IJG> Vol.2 No.4, November 2011

OPEN ACCESS

# Validity of the Refraction Microtremors (ReMi) Method for Determining Shear Wave Velocities for Different Soil Types in Egypt

PDF (Size:5035KB) PP. 530-540 DOI: 10.4236/ijg.2011.24056

Author(s)
Mohamed Ahmed Gamal, Satish Pullammanappallil

ABSTRACT
The Refraction Microtremor (ReMi) method is being used around the world by the geotechnical and geophysical community to determine shear-wave velocities. This is due to its faster, less expensive and accurate determination of shear wave velocities, when compared to other methods used. Unlike standard crosshole and downhole techniques, ReMi does not require any drilling. It eliminates the problem of shear-wave source and quiet site that are pre-requisites for good seismic refraction surveys. In this paper we present refraction microtremors (ReMi) measurements done at sites underlain by different soil types in Egypt. The ReMi data were collected using standard refraction equipment employing 12, 24 or 48 channels. We used deep oceanographic noise and ambient noise including energy from power generators, pile drivers and traffic. The data were processed using the SeisOpt® ReMi? (© Optim, Inc.) software to reveal one-dimensional shear-wave velocity structures beneath the arrays. To access the validity of the method for the Egyptian soils, the shear-wave profiles obtained from the ReMi measurements were compared to downhole and crosshole data for different soils. Comparisons demonstrate the robustness of the ReMi technique for obtaining shear-wave velocities for different soil types in Egypt.

KEYWORDS
Refraction, Microtremors, ReMi, Crosshole, Downhole, Shear Wave, Egypt

Cite this paper
M. Gamal and S. Pullammanappallil, "Validity of the Refraction Microtremors (ReMi) Method for Determining Shear Wave Velocities for Different Soil Types in Egypt," *International Journal of Geosciences*, Vol. 2 No. 4, 2011, pp. 530-540. doi: 10.4236/ijg.2011.24056.

References

[1] J. N. Louie, "Faster, Better: Shear-Wave Velocity to 100 Meters Depth from Refraction Microtremors Arrays," Bulletin of the Seismological Society of America, Vol. 91, No. 2, 2001, pp. 347-364. doi:10.1785/0120000098

[2] S. Pullammanappallil, B. Honjas, J. Louie, J. A. Siemens and H. Miura, "Comparative Study of the Refraction Microtremors Method: Using Seismic Noise and Standard P-Wave Refraction Equipment for Deriving 1D Shear- Wave Profiles," Proceedings of the 6th SEGJ International Symposium, Tokyo, January 2003, pp. 192-197.

[3] R. Said, "The Geology of Egypt," Conco Hurghada Inc., Rotterdam, 1990.

[4] EGSMA, Geological Map of Greater Cairo Area. Outline of Geology Stratigraphy, Egyptian Geological Survey and Mining Authority, 1983.

[5] J. R. Thorsonand J. F. Claerbout, "Velocity-Stack and Slant-Stack Stochastic Inversion," Geophysics, Vol. 50, No. 12, 1985, pp. 2727-2741. doi:10.1190/1.1441893

[6] M. Horike, "Inversion of Phase Velocity of Long-Period Microtremors to the S-Wave-Velocity Structure Down to the Basement in Urbanized Areas," Journal of Physics of the Earth, Vol. 33, 1985, pp. 59-96. doi:10.4294/jpe1952.33.59

• Open Special Issues
• Published Special Issues
• Special Issues Guideline

IJG Subscription

Most popular papers in IJG

About IJG News

Frequently Asked Questions

Recommend to Peers

Recommend to Library

Contact Us

[7] R. W. Clayton and G. A. McMechan, "Inversion of Refraction Data by Wavefield Continuation," Geophysics, Vol. 46, No. 3, 1981, pp. 860-868. doi:10.1190/1.1441224

[8] G. Fuis, W. Mooney, J. Healy, G. McMechan and W. Lutter, "A Seismic Refraction Survey of the Imperial Valley Region, California," Journal of Geophysical Research, Vol. 89, No. B2, 1984, pp. 1165-1190. doi:10.1029/JB089iB02p01165

[9] G. A. McMechan and M. J. Yedlin, "Analysis of Dispersive Waves by Wave Field Transformation," Geophysics, Vol. 46, No. 6, 1981, pp. 869-874. doi:10.1190/1.1441225

[10] C. B. Park, R. D. Miller and J. Xia, "Imaging Dispersion Curves of Surface Waves on Multi-Channel Record," Annual Meeting Abstracts, Society of Exploration Geophysicists, Tulsa, 1998, pp. 1377-1380.

[11] R. D. Miller, C. B. Park, J. M. Ivanov, J. Xia, D. R. Laflen, and C. Gratton, "MASW to Investigate Anomalous Near-Surface Materials at the Indian Refinery in Lawrenceville," Kansas Geology Survey, Open-File Report, Lawrence,2000, p. 48.

[12] S. Nazarian and K. H. Stokoe II, "In Situ Shear Wave Velocities from Spectral Analysis of Surface Waves," Proceedings of the World Conference on Earthquake Engineering, Vol. 8, San Francisco, 21-28 July 1984.

[13] C. B. Park, R. D. Miller and J. Xia, "Multi-Channel Analysis of Surface Waves," Geophysics, Vol. 64, No. 3, 1999, pp. 800-808. doi:10.1190/1.1444590

[14] M. Saito, "Computations of Reflectivity and Surface Wave dispersion Curves for Layered Media; I, Sound Wave and SH Wave," Butsuri-Tanko, Vol. 32, No. 5, 1979, pp. 15-26.

[15] M. Saito, "Compound Matrix Method for the Calculation of Spheroidal Oscillation of the Earth," Seismological Research Letters, Vol. 59, 1988, p. 29.

[16] Y. Zeng and J. G. Anderson, "A Method for Direct Computation of the Differential Seismograms with Respect to the Velocity Change in a Layered Elastic Solid," Bulletin of the Seismological Society of America, Vol. 85, No. 1, 1995, pp. 300-307.

[17] T. Iwata, H. Kawase, T. Satoh, Y. Kakehi, K. Irikura, J. N. Louie, R. E. Abbott and J. G. Anderson, "Array Mi- crotremor Measurements at Reno, Nevada, USA," EOS, Transactions of the American Geophysical Union, Vol. 79, No. 45, p. F578.

[18] J. Xia, R. D. Miller and C. B. Park, "Estimation of Near-Surface Shear-Wave Velocity by Inversion of Ray- leigh Wave," Geophysics, Vol. 64, No. 3, 1999, pp. 691- 700. doi:10.1190/1.1444578

[19] E. H. Field, S. E. Hough and H. Jacob, "Using Microtremors to Assess Potential Arthquake Site Response, a Case Study in Flushing Meadows, New York City," Bulletin of the Seismological Society of America, Vol. 80, No. 6A, 1990, pp. 1456-1480.