THE INSTITUTION OF CIVIL ENGINEERS

WORLD WATER '89

Managing the future — learning from the past

Delegates intending to speak are requested to hand in a completed discussion slip at the Reception Desk not later than 10 minutes before the start of the relevant session.

No tape recording or shorthand record of the Conference will be taken.

Delegates taking part in the discussion on any paper are therefore asked to give a written version of their contribution with any figures to the Conference Editor as soon as possible after the session concerned.

Delegates for whom there is insufficient time to speak may also hand in written discussion.

No discussion contributions can be accepted after the Conference.

14 –16 November 1989
WEMBLEY CONFERENCE CENTRE, LONDON

P. RIGO, PhD, University of Liège, Belgium

P23. Conception and computation of movable barrages

First, we present a new kind of movable barrage which is very efficient for low heads (3 to 5 m). It is a radial gate which can be lifted and lowered. It allows undershot and overshot flow without lowering the rigidity. Next, we use the L.B.R.-3 software to compute this structure. It is a specific software for hydraulic orthotropic steel structures as movable dams, lock gates, tidal surge barriers, barges, tanker boats, ...We prove the high accuracy and the good quality of results which are assured at any point of the structure by the computation of the proposed radial gate.

INTRODUCTION

1. The movable barrages are essential structures for the realisation of waterways to increase the economic development of a country. They allow the creation of reaches which are necessary for the navigation, but can also be used as a water reserve for drinking-water, irrigation or the production of hydro-electricity.

A NEW RADIAL GATE SYSTEM

2. During the next 10 years many old movable barrages will have to be modernized or replaced by new modern systems. The most often selected ones are the tilting gates, lift gates and radial gates. For small heads, we suggest to build single-element barrages, which can be lifted and lowered, and we apply this system to radial gates (see Fig. 1). This system is very efficient for low heads (3 to 5 m) because this solution is very simple, has a strong rigidity and is apt to bring about cost savings.

3. The movable barrages and especially the radial gates are very complex structures; we have studied them in detail in order to see the influence of the supporting arms on the general behaviour of the "sector-arms" structure. For this study, we use our computer programme L.B.R.-3 (Logiciel des Bordages Raidis, version 3). This programme has been developed during the general study of computing hydraulic orthotropic steel structures (ref.1). It enables us to optimize locks, mobile dams, floating bridges, storm surge barriers, ships, ...

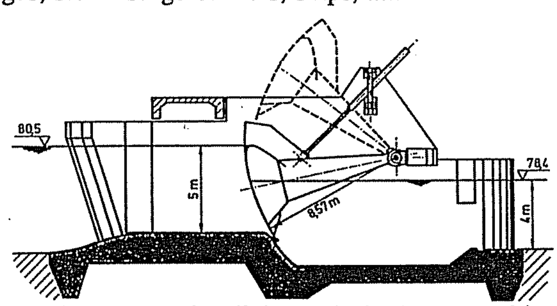

Fig. 1. The proposed radial gate in its lower position to allow an overshot flow.

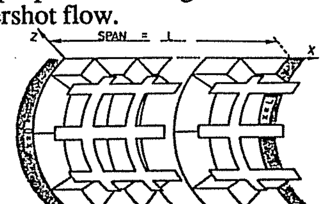

Fig. 2. A shell element with its stiffeners (2 types).

A SOFTWARE FOR HYDRAULIC STRUCTURES

4. A mobile dam (or any other structure) could be computed with L.B.R.-3 if it meets the following conditions: having a main direction for the development according to a Fourier series, being limited in the elastic strain and being suitable for discretisation into parts of orthotropic cylindrical shells (see Fig. 2). These shells can include 3 types of stiffening reinforcement ribs (longitudinal and transversal stiffeners and cross-bars).

5. The advantages presented by the computer programme are numerous. It is highly efficient when the stiffening is very important because it takes into account the place and the shape of the stiffeners without slowing down the resolution of the differential system of D.K.J. equations. High accuracy and good quality of results are assured for stresses as well as for displacements. Moreover, these results can be obtained at any point of the structure (sheathing, sheathing-rib junction, web-flange link, ...)

6. The complete computing of a complex structure such as this radial gate (see Fig. 3) can be finished within 12 hours (discretisation, data correction, computing, printing and analysis of the results). This very short calculation time is of great importance to a designer because, in this way, he can get a quick confirmation of the good or the bad behaviour of his projected structure.

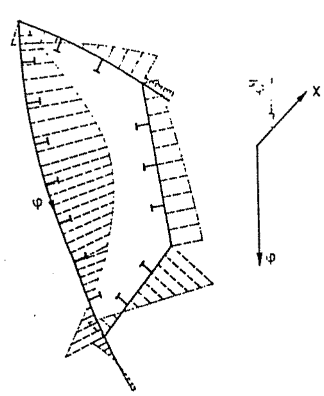

Fig. 3. Transversal stresses σ_φ in the sheathing in the radial gate at mid-span.

REFERENCE

1. RIGO Ph. Applications des développements harmoniques au calcul des ouvrages hydrauliques métalliques, Coll. Publ. Université de Liège, n°120, 1989, 1-250.

World Water '89. Thomas Telford Limited, London, 1989