

Evaluation of seismic response of bridges under asynchronous excitation and comparisons with Eurocode 8-2 provisions

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Abstract The paper aims to evaluate the way Eurocode 8 treats the consideration of asynchronous earthquake ground motion during the seismic design of bridges, and to discuss alternative solutions for cases wherein existing provisions do not lead to satisfactory results. The evaluation of EC8-2 new provisions and simplified methods is performed through comparison with a more refined approach whereas an effort is made to quantitatively assess the relative importance of various design and analysis assumptions that have to be made when spatial variability of ground motion is taken into consideration, based on the study of the dynamic response of 27 different bridges. It is concluded that, despite the complexity of the problem, there are specific cases where EC8 provisions can be safely and easily applied in practice, while in other cases ignoring the effect of asynchronous excitation or performing simplified calculations can significantly underestimate the actual seismic demand.

Keywords Bridges · Seismic design · Earthquakes · Ground motion · Spatial variability

1 Introduction

From all the parameters that define the non-linear dynamic response of complex structures such as bridges, the input motion has by far the highest level of uncertainty. The last two decades different approaches, methodologies and tools have been developed to deal with this uncertainty and put it in a framework that can be quantified and thus uniformly interpreted by the practicing engineers and the scientific community. The extensive work on predicting or producing refined response spectra, as well as the large data of actual ground motions recorded on different soil and seismotectonic conditions that are currently available, are a precious source of information that has allowed a better understanding of both the characteristics of

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