

LIRE

PARIS - FRANCE

Monitoring of the movements of the Paris metro tunnels during construction with the Tunnel Boring Machine

A new water main tunnel was constructed between 2 reservoirs (Menil-montant & Porte des Lilas) in Paris for the LIRE project. The tunnel was excavated with a tunnel-boring machine.

The tunnel alignment passed directly beneath four key facilities of the urban metro operator RATP :

- Two tunnels in service.
- A station with two platforms.
- A tunnel crossover.

The minimum distance between the new tunnel and the existing RATP facilities was only 3 m. Such close proximity involved a considerable risk to the traffic and maintenance of RATP train services.

The solution was to use real-time monitoring in the live tunnels. Two types of instrumentation were installed to control the works :

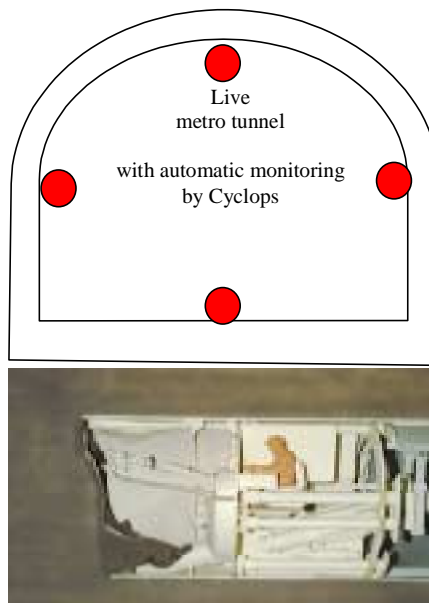
Tunnels : 2 Cyclops (1 per tunnel). Each Cyclops fixed to the wall of the existing tunnel gave real time monitoring of the displacement in X, Y & Z for five rings of prisms. Speed & ease of installation allowed 2 Cyclops to cover 3 tunnels.

Station : 2 Electrolevel Chains. These were installed to monitor the platforms, as lines of sight were frequently blocked by trains stopping to embark and disembark passengers.

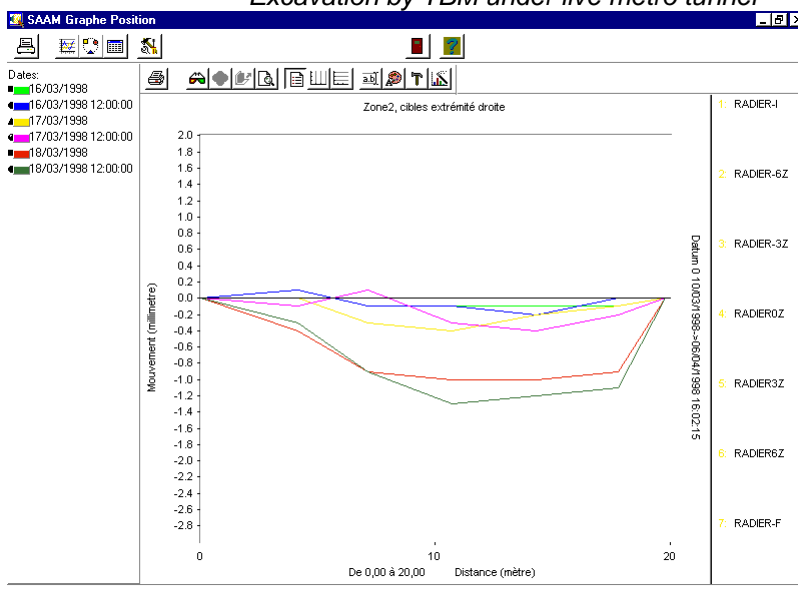
The data from all the instruments was presented in real time on the screen in the station control room, over 500 m from the tunnels.

The maximum deformation of the existing tunnels was limited to 2.7 mm.

The precision of the measurements taken by the CYCLOPS optical system reached +/- 0.1 mm.



Excavation by TBM under live metro tunnel



OWNER : RATP (PARIS METRO OPERATOR)

DATE OF WORKS : 1998

WORKS DONE :

- Real-time monitoring of 3 operating tunnels with Cyclops, with 0,1 mm of accuracy.
- Real-time monitoring of one operating station with electrolevels.
- Early warning system in case of movements.