The Dynamic Investigation of the Cultural Heritage Buildings in Vilnius City

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Summary

In this paper, the experimental investigation of the behaviour of Vilnius Arch-Cathedral Belfry affected by the dynamic loading induced by the operation of a modern bell system is considered.

During the preliminary investigation the significant damage and multicracking in the main masonry walls of the Belfry were observed. They were caused by long–term use of this historical building. In 2002, 6 new bells were installed according to a modern location scheme. It is evident that the bells produce different dynamic effect on this historical building, which has not been investigated yet.

The dynamic investigation was conducted to predict the behaviour of the structure considered. Mass accelerations of Belfry structures were measured during the dynamic investigation. A contribution of dynamic effects was evaluated in terms of response spectra. The results obtained were thoroughly analysed and the appropriate remarks and conclusions were provided.

Keywords: dynamic investigation, dynamic load, accelerations, response spectra, historical heritage, bells.

1. Introduction

A historical nucleus of the Vilnius city - the Old Town is one of the largest in the East Europe. Because of its uniqueness, in December 1994, the historical city Centre of Vilnius – the Old Town – was included into the UNESCO World Heritage List. The most important and prominent building in the Old Town is the Arch Cathedral Basilica with the Belfry beside.

There are two most critical factors reducing the ability of structures of historical heritage, to retain their original properties and serviceability. Natural long-term degradation of the materials under the exposure to the environment, which nowadays is often aggressive, belongs to the first category. Short time dynamic actions, such as vibrations or impact loads (operation of the bells, traffic, earthquakes, etc.) may be considered the second even more dangerous factor influencing the resistance and reliability of structures of cultural heritage.

Apart from long-term natural and artificial trouble, a new source of trouble of the Vilnius Arch-Cathedral Belfry structures emerged in 2002, when six new bells were installed according to a modern location scheme and their ringing order was changed. Evidently, the bells cause different dynamic loads which are not completely controlled and their effect on this historical building in the Old Town of Vilnius can hardly be predictable.

In all countries possessing valuable historical monuments they are protected by special laws, while their technical state is checked periodically, and their reliability, strength and resistance to various

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