

Effect of Vibration Induced by Dynamic Tests on an Adjacent Building – Finite Element Investigations

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Abstract. Structures often experience vibrations generated by different sources that propagate through the soil mass. These vibrations might adversely affect the occupants immediately and building upon long exposure. These vibrations should be quantified and limited to the permissible values recommended by the relevant standards. Pile driving during the construction process is one such source of vibration. Depending on the driving technique, the vibration is either transient or continuous. This paper presents experimental and numerical studies on vibrations induced in a nearby building from the dynamic load tests (similar to continuous source of vibration) on pile groups. Vibrations generated during the dynamic pile load tests were quantified at the source and different floor levels of an adjacent building in the form of acceleration and velocity-time histories. 2D Finite Element (FE) integrated model of the building with foundation, pile group with pile cap, and supporting soil mass has been developed in commercially available FE package ABAQUS. The integrated 2D FE models have been analyzed for the combined effect of gravity and dynamic loading. The response obtained through the experiment is also compared with 2D FE analyses of the integrated building-pile group-soil system. The estimated vibration responses in terms of peak ground acceleration (PGA) and peak ground velocity (PGV) are compared with the specified maximum permissible limits recommended in the relevant standards and codes of practice.

Keywords: Dynamic pile tests, Vibration measurement, Field experiment, 2D Finite element analyses, Building vibration.

1 Introduction

The rapid increase in urban population and infrastructure development requires an optimized use of available land for construction. With the futuristic plan to convert old cities into smart cities, the construction fraternity has to face many challenges throughout the project. One major challenge is the vibration experienced by the occupants of the existing building in the locality. These vibrations might be due to different sources,