EARTHQUAKE RESISTANT DESIGN OF EARTH SLOPES

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SUMMARY:- The paper presents an earthquake resistant design of an earth slope based on rigid and elastic body response analysis. Stability analyses alongwith changes in the pattern of pore water pressure during earthquake are examined.

ANALYSIS BEFORE EARTHQUAKE:-

A typical cross section of Tapar dam situated in seismically active zone in India was analysed by Bishop's method for drawdown condition. Critical centre was located with respect to average exterior slope with α angle of 34° and β angle of $36^{\circ}-30'$. IBM 360 computer was used for analysis.

ANALYSIS DURING EARTHQUAKE:-

Rigid body response analysis was made using uniform seismic co-efficient of 0.15 for this seismic zone. The vertical co-efficient for acceleration was taken as one half of horizontal seismic co-efficient.

The earth embankment, however, cannot be expected to behave as a rigid body. The use of elastic response analysis is more appropriate. Previous studies have shown that the seismic co-efficient varies from a maximum value at crest to minimum value at bottom. For analysis the distribution is adopted as $\alpha y=(2.5-1.5\ y/H)\alpha b$, where; αy=seismic co-efficient; y=depth below crest; H=height of embankment; αb=a parameter dependent on average acceleration, natural period of vibration and percentage damping.

SAFETY FACTORS:-

The contours of safety factors for various conditions are presented in Fig.1. The critical centre remains the same but the contours have shifted below considerably. The safety factors obtained by elastic response analysis are lower than those obtained by rigid body analysis.

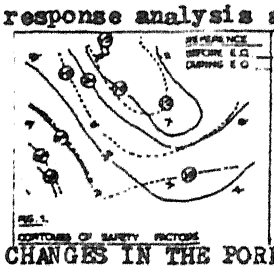

FIG.1.
CONTOURS OF SAFETY FACTORS

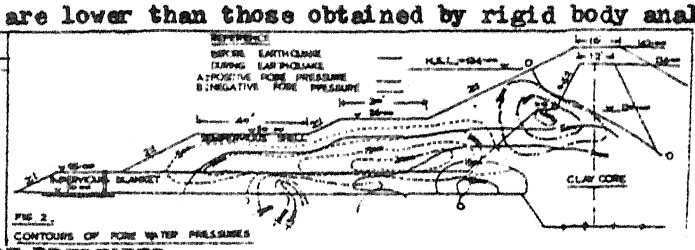

FIG 2.
CONTOURS OF PORE WATER PRESSURES

CHANGES IN THE PORE PRESSURES:-

There is a considerable shifting of high pore pressure zone in the shell material, specially at the bottom of shell zone. There is a concentration of pore pressures during earthquake which tend to uplift the mass and consequently increasing the actuating force. In the clay core near phreatic line, negative pore pressures are set up as a result of pore pressure variation and the resultant of T-force and horizontal inertia force around the region. Due to cohesive material in the blanket, negative pore pressures are set up within the blanket as indicated in Fig.2.

CONCLUSION:-

The earth material in the body of the dam does not behave much as a rigid mass. The use of elastic response analysis is more appropriate. Such an elastic response analysis presents the critical condition.

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