REVISION OF REGIONAL FLOOD FREQUENCY ANALYSIS AND THE DEVELOPMENT OF DESIGN FLOOD ESTIMATION SOFTWARE FOR PENINSULAR MALAYSIA

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JULAI 2001

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ABSTRACT

Reliable estimates of the magnitude and frequency of floods are essential for the economical planning and safe design of any hydraulic structure. If a hydraulic structure is under designed, the results could be a disaster; the dam may break, the highway may flood or the bridge may collapse. On the other hand, if the structure is over designed and hence very safe, the cost involved could be unreasonably expensive. The Drainage and Irrigation Department of Malaysia has published the manuals on the estimation of design flood in the form of Hydrological Procedures. These procedures were developed around 10 to 20 years ago using the hydrological data from about 8 to 36 years of record (Pre-1960 to 1980). Since flood estimation involves the application of probability and statistical analysis for time series of data, the accuracy of the estimation would be improved if longer record of data were used. The first part of the report discusses the revision of Regional Flood Frequency analysis using extended record of data (1960 up to 2000) and additional data from 45 more stations. In the revision, new values of flood peaks for different return periods are derived for each station by applying Gumbel probability analysis. This analysis would produce revised regional frequency curves and derive a new average median curve for each frequency region. The study also invents into a more objective way to read the curve, namely by using the equations of best fit. Next, revised MAF equations for ungauged catchments, relating mean annual flood with catchment characteristics, are developed by multiple regression techniques using SPSS software. The second part of the report looks into the development of design flood estimation software using Visual Basic programming language. The software will implement the three design flood estimation techniques used in Malaysia, namely the Regional Flood Frequency Analysis, Rational method and the Triangular Hydrograph method plus revised Regional Flood Frequency Analysis . It is expected that the Malaysian design flood would be better estimated in a more efficient way as a result of the project.

CHAPTER 1

1. INTRODUCTION

1. 0 Floods

Flood, a very common natural disaster damages properties and structures, endanger lives, cause heavy financial losses, interfere with drainage and economic use of lands, cause soil erosion and sediment deposition problems. Floods occur when water runs off the land in the amount that exceeding the capacity of stream channels or reservoirs. Floods occur naturally on many rivers, overflowing the riverbank to the flood plain areas. A flash flood is flood that rises and falls rapidly with little or no advance warning.

1.1 Flood Magnitude

Flood magnitude is the amount of water that is discharged through the rivers and streams during a flood, and measured in cumecs (m^3/s). The relative elevation of the water in the stream channel is measured at stream gaging stations. Usually, the gage consists of a float mechanism in a stilling well adjacent to and interconnected with the stream. The discharge is the volume of water passing a given point of a stream in a certain period of time and is given by

Discharge (Q) = Velocity (V) x Cross-sectional area (A)