

## **Improvement of IWT through structural measures**

(ecology-sensitive maintenance and upgrading of the waterway, the embankments and river habitats)

H. H. Bernhart

Institute for Water and River Basin Management, Universität Karlsruhe (TH),  
Kaiserstraße 12, 76128 Karlsruhe, Germany, email: [bernhart@iwg.uka.de](mailto:bernhart@iwg.uka.de)

The development of the inland waterway transportation has led to ever-growing ship units. The classification of waterways was made ignoring the natural river characteristics. Draught, curve radius and travelling speed were defined from an economical perspective only. The one-sided goal was to improve the shipping conditions to guarantee the safety and facilitation of the traffic without considering the hydrological and morphological restrictions in the rivers.

In the last decades free flowing rivers were transformed in canalized and dammed expressways. This had grave consequences for the rivers ecology and many species are endangered or even extinct. This purely technically orientated development will be explained in a short review. The construction methods so far created linear and monotone structures, e.g. uniform river embankment massively protected by riprap to prevent side erosion. This favoured the deepening of the river bed with negative impact on the natural environment.

A new design philosophy for improvement of the still natural waterways is necessary and of utmost importance. It has to be reminded that this protection of the environment is based on already existing legal requirements. Alternative regulating measures which allow a further natural development of the rivers have to be adapted to the individual local conditions and must include ecological needs.

The aim is to minimize the interference with the given natural condition of a river system. The transfiguration of complete river sections, as e.g. longitudinal measures without considering fluvial processes are not longer acceptable. Instead, targeted local measures, e.g. groynes, training structures, stabilising of fords, in near-nature execution have to be adopted.

The impact of the planned measures on the given flow conditions and in particular on the sediment transport has to be investigated. This requires profound knowledge of the runoff conditions and consequently needs detailed hydrological and mathematical modelling. Only on this basis it is possible to set up a well-balanced and sound construction suggestion, which must be based on a integrally overview.

Living proof for the still one-sided approach is the planning of the Vidin-Calafat bridge. This crucial decision was made without looking at issues concerning navigation purposes and the impact on the river bed itself had not been considered. Also the example from the Bavarian Danube (river stretch Straubing-Vilshofen), shows that old-fashioned ideas still exist. In contrary on the Austrian Danube and on the Rhine River (the waterway with the highest ship traffic in Europe), solutions to improve the ecological condition of the river system are not only planned but already realized. In combination with measures for flood control this can lead to a remarkable ecological improvement of the river.

As every river has its own characteristic one-sided measures that are often based on economical decisions and prognoses are no longer indicated. The experience of the last decades lead to the conclusion that all concerning interests have to be evaluated and included in the design process for any action on a river. Since inappropriate measures for the improvement of the shipping conditions may have great impact on the river system those works require intuition.