CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

A number of numerical models in this study are based on the concept of energy flux conservation. Widely used formulas for computing energy dissipation rate were developed based on bore concept and stable energy concept. The main difficulty is how to compute the energy dissipation rate or D_B due to its complexities.

2.2 Regular Breaking Wave Models

2.2.1 Bore concept

Originally, Le Mehaute (1962) introduced this concept by assuming that the energy dissipation rate of a broken wave is similar to the dissipation rate of a hydraulic jump. He suggested that when the slope is equal to 0.02 (critical slope), the corresponding wave height to water depth ratio is 0.78. It has been found that this concept gives reasonable estimates of the energy loss and several models use the bore analogy to calculate the energy dissipation.

Battjes and Janssen (1978) proposed a model developed from bore concept to compute the energy dissipation rate in a single-random breaking wave. They developed the model by assuming that the ratio of wave height to water depth is equal to 1.00 and including the probability of the occurrence of breaking waves of the given height. Good comparison was obtained between calculated wave height and laboratory measurements.

Thornton and Guza (1983) presented a refinement of Battjes and Janssen's model. The energy dissipation is considered primarily due to the conversion of potential wave energy to turbulent kinetic energy, which is eventually lost due to heat during wave breaking and secondarily due to the bottom frictional losses. The agreement between calculated and measured wave height on a gently beach were found and the accuracy of the model is dependent on the selection of a breaker coefficient.

Stive (1984) studied the energy dissipation in wave breaking on gentle sloping beach. In order to model the turbulence in the surf zone based on bore concept, he adopted the bore model through the inclusion of a dissipation factor to overcome the underestimation of the bore model comparing with his experiment. He found that the wave height decay and the mean water level appeared to be well predicted for waves of moderate steepness on slopes of 1/80-1/20.

Deigaard et al. (1991) developed the formula to express the rate of energy dissipation of a broken wave. When waves break in the surf zone, wave height and wave energy decrease toward the shoreline due to the strong energy dissipation through the energy loss in a bore. Generally, the agreement with the measured data is good.

Karambas and Koutitas (1992) modified Stive's model by including the wave height stabilization, which can be associated to the wave re-forming process. By applying the stable energy concept introduced by Dally et al. (1985). This can be associated to the wave when it leaves the breaking area and propagates without breaking. The model can be applied to a horizontal bottom as well as to a beach with uniform slope and it gives very satisfying results for the prediction of the variation of the wave height outside and inside the surf zone in comparison with the experimental data.

2.2.2 Stable energy concept

This concept was proposed by Dally et al. (1985), based on an analysis of the laboratory data of Horikawa and Kuo (1966). By using the assumption that the energy dissipation rate is proportional to the difference between the local energy flux and the stable energy flux. The experiment showed that the stable wave height is governed by the local water depth as $H_s = \Gamma h$. The advantage of this concept is that it is able to reproduce the pause or stop breaking in the wave breaking process at a finite wave height on a horizontal bed or in the recovery zone while the bore model gives a continuous dissipation due to wave breaking.

Dally et al. (1985) also proposed the model based on stable energy concept by determine the best value for the stable wave coefficient (Γ) and the wave decay coefficent (K_d) by calibrating the formula with the experimental result from Horikawa and Kuo (1966). Finally, they proposed to use the constant value for the stable wave coefficient, $\Gamma = 0.4$ and K_d=0.15 to give the best results over a wide range of monotonic beach slopes and recommended for the models, which included wave setup.

Rakha and Kamphuis (1995) developed the prediction of wave height to be accounted for the wave reflection. They studied the effect of the steepness and included into the stable wave equation (Γ). It is revealed that this model gives a well prediction of wave decay.

Rattanapitikon and Shibayama (1996) modified the model of Dally et al. (1985) based on the analysis of laboratory data of Kajima et al. (1983) and proposed the determination of the stable wave function from the correlation between the measured Γ and the computed Γ. Finally, they found that the correlation between measured Γ and $h/\sqrt{LH}$ appeared to be the best. The model was developed based on a large amount of published experiment results and the validity is confirmed by small-scale and large-scale experiment.