A Study on the Long-Term Performance

of

Seepage Barriers in Dams

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ABSTRACT

In a vast majority of cases, seepage barriers increase the reliability of dams. However, it is important to recognize that seepage barriers often drastically increase hydraulic gradients around the boundaries of the barrier, and through any windows or defects in the barrier. The result is increased water pressures and hydraulic gradients behind and around the barrier. These increased pressures and gradients have potential to provide the catalyst for initiation of several modes of internal erosion that were either unlikely or less likely without the seepage barrier. As a consequence, seepage barriers give rise to the potential for additional mechanisms of internal erosion and piping in the dam and the foundation.

Mechanisms of erosion and piping that are uniquely related to seepage barriers have been investigated through review of measured performance of existing dams, and through analytical studies. A compendium of 30 case studies of dams that have had seepage barriers in place for over 10 years has been assembled, and observations and insights garnered from these case studies were compiled. Finite element seepage and deformation analyses have been performed to provide better understanding of the performance of seepage barriers and the mechanisms that affect their performance. Based on the findings from the case studies and analyses, potential failure modes specific to dams with seepage barriers were identified, and the sequences of events required for the propagation of these failure modes were developed. The observations and insights acquired in this study were distilled into conclusions regarding the long-term performance of dams with seepage barriers.

The information derived from this study will be useful in 1) assessing the potential for internal erosion and piping developing in dams with seepage barriers, 2) designing to minimize that possibility, and 3) assessing the risks associated with these mechanisms of erosion and piping. It is envisioned that the results of this study will provide dam owners and engineers with a better understanding of the issues involved with dams having seepage barriers and that this understanding will lead to improved practices in assessing, designing, and monitoring of dam seepage barriers. In addition, by improving the means by which seepage barriers can be assessed and designed, it is hoped that the confidence level that dam engineers have with regard to properly designed seepage barriers will be increased, and that properly designed seepage barriers can be viewed as safe and viable alternatives for mitigation of seepage problems.

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