The Engineering of Large Dams

Part II

HENRY H. THOMAS
Engineering Consultant,
Formerly Deputy Chief Civil Engineer,
The Hydro-Electric Commission, Tasmania,
Australia

ENEL
J7 / 20065
BIBLIOTECA CENTRALE

A Wiley — Interscience Publication

JOHN WILEY & SONS
London · New York · Sydney · Toronto

Contents

Introduction

A large dam has been defined by the International Commission on Large Dams as either:

A dam above fifteen metres in height, measured from the lowest portion of the general foundation area to the crest, or

A dam between ten and fifteen metres in height provided it complies with at least one of the following conditions:

(a) the length of crest of the dam to be not less than 500 metres;
(b) the capacity of the reservoir formed by the dam to be not less than one million cubic metres;
(c) the maximum flood discharge dealt with by the dam to be not less than 2000 cubic metres per second;
(d) the dam has specially difficult foundation problems; or
(e) the dam is of unusual design.

Although this book has been prepared for application to dams of heights 30 m to 100 m, the text will generally be applicable to smaller dams. On the other hand, any dam exceeding 100 m in height must be considered as unique. Every aspect of its design and construction must be treated as a problem specifically related to that particular site.

At this time in history, when advances in technology are so rapid and when the flow of technical papers is so great, the Engineer should pause and carefully study some of the monumental hydraulic works of the past. He may be surprised how often our forebears adhered to principles now credited to the twentieth century.

A prestige publication was prepared in 1970 by Norman Smith for the Spanish National Committee on Large Dams to mark 'the crossing of the barrier of its 500 completed dams'. Under the title *The Heritage of Spanish Dams*, it presents the history of dam building on the Iberian Peninsula. It was there that the Romans built some of their finest dams, at least two of which are still performing their useful functions.

The same author covered the world scene with *A History of Dams 1971*.[1] This provides an intriguing story from 'Sadd-el-Kafara' built south from Cairo between 2950 and 2750 B.C. to dams of the twentieth century.

Possibly the first arch dams were those built by the Romans in the first century A.D. in Northern Italy and Southern France. Ponte Alto arch dam[1] was built some 5 metres high from 1611 to 1613. In 1752 it was raised to 17 m curved to a radius of about 15 m, with a thickness of 4 m. In 1824–5 it was raised to 25 m. In 1847–50 further additions were made to bring it to a height of 33 m. The final stage of 3 m was added in 1887 and the dam still stands at a height of 36 m. It appears reasonable to assume that the original builders selected a good foundation!

In the Australian continent dam building is perforce of the modern era. As a developing country considerable ingenuity was displayed to conserve water at minimum cost. Australia is the world's driest continent and it was very soon after settlement that the incidence of droughts threatened the very existence of the early settlers. Naturally the first dams were of earthfill, often consolidated by the feet of sheep driven back and forth across the dam. Possibly the dams that first provoked world interest were the thin arch dams built in New South Wales at the end of the nineteenth century.[2] Typical of these are Medlow dam (Fig. 1) and Wollongong dam (Fig. 2). These represented a boldness of approach that is still evident in Australian dam building. Restrictions on capital expenditure both then and now have brought forth considerable originality, not unduly influenced by custom.

Although a history of dam building in Australia has not yet been written, an excellent