

論文 / 著書情報  
Article / Book Information

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Title(English)	Evaluation of Local Site Amplification in Lima, Peru using Earthquake Ground Motion Records
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Category(English)	Doctoral Thesis
種別(和文)	論文要旨
Type(English)	Summary

## 論文要旨

### THESIS SUMMARY

専攻:	Environmental Science	専攻
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申請学位 (専攻分野):	博士 (Philosophy)
Academic Degree Requested	Doctor of
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Academic Advisor(sub)	

#### 要旨 (英文 800 語程度)

Thesis Summary (approx.800 English Words)

The present thesis evaluates the site response for the different soil formations over Lima Metropolitan Area, Peru, as well as the parameters that control the amplification - the S-wave velocity ( $V_s$ ) distribution and the frequency-dependent quality factor ( $Q_s$ ). In this study, site amplification was analyzed in the frequency range from 1 to 20 Hz. Actual ground motion records were used in the analysis. Results obtained from this research were previously unknown in Lima, due to the lack of earthquake data in the past, the difficulty to access to this information, as well as the lack of knowledge.

First, microtremor explorations were conducted in this study in order to characterize the shallow and deep structure at earthquake recording stations installed on sedimentary layers. This study defined the S-wave velocity ranges for the predominant soil formations over Lima based on the microtremor measurements performed in this work and also using as reference information from previous studies. The predominant soil materials over Lima are gravel, sand and clays deposits. This study concludes the gravel deposits have S-wave velocities in the range from ~400 to ~1500 m/s. The  $V_s$  range of the sand deposits varies within ~100 and ~500 m/s, and the S-wave velocities of the clays are ranging between ~200 and ~500 m/s. A geophysical test was also performed at one seismic station situated on rock. The S-wave velocity of the rock site gradually increases with depth from ~1000 to ~2200 m/s. The rock site is the only station installed on rock, so this station was chosen as the reference site in this work.

Second, site amplification was evaluated by using earthquake data recorded from 18 seismic stations installed on sedimentary layers. This study used the Spectral Inversion Method in order to evaluate the site response. This technique has the advantage of separating the three effects - site, propagation path, and source - from the observed ground motion record. This work concludes the gravel deposits mainly amplify at frequencies higher than 3 Hz, while the sand and clay deposits control the amplification in the entire frequency range from 1 to 20 Hz. The site response of sands and clays show several peaks at frequencies higher than 5 Hz due to the influence of the top layers with S-wave velocities varying between ~100 and ~500 m/s, while the large amplification at frequencies lower than 5 Hz is attributed to the high velocity contrast between the top and deep layers ( $V_s > \sim 800$  m/s). This research also analyzed the propagation path quality factor  $Q_s$   $Q_s = 95.6f^{0.66}$  for the crust and mantle. Several source parameters such as the seismic moment density function, the corner frequency and the seismic moment were evaluated in this study too.

Finally, the quality factor  $Q_s$  as a function of S-wave velocity and frequency were evaluated for the sedimentary layers over Lima. The  $Q_s$  parameter was estimated by inverting the observed site response. This study concludes the quality factor has a strong influence on the site response for clays, while the influence on gravels and sands is negligible. Clay deposits characterize for being soft soil materials ( $V_s$  between ~200 and ~500 m/s) with a relatively large thickness. The  $V_s$  structure was also estimated for the analyzed earthquake stations by inverting the observed site response. The new  $V_s$  models characterize the shallow and deep structure of the soil. These models slightly differ from the  $V_s$  profiles estimated from microtremor measurements. The explanation is the separation distance between the seismic recording station and the center of the microtremor array configuration.

Outcomes obtained from this research are expected to be used as a reference for updating the Zonation Map of Lima Metropolitan Area.

備考：論文要旨は、和文 2000 字と英文 300 語を 1 部ずつ提出するか、もしくは英文 800 語を 1 部提出してください。

Note：Thesis Summary should be submitted in either a copy of 2000 Japanese Characters and 300 Words (English) or 1copy of 800 Words (English).

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