THE NEW OLD BRIDGES OF TIMISOARA

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ABSTRACT
The paper presents several results of a small part of the ample rehabilitation programme regarding as well the tramway as also the carriage way and nevertheless the bridges. One of the particularities of Timisoara, is the age of approximate 80 years of the passing structures. The four bridges included in the rehabilitation process differ through the static structure and the cross section. It was necessary to redesign the bridge gauge and to consolidate the structure, in the case of the ancient bridges. For the fixing of the rails on the bridge, the ICOSIT system was used as a national premiere, being thus possible to give up the fixing with bolts in the concrete slab.

Keywords: bridge, steel-concrete structure, rehabilitation, ICOSIT

INTRODUCTION
The Transport Association of Timisoara was the beneficiary of an important external financing for the modernisation of the tramways in our city. Parallel with these project runs, the City Hall of Timisoara, has financed the rehabilitation of the streets affected by the works at the tramway and implicit of the bridges, which assure their continuity over the Bega Channel. In this context, we took part at the design of the technical solutions for the rearranging of the streets, regarding as well their geometry as also the road structure, for the bridges, but also for the underneath network affected by the works for the rebuilding of the way platform. The carriageway was designed in relation to the particularities of the areas, the road structure being adapted to the present traffic and the one in perspective.

MATERIALS AND METHODS
The rehabilitated tramways cross the Bega Channel in the following 4 sections: Mihai Viteazu Bridge, Dacilor Bridge, Decebal Bridge, respectively the Traian Bridge.

Under the influence of traffic, extremely intense and discrete (auto and tram) and of the frost-defrost process, but also due to the improper quality of the road coating, the carriageway has suffered important degradations, placed especially in the areas between the rails of the tramway.

The works considered to be necessary for the rehabilitation of the 4 bridges mentioned before, advert to the repairing of the areas with foliated concrete, relaying of the waterproofing, rebuilding of the footways and carriageway, using of performant systems for covering the expansion joints, fixing of the rails of the tramway in a modern and reliable solution, repairing of the parapet and ornamental elements in the degraded areas, with a material, which should give the structure the initial character (for the ancient bridges Traian and Decebal), respectively their replacement at the other two bridges.

At the hereof bridges the redesign of the gauge was aimed (carriageway and footways) in order to adapt it to the current traffic and the one in perspective, as it is shown in the Fig. 1-4:
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Fig. 1. Dacilor bridge

Fig. 2. Mihai Viteazu bridge

Fig. 3. Traian bridge
1. Dacilor Bridge

At the Dacilor Bridge [1], due to the existence of incomplete technical documentation and to the new elements raised after the execution was started, the elaboration of special details in correlation with the real situation was required. An equalization slab was executed, aiming to obtain an appropriate surface for laying the waterproofing, but also a vertical curve as a consequence of the redesign of the longitudinal profile.

The steel deck was cleaned through water „blasting”. The anticorrosion protection was realized with a performant SIKA protection system (fig. 5, 6). The coating of the footways with an epoxy–polyurethane solution with quartz sand, assures a good waterproofing of the footway concrete and an efficient skid-proof roughness, but allows a colour treatment of the area meant for the pedestrian traffic.

In order not to affect the resistance structure of the bridges by using solutions for the fixing of the tram rails, which would imply the drilling of the concrete slab (the ORTEC system used in current way), the SIKA system was adopted, which consists of fixing the railway on the bridge by gluing it with ICOSIT KC 340/45 (fig. 7).
2. **Mihai Viteazu Bridge**

In the case of the Mihai Viteazu Bridge [2], released for exploitation in 1981, the existing technical documentation from the records of the administrator, has proven to be incomplete and in unconformity with the executed works. The Mihai Viteazu Bridge has two traffic lanes on each direction, the two directions being emplaced on parallel structures, separated through a longitudinal joint. The existence of two separate structures made possible the execution works, over the year 2005, to develop separately on each superstructure. The traffic evolutes in two senses always on the unaffected superstructure (before, respectively after the rehabilitation).

The pickling of the existing layers on the bridge, revealed a cast in place slab, with a neat execution, having relative few geometrical imperfections. In contrast to the initial documentation, it has been found that in the area of the tramway the slab was executed like a shaft (fig. 8). As a consequence the cross section had to be redesigned and the concrete carriageway was replaced with lighter bedding for the bridge carriageway.

Due to the degradations on wide areas and with considerable depth in the concrete of the parapet girder, respectively of the steel structure of the pedestrian parapet, the replacement of the entire assembly parapet-parapet girder was arranged (fig. 9). The parapet girder was rebuilt by completing the existing reinforcement considering the new geometry of the girder.

The new parapet is conceived as a modulated steel structure, protected through galvanizing and which has a high transparency degree, being also able to fulfil the standard stress (fig. 10, 11).
3. Traian Bridge

The Traian Bridge [3], is the first ancient bridge included in the rehabilitation program of the tramway (fig. 12).

The bridge, which’s auction for the execution works was made public in 1911, was build in a medieval style, which had to fit in the neogothical architecture of the left bank of the Bega Channel. The construction was finished in 1914, but due to the war, the bridge was given in exploitation only at the beginning of 1916, belonging to the category of “ancient” bridges being in service since 95 years.

The bridge is realized out of reinforced concrete, its structure being a Gerber type. The bridge is meant for the pedestrian traffic, auto and tram. Because we saw multiple cracks with different orientations, which were hidden from the eye by a cement grout layer, we decided to make laboratory determinations on concrete samples extracted from the girder webs, which confirmed the low quality of the concrete $R_{c,med} = 13.7 \text{ N/mm}^2$ (C8/10).
The central deck, out of reinforced concrete, was demolished by longitudinal fractionation. After the clearance of the emplacement the short cantilevers were consolidated by high tensile steel bars of 20 mm, stressed at 120 kN (fig. 13, 14).

The initial reinforced concrete deck was replaced with a deck realized in a composite steel-concrete solution, which respected the geometry of the initial structure: the girders were realized out of HE 550A (S275) profiles and the slab of concrete C25/30 with 18 cm thickness (fig. 15). For the footway coating a solution with epoxy resin and quartz sand was used. The pedestrian protection was assured by the means of a separating parapet out of pipe and the original pedestrian parapet was restored and remounted on the bridge with an adequate fixing system (fig. 16).

The stone parapet was replaced entirely, with similar stone and original geometry (fig. 17, 18).
4. Decebal Bridge

The Decebal Bridge [4] is the oldest bridge from Timisoara which crosses the Bega Channel. The Decebal Bridge, realized at the beginning of the XXth century, more precise in 1908, belongs to the gallery of the ancient bridges of Timisoara.

The structure, european record at that time, crosses diagonally the Bega Channel, connecting the centre with the former industrial area Fabric. The traffic in the bridge area is divided on 4 lanes. The vicious execution of the carriageway on the bridge, in correlation with the frost-defrost process, lead to massive degradations of the asphalt coating and the damaging of the waterproofing. The concrete parapet suffered degradations throughout time, areas with cracks and corroded reinforcement being visible.

The width of the footways was reduced in order to make possible a parallel develop of tram and auto traffic (4 traffic lanes).

The border stones out of natural stone separate the concrete carriageway and the footway the latter one having an epoxy resin and quartz sand coating. The carriageway for the tram was realized in a similar solution as shown at the previously presented bridges.

The reinforced concrete structure, blasted and repaired, was protected in a Sika multilayer system, sealed at the extrados, on the lateral faces and at the intrados of the marginal girders, respectively permeable at the intrados (fig. 19).

These measures did not affect the architectural aspect of the bridge (fig. 20).
CONCLUSIONS
The concern for the rehabilitation of the bridge structures, technical and architectonical monuments, representative for the civilization level of an area, eventually by restraining the traffic, using new and discreet consolidation solutions, diminishing the architecturally disturbing interventions at the “invisible“ elements, can save from demolition numerous passing structures. It is possible to simultaneously regrant their greatness but also the functionality required by the exploitation conditions.

REFERENCES