

HR-307 Sediment Control in Bridge Water Ways

Key Words: Iowa vanes, Sediment transport, Bridge waterways,

The objective of this study was to develop guidelines for use of the Iowa Vanes technique for sediment control in bridge waterways. Iowa Vanes are small flow training structures (foils) designed to modify the near-bed flow pattern and redistribute flow and sediment transport within the channel cross section. The structures are installed at an angle of attack of 15 - 25° with the flow, and their initial height is 0.2 - 0.5 times water depth at design stage. The vanes function by generating secondary circulation in the flow. The circulation alters magnitude and direction of the bed shear stress and causes a reduction in velocity and sediment transport in the vane controlled area. As a result, the river bed aggrades in the vane controlled area and degrades outside.

This report summarizes the basic theory, describes results of laboratory and field tests, and presents the resulting design procedure.

Design graphs have been developed based on the theory. The graphs are entered with basic flow variables and desired bed topography. The output is vane layout and design. The procedure is illustrated with two numerical examples prepared with data that are typical for many rivers in Iowa and the midwest. The report also discusses vane material.

In most applications, the vane height will be between 30% and 50% of bankfull flow depth and the vane length will be two to three times vane height. The vanes will be placed in arrays along the bank of the river. Each array will contain two or more vanes. The vanes in an array will be spaced laterally a distance of two to three times vane height. The streamwise spacing between the arrays will be 15 to 30 times vane height, and the vane-to-bank distance will be three to four times vane height. The study also shows that the first (most upstream) array in the vane system must be located a distance of at least three array spacings upstream from the bridge, and there must be at least three arrays in the system for it to be effective at and downstream from the third array.