



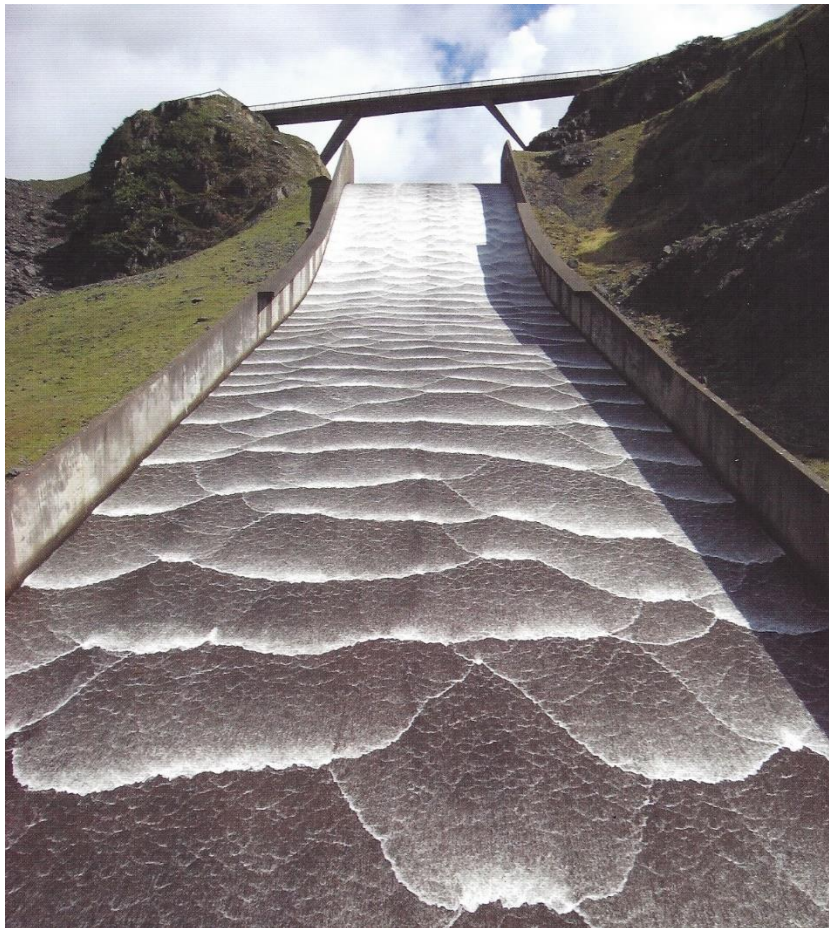
# The British Dam Society

## EVENING MEETING

Monday 1<sup>st</sup> March 2021 at 6:00pm

## Spillway design and inspection Some practical guidance

Dr Peter J Mason



**For synopsis and brief presenter biographies see overleaf**

This meeting will be streamed live on the internet via MS Teams. For more details please visit the events page on the BDS website: <https://britishdams.org/meetings-and-events/events-calendar/>

For more information please contact the ICE on 020 7665 2147 or email: [societyevents@ice.org.uk](mailto:societyevents@ice.org.uk)

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## Synopsis

The recent failures of the spillway chutes at Oroville in the USA and at Toddbrook in the UK have once again highlighted the importance of these structures to the safe operation of our dams and reservoirs. It has also illustrated their potential vulnerability and need for experienced design and maintenance. In fact, these failures follow others in the UK in the not-so-distant past such as the masonry chute failures at Boltby and Ulley and also elsewhere in the world. Perhaps more surprisingly in all these cases was that the failures occurred at floods far below their supposed design capacities. While the floods involved in each case could be described as unusual, they were by no means extreme.

The design of spillways is a particular speciality. Spillways are one part of our dams where structural engineering, material properties, hydrology, hydraulics and hydrodynamics, geology and rock mechanics and sometimes mechanical and electrical engineering, all need to work together for the spillway to be successful. In some cases, the cost of constructing a spillway can be almost as much as the cost of the main dam wall and yet it is also the one aspect of dam engineering for which formal UK design guidance is lacking.

In the presentation Dr Mason will outline the hydraulic and other factors needed for the sound design of spillway chutes. This will focus mostly on concrete chutes and on both rock and soil foundations. It will also touch briefly on stepped masonry chutes and on the selection of terminal, energy dissipation structures. Some guidance will also be given on inspection and maintenance aspects.

## Presenter Biography

Dr Peter J Mason graduated with a BSc in Civil Engineering and later, MSc and PhD degrees in Applied Hydraulics at the City University, London. He is Director of Damsolve Ltd and also a Technical Director, International Dams & Hydropower for Stantec UK Ltd (previously MWH UK Ltd) with a career spanning over 50 years and also approximately 45 countries. He has worked on major international dam & hydropower projects in Africa, Asia, Europe and North and South America. He is a member of the All-Reservoirs Panel under the UK Reservoirs Act (1975) and a past Chairman of the British Dam Society and the ICE, Reservoir Safety Advisory Group. In 1993 he was named in a USBR report on erosion at dams as the foremost, state-of-the-art author on plunge pool scour downstream of spillways.

When he became a member of the Institution of Civil Engineers in 1973 his design submission had been the detailed design of four spillways with a combined capacity of 8,500 m<sup>3</sup>/s. Since then, he has designed and/or carried out safety inspections on approx. 60 spillways with design discharge capacities in excess of 1,000 m<sup>3</sup>/s as well as many other smaller capacity works. His Masters and Doctorate degrees were both in applied hydraulics associated with spillways and for many years he was the UK representative on the ICOLD Committee on Hydraulics for Dams. Following the failure at Ulley, Dr Mason worked with Johnathon Hinks as the team appointed by Defra to establish the cause of the failure. Similarly, after the failure at Toddbrook, Dr Mason was appointed by Defra to work as the All-Reservoir Panel Engineer assisting Professor Balmforth to establish the cause of that failure.

He currently Chairs the Board of Management for a US\$ 4.2 billion hydropower project under construction in Asia. He is also a Member and/or Chair, of Expert Advisory Panels for major dam & hydropower projects under construction or refurbishment in Albania, Canada, Uganda, the USA and Zambia with a particular focus on dam safety, concrete and hardfill dams and spillways and hydraulic structures in general. He has authored over 80 technical papers on all aspects of dams and hydropower.

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## References

During the presentation Peter refers to a number of papers and technical guides. The following list of selected documents is provided for reference:

### General Spillway Design Details and Aspects

Mason, PJ, *“Spillway chutes; Practical design considerations and details”*, *Hydropower & Dams*, Issue 5, 2017.

*“Design Standard No 14, Appurtenant Works for Dams, Chapter 3, General Spillway Design Considerations”*, USBR, August 2014.

### Masonry Spillways

Mason PJ, *“Hydrodynamic forces and repairs to stepped masonry spillways”*, *Hydropower & Dams*, Issue 6, 2015.

Winter C, *“Research into the hydrodynamic forces and pressures acting within stepped masonry spillways”*, *Dams & Reservoirs*, UK, Vol. 20, No 1, 2010.

Winter C. et al, *“Guidance for the Design and Maintenance of Stepped Masonry Spillways, Report – SC080015/SR”*, Environment Agency, UK, Oct 2010.

### Spillway Chute Hydraulics

*“Report DSO-07-07, Uplift and Crack Flow Resulting from High Velocity Discharges Over Offset Joints”*, USBR, Denver, CO, USA, December 2007.

Falvey HT, *“Cavitation in Chutes and Spillways”*, USBR, Denver, CO, USA, April 1990.

### Spillway Chute Inspections and Safety Assessments

Schweiger P, et al, *“You Don’t Know What You Don’t Know – Inspecting and assessing spillways for potential failure modes”*, *Sustainable and Safe Dams Around the World*, Canadian Dam Association, 2019.

Firoozfar AR, *“Generalized Programmatic Framework for Spillways and Potential Failure Mode Assessments”*, *Proceedings of the US Society on Dams, Conference, Miami, FL, USA, 2018.*

### Energy Dissipater Selection

Mason P J, *“The choice of Hydraulic Energy Dissipater for Dam Outlet Works based on a Survey of Prototype Usage”*, *Proceedings of the Institution of Civil Engineers, Part1, (72), May 1982*