INVESTIGATIONS ON COASTAL SEDIMENT TRANSPORT AND SHORELINE BEHAVIOUR

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Degree of Master of Science

DEPARTMENT OF CIVIL ENGINEERING

UNIVERSITY OF MORATUWA

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By

K. M. M. Ansaf

A thesis submitted to the Department of Civil Engineering of the University of Moratuwa for the Degree of Master of Science

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Research Supervised

By

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Prof. S. P. Samarawickrama

DEPARTMENT OF CIVIL ENGINEERING
UNIVERSITY OF MORATUWA
SRI LANKA

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K. M. M. Ansaf

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UNIVERSITY OF MORATUWA
SRI LANKA

July 2011

DEDICATION

The Thesis is dedicated to my Father and Mother.

&

The Research Work carried out for the M.Sc Degree is dedicated to the Professional Coastal Engineers and Coastal Managers of Sri Lanka.

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DECLARATION OF THE CANDIDATE

This thesis is a report of research carried out in the Department of Civil Engineering, University of Moratuwa, between July, 2009 and September, 2010. Except where references are made to other work, the contents of this thesis are original and have been carried out by the undersigned. The work has not been submitted in part or whole to any other university. This thesis contains 146 pages.

..... Date: .....

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DECLARATION OF THE SUPERVISORS

I have supervised and accepted this thesis for the submission of the Degree.

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I am also thankful to Lanka Hydraulic Institute (LHI) and staff of LHI for making available of Galle offshore wave data and guidance in familiarizing with MIKE 21 modelling tool. I would also like to extend my gratitude to all the staff members of the Hydraulic and Water Engineering Laboratory of the Department of Civil Engineering for helping me in every aspect of technical needs.

My special thanks go to the postgraduate colleagues of the Hydraulics Laboratory for their support in field measurements and encouragement in research works. Their contribution was very much appreciated.

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ABSTRACT

The ever-increasing economical and environmental considerations of coastal areas have provoked further studies of the variety of processes taking place in the coastal zone. This thesis elaborates a study conducted to quantify the coastal sediment transport rates along the Southwest coast of Sri Lanka.

Representative near-shore wave climates have been established for the individual coastal cells along the considered coastline from Galle to Colombo. Available Galle offshore data measured at 70 m depth was used for the stated purpose with the help of MIKE 21 NSW numerical modelling tool. A statistical analysis was performed with the offshore wave records to identify the wave occurrence probability, and clear variations between the seasons were observed. The model has been validated with observed wave data in Hikkaduwa at 15 m depth near-shore and found that the model is accurately applicable for the Southwest coast. Near-shore wave climates were prepared separately for swell and sea conditions versus their occurrence probability.

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Kamphuis (2002) model is found to be simple and reliable for the sediment transport computation of the Sri Lankan coast. This computation has revealed that the highest sediment transportation takes place during the Southwest monsoon period. Sediment transportation induced by the swell wave conditions dominates over the sea waves. An annual net sediment transport rate of 10^5 m^3 was obtained across all the cells along the Southwest coast. The direction of movement is towards north in almost all the cells. These transport rates could be termed as long-term and one dimensional morphology model was used to find possible monthly shoreline movement in various seasons.

A series of field measurements carried out, have helped in understanding and determining seasonal changes of shoreline, local erosion/accretion behaviour, and representative median sediment size for the individual cells.

The study can be considered as a new approach to quantify coastal sediment transport rates and to understand shoreline behaviour in Southwest coast of Sri Lanka.

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