

PROCEEDINGS OF THE INTERNATIONAL SYMPOSIUM ON NEW TRENDS
AND GUIDELINES ON DAM SAFETY/BARCELONA/SPAIN/17-19 JUNE 1998

Dam Safety

Edited by

L. Berga

Civil Engineering School of Barcelona, Spain

VOLUME 2



A.A. BALKEMA/ROTTERDAM/BROOKFIELD/1998

The texts of the various papers in this volume were set individually by typists under the supervision of each of the authors concerned.

Authorization to photocopy items for internal or personal use, or the internal or personal use of specific clients, is granted by A.A. Balkema, Rotterdam, provided that the base fee of US\$ 1.50 per copy, plus US\$ 0.10 per page is paid directly to Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923, USA. For those organizations that have been granted a photocopy license by CCC, a separate system of payment has been arranged. The fee code for users of the Transactional Reporting Service is: 90 5410 974 2/98 US\$ 1.50 + US\$ 0.10.

Published by

A.A. Balkema, P.O. Box 1675, 3000 BR Rotterdam, Netherlands

Fax: +31.10.413.5947; E-mail: balkema@balkema.nl; Internet site: <http://www.balkema.nl>

A.A. Balkema Publishers, Old Post Road, Brookfield, VT 05036-9704, USA

Fax: 802.276.3837; E-mail: info@ashgate.com

For the complete set of two volumes, ISBN 90 5410 974 2

For volume 1, ISBN 90 5410 975 0

For volume 2, ISBN 90 5410 976 9

© 1998 A.A. Balkema, Rotterdam

Printed in the Netherlands

Table of contents

Structural safety (continued)

Epoxy grouting of cracks at Eugio buttress dam <i>A.Marcello, M.Berra & N.Brizzo</i>	801
Construction of a drainage gallery at the Ennepe dam, Germany, using a Tunnel Boring Machine (TBM) <i>C.Heitefuss & H.Ruhnke</i>	809
Three dimensional dynamic behavior of zoned-rockfill dams with emphasis on a real case study <i>F.Jafarzadeh & A.Yaghobi</i>	817
Filter material study for an earth dam project <i>H.M.Lilja, M.Rother & O.T.Ravaska</i>	825
Experimental study of flow through a bed of packed glass beads <i>M.Billstein</i>	833
Modelling saturation settlements in rockfill dams <i>P.Anthiniac, S.Bonelli, A.Carrère & O.Débordes</i>	841
Post-construction settlements of rockfill and embankment dams <i>F.Bonnaire</i>	849
Two dimensional nonlinear dynamic analysis of rockfill dam <i>V.Mircevska & V.Bickovski</i>	859
Karameh embankment dam – Construction stage geotechnical and seismic issues <i>C.Makinson, L.SASIC-GRIL & J.G.Penman</i>	867
Safety appraisal of embankment dams with impervious facing <i>R.Jappelli, A.Musso & F.Federico</i>	881
Behaviour of the concrete faced rockfill dam subjected to earthquake excitation <i>J.Noorzaei, Y.Haqiqi & E.Mohammadian</i>	889

Earth loads on conduits buried under embankment dams <i>F.Sáenz de Ormijana & M.Lindon</i>	895
Finnish dam safety code prohibited collapse of the Uljua earth dam <i>H.Rathmayer & J.Pöllä</i>	903
Providing of stability of the terrace downstream from the Serebranskaya dam-2 <i>M.Pavchich, V.G.Radchenko, A.V.Stulkevich & G.A.Tchugaeva</i>	911
Stability evaluation of the rockfill dam with cracks <i>H.M.Shin & S.R.Ahn</i>	917
Slope failure at Dychów dam – Analytical and numerical study of the accident <i>J.M.Dłuzewski & W.Hrabowski</i>	925
Solutions for the improvement of safety conditions of Lugasu earth dam, Romania <i>E.Luca, D.Teodorescu & A.Korbl</i>	933
Remedy solutions for the slag and ashes deposit dike at Craiova II, Romania <i>S.Hancu, E.Luca & N.Iorgulescu</i>	941
Dubrava Multipurpose Scheme earthfill embankments safety <i>B.Franković, VŽarković & V.Jurić</i>	949
Problems and successful solution in refurbishment of Hardap dam asphalt-concrete sealing <i>L.D.Schewe</i>	957
Erosion problems of concrete faced rockfill dams during construction: The case of Messochora dam <i>J.Thanopoulos & J.Ticof</i>	967
The experience in the use of pattern recognition principles for assessment of safety of Enguri dam <i>D.Mirtskhulava</i>	975
Surveillance of Gariep dam using neural networks <i>L.C.Hattingh & C.Oosthuizen</i>	981
The mathematical model of dam safety monitoring based on multiple survey points <i>J.He & Z.Li</i>	989
Remote visual controls of dams <i>H.Lançon, D.Reith & M.H.Inchauspe</i>	997
Use of geo-radar for detecting irregularities in concrete face dams <i>C.Olalla, J.M.Ruiz & A.J.de la Cuadra</i>	1005
Innovative dam monitoring systems <i>M.Aufleger, J.Dornstädter & Th.Strobl</i>	1013

Monitoring impaired dam structures <i>W.Ernst</i>	1021
Use of electrical and electromagnetic techniques for controlling water content in earth dam cores <i>J.M.Ruiz, C.Olalla & A.J.de la Cuadra</i>	1027
The role of monitoring on the assessment of the safety of El Atazar dam <i>A.Soriano, A.Arcones & F.J.Sanchez</i>	1035
Significance of predicted displacement limits in arch dam safety assessment <i>D.Stematiu, R.Sarghiuta, T.Bugnariu & A.Abdulamit</i>	1043
Integrated monitoring systems for the seismic reassessment of existing dams <i>G.Mazzà, G.Giuseppetti, G.Ruggeri & P.Bonaldi</i>	1051
An advanced automatic monitoring system <i>E.K.Wagner & B.Kofler</i>	1059
Use of computerized monitoring diagnostic system for evaluation of safe structural behaviour of hydropower plants <i>G.Y.Berdichevski, E.I.Vorontsov, B.D.Chumichov, V.I.Shcherbina & M.F.Rogal</i>	1067
The combined use of monitoring and mathematical models to assess instantaneously dam safety in the Segura Basin Defence Scheme <i>C.Marco, E.Salete, D.Salete, L.Moreno, M.Crevillén & C.Aviles</i>	1073
The Czorsztyn-Niedzica and Sromowce Wyżne water reservoirs' dam safety monitoring system <i>W.Dobosz & W.M.Krakowski</i>	1081
Jinvali dam safety monitoring automatic system <i>D.Mirtskhulava, I.Noniev & E.Chachkhiani</i>	1087
Aging of dam instrumentation <i>T.Roth & U.Marti</i>	1091

Hydrological safety

New trends in hydrological safety <i>L.Berga</i>	1099
Flood estimations for dam safety in Norway <i>L.-E.Pettersson</i>	1107
Guidelines for assessing reservoir flood safety in the Czech Republic <i>L.Macháček</i>	1113
Characteristic properties of dams and spillways related to the risk of flood control <i>St.Ionescu</i>	1119

New aspects of freeboard design at dams <i>H.Martin & R.Pohl</i>	1127
Swedish dam safety guidelines (RIDAS) concerning spillway gate functions <i>S.Lagerholm</i>	1135
New representative tests on chains question capacity of flood control equipment <i>J.J.Roche & J.H.Bulloch</i>	1143
Safety of dams with large diameter steel-reinforced concrete pressure conduits <i>O.D.Rubin & S.E.Lisichkin</i>	1151
Cracked bearing pins in gate lifting chains – A fitness-for-purpose assessment <i>J.H.Bulloch, A.G.Callagy, P.J.Bernard & J.J.Roche</i>	1155
Safety of rockfill dams subject to overtopping <i>M.A.Toledo</i>	1163
Hydrodynamic loading and stability of rockfill spillways <i>B.Westrich & A.Rathgeb</i>	1171
Optimum design of embankment dams cofferdams <i>R.Lopez</i>	1179
Cost aspects of flood control dams <i>F.Lempérière</i>	1187
Flood retention installations in Styria, Austria: State of the art – performance – safety <i>B.Saurer</i>	1193
Station-year and Lombardi's approaches: Tools for estimation of design floods <i>H.Garros-Berthet</i>	1199
A methodology for analysing return periods for design discharges in Spanish dam spillways <i>L.Ardiles, T.Estrela & M.Menéndez</i>	1207
A physically-based approach to predict input hydrographs in managed reservoirs <i>M.J.J.Pirotton</i>	1215
Application of PMP-PMF methodology to the Mattmark scheme <i>J.-L.Boillat & J.Dubois</i>	1221
Probable inference using entropy applied to regional flood modelling <i>V.Solana & A.Solana</i>	1229
Spillway design flow calculation in river Dalälven, Sweden <i>M.Sundby, M.Sassner, J.Östberg, J.Hansson & A.Lärke</i>	1237

Upgrading of the hydrological safety at Sädvajaure dam, northern Sweden <i>C.-O.Brandesten, M.Engström & P.Lindström</i>	1245
Use of the S.A.I.H. for flood management in dams <i>F.Cabezas & J.Yagüe</i>	1253
Hydrological forecast and dam safety <i>Z.Pei</i>	1261
Flood forecast systems in Spain for dam safety and people protection <i>E.Velasco</i>	1265
Reservoir management for the control of flood volume in the hydrographical network of the Ebro <i>C.Ferrer, G.Cobos & R.Martínez</i>	1273
The ASTER-ERHIN System in the management of winter flooding <i>L.Pérez, J.A.Hinojal, M.Arenillas & R.Martínez</i>	1281
Flood control in dams of the Guadalquivir river basin <i>J.Saura & A.Argüelles</i>	1289
Routing of high and extreme floods through chain of reservoirs <i>A.Aasarin</i>	1297
Hydraulic mathematical model application for reservoir management <i>Z.Obušković & B.Stišović</i>	1301
The development of an operation rule for flood conditions at an Alpine hydro plant river chain <i>H.Gaisbauer & H.Keller</i>	1307
Flood management in dams – Maximum operation levels and methodology for an operation procedure <i>J.Grás, P.García & R.Rollán</i>	1315
Operating rules in the Borbollón and Rivera de Gata dams, Tagus Basin <i>L.Perez, G.Marin, J.Grás & M.Mareca</i>	1323
A model for visual analysis of gate operation for flood control <i>L.Garrote</i>	1331
Safety of gravity dams and spillways in extreme floods <i>P.Léger, R.Tinawi & R.Larivière</i>	1339
Experience in spillway operation – Incidents and lessons learned <i>R.del Hoyo</i>	1347
Dobczyce dam on Raba River during the large flood of July 1997 <i>T.Adamczyk, T.Reszka & J.Wencewicz</i>	1353
Extreme flood event during the first impounding of the Jiroft dam in Iran <i>M.Rashidi, S.H.Valeh & W.Indermaur</i>	1361

Case study of the flood mitigation role of Muda, Pedu and Ahning dams in Kedah, Peninsular Malaysia <i>K.M.Loh & F.S.Lai</i>	1371
New spillway for a 105 m high rockfill dam, in order to update hydrologic and geotechnical safety – Case of Arenós dam, Spain <i>E.Cifres</i>	1379
Linking theoretical and experimental studies for evaluation of aeration necessity in the 1600 m ³ /s tunnel spillway of Arenós dam, Spain <i>L.Mouvet & E.Cifres</i>	1387
Motz dam: A global study of the new spillway <i>P.Brun & P.Carlioz</i>	1395
Hydrological and structural safety of Yaté dam <i>M.Salembier</i>	1405
Anchorage of a floating sluice gate of the spillway of the Tranquera dam <i>J.L.Uceda & H.J.Morlans</i>	1413
Rehabilitation of the Montsalvens dam <i>D.Golliard, R.Bremen & S.Chevalier</i>	1419
Some problems of ‘fuse’ elements application to discharge extreme floods <i>V.P.Kupriyanov, M.E.Lounatsi, A.M.Proudovsky & V.B.Rodionov</i>	1429
Fuseshell: An innovation in dam safety <i>K.Emami</i>	1437
CFD modelling of spillway capacity – A comparison between hydraulic and mathematical models <i>M.Cederström, B.Dargahi, L.Hammar, N.Johansson & J.Rundqvist</i>	1445
Aeration of outlets with free surface flow – Design consideration and computer program application for some constructions <i>R.Gutierrez</i>	1451
Hydraulic scale model tests to check on the safety of a flood control reservoir <i>G.Heigerth, E.Kresnik, H.Knoblauch & T.Dum</i>	1459
Design of large skyjumps on small rivers: Casasola dam <i>R.Lopez, M.Alonso Franco & A.Botia</i>	1467
Rialb dam: Some project safety criteria <i>M.Zueco & F.J.Hijos</i>	1475
Drain system in Itoiz dam <i>R.J.Lafuente & M.Zueco</i>	1483
The Val dam: Hydraulic project criteria and reduced-scale modeling <i>N.Alonso, M.A.Bermúdez, V.Elvio & M.Zueco</i>	1491

Accurate measurement of large flows – Revision on criteria applied to spillways of dams <i>J.Riera & A.Moñino</i>	1499
Hydraulic redesign safety stilling basins <i>T.P.Provorova</i>	1507
Estimation of safety of separating walls subjected to hydrodynamic loads within zones of energy dissipation <i>V.P.Kupriyanov, A.M.Proudovsky, V.B.Rodionov & Y.P.Voinov</i>	1513
Resistance of ALAG concrete to hydraulic abrasion and cavitation in dam structures <i>J.-L.Cabiron & S.Lavigne</i>	1521
<i>Working groups</i>	
Dam legislation in some European countries <i>P.Le Delliou</i>	1533
Report of the European R&D Working Group ‘Floods’ <i>H.-E.Minor</i>	1541
Uplift pressures under concrete dams – Progress report <i>G.Ruggeri</i>	1551
RCC dams – Progress report <i>J.Diez-Cascon</i>	1561
Internal erosion in European embankment dams – Progress report of Working Group on internal erosion in embankment dams <i>J.A.Charles</i>	1567
Working Group for geomembranes and geosynthetics as facing materials: Final report <i>A.M.Scuero & G.L.Vaschetti</i>	1577
Author index	1587