

REAL TIME OBSERVATIONAL COMPENSATION GROUTING, RIO PIEDRO PROJECT, PUERTO RICO

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ABSTRACT

Ground movements induced by underground excavation are always of critical concern, particularly in urban areas. Compensation grouting now appears as a safe means to control these movements. The paper presents the new concept of a feed-back loop including advanced 3D model for settlements prediction and new softwares to bring at all stages of the project an efficient control of operations. A case history is presented, taken from the construction site of Tren Urbano, Rio Piedras Section, constructed beneath a historic commercial section of San Juan de Puerto Rico.

1. SUBSIDENCE DUE TO TUNNELLING WORKS

Whatever the excavation method used, underground works produce subsidence at the surface. Ground loss at front face is nearly impossible to avoid and creates at the surface a settlement trough which has the general shape of a gaussian bell.

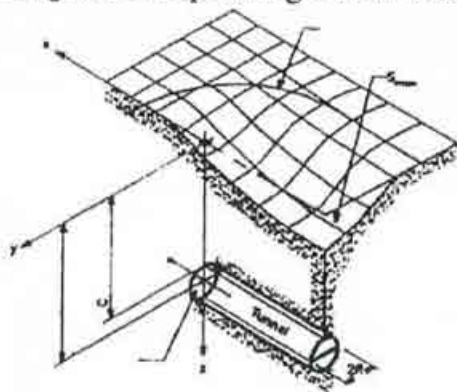


Fig. 1 General scheme of the settlement trough (AFTES document).

Prediction of settlements before the works by finite elements models is very hazardous and would never overcome

unexpected events such as: soil heterogeneity, drainage of underground water, or impact of the construction sequence on soil characteristics.

Subsidence is a dynamic process, a complete evaluation requires high performance systems to model in 3D the interaction of soil, water, construction process; finally it is not practical for a daily follow-up of the construction site.

As a result there is very little means available on site to control subsidence when it starts exceeding tolerances: reduce excavation rates, consolidation grouting, reinforce the lining, etc. In any case, they seriously impinge on production rates and economy of the site.

This situation creates the need for new technologies providing the best possible level of safety on underground construction sites, versatile enough to fit with a large variety of configurations and compatible with high production rates of modern tunnelling sites.