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Limit analysis of submerged slopes subjected to water drawdown

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Abstract: A rapid draw of water from a reservoir can cause a temporary increase in the hydraulic gradient that may not be tolerated by the slope of an earth dam. The increased seepage forces may lead to slope instability, causing the collapse of the structure. The kinematic approach of limit analysis is used to examine stability of slopes subjected to a rapid or slow drawdown. Combinations of slope inclination, soil properties, and hydraulic conditions are found for which the slope becomes unstable. The results are presented in the form of charts for convenient practical use, and the safety factors can be obtained from the charts without the need for iteration. For granular slopes, particularly if shallow, subjected to drawdown, a simple translational mechanism with a shallow failure surface is not the most adverse mechanism for all water-draw regimes.

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