Chapter

2

Upgrading the Seismic Safety of the Chritzi Bridge, Switzerland

Predrag Stefanovic, Structural Engineer, Emch + Berger SA Lausanne, Switzerland

Abstract: In the following text, a method of seismic safety improvement of bridges is proposed. It takes into account following requirements: structural security, serviceability, durability, and resistance towards earthquakes under conditions of the cost and value optimization.

Keywords: seismic safety improvement; elastic response spectrum; structural response.

2.1 Introduction

In the scope of the design methods, particularly of the dynamic loads, the engineer's knowledge and design codes have importantly advanced in the last decades. Most bridges of the Swiss national road system have been constructed before the introduction of the modern Seismic codes. The bridges, which have been built 30 and more years ago in the severe seismic Alpine regions, are to be examined within the maintenance and retrofitting processes. They are also examined for the seismic loads and have to be adjusted to the requirements of the presently valid design codes. This represents a challenging task for the design engineer.

Earthquake is a phenomenon of the rapid ground displacements with a general three-dimensional action vector towards the structure. The structure reacts to the excitation due to earthquakes in two ways: by the transfer and amplification of the ground displacements to its own structural body and by the generation of internal stresses within the structure. This pair of the interactive phenomena, displacements and stresses, is coupled and their relation in the structure is determined by the stiffness of the structural elements. The greater the stiffness of the bearing structure, the smaller are the deformations and the greater are the induced stresses and vice versa. Another problem arises from the spatial nature of the seismic propagation. As a result of wavelike earthquake oscillations, the pier foundations and abutments move asynchronously towards each other. The distance between different bridge supports increases and gets reduced periodically. Moreover, the ground settlement, liquefaction, instability, and collapse can result from an earthquake action.

https://doi.org/10.2749/sed012.009