Eastern Outfall Tunnel for Mexico City: Big Challenge for Engineering and Construction

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1 INTRODUCTION

In the northern zone of the Valley of Mexico at north of Mexico City, where there are volcanic formations as well as clayey and silty lake deposits, with very soft and firm consistencies, a 62 km long drainage conduit, with an internal diameter of 7 m is now under construction, at depths ranging from 28 to 155 m. At present almost 10% of the total length have been excavated and lined with an initial support of precast concrete segment rings.

For the excavation of the long tunnel for drainage called “Tunel Emisor Oriente”, (Eastern Outfall Tunnel), or simply TEO, six tunnel boring machines of the EPB type with diameters of 870 and 890 cm, will be used. With those machines an initial lining of precast concrete segment rings, will be placed, with external diameters of 840 and 860 cm, and thicknesses of 35 and 40 cm, respectively. Afterwards a final lining of cast in place reinforced concrete will be added to leave an internal diameter of 700 cm.

2 GEOLOGICAL AND HYDRO-GEOLOGICAL CONDITIONS

Starting at the south (near Mexico City) and going north, the TEO crosses in its first 2.5 km, soft clayey (Quaternary) lacustrine deposits, from the Valley of Mexico basin, and later on, when crossing the Nochistongo ridge, there are found volcanic materials, of the Huehuetoca formation (Pliocene) followed by lacustrine deposits (Pliocene), of the Taximay formation, disposed as tectonic blocks covered by alluvial fans, and some lava flows, near the Exit Portal (Fig. 1).

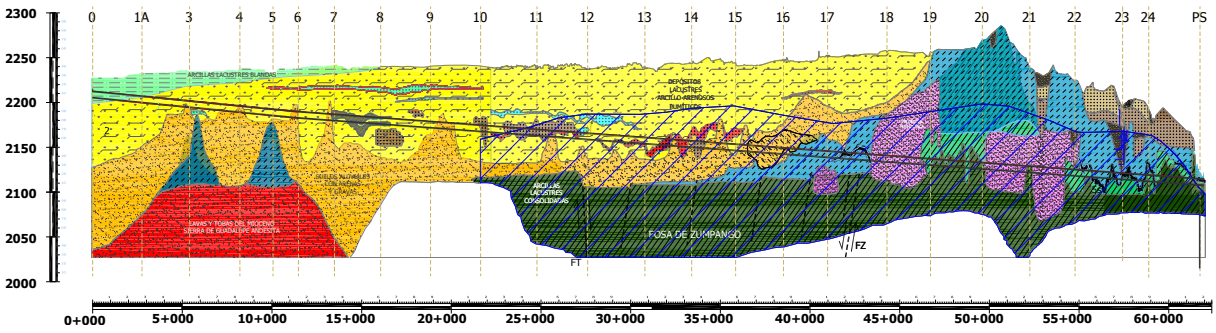

Figure 1 Geology along the TEO line (After Mooser, 2010)

Formation 1. Lacustrine deposits from the upper Quaternary at the Valley of Mexico basin (From km 0+000 to km 21+140); strata: green, yellow and light blue.

Formation 2. Basaltic cinders from the Quaternary at the Valley of Mexico basin and basaltic fractured lava flows from the northern flank of the Nochistongo ridge and from the Tultepec hill, (From km 21+140 to 30+300); strata: brown and red.

Formation 3. Sub-lacustrine soils (From km 30+300 to km 38+000); strata: light Brown.

Formation 4. Alluvial fans from the Plio-Quaternary at the Nochistongo ridge (From km 38+000 to km 40+350); strata: blue.

Formation 5. Volcanic materials, Huehuetoca, from upper Pliocene (From km 40+350 to km 46+000); strata: pink)

Formation 6 (Taximay). From medium Pliocene (From km 46+000 to km 62); upper strata: light green and lower strata: dark green.

One of the main challenges of the TEO is to finish and put in operation next 2012, the first 10 km of the tunneled conduit (Stretch I), which means almost 17% of the total length of the TEO. This tunnelling work is located in one of the most difficult geological environment of the line, due to the presence of highly compressible soft clays, with natural water content around 300% and a very low values of shear strength in the order of 25 kPa. Also there is a general subsidence phenomenon in the area and the tunnel is built near an existing open drainage channel (the Gran Canal).

3 CONCLUSIONS

The construction of the TEO represents a great challenge of engineering and construction, due to the extraordinary complexity and heterogeneity of the materials which must be excavated to built the 62 km long drainage conduit.

Today just 10% of the total length of the TEO has been excavated and lined with concrete segment rings, mainly in the zone with very soft materials at the beginning of stretch I, and also at the end of stretch 6, where relative competent hard clayey silts are present.

In the months to come, there will be harder materials to be excavated including basaltic lava flows in a media with relative high ground water pressures with maximum values around 0.75 MPa.

There will be a very interesting opportunity to observe the behavior of the tunnelling equipment during construction and also the behaviour of the tunnel primary and secondary linings.

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