ELASTIC-PLASTIC DYNAMIC ANALYSIS OF SOIL-FOUNDATION-STRUCTURE INTERACTION

by

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The primary objectives of this study are to develop procedures for determining the response of soil-foundation-structure systems during earthquakes as well as to investigate the nature of interaction phenomenon. A two-dimensional soil-foundation-structure model is formulated to simulate the dynamic behavior of a system which consists of a plane framed building, rigid embedded foundation and horizontally layered soil deposit. The method of finite elements, representing the soil deposit, is incorporated in the interaction model utilizing an equivalent linear and elastic-plastic stress-strain relationship. A special side boundary treatment is used to eliminate the influence of artificial side boundaries. The parameter studies are carried out changing soil properties and depth, structures, foundation embedment and bedrock motions. The results of the parameter studies are discussed by means of an amplification factor and interaction coefficient.

The analytical procedures developed provide an effective means of determining the dynamic response of a soil foundation structure system during earthquake loading. By utilizing the partial viscous side boundary treatment, an accurate finite element model of interaction can be constructed. The interaction effect is a function of the ratio T_b/T_s, the ratio of the foundation embedment depth to soil thickness, and the relation of soil's strength vs. peak bedrock acceleration. Because the foundation embedment has significant effect upon the interaction, careful attention should be paid upon the evaluation of embedment effect. The consideration of plastic strains in the interaction analysis may or may not be required, depending on soil strength and the intensity of bedrock motion being considered. (For detailed results, refer to, "Analysis of Soil-Foundation-Structure Interaction During Earthquakes", K. Ukaji; Technical Report No. 18; JABEEC, Stanford University, March 1975).

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