



NHI GROUP

TRASVASE GUADIARO - MAJACEITE

4.88 m DIAMETER DOUBLE TELESCOPIC
SHIELDED HARD ROCK TBM



Southern Spain has been suffering for many years, from severe droughts meaning, for thousands of residents, water usage restriction as it often happened in the province of Cadiz. Now, the 12.2 km bored tunnel, ordered by the Confederación Hidrografica del Guadalquivir, to divert waters from the Guadiaro river to the Barrida river, confluent of the Majaceite, will mitigate this phenomenon and ease the supply of water to the city of Cadiz.

THE REALIZATION

THE GLOBAL PROJECT:

The trasvase Guadiaro-Majaceite project has consisted in the realization of a water collector for the city of Cadiz. A tunnel of 12.2 km has been driven with a hard rock TBM, through the mountains Sierra Libar and Blanquilla to bring the waters for piping 100 km west to Cadiz. The contractor the UTE JV, comprising Fomento de Construcciones y Contratas (FCC) and Dragados y Construcciones, in collaboration with ITS (International Tunnelling Services), a joint venture constituted by SELI (Italy) and JAEGER (Austria), has chosen a double telescopic shielded hard rock tunnelling machine to perform on the job. This tunnel is, until now, one of the longest tunnel in Spain driven by a TBM.

The total length of the tunnel was bored in less than 15 months, from November 1995 through beginning of February 1997.



Tunnelling works done with the TBM

Main characteristics of the work:

Tunnel:

- Length: 12,195 m
- Excavation diameter: 4.88 m

Lining:

- Hex shaped precast segments
- Width: 1.3 m
- Weight of 1 piece: 3 t
- Outside diameter: 4.70 m
- Internal diameter: 4.20 m

IN COLLABORATION WITH:



THE TUNNELLING MACHINE

The tunnelling machine is a hard rock double telescopic shielded machine designed and manufactured by NFM TECHNOLOGIES in collaboration with BORETEC and MITSUBISHI HEAVY INDUSTRIES.

This machine has been designed with special features to cope with the different

types of geological formations such as soft and swelling clay or hard limestones.

The cutter head was of a flat design, electrically powered with variable speed, able to produce very high torque at low speed in soft clay, and low torque at higher speed in limestones.

MAIN ACHIEVEMENTS (in metres)

Segments installation:		
	average maxi	
Per day	20	60
Per week	122	263
Per month	625	1,027
Best advance rates:		
Best day	78 m	
Best week	342 m	
Best month	1,335 m	

CHARACTERISTICS OF THE MACHINE

TYPE:

- Double telescopic shielded TBM
- Excavation diameter: 4.88 m

CUTTERHEAD:

- Flat design with 17" disk cutters and scrapers

CUTTERHEAD DRIVE:

- Power: 1,500 kW
- Electrical drive-continuous variable speed 0 to 9 rpm
- Working torque: 2,600 kN.m - 0 to 4.5 rpm
- Unseizing torque: 3,900 kN.m

MAIN THRUST:

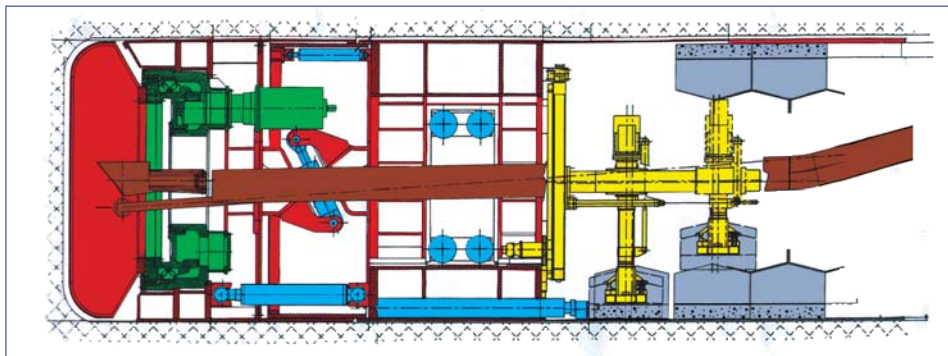
- 15,200 kN

AUXILIARY THRUST:

- 23,300 kN (40,000 kN in exceptional mode)

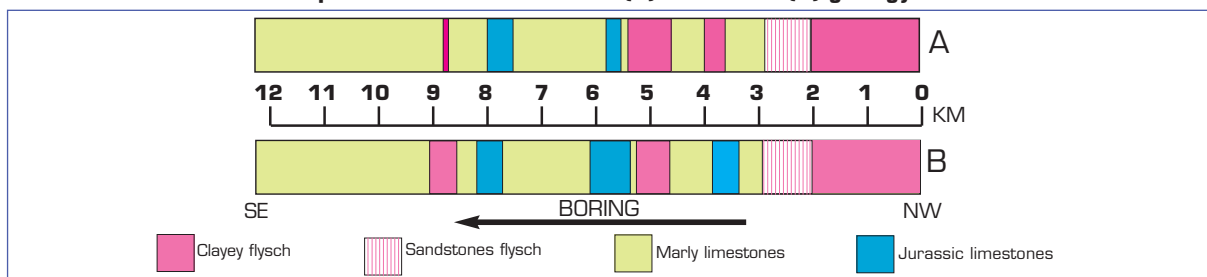
GRIPPERS:

- 2 X 15,000 kN

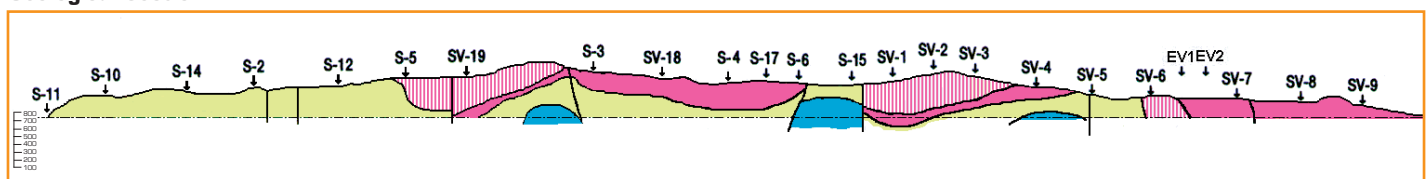


GEOLOGICAL CONDITIONS

Comparison between estimated (A) and actual (B) geology



Geological section



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