

PRECAST TRACK PLINTH

Field of the Invention

Structural engineering and precast construction techniques of precast concrete track plinth for railway and mass transit systems.

Background of the Invention

There are several kinds of ballastless track formation which have been designed and constructed on elevated, at-grade or underground railway/mass transit systems around the world such as Direct Fixation Track, Low-Vibration Track, Shinkansen Slab Track, Rheda 2000 Slab Track, etc. Some track systems are fully cast in-situ and some are partially designed in precast elements before embedding by cast-in-situ concrete at site.

Track plinth is one of the track formations which have been designed and constructed as a cast in-situ system where the quality of the works is hardly controlled at site depending on site accessibility, workmanship, formwork and falsework system, etc. Time for casting of cast-in-situ track plinth is also quite long because of a lot of sequences to fix the rebar cage with fastening systems, rails and all embedded elements, set up the formworks and adjust final elevation before casting concrete.

Therefore, the inventor has developed the precast concrete track plinth system to solve such problems by designing and adjusting its dimension, reinforcement and all embedded elements with appropriate fastening systems according to international recognized standards. The quality of works and construction time cycle will be improved by this precast concrete track plinth.

Summary of the Invention

The upper part of track plinth will be pre-cast in L-shape from factory, where the quality could be better controlled, with rectangular openings between fastenings. Some reinforcement will be extruded through these openings for further bonding with sub-structures or concrete slab below through cast-in-situ concrete and shear connectors.

As a precast system, plastic inserts for fastenings will be cast at the same time with precast plinth. The spacing of inserts/fastenings could be varied according to the client's specification and requirement. Steel reinforcement of precast track plinth is comprised of longitudinal rebars and stirrups. Their positions and spacing are designed and adjusted to retain the stress during transportation and handling also.

The preparation of concrete sub-structures or slab below is similar to the conventional cast-in-situ system. Their concrete surface shall be roughen for proper bonding. The shear connectors could be pre-embedded in sub-structures or installed later to plastic dowels which previously cast with the sub-structure.

After delivery of precast track plinth to construction site, these precast elements will be put in place, fastened to rails and fastenings. The alignment and level of the whole track will be adjusted according to the design. Then the concrete will be poured through the openings to bond the precast elements to sub-structures below by embedding the extruded reinforcement of the precast track plinth and shear connectors of sub-structures.

The Purpose of the Invention is to develop a conventional cast-in-situ concrete track plinth to be a precast track plinth system in order to improve the quality of works and construction time cycle. The construction cost could also be reduced from these improvements.

Brief Description of the drawings

Drawing 1 is the top view of the precast track plinth according to this invention.

Drawing 2 is the cross-section of the precast track plinth after being installed according to this invention.

Drawing 3 is 3-dimension view of a precast track plinth element according to this invention.

Detailed Description of the Invention

Drawings 1, 2 and 3 show the features of a Precast Track Plinth element to be installed on a concrete sub-structures or slab according to this invention and all embedding elements to be installed with the precast plinth. Track plinth cross-section is in L-shape where its 1st longitudinal structure (11), namely the up-stand, is in parallel with 2nd longitudinal structure (14). The height of 1st longitudinal structure is higher than the 2nd one for damage protection after train derailment.

The length of the 1st longitudinal (11) and of the 2nd longitudinal structures (14) are varied from 2.4 to 5.7 metres which are the proper sizes for handling, construction and drainage between each track plinth.

The top ridges of the 1st longitudinal structure (11) and the 2nd longitudinal structure (14) are higher than the top ridge of the transverse structure (13) which links between two longitudinal structures at equal spacing. The spacing of transverse structures is in accordance with the spacing of fastenings as specified in the design. Plastic Inserts are embedded in each transverse structure (13) for further installation of the fastenings at construction site.

There are three sets of steel reinforcement in precast track plinth i.e. longitudinal reinforcement (7) and transverse stirrups (8, 9). First stirrups (8) are reinforced vertically along 1st longitudinal structure (11). The second stirrups (9) are reinforced horizontally linking between the 1st longitudinal structure (11) and the 2nd longitudinal structure (14).

The openings or blockouts (2) are located in the middle between the two longitudinal structures (11, 14) and the transverse structure (13). Therefore, steel reinforcements (7, 9), at opening position, are extruded through the openings and they will be fully embedded and bonded by cast-in-situ concrete at construction site.

All opening positions are designed and interfaced to comply with the position of plastic inserts (5) which pre-embedded in the sub-structure or slab underneath for further installation of shear connectors or anchor bolts (6). Shear connectors could be designed as steel rebars in L-shape or U-shape extruding from sub-structures or slab so the opening size, shape and position shall be determined to comply with types of shear connectors.

Plastic clips (10) are fixed between each steel reinforcement, where it crosses and contacts to each other, in order to prevent the flow of electric stray current between each rebar. At each end of precast plinth, a steel flat bar (12) is fixed to lower level of longitudinal steel reinforcement (7) to release electric stray current from track plinth structures for the purpose of steel corrosion protection. After installation of track plinth in place, all steel flat bars will be welded to the main earthing system

A number of plastic inserts (4) for installation of conductor rail system are embedded to the outer side of 1st longitudinal structure (11) at designated positions as required manufacturer specification.

For installation of the precast track plinth, a set of track plinths shall be fastened to rails by all fastenings then the track alignment and level shall be adjusted according to the design. Appropriate gaps between precast track plinth and sub-structure below shall be determined in advance during the design phase for construction flexibility and quality control. Shear connectors (anchor bolts) shall be installed and all formworks shall be assembled to close all gaps between precast track plinth and sub-structure/slab below. Then concrete will be poured into the openings/blockouts to fill all gaps and complete the construction of track plinth.

Claims

1. A precast track plinth comprising:
 - a L-shape cross section resulting from an arrangement of a first longitudinal structures, and second longitudinal structures and a transverse structure,
 - each of the first and second longitudinal structure including top ridges, the top ridges of the first longitudinal structure having a higher height than the top ridges of the second longitudinal structure,
 - the arrangement comprising of the first longitudinal structure arranged in parallel with a second longitudinal structure, and a plurality of transverse structures adapted to link the first longitudinal structure and the second longitudinal structure at equal intervals,
 - an opening is provided within the first and second longitudinal structures and the transverse structure,
 - the opening includes reinforced steel bars positioned in a longitudinal direction and a first set of transverse stirrups linking between the first and second longitudinal structures in a horizontal direction,
 - a second set of transverse stirrups are vertically reinforced within the first longitudinal structure,
 - a plurality of plastic inserts are embedded on top of the transverse structure and the plastic inserts are adapted for fastening installation,
 - a plastic clip is fixed between each steel reinforcement where it crosses and contacts to each other in order to prevent the flow of electric stray current between each rebar,
 - at each end of the precast plinth, a steel flat bar is fixed to lower level of longitudinal steel reinforcement to release electric stray current from track plinth structures for the purpose of steel corrosion protection.
2. The precast track plinth according to claim 1, wherein the intervals of the transverse correspond with the spacing of sleepers and rail fastenings.
3. The precast track plinth according to claim 1, wherein the first and second longitudinal structures have a range of 2.40 metres to 5.70 metres in length.

4. The precast track plinth according to claim 1, further comprises of a number of plastic inserts embedded in the outer side of the 1st longitudinal structure and the plastic inserts are adapted for installation of conductor rail system.
5. The precast track plinth according to claim 1, further comprises of openings which are designed and interfaced to comply with the positions of plastic inserts pre-embedded in sub-structure or slab underneath where the shear connectors or anchor bolts will be installed before pouring cast-in-situ concrete.
6. The precast track plinth according to claim 7, further comprises of the feature of anchor bolts for shear connectors, is applicable with another types of shear connectors i.e. L-shape or U-shape steel rebars pre-embedded sub-structures or slab underneath in accordance with the position of the openings

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Abstract

Precast track plinth according to this invention is developed from a conventional cast-in-situ system. The features are generally in L-shape. There are openings between rail fastenings for installation of shear connectors and concrete pouring at construction site. Plastic inserts for rail fastenings and conductor rails are embedded into the precast plinth from the factory according to the design and manufacturing specification. There are two types of steel reinforcement i.e. longitudinal rebars and transverse stirrups which extruded through openings for further bonding with shear connectors and sub-structures below by cast-in-situ concrete. After precast track plinths are installed at site, they will be fastened with rails. Alignment and level of track will be adjusted. Formworks will be installed and concrete will be poured into the openings to form a complete track plinth. This invention helps to improve the quality of works, construction time cycle and cost comparing with the conventional system.

Figure 1.