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**APPLICATION OF FUZZY SETS AND OTHER
STATISTICAL TECHNIQUES IN LANDSLIDE HAZARD
ZONATION MAPPING**

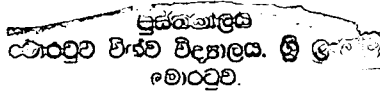
by

Kumari Mala Weerasinghe



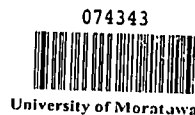
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This thesis was submitted to the department of Civil Engineering of the University of Moratuwa in partial fulfillment of the requirements for the Degree of Master of Engineering in Geotechnical Engineering



Department of Civil Engineering
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August, 2001



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DECLARATION

I Kumari Mala Weerasinghe do honestly and truly declare that the work included in this thesis in part or whole has not been submitted for any other academic qualification at any institution.

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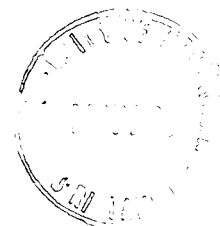
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APPLICATION OF FUZZY SETS AND OTHER STATISTICAL TECHNIQUES IN LANDSLIDE HAZARD ZONATION MAPPING

by

Kumari Mala Weerasinghe

An abstract of the thesis submitted to the Department of Civil Engineering at the University of Moratuwa, in partial fulfillment of the requirements for the degree of Master of Engineering in Geotechnical Engineering.

August, 2001

The objectives of this research are, (1). establish a methodology that quantifies the severity levels of causative factor attributes that are rated subjectively, and (2). optimize weights and severity levels of the causative factor attributes in order to achieve maximum agreement between the predicted landslide hazard potential and the actual landslide intensities observed in the field.



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The landslide hazard potential is evaluated based on a decision tree consisting of two levels of attributes identified as primary and secondary. It is assumed that the primary and secondary attributes have independent contributions towards the final result. The relative importance of each component attribute (factor) among the other factors that are connected to a nodal point of this tree is indicated by a subjective (or linguistic) description. Fuzzy sets mathematics which is an effective tool for mathematical representation of subjective expressions such as “quite high”, “medium” or “not that high” etc. are used to describe the relative importance of component attributes. Moreover, linguistic ratings used to describe the severity of each secondary factor are also considered as fuzzy numbers in order to account for the vagueness or the subjectivity in the rating procedure.

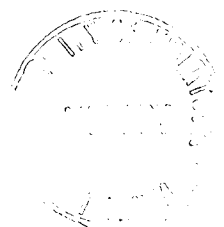
Computer routines are developed to express the fuzzy sets that describe the subjective ratings and weights and then manipulate them using a technique resembling the Monte-Carlo simulation in order to determine the overall hazard potential of a given site. Eventually, the resulting overall degree of hazard, which itself is a fuzzy set, is

converted back to an appropriate linguistic scale containing 'very high', 'high', 'medium', 'low', or 'very low' designations, in order to interpret the overall landslide potential of the site. Once the hazard potential estimates are predicted for every zone demarcated on a selected study area, they are compared with actual landslide intensities estimated for the same zones based on available field data. Then, through an iterative procedure the initially assigned weights of the primary and secondary attributes are systematically adjusted until the field observed landslide intensity matches at a satisfactory level with the predicted hazard potential.

When the developed methodology is applied to the remaining study areas in Sri Lanka, and weights are refined further, it would become an effective tool in accurate landslide hazard zonation.



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Kumari Mala Weerasinghe

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