LIQUEFACTION POTENTIAL IN SRI LANKA- PREPARING A LIQUEFACTION HAZARD MAP USING GEOTECHNICAL INVESTIGATION DATA

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Dedication

Initially this thesis is dedicated to project supervisors, Dr. L.I.N.De Silva and Prof. S.B.S. Abayakoon, who guided till successful completion.

This thesis is dedicated to my parents and sisters who have supported me all the way since the beginning of my studies.

Also, this thesis is dedicated to my classmates who have been a great source of motivation and inspiration.

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Abstract

Soil Liquefaction is a process, where granular soils below the ground water table temporarily lose its strength due to cyclic loading created by an earthquake. Liquefied soil behaves as a viscous fluid rather than a solid. During liquefaction, porewater pressure is suddenly increased, forcing the soil particles to suspend in water. As a result, the buildings, utility services, natural substances and other structures are collapsed causing severe damage to the people and the nature. In some cases, the destruction due to liquefaction is not repairable. Therefore, the mitigation measures are essential to prepare for liquefaction. In Sri Lanka, it is rare to find the historical data of liquefaction or related incidents. Recent studies demonstrated that there is a potential for liquefaction in some places of the island. It could be evaluated by using the basic geotechnical investigation data, according to the simplified procedure proposed by Seed and Idriss (1971). This study is intended to prepare a liquefaction hazard map for Sri Lanka by identifying the hazard zones, using an extensive geotechnical investigation data base. As per the analysis 218 locations were identified as susceptible for liquefaction during an earthquake of magnitude 6.0 out of 3282 locations analyzed. Further, the research has given a special attention to the variation of ground water table and the maximum possible ground acceleration.

Keywords: liquefaction, ground acceleration, magnitude, earthquake

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U	Pore water pressure
σ'	Effective stress
σ_{ov}	Total overburden stress
SPT	Standard penetration test
CPT	Cone penetration test
CSR	Cyclic stress ratio
CRR	Cyclic resistance ratio
a_{max}	Peak horizontal acceleration at ground surface generated by the earthquake
σ_{vo}	Total vertical overburden stress
σ'_{vo}	Effective vertical overburden stress
r_d	Stress reduction factor
g	Gravitational acceleration
z	Depth below the ground surface in meters
N	No of blows in standard penetration test
M	Magnitude of the earthquake
FC	Fines content
$CRR_{7.5cs}$	CRR value for earthquake magnitude of 7.5 and to the clean sand base curve
$(N_1)_{60}$	SPT blow count corrected to an effective overburden pressure 100 kPa and to a hammer energy efficiency of 60%
$(N_1)_{60cs}$	Equivalent clean sand value of $(N1)_{60}$
C_N	Correction factor for effective overburden pressure
C_E	Correction factor for hammer energy ratio
C_B	Correction factor for borehole diameter
C_R	Correction factor for rod length
C_S	Correction factors for samplers with or without liners
σ'_o	Effective overburden pressure
P_a	Atmospheric pressure in the same unit as σ'_o
$(q_{c1N})_{cs}$	Corrected CPT tip resistance
MSF	Magnitude scaling factor
t	Layer thickness below Ground water level

List of Annexure