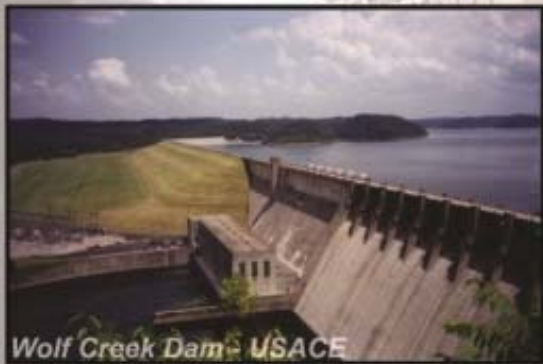


Best Practices in Dam and Levee Safety Risk Analysis



Dallas Floodway - USACE



Wolf Creek Dam - USACE

background: Hoover Dam - BOR



**U.S. Department of the Interior
Bureau of Reclamation**



**U.S. Army Corps of Engineers
BUILDING STRONG®**

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Best Practices in Dam and Levee Safety Risk Analysis

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ACRONYMS AND ABBREVIATIONS

1D	one-dimensional
2D	two-dimensional
3D	three-dimensional
AALL	average annual life loss
ACR	alkali carbonate reaction
AEP	annual exceedance probability
AF	acre-feet
AFP	annualized failure probability
ALL	annualized life loss
ANCOLD	Australian National Committee on Large Dams
ANS	American Nuclear Society
ANSI	American National Standards Institute
APF	annual probability of failure
ARS	Agricultural Research Service (USDA)
ASCE	American Society of Civil Engineers
ASDSO	Association of State Dam Safety Officials
ASR	alkali silica reaction
BEP	backward erosion piping
BLM	Bureau of Land Management
BPT	Becker-Hammer penetration test
CAD	computer aided design
CAS	Corrective Action Study
CCTV	closed-circuit television
C-D	capacity minus demand
CD	consolidated-drained (tests)
CDA	Canadian Dam Association
CDF	cumulative distribution function
CDOT	Colorado Department of Transportation
CE	continuing erosion
CEUS-NGA	Central and Eastern United States Next Generation Attenuation
CEUS-SSC	Central and Eastern United States Seismic Source Characterization
CFM	Comprehensive Fracture Model

CIRIA	Construction Industry Research and Information Association
CMS	conditional mean spectra
CPT	cone penetrometer tests
CR	Comprehensive Review
CSR	cyclic stress ratio
CSSM	critical state soil mechanics
CSZ	Cascadia Subduction Zone
D.C.	District of Columbia
DAMRAE	Dam Risk Analysis Engine
DC	direct current
DDA	discontinuous deformation analysis (code)
DEM	digital elevation models
D_f	diameter at failure
DHR	differential head ratio
DSAC	Dam Safety Action Classification
DSAT	Dam Safety Advisory Team
DSHA	Deterministic Seismic Hazard Analysis
DSMS	Dam Safety Modification Study
DSO	Dam Safety Office (Reclamation)
DSPR	Dam Safety Priority Rating
EE	excessive erosion
EFA	Erosion Function Apparatus
El.	elevation
EM	Engineering Manual
EPRI	Electric Power Research Institute
EROS	Center for Earth Resources Observation and Science
ESP	exchangeable sodium percentage
ETL	Engineering Technical Letter
F	force
FB	ForeBay
FC	finer content
FCM	fracture critical members
F_d	drain factor
FE	finite element
FEMA	Federal Emergency Management Agency

FERC	Federal Energy Regulatory Commission
FLAC	Fast Lagrangian Analysis of Continua
FOSM	First Order Second Moment
FS	factor of safety
FSSS	fully softened shear strength
FTA	fault tree analysis
GIS	Geographic Information Systems
GMPE	Ground Motion Prediction Equations
gpm	gallons per minute
HEC	Hydrologic Engineering Center (USACE)
HET	hole erosion test
HHA	hydrologic hazard analysis
HHC	hydrologic hazard curve
HL	Hydraulic Laboratory
HMR	Hydrometeorological Report
HSE	Health and Safety Executive
ICOLD	International Commission on Large Dams
IDF	Inflow Design Flood
IE	Issue Evaluation
IES	Issue Evaluation Study
IFSAR	Interferometric Synthetic Aperture Radar
IPET	Interagency Performance and Evaluation Team
IR	interaction ratio
JET	Jet Erosion Test
lb/ft ²	pounds per square foot
LiDAR	light detection and ranging
LSAC	Levee Safety Action Classification
LST	Levee Screening Tool (USACE)
M	moment
MC	Monte Carlo
MCE	Maximum Credible Earthquake
MPBX	Multi-Point Borehole Extensometers

NATO	North Atlantic Treaty Organization
NE	no erosion
NED	National Elevation Dataset
NEHRP	National Earthquake Hazards Reduction Program
NFIP	National Flood Insurance Program
NLD	National Levee Database
NMSZ	New Madrid Seismic Zone
NRC	National Research Council
NRCS	Natural Resources Conservation Service
NSW DSC	New South Wales Dam Safety Committee
NWS	National Weather Service
OCR	over-consolidation ratio
OMB	Office of Management and Budget
PA	Periodic Assessment
PAR	population at risk
PDF	probability density function
PERT	program or project evaluation and review technique
PFDHA	Probabilistic Fault Displacement Hazard Analysis
PFM	potential failure mode
PFMA	potential failure mode analysis
PG&E	Pacific Gas & Electric Company
PGA	peak ground acceleration
PGD	permanent ground deformation
PHA	peak horizontal acceleration
PI	plasticity index
P.L.	Public Law
PMF	Probable Maximum Flood
PMP	probable maximum precipitation
POR	pool of record
PSHA	Probabilistic Seismic Hazard Analysis
RAS	River Analysis System
RCC	roller-compacted concrete
RCEM	Reclamation Consequences Estimating Methodology
RCT	rotating cylinder test
RD	relative density

Reclamation	Bureau of Reclamation
RM	river mile
RMC	Risk Management Center (USACE)
RMR	rock mass rating
RQD	rock quality designation
RWS	reservoir water surface
SA	spectral acceleration
SCADA	Supervisory Control and Data Acquisition
SEFM	Stochastic Event Flood Model
SI	statistically independent
S-O	Second-Order
SOP	standard operating procedure
SPF	standard project flood
SPT	standard penetration test
SQRA	Semi-Quantitative Risk Assessment
SSHAC	Senior Seismic Hazard Analysis Committee
SWV	Shear Wave Velocity Tests
TIN	Triangular Irregular Network
TR	Technical Report
TU Delft	Delft University of Technology (Netherlands)
TVA	Tennessee Valley Authority
U.S.	United States
UAS	Unmanned Aerial Systems
UCERF3	Uniform California Earthquake Rupture Forecast, version 3 (USGS)
UCS	unconfined compressive strength
UDEC	Universal Distinct Element Code
UHRS	Uniform Hazard Response spectra
UHS	uniform hazard spectra
USA	United States of America
USACE	United States Army Corps of Engineers
USCS	Unified Soil Classification System
USDA	United States Department of Agriculture
USGS	United States Geological Survey
USNRC	U.S. Nuclear Regulatory Commission

USSD	United States Society on Dams
UU	unconsolidated-undrained (tests)
V/H	vertical/horizontal
Var	variance
VST	vane shear test
WUS	Western United States

Symbols

°	degree
%	percent

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