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Identifying Dynamic Structural Parameters of Soil-Structure System Based on Data Recorded during Strong Earthquakes

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Abstract : In many applied engineering problems, structural analysis is usually conducted by assuming a rigid bed, while imposing the effect of structure bed flexibility can affect significantly on the structure response. This article focuses on investigation and evaluation of the effects arising from considering a soil-structure system in evaluation of dynamic characteristics of a steel structure with respect to elastic and inelastic behaviors. The recorded structure acceleration during Taiwan’s strong Chi-Chi earthquake on different floors of the structure was our evaluation criteria. The respective structure is an eight-story steel bending frame structure designed using a displacement-based direct method assuring weak beam - strong column function. The results indicated that different identification methods i.e. reverse Fourier transform or transfer functions, is capable to determine some of the dynamic parameters of the structure precisely, rather than evaluating all of them at once (mode frequencies, mode shapes, structure damping, structure rigidity, etc.). Response evaluation based on the input and output data elucidated that the structure first mode is not significantly affected, even considering the soil-structure interaction effect, but the upper modes have been changed. Also, it was found that the response transfer function of the different stories, in which plastic hinges have occurred in the structure components, provides similar results.

Keywords : bending steel frame structure, dynamic characteristics, displacement-based design, soil-structure system, system identification
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