EXPERIMENTAL ANALYSIS OF GROUND VIBRATION DUE TO TAPERED PILES DRIVING

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ABSTRACT

Piles are normally driven into the ground using appropriate tools such as free-fall hammers or diesel pile driver and then loaded. Use of this method may create some different problems in environmental cycle such as noise, air pollution and ground vibration. The ground vibration induced by hammer impact is too important to consider during pile driving and it may cause serious effects on adjacent area. In this paper, the drivability of tapered and cylindrical piles and the ground vibrations induced in the adjacent area are investigated using experimental, analysis and field tests. To record induced pile and soil velocity during driving, different instruments were used: (a) the pile driving analyzer (PDA) with two accelerometers and strain transducers, and (b) Seistronix RAS24 seismograph and 4*100 Hz geophone devices. Geophones arrays are the linear radial with distances of 8, 12 and 16 times of pile diameter. The results of wave propagation and the induced velocity in the soil at different distances from the pile-C and pile-T are measured and after analyzing the data recorded by the devices and the processing and filtering of waves, wave-induced velocity will be obtained. It is important to notice that the pile shape and geometry have direct effect on ground vibrations. Also, with comprising soil particle velocity in different time, it is concluded that the vibration amplitude and radius decrease with increasing the distance from the pile. Due to material damping in the soil and pile and radiation damping, the propagated waves are dissipated.

INTRODUCTION

Pile driving is one of the conventional methods for the construction of deep foundations. Pre-cast steel or concrete piles with different geometries are penetrated to the specified depth by appropriate tools such as free-fall hammers or diesel pile driver and then loaded. Use of this method may create some different problems in environmental cycle such as noise, air pollution and ground vibration. The ground vibration induced by hammer impact is too important to consider during pile driving and it may cause serious effects on adjacent area. Despite of difficulty to estimate and mitigate the vibrations, the determination of driving resistance provides important information by pile penetration. It is necessary to model and analyze full-scale pile driving problem with numerical methods to achieve more accurate results. In recent years, the advantages of tapered piles compared to cylindrical ones have been investigated. The axial response of such piles under static loading has been analyzed using 1-D finite element method by Ghazavi et al. (1997). Wei and El Naggar (1998) had done some laboratory tests on different shaped piles. Ghazavi, (2000) have investigated the kinematic response of such piles under earthquake loading. The numerical analysis of pile driving for tapered piles was presented by Ghazavi and Tavasoli (2012). A three-dimensional finite difference analysis for taper angle and geometry effects has been used on pile driving response of tapered