

**9. PROJECT REFERENCE**  
**PISTA NUEVA MALAGA**

**9.1 Project Details**

**History & brief description:**

A Joint Venture of Acciona Infraestructuras and Sando Construcciones were awarded the construction of the suburban rail line by AENA. The extension to Malaga airport required an investment of €280 million. The Los Prados-Airport section runs almost entirely below the surface, crossing under the Guadalhorce River and Malaga Airport's new runway. The name of the tunnel is "Túnel Guadalhorce-Aeropuerto". It is an electrified double track tunnel and is part of "La línea C-1 de Cercanías Málaga", between Málaga and Fuengirola.

**Client and Location:**

ADIF (Administrador de Infraestructuras Ferroviarias); Spain

**Type of tunnel:**

Railway

**Ground conditions:**

Alternating gravel, sand and clay layer

**Alignment length:**

2900m; Depth=15-28m

**TBM type:**

Operating thrust=8500-36600kN; Maximum theoretical thrust=83643kN

**9.2 Design Approach Adopted**

**Design method & standard used:**

Spanish code EH-91

**Specified strengths of concrete – compressive and residual tensile:**

50 N/mm<sup>2</sup>, Flexural tensile strength= 5 N/mm<sup>2</sup>, Residual Strength= 2.9 N/mm<sup>2</sup>

**Inner and outer diameter:**

ID 8,43 m, OD 9,07m

**Ring segmentation:**

6 segments + 1 trapezoidal key

**Dimensions of segments :**

Segment Width: 1,5 m, Thickness: 0.320m,

**Type of segment reinforcement :**

Hybrid: macrosynthetic fibre & steel bar

**Quantity of reinforcement per m<sup>3</sup> of concrete :**

5 kg/ m<sup>3</sup> Barchip fibres & 98 kg/ m<sup>3</sup> bars

**9.3 Project Benefits**

Use of macrosynthetic fibres as non-corrosive reinforcement for:

- Crack control
- Reduced concrete cover
- Minimising spalling in handling and installation
- Bursting resistance under jacking loads

**9.4 Picture Reference**



Figure 33 : Portal of the TBM tunnel



Figure 34 : Stacked segments