

## **Tunnelling on terrace soil deposits: Characterization and experiences on the Bogota-Villavicencio road**

Julio E. Colmenares<sup>\*1)</sup>, Juan M. Dávila<sup>2)</sup>, Jairo Vega<sup>2)</sup> and Jong-Ho Shin<sup>3)</sup>

<sup>1)</sup> *Department of Civil and Agricultural Engineering, Universidad Nacional de Colombia, Carrera 30 No. 45-03 - Bogotá D.C., Colombia. [jecolmenaresm@unal.edu.co](mailto:jecolmenaresm@unal.edu.co)*

<sup>2)</sup> *EDL SAS, Calle. 26 No. 59 - 41 - Bogotá D.C., Colombia. [info@edlingenieros.com](mailto:info@edlingenieros.com)*

<sup>3)</sup> *Department of Civil Engineering, Konkuk University, 120 Neungdong-ro, Jayang 1(il)-dong, Gwangjin-gu, Seoul, Korea. [jhshin@konkuk.ac.kr](mailto:jhshin@konkuk.ac.kr)*

### **ABSTRACT**

Terrace deposits are often encountered in portal areas and tunnels with low overburden. Those deposits exhibit a great mechanical and spatial heterogeneity and a very high stiffness contrast within the ground. Terrace deposits are challenging to excavate, and difficult to characterize. Lessons learned and experiences and challenges encountered during tunnelling in terrace deposits on the Bogota-Villavicencio road (central-east Colombia) are presented. Designs will be successful when adequate ground investigation and material characterization techniques are used. Adequate ground and material characterization allows the tunnelling engineer to take advantage of an eventual soil strength or deformation parameters increase due to an adequate volumetric block proportion evaluation in order to produce less conservative designs. The ground investigation is mostly carried out before the construction stage (i.e. sampling in portal areas), and when the construction starts it is the time for tunnelling engineers to verify the ground properties, the influencing factors, and the system behaviour with those assessed during the design stage. Numerical simulations (i.e. back analysis) allow for the designs and some details in the construction method to be calibrated. Clearly, the accuracy during the design stage must be as high as possible, always keeping in mind the uncertainties that the tunnelling engineer is dealing with. Lessons learned suggest that based on numerical simulations, laboratory testing and tunnel system behaviour documented, in several tunnels on the Bogota-Villavicencio road, where terrace soil deposits were found, an observational approach allows the engineer to optimize the excavation and support methods for the encountered ground conditions, resulting in a more economic and safe construction.

**Keywords:** alluvial deposits, terrace, complex terrain, ground characterization, ground behaviour.

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<sup>1)</sup> Titular Professor.

<sup>2)</sup> Consultant

<sup>3)</sup> Professor

\* Corresponding author