EVALUATING DISASTER RESILIENCE OF TRANSPORTATION INFRASTRUCTURE USING GIS

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Declaration

I declare that this is my own work and this thesis doesn't incorporate without acknowledgment any material preciously Submitted for a degree or diploma in any other university or institute of higher learning and to the best of my knowledge and belief it does not contain any material preciously published or written by another person except where the acknowledgment is made in the text.

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Abstract

Almost countries around the world have experienced any types of catastrophic natural disasters, such as volcanic eruptions, magnificent earthquakes, landslides, floods, droughts, cyclones, tornados, snow /sand storm, coastal erosion and tsunami. Hundreds of thousands of lives, property and physical infrastructures, including with transportation system & its infrastructure i.e. highways, railways, ports & air ports are caused to overwhelm, due to such these types of disasters. Traditional reconstruction practices, as a "post-disaster resilience strategy" is an extra burden to the economies of the countries. Application of modern technological strategies, on disaster resilience practices, as a "pre- disaster resilience strategy", is behaving on conceptual stage among the 3rd world, developing countries, while the developed countries are on its testing and utilizing stage in micro / macro levels. Hence an efficient pre-disaster resilience assessment process should be developed, especially for the transportation system in the developing countries, based on up to date technology. All physical and demographic information that is related to the factors affecting disaster risk on transportation infrastructure such as terrain, soil condition, drainage pattern, weather pattern land use, population which is available in a scattered manner, has not been analyzed in an integrated manner to identify the disaster possibility on transport infrastructure. Identification of disaster resilience of existing and proposed transportation infrastructure will be very useful to minimize impacts due to any natural disaster.

The main objective of this research is to develop a methodology, which helps to build up a systematic tool to identify the possible risk areas, on transportation infrastructure, based on the information available, using ArcGIS software.

The initial step of the methodology of this research is, based on disaster records and relevant data, which were gathered from the responsible institutes, online journals and research papers, library & field surveys, as the data collecting phase. Along with the literature survey relevant data such as disaster records, together with floods and landslides data, land use pattern, soil, geographical & climatic data, demographic information will be collected and to prepare a GIS database. By using world famous frequency estimation methods, i.e. Gumbel's , Weibul's, Gringroatan's, Hanzen's, Blayerd's, the flood return periods were calculated. By using simple statistics, the flood gauge heights, corresponds to the different flood return periods were defined. The flood and landslide risks were identified in order to the given parameters, by the responsible institutes; and ranked them for analyzing purposes. Finally, by integrating the flood and landslide risk ranks, using a program, written in VB, the total disaster risk, of a place, area, could be identified, and produced the results in map media, by using the ArcGis software.

10 km circle area, covers with 314.28 km^2, around the Ratnapura town, in the Ratnapura sub catchment of Kalu River, has been selected as the pilot site to do the cause study. After the application of the defined methodology to the pilot site, the results were obtained as, 58.1%, (182.4381 km^2 out of 314.28km^2 pilot site) is belonging to Very low (or No risk) risk area, while other Low risk, Moderate risk and High risk areas were 20.9% (65.7067 km^2), 19.3% (60.75185 km^2) and 1.7% (5.262446 km^2) respectively. And all the inundation areas correspond to flood return periods, and major risk areas of flooding and landslides were produced by using ArcGIS software.

Key words: *Disaster resilience, Flood returns period, ArcGIS, frequency estimation.*

Dedication

To
My Loving
Father, Mother & Wife

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Abbreviations

DMC SL –	Disaster Management Center – Sri Lanka
ESRI -	Environmental System Research Institute
FDV –	Flood Discharge Volume
FGH –	Flood Gauge Height
GIS –	Geographical Information System
MSL-	Mean Sea Level
NBRO –	National Building Research Organization
OS -	Operating System
RS -	Remote sensing
SL -	Sri Lanka
UTM –	Universal Transverse Mercator
VB -	Visual Basics