Building Research Establishment Report

An engineering guide to seismic risk to dams in the United Kingdom

J A Charles, PhD, DSc(Eng), FICE
C P Abbiss, BSc, MSc, PhD
E M Gosschalk, MA, FICE*
J L Hinks, MA, MSc, MICE*

* Sir William Halcrow and Partners

Building Research Establishment
Garston
Watford
WD2 7JR

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Foreword

This Guide has been prepared by the Building Research Establishment and Sir William Halcrow and Partners Ltd as part of the Department of the Environment's reservoir safety research programme. It is intended to help those responsible for reservoir safety in the United Kingdom to assess seismic loading. It is hoped that it will aid consistency in applying standards and analytical techniques for safety evaluation.

The Guide has been prepared as a result of careful consideration and with reference to representative authorities concerned with the safety of dams. It is not a code of practice, however. It cannot relieve the Engineer appointed under the Reservoirs Act 1975 of his responsibility nor should it restrict his discretion in deciding criteria to be adopted, techniques to be used and standards to be met in the interests of safety.

The objective of the research project, which was essentially in the form of desk studies, was to assess the seriousness of seismic risk and to propose criteria for earthquake safety evaluation of existing dams. The recorded performance of well constructed embankment dams and concrete dams when subjected to earthquakes has been exceptionally good worldwide. Nevertheless, the possibility of severe earthquake loading has not been fully appreciated in the past in the UK and there are small but finite risks that more severe earthquake loading might occur in the future than has generally been perceived.

It is proposed that the seismic safety evaluation of a dam and its ancillary works should be based on a safety evaluation earthquake. The safety of the dam against catastrophic failure (ie breaching) should be ensured under the level of ground motion produced by this earthquake and loss of life should not be expected. Recommended peak ground accelerations for the safety evaluation earthquake are related to 4 dam categories based principally on the downstream hazard posed in the event of failure and 3 zones of seismicity level into which it is suggested that the UK can be divided. The most rational methods practicable should be used in evaluating the safety of dams against realisable combinations of risks of all kinds and this approach should result in the most cost effective practice. A satisfactory balance is required between reducing risk and the expenditure entailed; it is important that seismic hazard and risk should not divert attention from other aspects of dam performance which may be more critical for safety.

Work is progressing in many places on several of the subjects dealt with in this guide (eg UK seismicity, methods of dynamic analysis). While every effort has been made to present the state-of-the-art, the Guide should be regarded as provisional in character and it is recommended that after a reasonable period it should be reviewed and, where necessary, revised.