SEISMIC HAZARD ASSESSMENT FOR COLOMBO CITY WITH LOCAL SITE EFFECTS

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Degree of Master of Engineering

Department of Civil Engineering

University of Moratuwa

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DECLARATION

I declare that this is my own work and this dissertation does not incorporate without acknowledgement any material previously submitted for a Degree or Diploma in any other University or institute of higher education and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

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Abstract

Sri Lanka was believed to have no seismic threat compared to other natural hazards such as floods, droughts, landslides etc. Due to the experiencing of ground shaking in last few decades and the disaster on 26th December, 2004 due to tsunami, Sri Lanka cannot further treated as an earthquake damage free country. Few research has been carried out to investigate seismic hazards at Colombo city area and the response spectrum at rock level for Colombo city area has been proposed with the PGA (Peak Ground Acceleration) of 0.1g. However, no studies have been carried out to develop earthquake response spectrum for Colombo city with local soil variations.

This study discusses generalized soil profiles for Colombo city and earthquake response spectrum with local site effects for Colombo city area.

77 borehole logs done at the study area are collected and locations were plotted on a map of study area. Eight vertical sections were obtained through the study area and using them eight soil profiles which have horizontal soil layers were developed. All eight profiles highlight that the average soil cover in Colombo city area is about 20m. Just above the basement rock dense to very dense silty sand/ sand layer is present. Topmost layer also having loose to dense sandy soil. In between both of sand layers, very loose to loose clay/ silt or organic material layer is encountered in all boreholes.

The developed soil profiles were used to analyze with earthquake motions using the computer software called EduShake. The six earthquake motions are applied at rock level as input motions. The response spectra at rock level and the response spectra with the local soil effects were obtained as the output file. The program was run for the eight soil profiles and obtains the average value of both output files as final result. Finally, earthquake response spectrum has been proposed for Colombo city area and it was compared with existing response spectrum at rock level for Colombo city.

According to this study, the PGA with local site effects is 0.13g for Colombo city area.

Key words: *Colombo city, local site effect, seismic hazard analysis, intra-plate earthquakes.*

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Notations

A	-	Crosssectional area
E	-	Young's modules
f,g	-	Arbitrary functions
G	-	Shear modulus
J	-	Polar moment of inertia of the rod about its axis
k	-	Wave number
K	-	Stiffness of the object
M	-	Constrained modulus
m	-	Mass of the object
PGA	-	Peak ground acceleration
PHA	-	peak horizontal acceleration
PHA	-	Peak horizontal acceleration
RSRL	-	Response spectrum at rock level
RSLSE	-	Response spectrum with local site effects
SPT	-	Standard Penetration Test
SCPT	-	Standard Cone Penetration Test
S_a	-	Spectral acceleration
t	-	Time
T	-	Period, torque
T_n	-	Natural period of object
$\bar{T}$	-	Period of the applied loading
x	-	Distance
u, v, w	-	Particle displacement in x,y and z directions respectively
v_p	-	Longitudinal wave propagation velocity
v_s	-	Torsional wave propagation velocity
(t)	-	Steady state harmonic stress
λ	-	Wave length, Lame constant
μ	-	Lame constant
ϖ	-	Circular frequency
ν	-	Poisson ration

ρ	-	Density of element
ξ	-	Damping ratio
$\sigma_x, \sigma_y, \sigma_z$	-	Normal stress in x, y and z-direction respectively
σ_0	-	Stress wave amplitude
$\varepsilon_x, \varepsilon_y, \varepsilon_z$	-	Strain in x, y and z-direction respectively
$\bar{\varepsilon}$	-	Dilatation
Φ, Ψ	-	Potential functions