



### Construction of 1.1 km of tunnel, an underground station and 2 shafts



Under the framework of the Line B Underground project in Toulouse, Solétanche Bachy was awarded the works relating to Lot 3 as part of a Joint Venture. This involved carrying out works relating to the inter-connection between Lines A and B (Jean Jaurès station), within a very dense urban area

#### Tunnels

Five sections of tunnel were excavated using a CSM Bessac compressed air tunnel boring machine (excavation diameter:

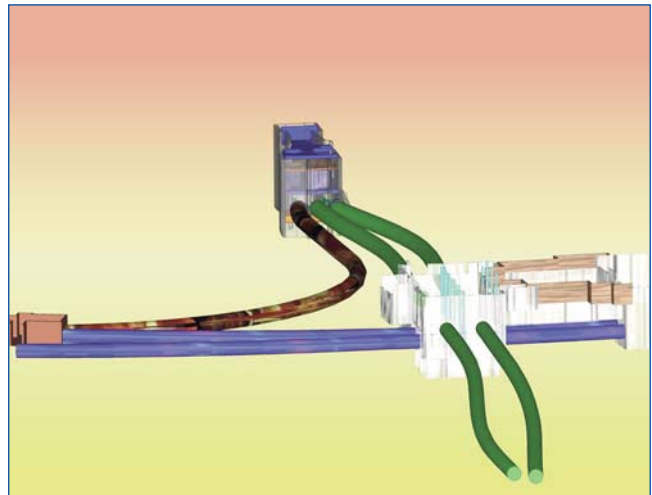
CLIENT:	SMAT - SOCIÉTÉ DU MÉTRO DE L'AGGLOMÉRATION TOULOUSAIN - SMTC
ENGINEER:	SYSTRA - TTE - INGEROP - SETI
CONTRACTORS:	CARI (MAIN CONTACTOR) - CSM BESSAC - SOLÉTANCHE BACHY BEC - URBAINE DE TRAVAUX - MALET
CONTROLERS:	SOCOTEC - VERITAS - AINF
PERIOD OF WORKS	MAY 2001 - JUNE 2005

#### MAINS QUANTITIES:

- Tunnel with an external diameter of 5.30m (cladding using concrete lining segments): 1,068 linear metres
- Diaphragm wall: 4,915m<sup>2</sup>
- Earth moving: 78,000m<sup>3</sup>
- Watertightness works: 8,000m<sup>3</sup>
- Etanchéité : 8,000m<sup>2</sup>
- Pipe roofing: 750m



Grouting operation in the Victor Hugo shaft



3D view of the project (A line, B line and connexion tunnel)

5.30m), comprising a total length of 1,068 m:

- 4 twin-tube tunnels for passing Line B through Jean Jaurès station,
- 1 tunnel for connecting Line B and Line A.

The path of the connection tunnel passed under various buildings and featured a curve with a radius of 95 m. The tunnel boring machine was specially designed to be disassembled and reassembled from the inside, thus removing the need to sink a shaft in a very dense area.

A 30m-long inlet gallery was also excavated, in divided sections, under the protection of pipe roofing. Temporary cladding consisting of metal arches and sprayed concrete was installed prior to application of the final cladding, which

consisted of reinforced concrete placed using formwork.

### Shafts

Two shafts were constructed using diaphragm walls and excavated beneath a slab ("top-down" method):

- the Victor Hugo shaft: 45 x 20m, depth: 23m,
- the Aubuisson shaft: 16.40 x 12.70m, depth: 28m.

The base of the Victor Hugo shaft was enlarged by an underpinning excavation operation (demolition of the diaphragm wall, excavation and underpinning after reinforcing by silicate grouting).

### Station

Jean Jaurès station consists of two adjoining works constructed using

diaphragm walls:

- the Line B station (an enclosed space that is 57m long, 24m wide and 17m deep),
- the Line A/Line B exchange area (an enclosed space that is 32m long, 37m wide and 17m deep).

The covering slab rests on a series of precast columns on barrettes which were then embedded in the final round columns supporting the station's various floors. The works were excavated using a "top-down" method, with monitoring using real-time remote soundings.

The civil engineering works were particularly complex because, as what was involved was an interconnection station, one of the lines remained in operation while the works were in progress.



Excavation of the diaphragm wall using an HC03



Construction of the pipe roofing