TITLE:

"Nonlinear time history analysis of soil-structure interaction under seismic conditions using Diana: an application to a curved bridge situated on the Italian Tollway A25"

ABSTRACT:

The present study is focused on the analysis of soil-structure interaction (SSI) for reinforced concrete structures under seismic action.
The first objective of the work consists in reproducing the effects on the structure of seismic waves amplification due to soil which can cause structural members to undergo critical solicitation regimes during a seismic excitation. The soil amplification is considered directly in the analyses through the explicit modelling of a significant part of the soil volume underlying the structure, without using site-specific multiplicative coefficients for the acceleration.
The second objective is to investigate possible issues related to the computational approach to SSI problems, in order to evaluate them correctly. In order the FEM model to appropriately fit the problem physics, several aspects are considered in the numerical modelling.
The investigations are used to calibrate a sophisticate 3D finite element model of a bridge developed using the program DIANA. The "Della Valle viaduct" on Tollway 25, "Autostrada dei Parchi", was built in the 1970's in the Abruzzo Region, Italy. The "Autostrada dei Parchi" company, which manages the Tollway, has provided extensive information on the bridge design and construction details. The bridge is curved and has a continuous prestressed concrete caisson girder with two separate bridges, one in each direction. The hollow piers are prismatic and their height varies between 5.5 and 50 meters. The foundations, which consist of piles and caissons, are modelled explicitly along with the soil. In this manner it is possible to study how the ground motion that is input at the base rock is filtered at the superficial soil layer, and its effects on the structure. Realistic nonlinear constitutive models for cyclic loading are used for structural materials. Results obtained both from the series of tests and calibrations conducted and from the numerical investigation of the bridge, led to the development of a generalized framework for FEM treatment of SSI problems.

Keywords: Soil structure interaction, Advanced structural analysis, Case histories

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