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WAVE TRANSMISSION STUDY THROUGH TWO ROW PILED BREAKWATERS

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INTRODUCTION:

Pile type breakwaters, being permeable and porous structures act as an alternative design approach whenever appropriate. Permeability of these structures makes the wave transmission an important design condition. Although there are some experiments in the literature examining transmission through one row pile system, it is much less in two row systems. Thus, aim of this study is to understand the transmission phenomenon of waves passing through two row piled breakwater system.

The model studies were implemented to comprehend how the transmission coefficient will change under the effects of;

- **Different incident wave angles**
- **Different spacing distances between piles**
- **Different wave steepness values**

EXPERIMENTAL SETUP:

Model Scale = 12.857.

Prototype
Water Depth = 20 m
Pile Diameters (D) = 1.8 m
Distance between rows (B) = 12m

Regular Waves
Steepness = 0,01 - 0,06

211 EXPERIMENTS

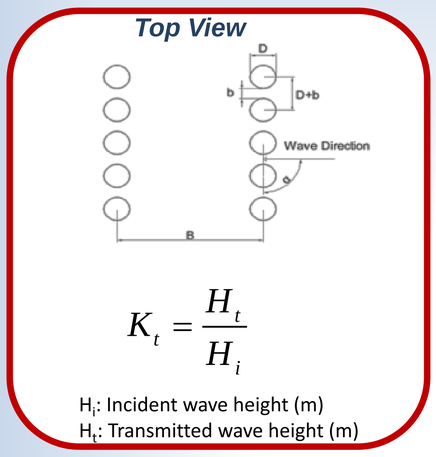


Figure-1 *Cross Section and Transmission Coefficient (Kt)*

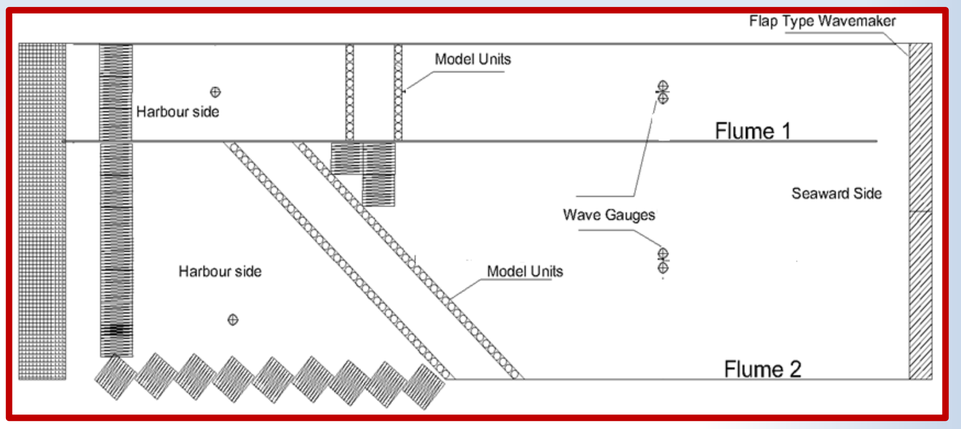


Figure-2 *Top View of Experimental Setup in Flume 1 and 2*

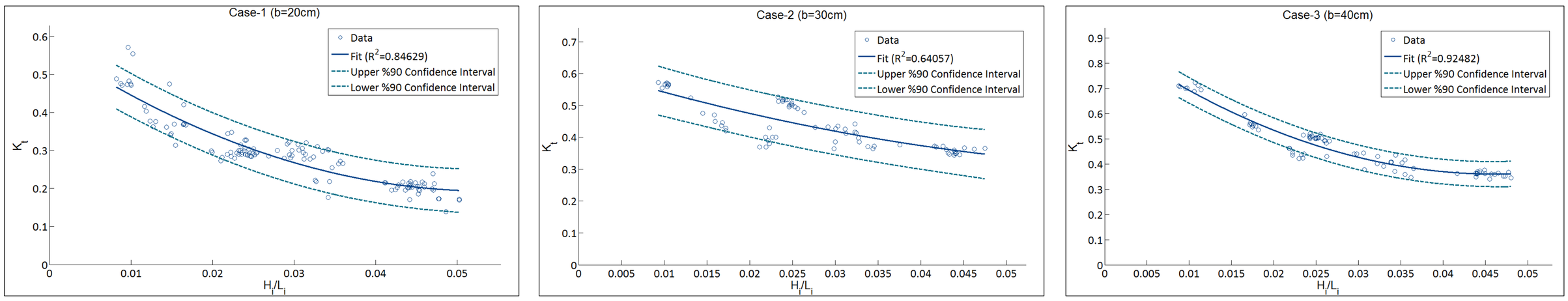
Case #	Pile Spacing b (cm)	Incident wave approach angle(α)
Case-1	20	90°
Case-2	30	90°
Case-3	40	90°
Case-4	20	45°
Case-5	30	45°
Case-6	40	45°

EXPERIMENTAL RESULTS:

The experimental results are presented in graphical forms to reflect the effect of the incident wave steepness (Hi/Li) versus transmission coefficient (K_t). Additionally, these results are discussed with respect to spacing between piles (b), incident wave approach angle (α_i) and gap ratio (b/D).

Incident Wave Steepness:

Figure-3- *K_t vs H_i/L_i for Case 1, 2 and 3*



Spacing Between the Piles:

To investigate the influence of spacing between piles, for the Cases-1, 2 and 3, where the pile spacing were changed as 20cm, 30cm and 40cm respectively. The results are plotted as H_i/L_i vs K_t in Figure 4 with relative spacing between piles as design parameter (b/D; where D: pile diameter).

Wave Approach Angle:

Case 4, Case-5 and Case-6 were carried out to investigate the effect of wave approach angle on transmission coefficient where the wave approach angle is set to α=45° degree using the experimental setup of Case-1, 2 and 3 respectively. The results of the experiments are presented for approach angles, α equals to 45° and 90° using the cases that have same pile spacing (b). (Figure 5)

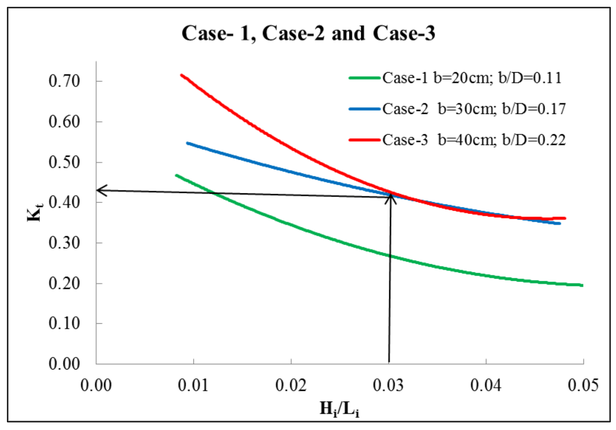


Figure-4- *K_t vs H_i/L_i for best fits of Case 1, 2 and 3*

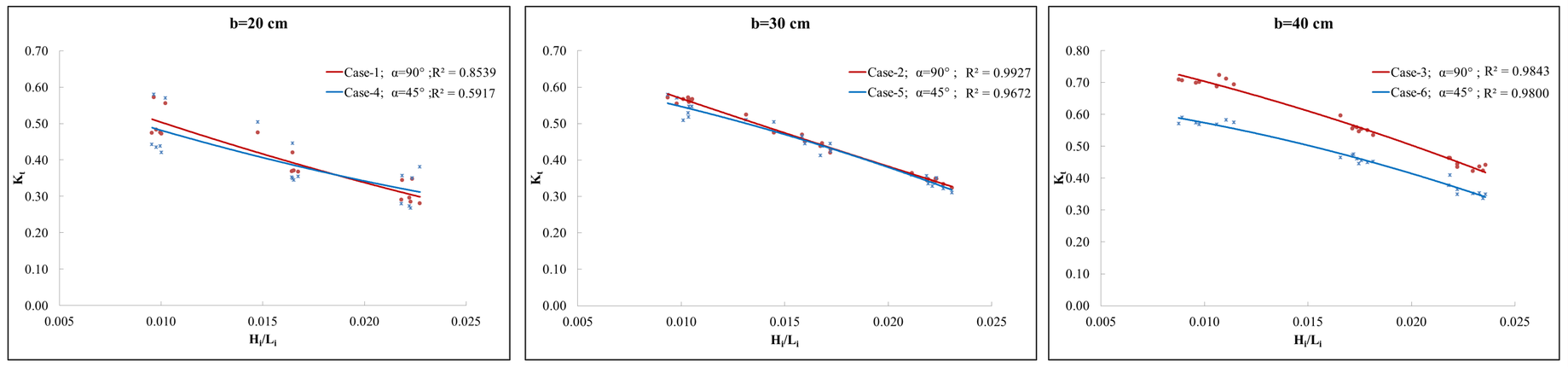


Figure5- *K_t vs H_i/L_i for best fits of Case 1, 2 and 3*

CONCLUSION:

Considering present research, following conclusions can be derived:

- Transmission coefficient (K_t) decreases with increasing incident wave steepness (H_i/L_i) for a given pile spacing (b). (Figure 2)
- For lower wave steepness ranges (H_i/L_i<0.030), the transmission coefficient values increase consistently with increasing pile spacing (b). However, in higher wave steepness range (H_i/L_i>0.030), influence of pile spacing (b) on transmission coefficient reduces for larger pile spacing values. (Figure 2)
- When the gap ratio (b/D) is increased up to 0.22, decreasing the wave approach angle cause a decrease up to 25% in transmission coefficient.

REFERENCES:

Bilici, Ergin (2014): A Model Study on Wave Transmission Through Pile Breakwaters: METU.
USACE (2003). Coastal engineering manual [CEM] Engineer Manual 1110-2-1100, US Army Corps of Engineers, CHL-ERDC, WES, Vicksburg, MS