

# Analysis of the Temperature Changes in the Steel Structure of the Puławy Bridge over the Vistula River, Poland

**Hanna ONYSYK**  
PhD Student, Civil Engineer  
Wrocław University of  
Technology,  
Wrocław, Poland  
*hanna.onysyk@pwr.wroc.pl*

## Summary

The paper presents results of the temperature measurement of the steel arch bridge in Puławy, Poland, over the Vistula River. Measurement data were obtained from the construction monitoring system which is one of three subsystems of which the monitoring system is composed to measure various physical quantities. Presented data refer to period of time from May 2009 to April 2011. Based on the gathered measurement data, the range of temperature changes, extreme values and differences between the values for specific types of elements were analyzed. The differences between various types of elements were analyzed as well. Presented data give an overview of the temperature level of the arch steel bridge with mediate location of the deck. A comparison of selected values with normative values in Polish code as well as in Eurocode has been made.

**Keywords:** structural monitoring; temperature of the structure; steel bridge; arch bridge.

## 1. Introduction

One of the main factors influencing the internal forces in bridge structures being under exploitation are environmental actions. In the case of long span bridges (often complex and/or unique in their form), the effects resulting from environmental actions have crucial influence on the effort of the structure, often much more than the live loads.

This paper presents results of the temperature measurements of the steel arch bridge along ring road of Puławy, Poland over Vistula River. The data have been obtained from the structural monitoring system installed on the bridge. The total length of the crossing is 1038.2 m (a four-span continuous structure) and the main arch river span is 212.0 m being the longest among the arch bridges in Poland. The composite steel and concrete deck is supported by steel arch girders by means of 28 bar hanger assemblies. Due to the great length and the complex structure of the river span, it was decided that a monitoring system should be designed and implemented. The system thoroughly measures various physical quantities at 35 test points [1], [2] - temperature is one of them.

The ranges of temperature changes measured at specified points of the structure on a daily and seasonal basis, as well as the differences between extreme values of the temperature of particular structural elements have been presented. The aim of this paper is to present real values of the structure temperature, ranges of their changes and data concerning extreme temperature values of the specific bridge in a specific location and time period. It is vital to stress that, firstly, the temperature of the structure is dependent mainly on specific climatic-topographic factors under which the bridge is being exploited and, secondly, that the long time of observations of the measured values and their statistical analysis are essential to drawing some general conclusions. Therefore, the data presented give an overview of the temperature level in steel arch bridges with mediate location of the deck. However, they cannot be generalized to define any normative values.

## 2. Structural monitoring system

The monitoring system installed on the bridge in Puławy is composed of three subsystems: monitoring of the structure, meteorological monitoring and video monitoring. The monitoring of the structure is designed to control the behaviour of the bridge by means of continuous electronic measurement of the following parameters: changes in strains, deflections, accelerations,