BEHAVIOR OF SOIL NAILED WALLS UNDER CYCLIC DYNAMIC LOADS WITH FINITE ELEMENT METHOD: CASE STUDY

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Soil nailing is a very versatile excavation retaining system suitable for deep excavations in urban areas surrounded by major structures. It is an innovative and cost effective technique in which the native soil is strengthened by placing steel rods into holes drilled in the wall and grouted. A soil-nailed system can override local weaknesses in the ground through stress redistribution and is less vulnerable than unsupported cuts to undetected adverse ground and groundwater conditions.

Many investigators (such as Babu et al., 2006 and Dodagoudar, 2010) have proposed soil nailing technique as a suitable method for stabilising vertical/nearly vertical excavations. Carla and Donatella (2008) presented an overview of experimental studies conducted on soil nail wall models. In order to study the deformation behaviour of soil nail walls, many researchers carried out finite element analysis of soil nail wall. The importance of facing design in the stability of soil nail walls was pointed out in their findings. The behaviour of soil nailed walls under dynamic loads has been studied by very few investigators.

A finite element analysis of the soil nail wall was conducted to study the behaviour of wall displacements using PLAXIS 2D, considering it as a plane strain problem and accounting for the long term behaviour using drained conditions. 15-noded triangular elements were used for generating finite element mesh of coarse density. Numerical simulations of the soil nail wall were performed considering Mohr-Coulomb (MC) model.

In the present study, the behaviour of a deep excavation of a huge structure in the East of Tehran That stabilized by combination methods of nailing and anchoring has been studied. The height of soil nail wall is 16 m.

The geometry of the soil nail wall model is shown in Figure 1.

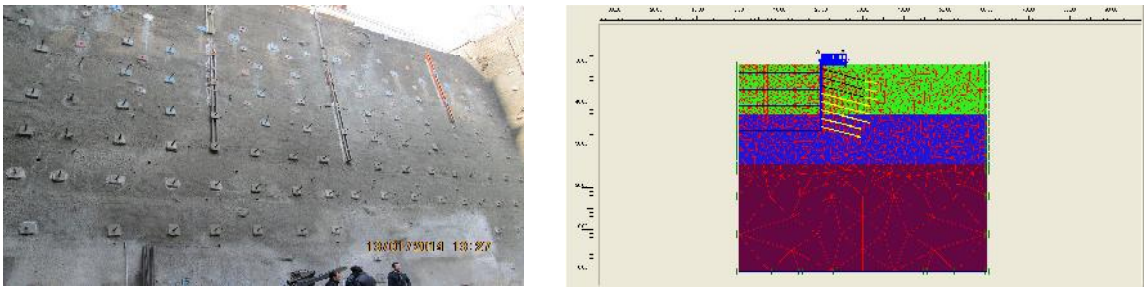
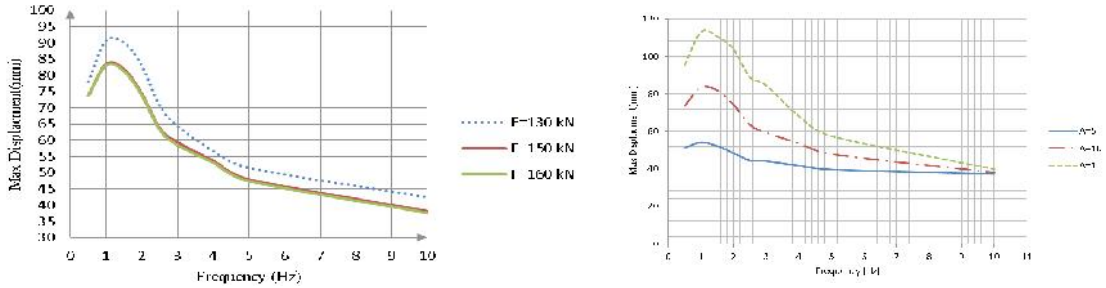


Figure 1. Soil nail wall model

Soil nail wall used on this projects are subjected to different loads during their service life. Typical applied loads are dead loads which include weight of the soil nail wall system, lateral earth pressure and the harmonic dynamic loads due to heavy machinery and industrial plants nearby soil nail wall. The dynamic loads applied with different frequencies and determine the resonant frequency of soil nail wall.

The behavior of soil nail wall is investigated in the following sections with respect to the variations frequency. Effects of the pretention force in anchors on the maximum displacement and Effects of the amplitude on the maximum displacement are evaluated.

Pretention force in anchor for different frequencies are compared in Figure 2.a



(a) (b)

Figure 2. Variation of the maximum displacement of soil nail wall with the frequency
(a) for various pretention forces in anchor (b) for various amplitude

For resonance frequency, it can be observed that the displacements are considerably higher for the smaller pretention force. However for frequencies lower than resonance frequency, the effect of pretention force is not significant.

Amplitude of dynamic load for different frequencies are compared in Figure 2.b. For resonance frequency, it can be observed that the displacements are considerably higher for the smaller amplitude. However for frequencies higher than resonance frequency, the effect of amplitude is not significant

REFERENCES

Blanco-Fernandez E and Castro- Fresno D (2013) Field measurements of anchored flexible systems for slope stabilisation: Evidence of passive behavior, Engineering Geology, 153: 95-104

Babu GLS and Singh VP (2008) Numerical analysis of performance of soil nail walls in seismic conditions, *ISET Journal of Earthquake Technology*, 45: 31-40

Carla Z and Donatella S (2008) Laboratory and field investigation on improved soil nails, World Tunnel Congress, 263-271

Debabrata G and Aniruddha S (2010) Dynamic behavior of small-scale model of nailed steep slopes, Geomechanics and Geoengineering: An International Journal, 5: 99-108

Dodagoudar GR (2010) Soil nailing for hill cut of NH 7 bypass-chainage 163.700 to 164.400 section Kayathar to Tirunelveli, Tamil Nadu, Project report