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Bridge Consolidation by Using Cable - Stayed Method

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Abstract

The increase of the road traffic and vehicle load during the last decades imposed the necessity to consolidate some of the existing older bridges.

Many of these bridges require both the carriage-way widening and structure consolidation. The consolidation of these bridges generally require the consolidation both of the superstructure and of the infrastructure. Sometimes the consolidation of the infrastructure and mainly of the foundations is very difficult and expensive, mostly because of the reduced space under the bridge and the existence of the crossed obstacle. Under these circumstances, is very difficult or impossible to use suitable equipment. These inconvenient may be eliminated using cable-stayed method for the consolidation of the existing bridges.

The method consists in supporting the existent superstructure deck from the pylons or towers by straight inclined cables. The pylons or towers are built in different solutions, according to the structure of the bridge requiring the consolidation. By this method the consolidation of the existent infrastructures can be avoided and replaced with the construction of new pylons which can be built in better construction conditions.

The method can be successfully used also when is required only the consolidation of superstructure.

Some possible bridge consolidation solutions and two examples of bridge consolidation presently under construction in Romania using this method are presented in the following. The pylons or towers usually are built in the existent bridge pier axes but, depending on the designer creativity, they can be placed in any other favorably locations.

The bridge consolidation by cable-stayed method is frequently accompanied by additional structure prestresses made with external prestressing tendons. Also, to accomplish the new structures it is necessary to build transverse prestressed beams with cantilevers which will be anchored from the pylons by cable stays.

Fig. 1 and 2 present an example of a bridge consolidation.

Fig. 1 shows the elevation of a bridge having the superstructure consisting of three spans continuous prestressed concrete girders requiring only the consolidation of the superstructure.

The superstructure having a box cross section (fig. 2a) can be consolidated by cable-stayed method by building two towers. The cable anchorage towers may be supported either by the existing superstructure (fig.2b) or by the existing piers (fig.2c).

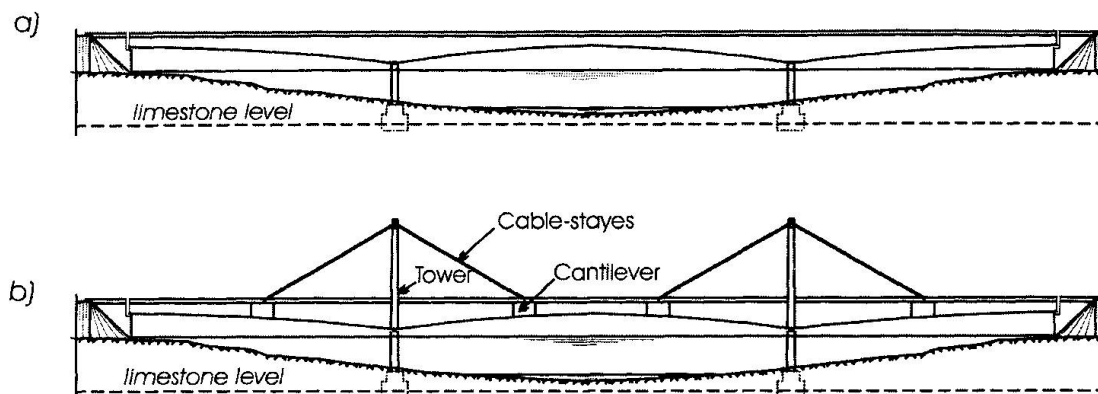


Fig.1 Elevation of a bridge with three-span continuous girders.
a) existing bridge; b) proposed solution.

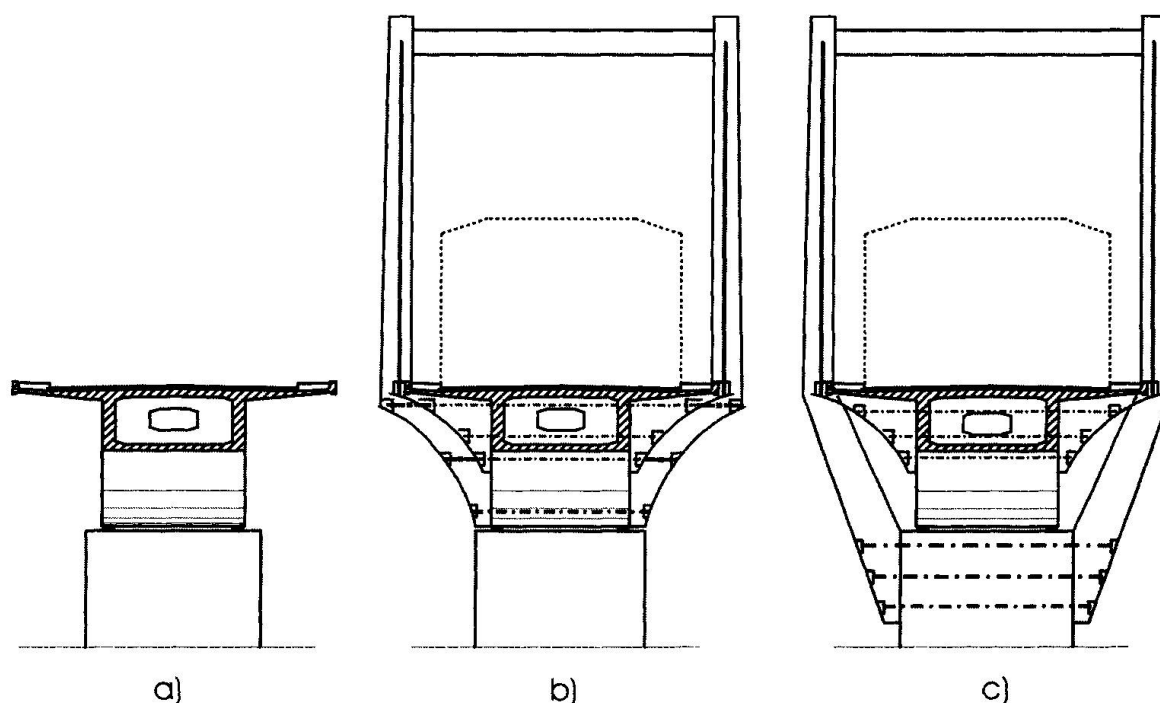


Fig.2 Bridge cross section.
a) existing bridge; b) bridge consolidated with towers supported by the superstructure;
c) bridge consolidated with towers supported by the piers.

Bridge consolidation by cable -stayed method can be an efficient alternative solution to solve the problems of the old bridges.

Use of this consolidation method may ensure some important technical - economical advantages as follows :

- lower investment cost;
- better drainage of water under the bridge;
- improvement of the bridge aesthetics.

Ingenuity and creativity of designers may ensure the achievement of very interesting and special new bridge structure.

The calculus has to consider the effective stresses both in the original and the new statical structure.