## An Investigation of Local Site Effects on Strong Ground Motions in Abbas-Abad (Tehran Mosalla) Region

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## ABSTRACT

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Local site effects play a very important role in characterizing seismic and design ground motions because they may strongly amplify (or deamplify) seismic motions before reaching the ground surface.

The purpose of this paper is to evaluate local ground response in ABASBAD region (around the TEHRAN MOSALLA). To perform dynamic analysis, soil layers dynamic characteristics is determined from seismic down-hole tests performed at 6 borehole stations. Bedrock Seismicity characteristics is evaluated and 15 accelerograms from various earthquakes around the world is selected. Considering the local topography and soil conditions, one dimensional equivalent linear analysis is performed and results is presented in form of microzonation maps of maximum ground acceleration and velocity, maximum amplification and site specific design spectra. The results indicate that presence of stiff shallow granular soil layers has no considerable affect on bedrock seismic motions and using Iranian earthquake code (2800) normalized design spectra for this site, is conservative at long periods.

## **KEYWORDS**

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Local Site Effect, Local Ground Response, Equivalent Linear Analysis, Microzonation.

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( ) Kelvin-Voigt  $A_{mn}(\omega) = \frac{u_m}{u_n} = \frac{\dot{u}_m}{\dot{u}_n} = \frac{\ddot{u}_m}{\ddot{u}_n} = \frac{E_m + F_m}{E_n + F_n} \tag{)}$ ( )  $u(z,t) = Ee^{i(\omega t + K^*z)} + Fe^{i(\omega t - K^*z)}$ () .[] F E  $v_s^*$   $K^* = \omega / v_s^*$ : () ()  $v_s^* = \sqrt{\frac{G^*}{\rho}} = \sqrt{\frac{G(1+i2\xi)}{\rho}} \approx \sqrt{\frac{G}{\rho}}(1+i\xi) = v_s(1+i\xi)$  () τ .[](()) Ν  $G_1 \stackrel{e}{\leftarrow} P_1$  $G_m \stackrel{g}{\leftarrow} P_m$ m+1 m+2 • N  $G_{m+1} \in S_{m+1} P_{m+1}$ :( ) (G)  $(G_{max})$ G :( )  $G_{\rm sec} = \frac{\tau_c}{\gamma_c}$ ()  $( ) = G^* \frac{\partial u}{\partial z} = (G + i\omega\eta) \frac{\partial u}{\partial z} = G(1 + 2i\xi) \frac{\partial u}{\partial z}$ () : () ()  $E_{m+1} = \frac{1}{2} E_m (1 + \alpha_m^*) e^{iK_m^* h_m} + \frac{1}{2} F_m (1 - \alpha_m^*) e^{-iK_m^* h_m}$ ( )  $\xi = \frac{W_D}{4\pi W_s} =$ ()  $W_D$  $W_{i}$  $F_{m+1} = \frac{1}{2} E_m (1 - \alpha_m^*) e^{iK_m^* h_m} + \frac{1}{2} F_m (1 + \alpha_m^*) e^{-iK_m^* h_m}$ () (( ) )  $A_{loop}$  $\alpha_m^*$ m+1 m : ()  $\alpha_m^* = \frac{K_m^* G_m^*}{K_{m+1}^* G_{m+1}^*} = \frac{\rho_m(v_s^*)_m}{\rho_{m+1}(v_s^*)_{m+1}}$ ()  $(E_1 = F_1)$ .[]  $A_{mn}$ т ( ) Sun Idriss n m :

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 Rollins, K.M., Evans, M.D., Diehl, N.B., and Daily, [] W.D. "Shear modulus and damping relationships for gravels", J. Geotech. Geoenv. Engrg., ASCE, 124 (5), 1998.

Seed, H.B., Wong, R.T., Idriss, I.M., and Tokimatsu, K. [] "Moduli and damping factors for dynamic analyses of cohesionless soils," J. Geotech. Engrg., ASCE, Vol. 112 (11), PP. 1016-1032, 1986.

Seed, H.B., Romo, M.P., Sun, J.I., Jaime, A., and Lysmer, J. "Relationships between soilconditions and earthquake ground motions in Mexico City in the earthquake of September 19,1985", Rpt. No. UCB/EERC-87/15, Earthquake Engineering Research Center, Univ. of California, Berkeley, 1987.

Stewart, J.P., Chio, S-J., Bray, J.D., Graves, R.W, [] Somerville, P.G. and Abrahamson, N.A., "Ground Motion Evaluation Procedures for Performance-Based Design", Rpt. No. PEER-2001/09, Pacific Earthquake Engineering Research Center, Univ. of California., 2001

Yoshida, N. "Aplicability of conventional computer code [] SHAKE to nonlinear problem", Proc. of the Symposium on Amplification of Ground Shaking in Soft Ground, JSSMFE, p.p. 14-31, 1994.

Youshida, N., Kobayashi, S., Suetomi, I. and Miuara, K. "Unified Equivalent linear method considering frecuency dependent characteristics of stiffness and damping", Soil Dynamics and Earthquake Eng., Vol. 22, pp. 205-222, 2002

- BARDET, J. P, ICHII K., and LIN C. H., "EERA, A [] Computer Program for Equivalent-linear Earthquake site Response Analyses of Layered Soil Deposits", University of California press,2000.
- Chang, S.W. "Seismic response of deep stiff soil [] deposits", Ph.D. Dissertation, Univ. of California, Berkeley, 1996.

Chang, S.W., Bray, J.D., and Seed, R.B. "Engineering implications of ground motions from the Northridge earthquake", Bull. Seism. Soc. Am., Vol. 86, pp. 270-288, 1996.

- Dickenson, S.E, "The dynamic response of soft and deep [] cohesive soils during the Loma Prieta earthquake of October 17, 1989", Ph.D. Dissertation, Univ. of California, Berkeley, 1994.
- Ishibashi, I. and Zhang, X. "Unified dynamic shear [] moduli and damping ratios of sand and clay", Soils and Foundations, Vol. 33, No. 1, pp. 182-191, 1993
- Kramer, Steven L., Geotechnical Earthquake [] Engineering, 1<sup>th</sup> ed., New Jersey, Prentice-Hall, 1996.

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