



## Temperature distribution in different bridges types based on data from SHM systems

Jan Biliszczuk, Maciej Hildebrand, Marco Teichgraeber

Wrocław University of Science and Technology, Wrocław, Poland

Hanna Onysyk

Research&Design Office MOSTY-WROCLAW, Wrocław, Poland

Contact: [marco.teichgraeber@pwr.edu.pl](mailto:marco.teichgraeber@pwr.edu.pl)

### Abstract

Monitoring systems have given the possibility of varied and long-term observation of bridge structures. The paper presents the analysis of temperature impact on various bridge elements. The data comes from three different large bridges in Poland, equipped with extensive monitoring systems, namely from an arch bridge in Puławy (built in 2008), cable-stayed bridge in Płock (built in 2005) and the cable-stayed bridge in Wrocław (built in 2011). After few years of observation an enormous and valuable database of measured parameters was stored. The analysis shows how temperature changes between individual bridge components (e.g. between decks, pylon and stay cables) affect the structure mechanical behaviour and whether the influence fulfil the standards' recommendations. Due to various static schemes and materials used in the described bridges, individual and non-typical impact of thermal loads is expected.

**Keywords:** bridges, monitoring, SHM, maintenance, temperature distribution

### 1 Introduction

In Poland, in the last 20 years, most large bridges have been equipped with SHM systems. They collect a lot of data relating to forces, deformations, vibrations and temperature changes in structural elements [10]. The paper presents the results of the changes and distribution of the temperature in various elements of the three bridges. The bridges considered are:

- Solidarity Bridge over the Vistula River in Płock; a steel cable-stayed bridge [4].
- John Paul II Bridge over the Vistula River in Puławy, a composite arch bridge [2], [7].

- Rędziniński Bridge over the Odra River in Wrocław; a concrete cable-stayed bridge [1].

The aim of the paper is to show what temperature differences are between the individual elements of the structure (pylon, deck, tendons or arch) during normal operation. Poland is located in the temperate climate zone, therefore the differences between summer and winter temperatures are significant. In addition, the position of the bridge axis in relation to the sun's route in the sky has a significant impact on the work of the structure. Table 1 presents the values of the angles between the axis of the decks and parallels on the map. The geographical coordinates of the structures are also given.