

First Code of Practice for Rubber Gates in Germany

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Abstract

Rubber gates are an alternative to conventional steel gates on waterways. There are many advantages of rubber gates in comparison to traditional gates [1]. That is the reason why there are high interests in building this weir type. Rubber gates consist of fabric layers embedded in elastomer layers. The fabrics are used for force transmission and are therefore important for static dimensioning. Depending on the gate height, the membrane is only a few millimetres to centimetres thick. The largest part of the cross-section consists of an elastomer which absorbs effectively no tensile forces [2]. Since there is no valid standard for the construction and operation of rubber gates in Germany, the Federal Waterways Engineering and Research Institute was commissioned to develop a design concept compatible with European standard principles. Developing a design method will shorten the approval process and standardise the safety margin for future projects.

We are currently working on a multi-part set of rules named "BAW Code of Practise" for rubber gates. The first part to be published is "Verification of the load-bearing capacity of membranes of water-filled inflatable gates on inland waterways". Currently in January 2019, the BAW Code of Practise is in a public draft process. In the following years, further parts will be added for hydraulic dimensioning, material testing, etc. The actual part shall also be extended and adapted.

The current version enables the user to carry out the verification of the rubber membrane at the ultimate limit state. One of the uncertainties in the design of rubber gate membranes is the determination of the effects of actions. In order to avoid complex numerical calculations, stress concentration factors (SCFs) were determined and specified. These only apply under the specified boundary conditions, but also provide valuable information for dimensioning under different boundary conditions. The information on stress concentration factors shall be extended in the following issues of the BAW Code of Practise. The long-term behaviour of the material used for rubber gates is not yet sufficiently known. The boundary conditions used at these weirs differ from those of architectural membranes. Therefore, methods for determining the long-term properties were derived and specified from a Japanese guideline for rubber gates [3].

References

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