THESIS

DEVELOPMENT AND VALIDATION OF HYDRODYNAMIC FLOOD ROUTING MODEL FOR RIVER CHENAB MARALA TO QADIRABAD REACH

submitted by:

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ABSTRACT

DEVELOPMENT AND VALIDATION HYDRODYNAMIC FLOOD ROUTING MODEL FOR RIVER CHENAB MARALA TO KHANKI REACH

Floods are natural phenomena and are frequent in many countries. The flood flow in a natural channel is purely unsteady, and is analyzed by Saint Venant equations of continuity and momentum conservation. The mathematical modelling of Saint Venant equations is the most commonly used tool to analyze the unsteady flow. In this study different models (hydrologic and simplified hydraulic) used for simulation of floods are critically examined. To overcome the shortcomings of these models a complete one dimensional hydrodynamic model was developed which can accurately describe the flow phenomena in a river.

The study was meant for the development of a one dimensional hydrodynamic flood routing model based on full Saint Venant equations. The governing equations were discretized by an implicit finite difference scheme (Preissmann Scheme). The system of equations was solved by the Newton Raphson method.

HEC-2 model was used to compute water surface profile for gradually varied (non-uniform) flow. The computational procedure of HEC-2 model was based on the solution of one dimensional energy equation. The energy equation was solved with

Manning's formula by Standard Step Method. The hydrodynamic model developed in this study was applied for simulation of the flood of 1992 in river Chenab.

The flood hydrograph of 1992 flood was routed through the selected reach by the hydrodynamic model. A series of hydrographs showing attenuation in peak flow at ten kilometer interval were generated. The validity of the hydrodynamic model was checked for the flood event of 1988 for the same reach. The hydrodynamic model was compared with HEC-2 model. A single representative uniform cross section (wide rectangular) was used as channel geometry in the hydrodynamic model whereas the irregular cross sections were used in HEC-2 model. Since HEC-2 model deals with steady uniform flow therefore only peak flood value was used in HEC-2 model to compute water surface profile. The steady state profile drawn by HEC-2 model were found in good agreement with the hydrodynamic model. It has been found that an average rectangular cross section can be adequately used to simulate flow conditions in a natural river.