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STUDY OF FLOW IN A NON-SYMMETRICAL COMPOUND CHANNEL WITH ROUGH FLOOD PLAIN

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ABSTRACT

The practical interest to study the flow in compound channel section arises from the necessity for accurate discharge predictions during flood events and for a reliable stage discharge relation for flood control measures and management schemes. It has been long realized that traditional hydraulic methods of channel subdivision are inadequate for discharge calculation due to the significant interaction between main channel and flood plain that previously rarely taken into account of. This paper presented the results of experimental investigations carried out on a small scale non-symmetrical compound channel with rough flood plain in order to compare the different methods available for discharge prediction in a compound channel. The weighted divided channel method (WDCM) has been used to check the validity of the horizontal division method and the vertical division method in predicting discharge. Results from this experimental investigations have shown that for non-symmetrical compound channel with wider flood plain, the horizontal division method provide the more accurate predictions of discharge while for narrower flood plain, the vertical division is more accurate.

Keywords: *Discharge Calculation, Flood Plain, Main Channel, Non-Symmetrical Compound Channel, Weighted Divided Channel Method (WDCM)*

1. INTRODUCTION

The term 'compound' or two stage covers channel cross-sections having berm(s) or flood plain(s) that come into action at high flows but which are normally dry (see Figure 1). It has been identified that modification of the velocity distribution and the resulting changes in the discharge capacity caused by the turbulent interaction between the main channel and the flood plain exist [1]. Compound channels have traditionally been analysed by dividing the compound cross-section into relatively large homogeneous sub-areas which are easier to analyse. This method is termed the divided channel method (DCM). However, this approach assumes no interaction between the subdivided areas despite the existence of mean velocity discontinuities at the assumed internal boundaries.

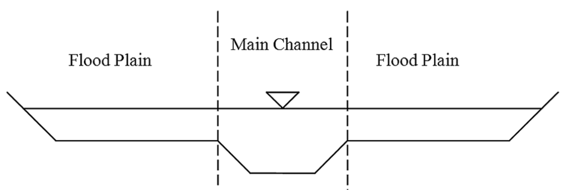

Figure 1: Compound channel section

Many experimental studies have been carried out addressing various aspects of the problem, ranging from the boundary shear distribution to the structure of turbulence in compound section and various methods as well as empirical formulas have been proposed for discharge calculation. The available studies on flow in compound channels include [2] - [5]. Despite the progress achieved so far, no consensus has been reached for the estimation of discharge in compound channel.

Since most of the available studies were done for symmetrical compound channel, this paper however addresses the results from experimental investigations done on a small-scale non-symmetrical compound channel model with rough flood plain. The objectives of the experimental investigations are:

(a) To study the flow characteristics for a non-symmetrical compound channel model with rough flood plain.
(b) To compare the validity of different methods available in predicting discharge for non-symmetrical compound channel through comparison of calculated and observed discharge values.
(c) To check which method produces the closest results to the observed data by using the weighted divided channel method (WDCM).

2. LITERATURE REVIEW

The hydraulics of flow in compound or two stage channels presents the drainage engineer with a problem. The problem arises in how to assess the stage discharge relationships for a situation where the flow may have radically different depths and roughness over different parts of the cross-section. Is it acceptable to treat the channel as if its overall hydraulic mean depth (defined as cross-sectional area over wetted perimeter) adequately describes its cross-section? How to incorporate the effect of variations of roughness over the various flow zones into a resistance equation? Are the usual resistance equations such as Manning's able to cover complex sections, bearing in mind that they were derived for simple-section shapes? These questions have to be resolved if water levels to be expected during floods are to be assessed with reasonable accuracy and assurance.