. The track slabs are connected to form the unit slabs comprising the positioning hole, that is, the first positioning holes **30** (for example each end surface comprising two holes) are separately disposed on the opposite side surfaces of two adjacent unit slabs. And the same number of the second positioning holes **40** (such as two) are provided on the corresponding position of the base slabs, which is convenient for the splicing of the track and ensures its stable and reliable positioning in both the horizontal and vertical directions.

[0089] In another example of a preferred embodiment of the disclosure, the first positioning holes **30** also can be a complete hole that exactly matches the contour of the positioning body, and its cross section can be a complete cylinder, rectangle, oblong, or ellipsoidal structure, etc., or any other matched shapes. At least one first positioning hole **30** is provided between two steel rails of the track slabs, whose specific number can be determined according to the actual requirements of the project.

[0090] As shown in FIG. 6, the second positioning hole **40** is disposed on the base that supports track slabs. The peripheral contour of the second positioning hole **40** is matched to the contour of the positioning body **20**, ensuring that another end of the positioning body **20** can be inserted in the second positioning hole **40**. The cross section of the positioning body **20** also can be rectangle, oblong, oval, or any other shape that matches the peripheral contour of the positioning body **20**. The second positioning hole **40** preferably has a certain depth which is determined by the thickness of the positioning body and the base.

[0091] The second positioning hole **40** comprises a positioning tooth **41** at the bottom thereof. The positioning tooth **41** matches the groove on the end surface of the positioning body **20**, thus being convenient for insertion of one end of the positioning body **20**. The positioning tooth **41** is provided with a bolt hole **42** that matches the through hole of the positioning body **20**. The bolt hole **42** connects with the through holes of the positioning body **20** to form a complete channel when the positioning body **20** is inserted in the second positioning hole **40**, thereby the bolt can pass through the channel and fix the positioning body to the base. That is, the bolt **40** passes through the through hole **42** and then is inserted in the bolt hole **42** to connect and fix the positioning body **20** to the base. In this Example, the bolt that can be disassembled and assembled is a crucial component when a connection is required that can detachably fix the positioning body **20** to the base and can be easily repaired and replaced.

[0092] When one end of the positioning body **20** is inserted in the second positioning hole **40**, the groove **12** on this end surface matches and gets stuck on the positioning tooth **41** disposed at the bottom of the second positioning hole **40**. After that, a bolt **40** is used to reliably connect and fix the positioning body **20** to the base. Another end of the positioning body **20** is matched to the first positioning hole **30** of the track slabs and can be inserted therein, thus preventing the displacement of the track slabs on the tracks, including a horizontal displacement limit, a vertical displacement limit, or a simultaneous horizontal and vertical displacement limit.

[0093] In another example of a preferred embodiment of the disclosure, the through hole of the positioning body **20** comprises an embedded sleeve **43**, which is convenient to

install a bolt **40**. The bolt hole **42** disposed in the second positioning hole **40** on the base preferably comprises an embedded sleeve **43**.

[0094] When this positioning structure is applied for positioning operation, a precast positioning block is installed after the track slabs are finely adjusted. The positioning block are disposed at the end of the track slabs or in the track slabs. The positioning block is fastened by the bolt and the embedded bolt sleeve in the base. The anchored bolt that need to be replaced can be unscrewed and remove the positioning block when the track slabs are damaged.

[0095] FIG. **8** is a structural schematic diagram of the precast base slabs comprising three bearing track platforms according to one embodiment of the disclosure. FIG. **9** is a structural schematic diagram of the precast base slabs comprising four bearing track platforms. FIG. **10** is a structural schematic diagram of the precast base slabs comprising five bearing track platforms. FIG. **11** is a structural schematic diagram of the precast base slabs comprising six bearing track platforms. FIG. **12** is a schematic diagram of the connection structure of the precast base slabs.

[0096] As shown in FIG. **12**, an assembled ballastless track comprises a plurality of unit slabs; each unit slab comprises at least one precast base slab **60**, and each precast base slab has a certain number of bearing track platforms. The design is suitable for on-site construction where must meet the requirements for the length of the track spliced by the plurality of unit slabs, which is convenient to match and lay flexibly.

[0097] The plurality of the base slabs can be combined to form a unit board with a length that satisfy the requirement of the site. The unit slabs is spliced by a plurality of different base slabs, in which the length or the number of the unit slabs in each group is different from that in other groups. That is, to flexibly satisfy the meet of the on-site requirements, the number and the length of the base slabs in different groups can be different from each other. The optimization greatly overcomes the deficiency of traditional methods that must manufacture the track slabs of different length models, and some special-shaped track slabs, thereby greatly improving the construction efficiency, and simplifying the processes of storage and on-site construction.

[0098] As shown in FIGS. **8-11**, in an example of a preferably embodiment of the disclosure, an assembled precast base slab for ballastless track comprises for example can be a base slab of four models including three bearing track platforms (the third slab), four bearing track platforms (the forth slab), five bearing track platforms (the fifth slab), and six bearing track platforms (the sixth slab). There is no particular limit on the model and the size of the base slabs of the disclosure. And the specific model can be determined according to the actual requirements of the disclosure.

[0099] In an example of a preferably embodiment of the disclosure, a base slab comprising three bearing track slabs has a length of 1.95 m; a base slab comprising four bearing track slabs has a length of 2.6 m; a base slab comprising five bearing track slabs has a length of 3.25 m; and a base slab comprising six bearing track slabs has a length of 3.9 m. There is no particular limit on the length of the base slabs of the disclosure, and the specific models can be determined by the actual requirements of the disclosure.

[0100] As shown in FIGS. **8-11**, there are two precast base slabs are configured and connected in pairs, in which the first one comprises a protrusion on the end and second one comprises a dent. The protrusion comprises a bolt hole **62** being disposed on the longitudinal end surface thereof and penetrating to the upper surface **61** of the base slab. The second one comprises a dent matched to the protrusion, and the dent also comprises a bolt hole being disposed on the longitudinal end surface thereof and penetrating to the upper surface **61** of the base slab. The protrusion is connected to the corresponding dent with mortise-and-tenon joint, and then a bolt passes through the two bolt holes **62** to fasten the joint.

[0101] In an example of a preferably embodiment of the disclosure, the precast base slabs connected according to the above on-site assembly method can be spliced to form a unit slab with a required length. For example, the base slabs respectively comprising three, four, five or six bearing track platforms can be randomly connected to form a combined unit slab comprising six to twelve bearing track platforms. The length of the combined unit slabs increases in a gradient.

[0102] As shown in FIG. **12**, the bolt hole **62** disposed on the longitudinal end surface of the protrusion of the base slab **60** penetrates to the opening disposed on the upper

surface of the base slab, to form a channel. The opening of the channel is higher than the upper surface of the base slab. The optimization can prevent water accumulating on the bolt that has been inserted in the opening, effectively avoiding the erosion due to the accumulation of water and dust and subsequent inconvenient maintenance, and facilitating the preparation and the subsequent construction.

[0103] In this example, as shown in FIG. 12, the bolt holes of the protrusion and the dent are arc-shaped holes. An arc-shaped bolt can pass through a complete bolt hole which is formed by aligning and splicing the two arc-shaped holes on the opposite position. In an example of a preferably embodiment of the disclosure, an embedded sleeve also can be provided in the arc-shaped holes, which is convenient for inserting the bolt in the hole.

[0104] In an example of a preferably embodiment of the disclosure, there is only one protrusion on the end of the base slab, accordingly, there is also only one matched dent on the opposite end. The protrusion is connected to the corresponding dent with mortise-and-tenon joint. In another example of another preferably embodiment of the disclosure, there are a plurality of protrusions on the one end of the base slab, and there are a plurality of according dents. The protrusions are separately connected with the according dents with mortise-and-tenon joint.

[0105] The newly designed connection structure comprises a protrusion and a dent respectively disposed on the opposite ends of two base slabs. The protrusion and the dent are connected with a mortise-and-tenon joint, and then a bolt fastens the joint. This design is convenient for anchoring and securing two base slabs. The protrusion and its corresponding dent are reliably spliced by matching and engaging, and then anchored and locked by bolts. An anchoring force are first transmitted via the protrusion and the dent and then transmitted by the connectors, improving the stability of the whole track slabs because of the reasonable transmission of anchoring force, and solving the problem that the track slabs easily deformed by force.

[0106] The unit slabs of different length specifications (or different number of bearing track platforms) are provided for different kinds of combination methods, thus satisfying the requirements for the unit slabs of required length or providing different combination

methods for the unit slabs required at the site. In an example of a preferably embodiment of the disclosure, different recombination methods are shown as follows: $\sqrt{\quad}$ represents the preferable solutions; and $\circ$ represents the alternative solution.

Combinations of assembled ballastless track

Number of bearing track platforms	Combinations	Remarks
6	6	$\sqrt{\quad}$
	3+3	$\circ$
7	3+4	$\sqrt{\quad}$
8	4+4	$\sqrt{\quad}$
	3+5	$\circ$
9	4+5	$\sqrt{\quad}$
	6+3	$\circ$
	3+3+3	$\circ$
10	5+5	$\sqrt{\quad}$
	6+4	$\circ$
	3+3+4	$\circ$
11	6+5	$\sqrt{\quad}$
	3+3+5	$\circ$
	3+4+4	$\circ$
12	6+6	$\sqrt{\quad}$
	3+4+5	$\circ$
	3+3+6	$\circ$
	3+3+3+3	$\circ$

	4+4+4	○
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[0107] It will be obvious to those skilled in the art that changes and modifications may be made, and therefore, the aim in the appended claims is to cover all such changes and modifications.

CLAIMS

1. A connection structure of base slabs for ballastless track, the connection structure comprising a first connector disposed on a first base slab of ballastless track, and a second connector disposed on a second base slab of ballastless track; wherein
the first connector is disposed on one end of the first base slab, and comprises a protrusion extending in a longitudinal direction; the protrusion comprises a longitudinal end surface provided with a bolt hole penetrating an upper surface of the first connector; and
the second connector is disposed on one end of the second base slab connected to the first base slab, and comprises a longitudinal dent that matches the protrusion; the dent comprises a longitudinal end surface provided with a bolt hole penetrating an upper surface of the second connector; the protrusion and the dent are matched and spliced to form a mortise-and-tenon joint when the ends of the two base slabs are connected to each other; the two bolt holes are exactly aligned and spliced to form a complete channel; and a bolt passes through the channel to connect and fix the two base slabs.
2. The connection structure of claim 1, wherein the upper surfaces of both the first connector and the second connector are higher than that of the first base slab and the second base slab; the upper surface of the connector is connected to the upper surface of the corresponding base slab via an inclined slope; an opening on one end of the bolt hole is disposed on the inclined slope, thus the opening is higher than the upper surface of the base slab.
3. The connection structure of claim 1, wherein a central axis of the opening on the inclined slope is perpendicular to a plane where the inclined slope is located.

4. The connection structure of claim 1, wherein the bolt hole disposed on the first connector and the second connector is an arc-shaped hole. The two arc-shaped holes are aligned and connected to form a channel that allows an arc-shaped bolt to pass through.
5. The connection structure of claim 4, wherein at least one arc-shaped bolt hole is disposed on the first connector and the second connector, respectively.
6. The connection structure of any one of claims 1-5, wherein at least one first connector is disposed on one end of the first base slab for ballastless track, and at least one second connector is disposed on one end of the second base slab for ballastless track.
7. The connection structure of any one of claims 1-5, wherein an embedded sleeve is disposed in the arc-shaped bolt hole.
8. A ballastless track comprising a connection structure of any one of claims 1-7.
9. An assembled positioning structure disposed between a track slab and a base for positioning the track slab and the base, the assembled positioning structure comprising:
 - a positioning body comprising a through hole penetrating through two opposite end surfaces of the positioning body; and one of the two opposite end surfaces of the positioning body being provided with a groove having a certain depth;
 - a first positioning hole disposed on the track slab and matching the positioning body in shape, so that one end of the positioning body can be inserted therein;
 - a second positioning hole disposed on the base and matching the positioning

body in shape, so that another end of the positioning body can be inserted therein; and
a positioning tooth disposed at the bottom of the second positioning hole, and
matching the groove on the positioning body, so that the positioning tooth is in
engagement with the corresponding dent when one end of the positioning body is
inserted in the second positioning hole; the positioning tooth comprises a bolt hole
aligned with the through hole penetrating through the positioning body when the
positioning body is inserted in the second positioning hole; a bolt passes through the
through hole and through the bolt hole to detachably fix the positioning body to the
base; the positioning body matches the first positioning hole to limit the track slabs.

10. The assembled positioning structure of claim 9, wherein the positioning body is a cylinder, a cuboid, an oblong, or an ellipsoid.
11. The assembled positioning structure of claim 9 or 10, wherein the first positioning hole is disposed at the connecting end of the track slab outside the steel rails; the first positioning hole is a quarter-hole partially matched to a peripheral contour of the positioning body; the two positioning holes form a half-hole structure that matches the peripheral contour of the positioning body after being spliced together, to limit the two track slabs after the positioning body is inserted in the first positioning hole.
12. The assembled positioning structure of claim 11, wherein two first positioning holes are disposed on each end of the track slab.
13. The assembled positioning structure of any one of claims 9-12, wherein the positioning tooth having a strip shape is disposed at and protrudes upward from the bottom of the second positioning hole.

14. The assembled positioning structure of any one of claims 9-13, wherein a number of the bolt holes of the positioning tooth is the same as that of the through hole of the positioning body.
15. The assembled positioning structure of any one of claims 9-14, wherein an embedded sleeve is disposed in the bolt hole of the positioning tooth.
16. The assembled positioning structure of any one of claims 9-15, wherein the positioning body comprises precast concrete or steel block.
17. An assembled ballastless track comprising the positioning structure of any one of claims 9-16.
18. An assembled ballastless track, comprising a plurality of unit slabs; each unit slab comprising at least one precast base slab, and each precast base slab comprising a certain number of bearing track platforms; wherein
every two precast base slabs are connected in pairs, one of which comprises a protrusion on the end and the other one comprises a dent; the protrusion comprises a bolt hole disposed on the longitudinal end surface thereof and penetrating the upper surface of the base slab; the dent matches the protrusion, and comprises a bolt hole disposed on the longitudinal end surface thereof and penetrating the upper surface of the base slab; the protrusion is connected to the dent with mortise-and-tenon joint, and a bolt passes through the two bolt holes to fasten the joint.
19. The assembled ballastless track of claim 18, wherein the unit slab has a length that satisfies the requirement of on-site construction, and comprises a plurality of different combination of the base slabs; the number and/or the length of the base slabs in

different groups can be different from each other.

20. The assembled ballastless track of claim 18 or 19, wherein at least three bearing track platforms are disposed on the precast base slab.
21. The assembled ballastless track of any one of claims 18-20, wherein the bolt hole disposed on the longitudinal end surface of the protrusion comprises an opening, and the opening communicates with the upper surface of the base slab and is higher than the upper surface of the base slab.
22. The assembled ballastless track of any one of claims 18-21, wherein the bolt hole disposed on the longitudinal end surface of the dent comprises an opening, and the opening communicates with the upper surface of the base slab and is higher than the upper surface of the base slab.
23. The assembled ballastless track of claim 21 or 22, wherein a central axis of the opening on the inclined slope is perpendicular to the plane where the inclined slope is located.
24. The assembled ballastless track of any one of claims 18-23, wherein the bolt hole separately disposed on the first connector and the second connector is an arc-shaped hole. The two arc-shaped holes can be exactly aligned and connected to form a channel that allows an arc-shaped bolt to pass through.
25. The assembled ballastless track of any one of claims 18-23, wherein at least one bolt hole is corresponding to the protrusion or the dent.

26. The assembled ballastless track of any one of claims 18-24, wherein at least one first connector is disposed on one end of the first base slab for ballastless track, and accordingly, at least one second connector is disposed on one end of the second base slab for ballastless track.