FEASIBILITY STUDY OF ONE-DIMENSIONAL APPROXIMATION FOR SEISMIC RESPONSE ANALYSIS

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SYNOPSIS

The results of one- and two-dimensional seismic response analyses performed for an offshore breakwater embankment indicate, that with proper modifications, it is feasible to utilize one-dimensional seismic analysis procedure to evaluate a two-dimensional seismic stability problem.

INTRODUCTION

Current state-of-the-art seismic analyses utilize either one-dimensional shear wave propagation theory or two-dimensional finite element techniques to calculate the seismic response. Three-dimensional models are possible, but they are too costly to run for practical problems. Both the one-dimensional and two-dimensional methods permit the use of non-linear strain-dependent modulus and damping values for the soils and embankment materials to account for material property variations. Two-dimensional (finite element) analysis is usually preferred in seismic response analyses. However, it is costly and time consuming because an iterative procedure is required to account for the non-linear properties.

SEISMIC ANALYSIS

Both one- and two-dimensional analyses were performed to evaluate the seismic response of a breakwater which is being designed to protect a floating power plant near the coast of New Jersey, some 85 miles southeast of New York City. The seismic response results of one-dimensional analyses performed on several vertical profiles through the breakwater foundation soil system are compared with the results of two-dimensional analyses. It is found that both analyses yield similar results except in the areas underneath the sloping portions of the breakwater embankment.

RESULTS AND CONCLUSION

The factors influencing the results of one- and two-dimensional analyses are examined in this paper. Based on this examination and comparison of results, modifications are also suggested in order to utilize the results of one-dimensional analyses for seismic evaluation of an earth dam or embankment which is usually treated as a two-dimensional problem.

The results of this study indicate that the use of one-dimensional analyses for seismic stability evaluation of an earth structure is feasible. Engineering judgement and careful examination of the various influencing factors must be exercised by the designer when one-dimensional approximation is used.

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