INFLUENCE OF TETRAHEDRON-LIKE PENETRATING FRAMES ON LOCAL VELOCITIES

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The riparian zones are an important part in river system. They play an essential role in river ecosystems. Vegetation in the riparian zones can not only reduce nutrient movements to streams and control nonpoint sources of pollution, but also aid sediments deposition and provide a physical habitat for fish. However, when a hydraulic project has been built in the upstream of river, discharged water will become clear, resulting in capacity increase for bed load transport and chute cut-off. The changes in morphology and flow characteristics lead to changes in river ecosystems.

Many measures have been studied to stabilize the riparian zones such as groins, longitudinal dykes, bagged concrete, prefabricated concrete interlocking units geotextiles and so on. The main purpose of measures above is to reduce river width and to remove the danger of scour from the banks, but is no more significant in restoration of riparian zones. Recently playing very important role is "ecological" aspect of every structure. Modern structures have to be environment-friendly. The vegetative groins (Keiichi Sugawara et al, 2002) and impermeable spurs (T.mioduszewski et al, 2005) have been studied in detail. They can be used to create and preserve a hospitable environment for aquatic life. The Institute of Water Science of Jiangsi and Hohai University (Zhang Wenjie et al, 2002) have used tetrahedron-like penetrating frames to aid recreational area and landscape formation by field experiment. Six poles linked together composed a tetrahedron-like penetrating frame. Many tetrahedron-like penetrating frames were shot together in shooting zone, which formed tetrahedron-like penetrating frames like groins.

In this paper, a laboratory experiment has been performed to study the influence of tetrahedron-like penetrating frames on local velocities. and explicate the observed results in the field. The experimental flume has 1.0 m wide and 20 m length, where the slope of the bed was fixed at 1/1000. Velocity measurements were made with a 3-D Acoustic Doppler velocimeter (ADV) made by Son Tex. The model scale of 1 to 60 was used. A series of experiments have been performed under various conditions of the shooting density, the shooting height of frames, the length and wideness of shooting zone, the space between two shooting zones and so on.

Laboratory experiments on a scaled model reveal that the additional drag contributed by the tetrahedron-like penetrating frames reduces the mean flow and makes the flow slow within or around shooting zone. The baffling of flow reduces the sediment load potential and promotes accumulation of sediment by reducing near-bed stress. It proves that the present tetrahedron-like penetrating frames have the basic function on reducing the near-bed velocity and Reynolds stress, which can be used as a part of restoration of riparian zones.

Laboratory experiments also show that we can control the flow velocity within or around tetrahedron-like penetrating frames by changing shooting parameters. The effect parameters are the shooting density in shooting zones, the span between shooting zones

and the dimensions of shooting zones. In order to save the cost of the tetrahedron-like penetrating frames, it is suggested that the shooting density ρis from 0.18 to 0.22, the shooting zone span to wideness ratio is smaller than 1.0, and the normalized length of shooting zone l/H = 1.3. The effects of shooting height on reducing the near-bed velocity seem to be not great as the l/H >1.3. But the effects on the flow resistance in the shooting zone can not be negligible.

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