Seismic Design and Parametric Study of Rigid Retaining Walls

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ABSTRACT

The main objective of the paper is to develop a simplified procedure for the seismic design of a rigid retaining wall. For the design of a rigid retaining wall various parameters that are taken into consideration include height of the wall, angle of inclination of backfill, backface angle of the wall, surcharge on backfill, safe bearing pressure of base medium and horizontal as well as vertical seismic acceleration coefficients. Safe design of a wall should satisfy four criteria, namely, factor of safety against sliding shall not exceed given limits, factor of safety against overturning shall be less than its permissible value, maximum pressure at the base of wall shall not exceed safe bearing pressure of the base soil and minimum pressure at the base of wall shall be greater than zero. In this paper an attempt has been made to give a simplified procedure for the seismic design of a rigid retaining wall. A parametric study to check the effect of various parameters affecting the seismic design of wall is carried out.

Keywords: Design, Earth Pressure, Earthquake, Factor of Safety, Overturning, Rigid Retaining Wall, Safe Bearing Pressure, Sliding

INTRODUCTION

The main objective of the paper is to develop a simplified procedure for the seismic design of a rigid retaining wall.

Newmark (1965) proposed a basic procedure for evaluating the potential deformation that would be experienced by an embankment dam shaken by an earthquake by considering the sliding block-on-a-plane mode. The method is based essentially considering rigid plastic behaviour of soils. Though this method was developed for sliding analysis of an earth dam, Richard and Elms (1979) used this concept for determining the weight of retaining wall satisfying the condition that factor of safety against sliding is unity that is just at the verge of sliding but zero displacement. Their observation was that for no lateral movement, the weight of the wall under seismic forces increased by a consid-
erable amount over the static condition, which may prove to be uneconomical. To overcome this problem, Richard and Elms (1979) have suggested a design procedure based on limited allowable wall movement. This concept brought the weight of the wall in reasonable limits.

As mentioned above, Richard and Elms (1979) analysis is based on factor of safety against sliding only and that is too considering it as unity. In this paper a method has been presented to obtain the weight of wall subjected to earthquake forces corresponding to adequate factor of safety against sliding, overturning, shear failure of soil and no tension at base that is satisfying all stability criterions. Further a parametric study to check the effect of various parameters affecting the seismic design of wall is carried out.

Due to seismic excitation, both backfill and foundation soils will vibrate along with the wall. It will increase the active earth pressure and decrease the allowable soil pressure.
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