PEDESTRIAN OVERPASS WITH GLUED LAMINATED DECK

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Abstract

Paper describes a design and construction aspects of a new pedestrian overpass over Ulmana street in Riga. With its seven spans and approach ramps, pedestrian overpass has a total length of 175 meters. Overpass has continuous glued-laminated wooden deck with a main span of 38 meters. The width of walkway is 3.00 meters and the height of slab is 0.4 m. The overpass is designed as a cable-stayed structure. The wooden deck is attached to steel pylons with 4 pairs of stays providing proper configuration of anchorage and joints.

1. Introduction

Construction of Ulmana street overpass marks beginning of a new initiative regarding the infrastructure improvement activities in Riga, capitol of Latvia. Traffic safety in a combination with aesthetic versatility and choice of structural materials are key qualities, which shaped a design of a newly build overpass compared to other recent bridge structures built in Latvia. Latest advancements in timber gluing allows for a wide choice of structural systems to be used in contrast to traditional wood works.

2. Preliminary Design

Site of the given overpass is characterised by high traffic intensity. Before construction particular area was fragmented by the street of six lanes and there were virtually no means provided for pedestrians and cyclists to cross this street. Opposed to normal river bridges, where usually only a part of structure is exposed to the human eye, here all of the structural elements form the aesthetic image of both surrounding environment and the structure in it. Exposure to drivers passing under required to add more of a value from aesthetic point of view. As a result it was chosen to apply symmetric cable-stayed system with "A" shaped tubular steel pylons. Load transfer to substructure was carried out by using solid steel stays – four from each pylon in a symmetric manner. For the minor spans rectangular hollow sections in the form of "T" type piers were employed. For a deck element traditional steel and concrete materials were considered among priorities. However, more natural feel was achieved by using glued-laminated timber elements, see visualisation and final layout of the structure in *Fig.1*.

Fig. 1 Visualisation-photomatch of the overpass and final layout

3. Superstructure of the pedestrian overpass

Modern technology of glued timber allows a wide variety of structural forms and sizes. Perhaps the only restriction regarding the size of structural elements is related with transportation and assembling capabilities. In this case total span of the glued timber is 135m, which due to the limitations mentioned above was split up to seven sections with lengths from 16.05m to 22.07m. As it can be seen in *Fig.2* each section is made from timber beams of BS 14 [1] class glued wooden planks. Separate beams are stressed together by steel rods of M27 hence forming solid panel elements. Challenging design issue was a joint configuration between the panels. In order to provide stiffness of the joint ribbed steel plates on the both sides of the wood panels were used. Hinge effect was further reduced by employing traditional wood shear connectors in combination with vertical bolts delivering required force transfer between the timber elements. Given the stiffness degree achieved by this joint configuration it is rational to assume uniform wood material properties throughout the superstructure plate. This aspect was important while updating design model of the overpass during the structural analysis process.

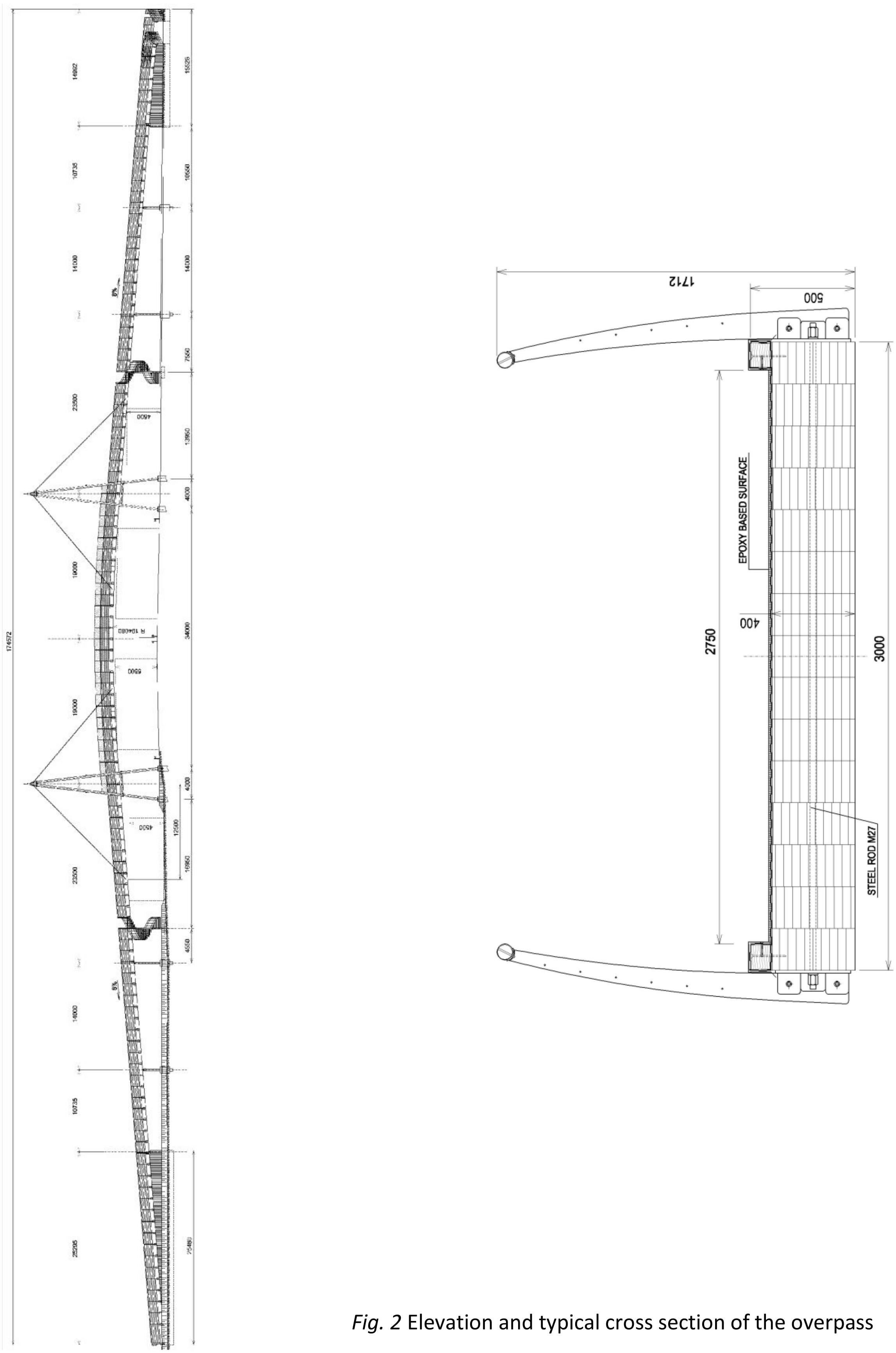

Fig. 2 Elevation and typical cross section of the overpass

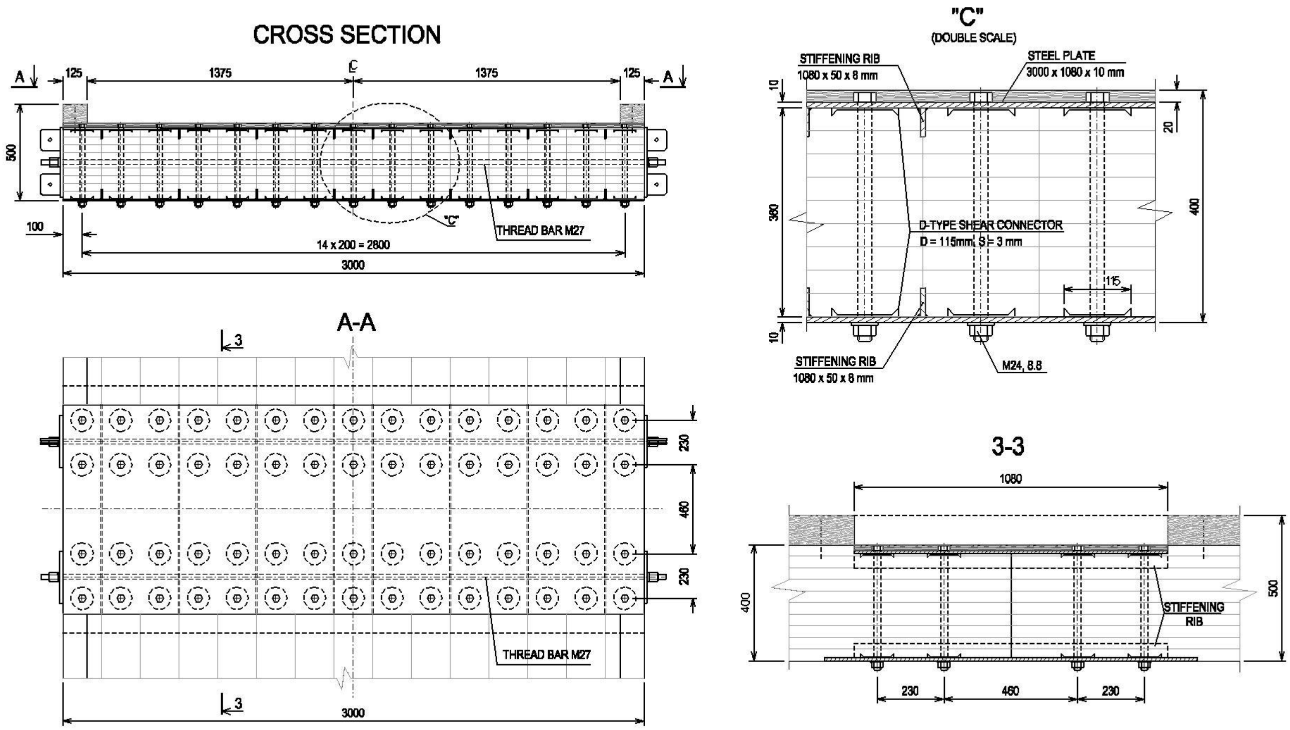

Fig. 3 Details of the wood panel joint

4. Construction process and assembling

One of the initial conditions of the design was to provide construction process with the least possible traffic disturbances. This requirement was successfully fulfilled due to the choice of structural system and materials. Most time consuming phase was related to construction of concrete parts such as drilled shafts and cast-in-place approach ramps. Other structural parts were fully prefabricated. As a result for a deck assembly and placement on the temporary supports traffic was restricted only for couple of hours during the night. Once the deck and stays were put in the position, other assembly works were done with negligible traffic limitations.

Fig. 4 Placement of the pylon and temporary supports for the deck

References

[1] LVS EN 408:2003, Koka konstrukcijas - Konstrukciju kokmateriāli un līmētie koka izstrādājumi - Dažu fizikālo un mehānisko īpašību noteikšana

[2] Guidelines for the design of footbridges, FIB bulletin 32, November 2005