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Methodology of determining stability of bridges using terrestrial laser scanning

ABSTRACT OF PHD THESIS

Infrastructure of bridges is a fundamental part of the land transport. Its importance in road construction puts emphasis on the requirements for safe and reliable use. Currently, railways in Poland undergoes technological transformation. The development of Polish railways applies not only to high speed trains but also to infrastructure. The largest group of railway bridges of PKP PLK SA are steel bridges, which mostly come from the 50^s and 60^s of the previous century. These constructions are showing their age. According to the recommendations of the Western European countries these railway bridges should be reviewed in terms of their usability for modern high speed train. Formal basis of the stability research of railway bridges are included in the PN standards and also in the industry regulations. Modern technological revolution applies not only to railway but also the development in the area of measurements techniques of displacement and deformations. New solutions relate to structural elements of measuring instruments (servomotors, aiming, ultra fast distance meters) and new measuring technology of instruments already implemented in land surveying, eg. more and more accurate terrestrial laser scanners. New technologies provide a more objective measurement results and accelerate their process, and in the study of determining stability of the bridge construction allow for non-contact measurement.

PhD research aim to define appropriate methodology of determining stability of railway bridges using terrestrial laser scanning.

PhD thesis has been divided into 12 chapters, the first three are devoted to literature research on the legal aspects of methodological stability testing of bridges. The fourth chapter is a summary of the literature studies and also contains purpose and thesis of dissertation. Other chapters are dedicated to empirical research. Chapter 5 deals with a research object, which is representative one of the population of steel railway bridges. Chapter 6 provides the concept of field research, pointing to the need for multivariate measurements of railway bridge and also its surroundings. Chapter 7 is a discussion on the need and the design work and preparation, to implement variants of development presented in the preceding chapter. Chapters 8 - 11 are study results of post-processing of traditional land surveying data and terrestrial laser scanning data. Chapter 12 contains the conclusions from the research and the proposes methodology of the stability research of bridges using terrestrial laser scanning.

The scientific results let to substantiation of thesis: *Strictly determining of the methodology of measurement and analysis of results of observation terrestrial laser scanner, with support of traditional surveying techniques, allows to determine the displacement of bridges.* According to the analyzes, the optimal methodology of determining stability of bridge structure using terrestrial laser scanning is a methodology involving the comparison of high resolution point clouds of object, with support of georeference system. This georeference system should be determined with high precision and relative reliability. The recommended methodology studies show the need to involve a strong spatial object georeference system.

