Determination of the MASW Field Parameters for Bangkok Subsoils

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Abstract

The MASW field parameters are important for recording surface wave data because they could be affected to the characteristics of dispersion curve. The characteristics of dispersion curve could then be used in obtaining the reliable shear-wave velocity. Therefore, this study aims at determining the optimum field parameters for Bangkok sub-soils. The results show that the MASW optimum field parameters of the Bangkok subsoils are 14-lbs sledgehammer, 10 Hz-geophone and 12 or more number of geophones. Moreover, the minimum offset was 5-10 m and geophone spacing was 1-2 m.

Keywords: MASW, Surface wave, Shear-wave velocity

1. Introduction

Bangkok is situated on the central part of the Chao Phraya basin which consists of Bangkok clay as its top layer as shown in Table 1 (Shibuya et al., 2003). Bangkok clay being soft can amplify frequencies of ground motion thereby increasing the earthquake damage (Tuladhar et al., 2004). Amplification properties of the Bangkok clay can be estimated from shear-wave velocity. Shear wave velocity can be analyzed by the MASW (multichannel analysis of surface wave) method- that is the method to analyze surface wave using multichannel data and obtain shear- wave velocity via inversion technique. To obtain a good shear-wave velocity, surface wave data has to be collected properly. Thus, it is important to choose the optimum field parameters for collecting data in the field. The important field parameters are source, frequency of geophone, minimum offset, receiver spacing and the number of receivers.

2. Experimental Results and Discussion

SurfSeis program was used to generate a Vs (shear-wave velocity) profile and it consisted of three steps: preparation of a multi-channel record (sometimes called a shot gather), dispersion curve and inversion. Dispersion curve had the greatest influence on the confidence in the Vs profile. Therefore, the optimum field parameters were selected in obtaining a good surface wave data by considering the characteristics of dispersion curves especially the fundamental mode. The suitable characteristics of the fundamental mode of dispersion curve were high amplitude, and high signal-to-noise ratio.

Table 1: Typical soil profile in the Bangkok area (Shibuya et al., 2003).

Depth(m)	Strata
0 to 14	Bangkok Soft Clay-dark grey highly compressible soft clay with 2m weathered zone forming a hard crust.
14 to 25	First Stiff Clay-light grey and brown fissure stiff clay.
25 to 40	First Sand layer-dense alluvial non-uniform sand, occasionally interbedded with stiff clay. Classified in parts as clayey sand.
40 to 44	Second Stiff Clay-light grey and brown, stiff often fissures silty clay.
44 to >70	Second Sand layer-clean light grey silty sand.

Further these characteristics also included easy separation from other modes of dispersion curve, clear, sharp and continuous shape. The field variable parameters in this research included source (8, 12 and 14 lbs-sledgehammer), frequency of geophone (10, 28 and 100 Hz), geophone spacing (1, 2 and 4 m), minimum offset (0, 3, 5, 7, 10, 15 and 20 m) and the number of geophones (12 and 24 geophones). If one field parameter was tested to find optimum field parameters, other field parameters had to be kept constant. The procedure for recording surface wave data is shown in Figure 1.

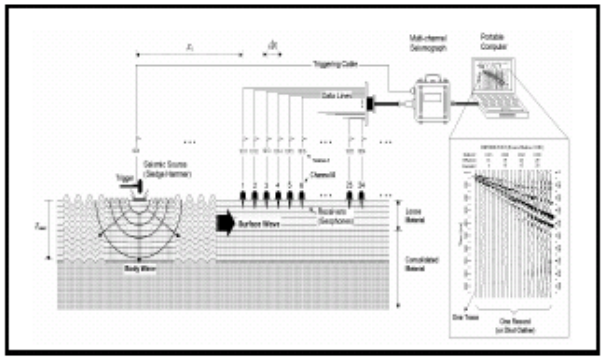

Figure 1: The procedure for recording surface wave data (Park et al., 1998)

For the study, source (14 lbs), frequency of geophone (10 Hz), geophone spacing (1 m), minimum offset (5 m) and number of geophones (24 geophones) were the optimum field parameters of the MASW method for Bangkok. These parameters gave the best fundamental mode of dispersion curve from which the reliable shear-wave velocity could then be obtained as mentioned above (Fig 2).

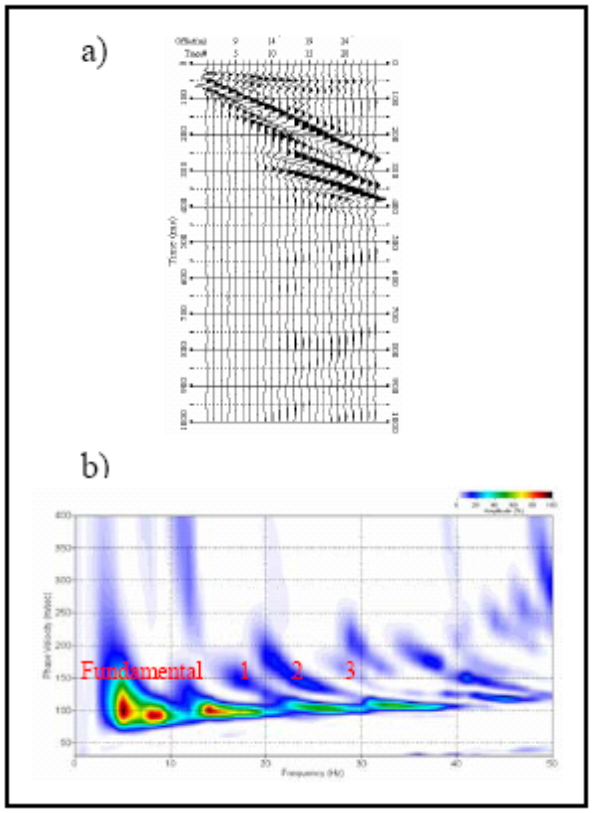

Figure 2: Shot gather (a) and the dispersion curve with different modes (b) of the surface wave data recorded using the optimum field parameters

3. Conclusions

From the results of study, the optimum field parameters of the MASW technique for Bangkok subsoils has be summarized and shown in Table 1. These parameters may be used as a guide -line and adjustment can be made to suit the exploration need. The depth of investigation is in the range of 20-30 m. The low-cut analog filter must not be applied during the acquisition and recording instrument with 24-bit or higher dynamic range should be used. Also, sampling interval of 0.5- 1.0 ms and total recording time of 1000-1500 ms are preferable. This study is conducted based on the availability of the equipment. Therefore some parameters may need to be further evaluated such as source and the receivers.

Table 2: Purposed optimum field parameters of the MASW method for Bangkok area.

Source (sledge-hammer, lbs)	Frequency of geophone (Hz)	Geophone spacing (m)	Minimum offset (m)	Number of geophone (geophones)
14 or heavier	10 or less	1-2	5-10	12 or more

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