



Book reviews

HYDRAULIC GATES AND VALVES IN FREE SURFACE FLOW AND SUBMERGED OUTLETS, 2nd edn

Jack Lewin, Thomas Telford Ltd, 2001; ISBN 0 7277 2990 X, £75, 299 pp.

This revised treatise reviews the options available to engineers and designers, together with the main advantages, disadvantages and potential problems associated with each type of gate and valve. Previous sections on trunnions of radial gates, seals, ice formation, gate operation and structural design have been extended. Also, the chapter on the types of gates has been expanded to include new types of water-operated hydraulic gates, rolling weir gates, fuse gates and barrier gates, and their details. Radial, vertical-lift, rolling, barrage, flap, mitre, drum, sector, bear-trap, intake and submerged outlet gates are described. Sluice, butterfly, hollow-cone, hollow-jet, needle, pressure-reducing, and sphere valves are reviewed and discussed.

There are new sections on hazards and reliability, earthquake effects, and environmental impact. Spillway gates are known to have had failures of controls, hoists, structure, leaking seals, and to have caused dams to fail when spillway gates have failed to open. Power supplies, limit switches and ice may also cause failures. The risks of these failures are assessed through probabilistic risk analysis and failure mode effect and criticality analysis. Examples are given of dams damaged by earthquakes. Analyses for seismic damage to gates, control buildings and machinery are discussed. Environmental impacts include avoidance of piers in navigation channels, the lower prominence of bottom hinged gates, and the risk of damage by debris.

Detailed design includes details of many types of seals, avoidance of friction, bearing pressures, limit switches, and design criteria for trashback and debris screens. Practical advice includes the use of mild steel to minimise deflections, and stainless steel for embedded parts that may be in contact with water. Structural considerations include analysis of stresses on plates subject to hydraulic pressure, and also the need to be aware of debris traps and loads from ice.

Hydraulic considerations include stage-discharge characteristics for various gates, hydraulic downpull on vertical lift gates, instability in a watercourse caused by the operation of a gate with limited ponded up water, vorticity at intakes, losses at gate slots, and cavitation and erosion at high flow velocities. Gates

may vibrate from extraneous effects, unstable flow, such as vortex shedding from the lip of a gate or leakage at a sill, or movement of a vibrating structure. Analyses of potential vibration are described, together with the use of spoilers and changes to gate seals to avoid vibration.

Operating machines are described with system diagrams for hydraulics and reasons for the use of squirrel cage induction motors on electromechanical plant. Control systems, including mechanical, electromechanical and water level instruments, are discussed, together with the need for back-up electrical or mechanical power supply.

This reviewer is not an expert in hydraulic gates and valves, but found a wealth of clear guidance and details for the practising engineer. The 300 pages include 205 illustrations, 37 equations, 10 tables and 278 supporting references. Clearly, the author is an expert in hydraulic gates and valves.

PETER BLAIR-FISH

EVACUATION OF SEDIMENTS FROM RESERVOIRS

Rodney White, Thomas Telford Ltd, London, 2001, ISBN 0 7277 2953 5, £60.00, 280 pp.

This is a most welcome volume, being clearly written and aimed at the practitioner who may have little time for reading but who requires a rapid primer of best practice. Although the title might infer that a range of techniques may be used to remove sediments from reservoirs, in fact this book considers only flushing methods. The preface concisely refers to alternative methods of removing sediments but importantly notes the need to develop catchment management practices that minimise sediment erosion and conserve soils in situ. Alternatively, sediment can be prevented from reaching reservoirs or sedimentation may be minimised by diverting sediment-laden flows. However, other than limited success with flushing, mechanical excavation or an acceptance of reduced capacity has largely been, to date, the management response to excessive sedimentation.

Flushing techniques are not applicable to all reservoir types and geographic locations, but with fewer good sites available worldwide and with the environmental and social problems which dams may engender, it is increasingly necessary to extend the life of reservoirs by maintaining capacity.

The text is based on both worldwide research and practical field experience. An extended executive summary is included which provides more information than is usual in a brief abstract. The main text opens with a consideration of the global scale of the problem of sedimentation and assesses the volume of storage likely to be lost. The implications for the provision of storage that is likely to be required to meet growing demand for water resources, especially hydropower and irrigation, are also reviewed. Drawing largely on the recent ICOLD *World Register of Dams*,¹ but utilising other data sources, information is presented from around 140 countries. The worldwide distribution of storage is tabulated chiefly by continent, and compared to projections for hydropower development and irrigation. Comparison is made with the present rate of storage construction and projected demand. The rate and distribution of storage loss is reported for regions of the world and the requirements for new storage are considered. This section is relatively brief and rightly so. It provides a statement of the current situation but, of course, political, social and environmental considerations can and will alter the geographic distribution of reservoir provision during this century, as increasingly there are calls to desist in the construction of large dams, and indeed to decommission some existing provision.

The practising engineer will probably turn directly to Chapter 3, which systematically considers those factors that influence the practice and success of flushing operations. This section of the text is comprehensive and is based on 30 years of first-hand experience of actual flushing systems, as well as a thorough appreciation of numerical and physical models of the associated processes. The text is easy to read and the factors that constrain practical criteria for successful flushing are clearly laid-out using the minimum of simple mathematical expressions. Finally, the practical requirements for successful flushing are summarised.

Chapter 4 considers worldwide experience in applying flushing criteria. This section is based primarily on a review of the result of flushing a large number of named reservoirs. Details are given succinctly in the text and are tabulated. The findings with respect to controlling factors are detailed at the end of the chapter. Importantly, the reader who requires more detailed information can turn to several appendices which, as well as listing key reservoir-specific data, also include further text on the details of regional case studies and a closer look at controlling erosion factors and processes.

Chapter 5 considers which geographical areas are best suited to flushing. The argument opens with a consideration of the controls on global sediment yield and this is a chapter which might usefully be read by scientists and engineers interested in soil conservation in general. At this point, the text is supported by maps of global erosion and sediment yield. Although these

maps are clearly drafted and provide to the uninitiated a broad-brush indication of regional erosion risk, they cannot substitute for detailed local knowledge of catchment-scale erosion processes for specific dams or proposed dam sites. However, they do serve to flag the degree of risk within given regions of the world. Five maps of worldwide precipitation distribution should have been produced in colour, or redrawn, as it is evident that the original source was a series of colour images. Unfortunately, as a result of reproducing these in monochrome, the spatial variation in precipitation is seriously obscured such that these latter maps are of little value. The disappointment felt at this point is then alleviated by an excellent discussion of the relationship between climate zones and erosion rates. This section does include some new analyses—specifically delineating which countries are within given climatic zones and the associated (likely) rates of sediment yield that might be expected.

Chapter 6 considers site-specific investigations in design considerations, including the possibility of bypassing influent sediments around reservoirs. Comment is also made concerning sediment investigations and physical and mathematical modelling. Although it might reasonably be argued that every site has its own peculiar requirements for design considerations, this chapter is still surprisingly brief and seems to have been added as an afterthought. In fact, the author states that the subject matter is beyond the scope of the present volume. Of course, a detailed treatise on these latter issues would have made the present volume unwieldy. However, the existing Chapter 6 is not especially informative and it would have benefited from a degree of expansion of the text and the inclusion of at least several references for each sub-heading to help the reader find more detailed relevant material. Nevertheless, key references supporting the whole text are included.

Overall, this is a very handy book for the practitioner and is a useful addition to its only competitor, *Reservoir Sedimentation*²—the latter is now somewhat dated but is still in print. In addition, given that White's text is very readable, the volume is worth dipping into by both those more academic engineers and erosion control scientists interested in seeing a wealth of research and practical findings reduced to a comprehensible tome. The book, priced at only £60, should find its way into the libraries of engineering consultancies worldwide, as well as into many university libraries.

REFERENCES

1. INTERNATIONAL COMMISSION ON LARGE DAMS. *World Register of Dams*. ICOLD, Paris, 1998.
2. STRAND R. I. and PEMBERTON E. L. *Reservoir Sedimentation*. US Bureau of Reclamation, Denver, Colorado, 1982.

PAUL A. CARLING