

Fixed carriageway for rail vehicles

The invention relates to a fixed carriageway for rail vehicles having rails fixed to sleepers, which are carried by a structure engineered in concrete or concrete composite.

Fixed carriageways which run on an engineered structure, possibly a bridge, have hitherto required a comparatively high construction cost. The regulations for the structural configuration of the fixed carriageway require that the sleepers be disposed on a superstructure panel. This superstructure panel rests on a hump panel in order to transmit horizontal forces. The hump panel is in turn disposed on a protective concrete panel, which may at least on one side abut an edge cap of a bridge structure in order to transmit lateral forces from the fixed carriageway into the bridge support structure. The regulations require furthermore that below the protective concrete panel a seal is provided. The various layers of such a fixed carriageway on a bridge may have a total thickness of 80 cm or more, and such fixed carriageways therefore require a high level of structural complexity and lead to comparatively high costs.

In DE 197 23 587 A1, an engineered structure such as bridge having a fixed carriageway has already been proposed, in which the sleepers are either disposed on a continuous supporting ridge or on individual humps disposed in a row. In manufacture, first a support panel of the bridge structure is produced, and then a second support panel is cast for the fixed carriageway. In a separate manufacturing stage, support ridges or humps are concreted on to the upper support panel, on which humps the sleepers for the rails are fixed. Even if this arrangement already affords a certain degree of simplification, a high level of structural complexity is still required, as the engineered structure is produced by a series of consecutive stages. In this, the manufacture of the subsequently concreted humps or support ridges is particularly complex.

The object of the invention is therefore to indicate a fixed carriageway for rail vehicles of the type mentioned in the introduction whose manufacture is simpler and therefore more economical.

To achieve this, it is proposed in a fixed carriageway of the type mentioned in the introduction that the sleepers are embedded in the structural concrete of the engineered structure or in a protective concrete layer or are mounted direct on the structural concrete or the protective concrete layer.

According to the invention, the carriageway panel in which the sleepers are embedded is produced simultaneously with the manufacture of the engineered structure, and unlike the known fixed carriageways, subsequent formation of the carriageway panel becomes superfluous, so that there is a saving in both materials and costs.

The invention is based on the knowledge that the structural concrete of the engineered structure or a protective concrete layer present on the engineered structure can simultaneously act as a carriageway panel, in that the sleepers are embedded in the structural concrete or protective concrete layer when this is manufactured. In the same way, the sleepers can be mounted direct on the structural concrete or protective concrete layer. The structural concrete or protective concrete layer meets all the structural requirements made of a carriageway panel for a fixed carriageway. Therefore, a separate carriageway panel or superstructure panel or a separate manufacturing stage can be omitted, so that the arrangement according to the invention is particularly simply constructed and results in a reduced consumption of material.

It is particularly preferred that the sleepers of the fixed carriageways according to the invention are single-block or multi-block sleepers. This covers all types of sleepers predominantly used. The sleeper blocks are connected together via grid supports and are embedded in the manufacture of the engineered structure, so that a monolithic fixed carriageway is achieved.

In the fixed carriageway according to the invention, it can be provided that this has a longitudinal and/or transverse reinforcement. The position of the reinforcement and the number of reinforcing rods can in this case be optimised, since the reinforcement present in any case in the engineered structure can also be used for the fixed carriageway.

In an engineered structure in the form of a bridge, it can be provided that the bridge has at least one edge cap and/or at least one cable channel disposed at the side, next to the sleepers in order to absorb lateral forces. By way of the edge cap or cable channel, forces acting laterally to the carriageway direction are transmitted to the supporting structure of the engineered structure. Thus complex construction elements such as humps or support ridges can be dispensed with. It is also possible for the engineered structure to be a concrete panel with a foundation.

If the sleepers of the fixed carriageway according to the invention are embedded in a protective concrete layer of a bridge, this protective concrete layer may advantageously act simultaneously as a bridge seal, so that an additional seal of the bridge deck can be dispensed with.

It is also possible to use the fixed carriageway according to the invention in an engineered structure formed as a tunnel, in which case the sleepers are embedded direct in a layer of compensating concrete. Since in this case also, an additional, separately manufactured carriageway panel can be dispensed with, the required inner diameter of the tunnel tubes is smaller.

Further advantages and details of the invention will be explained with the aid of embodiments with reference to the drawings, which are diagrammatic representations and show:

Fig. 1, a first embodiment of a fixed carriageway according to the invention on a bridge structure viewed in perspective;

Fig. 2, a second embodiment of a fixed carriageway according to the invention, in which the sleepers are embedded in a protective concrete layer;

Fig. 3, an enlarged detail of the fixed carriageway of Fig. 2 with only partially shown protective concrete layer;

Fig. 4, a third embodiment of the invention with a fixed carriageway in a tunnel; and

Fig. 5, a fourth embodiment of the invention.

Fig. 1 shows a perspective view in section of a bridge structure 1 with a fixed carriageway 2. The fixed carriageway 2 is formed integrally with the supporting structure 3 of the bridge structure 1. On both sides of the fixed carriageway 2 cable channels 4 and edge caps 5 are disposed. The cable channels 4 and the edge caps 5 are for transmitting lateral forces from the fixed carriageway 2 to the supporting structure 3.

The fixed carriageway 2 comprises dual-block sleepers 6, which carry rails 7. In the embodiment shown, the sleepers 6 are embedded direct in the structural concrete of the supporting structure 3, and a separate superstructure panel or carriageway panel is not present. In the plane of section rods of a longitudinal reinforcement 8 can be seen, and in addition reinforcing rods laid transverse thereto and forming a transverse reinforcement are present.

Fig. 2 shows a second embodiment in which the components corresponding to those of the first embodiment have the same reference numbers.

Unlike in the first embodiment, in the bridge structure 9 shown in Fig. 2, the sleepers 6 are embedded in a protective concrete layer 10, which rests on a supporting structure 11 of the bridge structure 9. To manufacture the bridge structure 9, first the supporting structure 11 is produced, and then the cable channels 4 and the edge caps 5 are assembled. The sleepers 6 are incorporated in the trough-like space between the cable channels 4 and edge caps 5 respectively and are positioned exactly. In the same way, the reinforcement 8 is applied. The manufacture of the protective concrete layer 10 is effected by casting with concrete. The protective concrete layer 10 can also act as a bridge seal.

Fig. 3 shows an enlarged detail of the fixed carriageway shown in Fig. 2 with the protective concrete layer only shown in part.

In Fig. 3, the dual-block sleepers 6 are shown before casting. Each pair of sleeper blocks 12, 13 is joined together via grid supports 14, which also act as transverse reinforcement. Between the grid supports 14, further reinforcing rods 15 are disposed in the transverse direction, just like the rods of the longitudinal reinforcement 8. After positioning and adjustment of the sleepers 6 and of the reinforcement, casting of the concrete takes place, so that only the upper regions 16 of the dual-block sleepers 6 still project from the concrete layer.

Fig. 4 shows a section view of a third embodiment of a fixed carriageway in a tunnel. The dual-block sleepers 6 are embedded direct in the structural concrete 16 of the tunnel, i.e. the fixed carriageway 17 is integrally joined with the structural concrete 16 of the tunnel. In the plane of section, the rods of the longitudinal reinforcement 18 are visible. Since no additional or separate carriageway panel is present, the diameter of the tunnel can be kept to a minimum.

If the fixed carriageway 17 is constructed in the tunnel, first the dual-block sleepers 6 are positioned and adjusted, and then structural concrete 16 is cast.

Fig. 5 shows a further embodiment of a fixed carriageway in a tunnel.

Unlike in the example shown in Fig. 4, a compensating concrete layer 19 is present, in which the sleepers 6 are embedded. Below the compensating concrete layer 19 is a concrete layer 20 in the shape of a segment of a circle. In this manner, the forces generated during operation of the fixed carriageway are transmitted direct into the sole of the tunnel.

Claims

1. Fixed carriageway for rail vehicles having rails fixed on to sleepers, which are supported by a structure engineered in concrete or concrete composite, characterised in that the sleepers (6) are embedded in the structural concrete (16) of the engineered structure or in a protective concrete layer (10) or are mounted direct on the structural concrete (16) or protective concrete layer (10).
2. Fixed carriageway according to claim 1, characterised in that the sleepers (6) are single- or multi-block sleepers.
3. Fixed carriageway according to claim 1 or 2, characterised in that it has a longitudinal and/or transverse reinforcement (8, 18).
4. Fixed carriageway according to one of the preceding claims, characterised in that the engineered structure is a bridge (1, 9) or a concrete panel with a foundation.
5. Fixed carriageway according to claim 4, characterised in that the bridge has at least one edge cap (5) and/or at least one cable channel (4) disposed at the side next to the sleepers (6) for receiving lateral forces.
6. Fixed carriageway according to claim 4 or 5, characterised in that the optionally available protective concrete layer (10) acts as a bridge seal.
7. Fixed carriageway according to one of claims 1 to 3, characterised in that the engineered structure is a tunnel.
8. Fixed carriageway according to claim 7, characterised in that the sleepers are embedded in a compensating concrete layer (19).