

## CNRGT55 GEOMETRICAL RELATIONSHIP FOR FLOW ESTIMATION IN OPEN CHANNEL

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### ABSTRACT

*This paper describes the geometrical relationship for open channel under overbank flow conditions. Hydraulic depth,  $D$  is one of the important geometrical parameter according to Darcy-Weisbach equation, which characterizes the properties of cross section in order to determine the flow in open channel. Previous studies assumed  $D = 4R$  for open channel in discharge estimation using Darcy-Weisbach equation. However, the result of this study proves that  $D$  is not equal to  $4R$  due to geometrical effects and irregular shape of the compound channel. In compound channel, the shapes are irregular, and the flow is usually turbulent with a considerable mixing. When the flow in compound channel is just overbank, sudden increment in wetted perimeter will decrease the value of  $R$  which is essential for discharge estimation during flood condition. Hence, a new relationship for hydraulic depth,  $D$  has to be developed for compound channel with different geometrical shapes and boundary conditions.*

**Keywords:** *geometrical relationship, overbank flow, compound channel.*

### INTRODUCTION

Geometrical parameters such as width, water depth and bed slope are very important to estimate the discharge for open channel. However, during overbank flow, the estimation of geometrical effect is complex because of the variability in natural river shape and surface conditions. For previous studies, methods for flow estimation during overbank condition are not very accurate. The main reason for this is because most of the previous researches are based on laboratory investigations, with certain idealized conditions, for example uniform channel cross-section, surface roughness and bed slope [1, 2, 3]. Under such conditions, the equations derived will be specific for a certain channel type, and it is not generally applicable for rivers with different geometrical shapes and boundary conditions.

In literature, Acker presented that the ratio of flood plain width to main channel width is an important factor [4]. Apart from this, the influence of geometry on channel capacity by comparing rectangular and compound shapes had been illustrated. Narrow flood plain tends to show better interference effect than wide floodplain. High velocities in the main channel of such deep central cross section to low velocities on the flood plains leads to the formation of a momentum transfer mechanism, in the form of a bank of vortices along the interface between the two zones of flow. Best fit lines were determined on each geometry parameter and used to calculate the parameter for particular values of cross sectional area in order to compare the carrying capacity of each shape at equal values of cross sectional area [5]. From these studies, it shows the danger of neglecting shape effects in open channels and it underlines the need for a systematic investigation on cross sectional shape in order to determine the discharge capacity of open channels. The objective of this paper is to determine the geometrical effect towards the flow estimation during overbank condition for compound channel by using data collected from previous studies.

### THEORY CONSIDERATIONS

The flow in pipes and ducts has been extensively studied in the fluid mechanics discipline. From the time of Prandtl (1875-1953) and Von Karman (1881-1963), research by many expert investigators has enabled considerable understanding of flow and associated useful practical application. The studies on pipe flow have lead to derivation of various flow and resistant equation such as the well known Darcy-Weisbach, Manning