New information about practical application of the modified magnetoelastic method

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Abstract. In the technical practice there is very often a need of axial force determination in the important structural elements of a building during its construction or operational state with adequate precision. The magnetoelastic method is one of the five experimental techniques usually used for that purpose in civil engineering practice. The modified magnetoelastic method is especially aimed on experimental evaluation of the axial forces in the prestressed steel reinforcements on prestressed concrete structures and it is usable not only for newly built structures but in particular for existing ones. New information and knowledge about practical application of the new approach based on the magnetoelastic principle is introduced in the paper. The results of three experiments are summarized, which were realized on the full locked cable PV 150 standardly used as a cable stay strand, on the MUKUSOL threadbar 15FS 0000 generally applied as a temporary prestressed reinforcement and on some prestressed tendons of an existing concrete road bridge, which is about thirty years old.

1 Introduction

The paper presents the latest knowledge and experience about the modified magnetoelastic method and brief results of its practical applications carried out by authors in the last year.

The fundamental motivation of the research work of the authors is to research and develop a new approach based on the "magnetoelastic" physical principle and to transfer the obtained knowledge to practical applications. This paper follows up their previously published activities, especially in [1-3].

The magnetoelastic method is based on the physical principle that is functional only on structural elements made of ferromagnetic materials, as are steel prestressed rods, steel wires and steel tendons for example. The new approach is in particular proposed for the experimental determination of axial forces in steel prestressed reinforcements on existing civil engineering structures made of prestressed concrete. This task is very common nowadays in technical practice, especially on bridges, but other methods are generally not usable for that purpose or the difficulties with their applications are more significant and the

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installation allows also good access to the prestressing reinforcement for corrosion engineers to do necessary revision. In the case of lower quality of the injection of cement grout, the EM sensor may reveal significant corrosion of tendons even outside the created opening.

5 Conclusions

According to the authors' opinion, the new approach based on the magnetoelastic method is currently the most suitable technique for experimental determination of the tensile stress or force in prestressed reinforcements on existing concrete structures where the reinforcements are permanently placed inside the surrounding concrete. It is, indeed, the truth that the concrete has to be removed in the position chosen for installation of the EM sensor, however, the required opening could be relatively small, and then its influence on the structure may be neglected.

The realized experiment shows that is possible to determine the prestressing forces in the full locked cables using the new approach based on the magnetoelastic method. The sensitivity of the EM sensor in this case is sufficient and similar to ones determined for other investigated prestressed elements.

It is possible to determine the prestressed forces in the threadbars and another prestressed bars using the modified magnetoelastic method and fully equipped EM sensor. However, the higher susceptibility to parasitic effects of eddy current has to be considered by preparation and design of an experiment realized on steel prestressed bars.

The experiment carried out on the existing bridge structure verified the possibility of additional installation and utilization of the EM sensors on the prestressed reinforcements on existing prestressed concrete structures. In the case of lower quality of the injection of cement grout, the EM sensor may reveal significant corrosion of tendons even outside the created opening.

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