THESIS

DETERMINATION OF WATER DEPTH UPSTREAM OF REGULATOR USING INFLUENCE FACTOR APPROACH

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ABSTRACT

Various types of control structures are located on irrigation canals e.g. cross regulator, head regulator and canal fall etc. There are various methods to regulate the irrigation canal e.g. upstream control, downstream control and proportional control etc. In recent years a mathematical equation is being developed which can be used for operation of irrigation canals. This equation is known as Influence Factor Equation (IFE). This equation gives influence factor and value of this influence factor ranges between 0 and 1. At the regulation structure magnitude of this factor is 1 and decreases as the depth of water decreases on the upstream side and where the effect of back water ends, its value becomes zero.

The main objective of this study was the application of 1FE under laboratory as well as under field conditions and comparison of the results obtained by IFE with the water surface profiles computed by HEC-RAS. For the application of IFE in the laboratory the glass sided tilting flume was used and a sluice gate was installed in flume. The application of IFE was done for two values of discharges and two gate openings. At these discharges the desired depth at the regulation structure was determined using IFE. The same hydraulic and geometric data was also used in HEC-RAS to plot the water surface profiles.

Under field conditions a reach of Rakh Branch Canal was selected from 219+500RD to 230RD. Gutwala cross regulator is at 229 + 520RD and two distributaries are off taking from its upstream side. Influence factor equation was used to determine the desired depth at the regulator to satisfy the delivery of off taking channels. The results obtained by influence factor equation were compared with HEC-RAS. The same hydraulic and geometric data of Gutwala cross regulator was used in HEC-RAS and water surface profiles were plotted.

A hypothetical check was also performed. A lined trapezoidal channel was used and comparison was performed with Standard Step method to verify the accuracy of IFE by using inverse modeling approach.

A comparison among the results obtained by IFE, HEC-RAS and Standard Step method revealed no significant difference. It concluded that the flow depth required at a regulator to satisfy the delivery of off takes calculated by IFE was realistically accurate. For earthen channels having smooth bed profiles this equation is also useful tool for their operation.

IFE takes only the effect produced by gated structures (cross regulators) and not considers the effect produced by the weir. And IFE uses S.I systems of units. For use in FPS system a multiplication factor should also be introduced. This equation should also be modified for operation of ungated structures.