New Trends in the Tunnels of the Future

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Summary
In the paper, three innovative and very cost-effective concepts for the construction of tunnels using the TBM ("Tunnel Boring Machine") technique are presented: the TISB concept for tunnels in soft soil, in seismic areas, and the TMG and TMF concepts, for railway and roadway tunnels, respectively. The added-value obtained with the use of these concepts in the construction of tunnels in the future is emphasized.

Keywords: Tunnels; TBM; Railways; Roadways; Soft soil; Earthquakes; TISB; TMG; TMF

1. Introduction

Tunnels are becoming increasingly used in the construction of transporting infrastructure, for both railway and roadway network systems.

The TBM ("Tunnel Boring Machine") technique is the most common, nowadays, for tunnel building, allowing for significant savings in costs and time. In underwater tunnels, the TBM technique also allows for the reduction of the environmental impacts, allowing for non disturbance of the sea bed. TBMs are of different types, according to the conditions of the soil to be drilled (EPB, Mix Shield, Double Shield, etc). It is becoming common, nowadays, a TBM to build more than 0.5 km of tunnel per month.

When building tunnels with a TBM, the cutter head of the front shield excavates the soil while the erector mounts precast segments around the tunnel surface, which are clamped together, forming the circular wall of the tunnel (Figures 1, 2). Afterwards, a filling on the bottom of the tunnel is executed, creating a platform for the circulation of the vehicles: trains in the case of railway tunnels, and cars or trucks in the case of roadway tunnels.

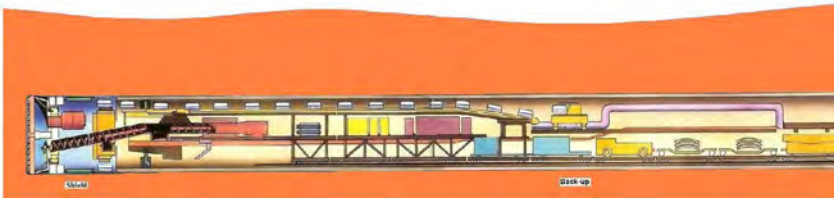

Fig. 1: Schematic view of a TBM

Fig. 2: Front shield of a TBM

The precast segments are made of high strength concrete (C40, or higher), with steel reinforcements or mixed with fibbers, having, in general, 1.20-1.60 m width. Its number will be the adequate to form the complete circles with pieces with a specific weight; commonly medium size tunnels have 6-8 segments per circle. Its thickness will depend on the surrounding acting stresses and on the thrust forces applied by the TBM; it corresponds, in common situations, to about 1/25 to 1/28 of the exterior diameter of the tunnel.

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