IABSE SYMPOSIUM
7-9 October 2020
Synergy of Culture and Civil Engineering
- History and Challenges
IABSE 2020
WROCŁAW POLAND

EXAMPLES OF BUILDINGS PROTECTION AGAINST VIBRATIONS AS ELEMENT OF SUSTAINABILITY IN CIVIL ENGINEERING

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SUMMARY

In this paper the elastic support of building structures is discussed as one of the technical solutions for protecting buildings against vibrations and structure-borne noise caused by the urban infrastructure. From among several presented options of the elastic support technique, two of them are described in detail on the examples of special-purpose facilities built in Poland in recent years. The building of National Synchrotron Radiation Centre 'Solaris' is elastically supported in the whole foundation area (surface vibration insulation). In Cracow Congress Centre, elastic support of structural elements at different levels of the building is used (linear and single-point vibration insulation). In both cases implemented protection measures provide the effective mitigation that comply with very high requirements related to accepted level of vibro-acoustic influences for buildings. The presented examples are intended to draw attention to the problem of noise and vibration pollution against which people and buildings should be protected rationally and properly – according to the concept of sustainable development.

Keywords: *Building protection, Elastic support, Vibration insulation, Structure-borne noise.*

1. INTRODUCTION

In the conditions of heavy urban traffic and well-developed rail infrastructure in cities (tramway, railway or metro lines) there is an increasing need to protect buildings and people staying inside buildings against vibrations and structure-borne noise [1-3]. Sometimes technical precise machines or specialized devices, which are sensitive to vibrations, also require such protection [4]. Therefore, the assessment of the risk should be considered in terms of adverse influences on: a) the building structure, because vibrations imply additional dynamic forces acting on the structure, b) people inside buildings regarding their health and comfort, c) special devices that need to work without any external disturbances. In particular, growing awareness about the protection of human environment and health, as well as the improvement of comfort at workplace, in the place of living and in other public or cultural facilities highlights the problem of people exposure to noise and vibrations. It mainly concerns those cities, where the dynamic development and infrastructure modernization result in an increase in the number and intensity of sources of vibro-acoustic impact. Also, decreasing space available for new investments is the reason why there is a frequent need to use areas localized in the direct vicinity of these sources. Depending on the type of the vibrations source, soil and groundwater conditions, terrain configuration and the building structure, the range of the impact zone may be on average: a) approx. 80 m (in individual cases up to 100-120 m) for a rail line of a freight or mixed freight-passenger trains, b) approx. 65 m for a rail line of passenger trains, c) approx. 25 m (in unusual cases up to 30-35 m) for tram line, d) approx. 40 m for metro line (shallow tunnel), e) approx. 25 m for a road. The range of the impact zone in case of sensitive devices should be determined individually, depending on the type of device to be protected against vibrations [5].

The subject of protection of residents and building structures against noise and vibrations is also included in European Directive 89/06/EEC and national legal regulations, becoming a necessity and an important design criteria in most countries [6-7]. According to them, as much as it is possible, buildings with rooms intended

https://doi.org/10.2749/wroclaw.2020.0676