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EVALUATION OF THE NEW EUROCODE 8-PART 2 PROVISIONS REGARDING ASYNCHRONOUS EXCITATION OF IRREGULAR BRIDGES

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ABSTRACT

During strong ground motion, it is expected that bridge structures are subjected to excitation that is non-uniform along their longitudinal axis in terms of amplitude, frequency content and arrival time, a fact primarily attributed to the wave arrival delay, their loss of coherency and the effect of local site conditions. Although considerable research has been carried out over the last twenty years in all the aforementioned directions, the knowledge gained has only partially been reflected on modern seismic code provisions. Currently, it is only Eurocode 8 - Part 2 that has adopted provisions for tackling this complex phenomenon of asynchronous motion, which have been revised in its final version. As a result, the goal of this paper is to assess these current provisions by focusing on some typical bridge structures. Using a special purpose computer program developed by the authors, the simplified approach proposed by EC8 is critically compared with the results of more refined analysis; the latter involves multiple support excitation of the bridges using pier-dependent artificial accelerograms that account for all the aforementioned three main sources of spatial variability of ground motion. The results indicate that although the new EC8 provisions contribute to a more accurate representation of earthquake loading, their application is subject to a number of limitations and has to be performed with particular caution and exercising engineering judgement.

INTRODUCTION

As bridge seismic design projects aim at a safe performance under unfavourable geological, seismotectonic and geotechnical conditions, the need typically arises for advanced design capabilities towards a number of uncertainties involved especially, and rather disproportionally, related to the definition of a ‘reasonable’ earthquake loading. Nowadays, it is customary to assume that, during an earthquake event all of the bridge supports experience identical ground motion time histories, even in the case of multi-span bridges of considerable overall length and/or span length. It should be pointed out that the assumption of identical