

SEISMIC DESIGN OF CAISSONS FOR
IN-SITU CONDITIONS

by

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When a Seismic Category I structure of a nuclear power plant is supported by caissons or piles, seismic analyses considering structure-caisson-soil interaction are required. This paper discusses a case study on the seismic analyses of caissons with probable variations of soil conditions in the field.

Unlike conventional designs where the caissons or piles are designed mainly for the axial loads, the design of caissons or piles for seismic loading conditions requires consideration of lateral dynamic load on the caissons; the lateral load is to be supported by caissons, surrounding soil and the bedrock. The case study considers the caissons in a soil profile which includes loose fill material having liquefaction potential. The study includes the analyses of the caissons on the basis of full soil support as well as partial soil support due to liquefaction. For both cases of analyses, the lateral resistance of the soil support was taken into account by employing Penzien's techniques. The soil moduli used was compatible with soil strain level. In computing the lateral spring constants, consideration was given to the group action of caissons for both the cases of full soil support condition and partial soil support condition.

In the design of caissons subjected to seismic lateral load, the various elevations which define the different strata of soil characterizing the intensity and distribution of soil support are important. The analyses have to consider these different elevations, however, the in-situ soil profile encountered during caisson construction may not be the same as the profile used in the analyses. For example, the top of competent bedrock may vary and thereby affect the stiffness of the caissons. Thus it changes the intensity and load distribution among caissons, soil and bedrock. In addition to considering the variation of soil profile in the vertical plane, the study considers the variation of soil in the horizontal plane, i.e., the condition where the caissons of the group are located in varying soil conditions.

On the basis of the seismic analysis model, the moments, shears and axial loads which are transferred to the bedrock are computed. The paper presents a rational method by which the lateral capacity of the rock socket is evaluated. The paper also discusses the various construction problems in ensuring the required lateral support as per design conditions.

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