TSUNAMI HAZARDS IN SRI LANKA: ASSESSMENT OF EXPOSURE LEVELS OF THE SOUTHERN COAST

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Degree of Master of Science

Department of Civil Engineering

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Thesis submitted in partial fulfillment of the requirements for the degree Master of Science

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DECLARATION

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DECLARATION OF THE SUPERVISORS

The above candidate has carried out research for the Masters thesis under my supervision.

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ACKNOWLEDGEMENT

I would like to take this opportunity to thank and offer my heartiest gratitude to all the great personalities who helped me throughout the hard journey of this Masters degree.

First and foremost, I would like to express my sincere gratitude to my research supervisors, Dr. T. M. N. Wijayaratne and Mr. A. H. R. Ratnasooriya, who persuaded me and offered continuous support and encouragement in successfully completing this research.

I must also express my sincere gratitude for the financial support given by University of Moratuwa, Sri Lanka through Senate Research Grants SRC/ST/2017/37 and SRC/ST/2018/16. Without this funding, this research would have never been arisen.

I am also grateful to Dr. R. L. H. L. Rajapakse and Dr. P. K. C. De Silva, Department of Civil Engineering, University of Moratuwa, Sri Lanka for their kind support and guidance given to me during this research work.

I must extend my gratitude to Prof. R. U. Halwathura and Dr. J. C. P. H. Gamage, the research coordinators of the Department of Civil Engineering, for coordinating the research work with the Postgraduate Division, University of Moratuwa.

I must also express my heartiest gratitude to the academic staff of the Department of Civil Engineering, University of Moratuwa, including Head of the Department Prof. S. A. S. Kulathilaka, for the kind support given to me and providing necessary facilities to carry out this research work. The non- academic staff of the Department, especially the staff of the Hydraulic Engineering Laboratory should be mentioned with due appreciations, for the support given to me in completing this research work.

At last but not least, I express my heart full gratitude to my dear husband Mr. Chathuranga Nagasinghe for all the support and encouragement given to me for the successful completion of this work.

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ABSTRACT

TSUNAMI HAZARDS IN SRI LANKA: ASSESSMENT OF EXPOSURE LEVELS OF SOUTHERN COAST

In Sri Lanka, monsoonal floods, droughts, cyclones and landslides are the common and well-known natural hazards and almost every year the country experiences one or more of these hazards. Tsunamis have not been frequent in the history of Sri Lanka but the Indian Ocean tsunami in 2004, subsequent tsunami alerts issued in the country and historical accounts of tsunami events in the past have clearly highlighted the exposure of Sri Lanka to tsunami hazards. Tsunamis are generated by a variety of causes and undersea earthquakes have been identified as the most common cause for tsunami generation. Considering the location of Sri Lanka and the undersea earthquake prone regions in the world, it is evident that the country is exposed to potential tsunami events generated at the Sunda Trench located to the east and the Makran Fault located to the north-west. The Indian Ocean Tsunami was caused by an earthquake occurred in the Sunda Trench. The Indian Ocean Tsunami caused widespread damages in coastal areas of the country and the exposure of many coastal areas to tsunami hazards became evident form the damages experienced. The southern area of the country was significantly affected by the in 2004 and the 03 main populated/urban areas along the southern coastline-Galle, Matara and Hambantota-were considered for the assessment of the levels of exposure.

Numerical models are widely used to simulate tsunami events in order to assess the exposure of coastal areas to tsunami hazards. The numerical model MOST with the user interface ComMIT, developed by the National Oceanic and Atmospheric Administration (NOAA) of the United States Department of Commerce was used to simulate the selected earthquakes at Sunda Trench and Makran Fault in this study. The tsunami wave height in coastal waters and the tsunami arrival times were obtained by numerical modelling were considered to assess the level of exposure. Sunda Trench was divided into 4 regions, extending from north to south along the trench, for the purpose of this study. The upper (northern) part of the trench was considered as Region 1, and the middle section were divided in to two regions, Region 2 and Region 3. The lower part was considered as Region 4. Based on the results of the study, it can be concluded that the southern coast is at a high risk due to the earthquakes generated in Regions 2 and 3 of the Sunda Trench. A high level of exposure was evident due to earthquakes of magnitudes higher than 9.0 Richter Scale. No significant level of exposure was evident due to tsunamis generated at the Makran Fault. An early warning system would be very effective in mitigating adverse impacts due to tsunamis and such a system can be based on a large database developed from the results of tsunami simulations similar to the ones carried out in the study. Further improvements of the results of such simulations can be made by considering higher resolution bathymetric information obtained by surveys, together with relevant overland topographic data to assess the inundation characteristics of tsunamis in coastal areas.

Key words: Makran Fault, Sunda Trench, Wave Height

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LIST OF ABBREVIATIONS

ComMIT	Community Model Interface for Tsunami
CTWP	Caribbean Tsunami Warning Program
DEM	Digital Elevation Model
GA	Geoscience Australia
GITEWS	German-Indonesian Tsunami Early Warning System
GUI	Graphical User Interface
IOC	Intergovernmental Oceanographic Center
IOT	Indian Ocean Tsunami
IOTIC	Indian Ocean Tsunami Information Centre
INCOIS	Indian National Center for Ocean Information Services
ITEWC	Indian Tsunami Early Warning Centre
ITIC	International Tsunami Information Center
JATWC	Joint Australian Tsunami Warning Center
JRC	Joint Research Centre
MF	Makran Fault
MOST	Method of Splitting Tsunamis
NCEI	National Centers for Environmental Information
NCTR	NOAA Center for Tsunami Research
NEAMTWS	North East Atlantic and Mediterranean Tsunami Warning System
NOAA	National Oceanic and Atmospheric Administration
NSW	Non-linear Shallow Water
PTWC	Pacific Tsunami Warning Center
RIMES	Regional Integrated Multi-Hazard Early Warning System
ST	Sunda Trench
UNESCO	United Nations Educational, Scientific and Cultural Organization
UTC	Universal Time Coordinate
WDS	World Data Services