DYNAMIC AND SEISMIC BEHAVIOUR OF A PIER-BRIDGE MODEL AT THE EUROPEAN TEST SITE

George Manos[1], Vladimiros Kourtidis[1], Anastasios Sextos[1], Philippe Renault[2], Vasileios Soulis[1]

[1] Department of Civil Engineering, Aristotle University of Thessaloniki
Thessaloniki, 54124, Greece. Email: gcmanos@civil.auth.gr
[2] Chair of Structural Statics and Dynamics, RWTH Aachen University, Germany

INTRODUCTION

Although the effect of soil-structure interaction (SSI) on the dynamic response of typical residential or commercial structures and infrastructure (i.e. bridges, [1]) has long attracted scientific attention, it is widely recognized that there is an urgent need for further experimental support and validation. This need is far more crucial in cases where the structure responds inelastically and/or the soil conditions favor the appearance of SSI phenomena. For these reasons, significant effort has been undertaken within the context of a number of projects, that has been continuously funded by the European Union for the last decade ([2], [7]).

This paper examines the behaviour of a model structure built at the Volvi European Test Site in Greece (http://euroseis.civil.auth.gr). As shown in figure 1, It is a small-scale representation of a single bridge pier and its foundation block with an overall geometry and mass distribution depicted in figures 2 and 3. The total mass is 185.3KN (41.7kips), 95.3KN (21.4kips) of which are concentrated at the deck level. This bridge pier model structure was recently built (2004) at the Euro-Test Site and can be considered as a reduced scaled model of a number of corresponding bridge pier specimens that were tested at ELSA laboratories of the European Joint Research Center [6], but of smaller dimensions and a different cross-section detailing (figure 4). More information regarding the material parameters, the reinforcement distribution and the testing of identical pier models at the laboratory are described in Manos et al. [2], and are not repeated here due to space limitation. This paper includes selective measurements of the dynamic response of this bridge-pier model, when it was subjected to man-made excitations of low or low-to-medium intensity. During the later sequence of tests the pier bridge model was damaged by developing cracking at its bottom region near the foundation footing. A number of numerical simulation predictions of the dynamic response of this structure are also included and discussed in this paper. Despite the disadvantages of being unable to produce significant in-situ levels of ground motion, when desired, as can be generated by an earthquake simulator, this is in part compensated for by the realistic foundation conditions, which are present for this model structure that is supported on the soft soil deposits in-situ. In fact, this model structure is susceptible to soil-structure interaction (SSI) effects according to Eurocode 8 criteria since the corresponding shear wave velocity (Vs) at the surface is approximately 100m/sec. The current extension of the in-situ facility has made it possible to subject the model structures to low-to-medium intensity man-made excitations (i.e. a number of simple forced vibration tests as well as explosions).