Summary in English

The subject of the paper is the analysis of the impact of the change of the static system on the redistribution of internal forces in bridge structures. In the case of many facilities both in Poland and abroad, there is a need to adapt to new traffic conditions, which is often associated with the need for their structural and functional modernization (e.g. their extension). The subject of the dissertation was to determine how the change in the static layout of the bridge structure, resulting from the need for its modernization, affects the redistribution of internal forces, as well as its further operation. This will be determined using computational models of selected bridge structures and subjecting them to numerical analysis.

The work is divided into 7 chapters. The first presents the subject of the work, its purpose and the meaning of the topic. A review of the world literature is also presented, in which the issue of modernization, repairs, failures, extensions – and thus the redistribution of internal forces – is discussed. The second chapter is devoted to the phenomenon of redistribution of internal forces in bridge structures, and more specifically the classification of the causes that cause it. The third chapter of this paper shows an example of a real object that has undergone modernization, and more precisely has been expanded and strengthened externally. The course of work, test loads before and after renovation is presented.

The implementation report consists of chapters four, five and six. The first of them contains a numerical analysis of the bridge structure, which was subjected to the study of the impact of changes in the static layout of bridge structures on the redistribution of internal forces (elimination of joints, change of the usable width of the bridge). Several variants of the model were developed, which were compared with each other in graphs and diagrams showing the percentage relationships between them.

The fifth chapter deals with the analysis of the impact of damage and reinforcement of bridge structures on the redistribution of internal forces. An original numerical model of the structural system of the bridge structure was developed in the SOFiSTiK program, which at a later stage underwent changes aimed at obtaining different variants of the same object. In the constructions, damage to the lower part of the structure was modeled, which reproduces the impact of an oversized vehicle on the bottom of the bridge structure. In models with damage, Gerber joints were also added. Thanks to this, more results were obtained, which were compiled

on the charts in a percentage way, and compared with each other create an interesting picture of the behavior of the structure depending on its static arrangement.

The sixth chapter contains analyses of the actual bridge structure located in Opole. The object has a very interesting, but also complicated structural system. The lower shelves of the girders have a variable width along the entire length of the spans – also almost every span cross-section of the object differs from each other. Photographic documentation and assessment of the condition of the structure were made. The results of concrete tests that were carried out for the needs of this work during the renovation of the facility carried out in 2015 are also presented.

In the next stage, the bridge structure was modeled in the SOFiSTiK numerical program, in which it was possible to map the diversity of the main girders (variable cross-sections). Work on the model was divided into several stages.

The first is a comparison of internal forces and displacements for the state before 2015, received from loads according to the standard at the time of construction of the object and Eurocode. The second stage is to change the static scheme (widening the usable width of the roadway) and compare internal forces and displacements as above. The third part involved the elimination of joints.

On the basis of the conducted analyses, conclusions were formulated and directions of further research work were given.

The work closes with a list of cited works referred to in individual chapters. The work is accompanied by attachments that contain drawings and reports from the SOFiSTiK computer program.

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