

Diaphragm wall

Plastic concrete wall - Grouting - Jet grouting

EL AZHAR ROAD TUNNELS

CAIRO - EGYPT



Construction of two 2.7km tunnels under old Fatimid city and Khan El Khalily working class district

This was a quite exceptional job on several counts:
- The preliminary feasibility study for this ambitious, complex project in the very heart of Cairo began in March 1998 with construction of the diaphragm walls scheduled to commence in August... of the same year!

- The whole job lies in an urban fabric which is severely congested both at street level (Khan El Khalily bazaar and old buildings in narrow crowded streets) and under ground (buried services, often inadequately mapped, even though passing near the tunnel and affecting the final route, horizontally and in depth).

- Despite this unsuitable site for a major construction project requiring heavy constructional plant, it was vital to meet the tight, 16 month, completion deadline, which included the time needed for the site survey and project planning studies.

The works included 1km of cut-and-cover tunnel with diaphragm walls 0.6m to 1.2m thick, TBM starting and arrival shafts, also with 1.2m



El Hussein ventilation station

ENGINEER:	NATIONAL AUTHORITY FOR TUNNELS
CONSORTIUM LEAD FIRM:	CAMPENON BERNARD SGE AND ARAB CONTRACTORS
SPECIAL WORKS:	SOLETANCHE BACHY
CONSTRUCTION PERIOD:	JUNE 1998 TO JANUARY 2000

MAIN WORKS QUANTITIES:

- Diaphragm walls : 150,000 m²
- Grout hole footage : 122,000m
- Grout : 20,000 m³
- Jet grouting : 28,000 m³



Diaphragm wall being built at El Hussein station

diaphragm walls (one of which had to be sunk under a fly-over carrying traffic), and two ventilation shafts 30m and 37m deep (one of which needed a 1.5m wide Hydrofraise trench right against dilapidated buildings in a state of imminent collapse).

The special works needed for the starting and arrival shafts deep below the water table called for a variety of techniques combining bentonite cement and silica gel grouting, jet grouting and plastic concrete pavings.

Soil treatment was continued downwards below the bottom of the

ventilation shaft diaphragm walls by jet and standard grouting or with a special tool capable of reaching the required depth directly, where there were sufficiently impermeous geological horizons to enable the shafts to be dewatered under a groundwater head of 35m. The cut-and-cover trenches had watertight grouted bottoms.

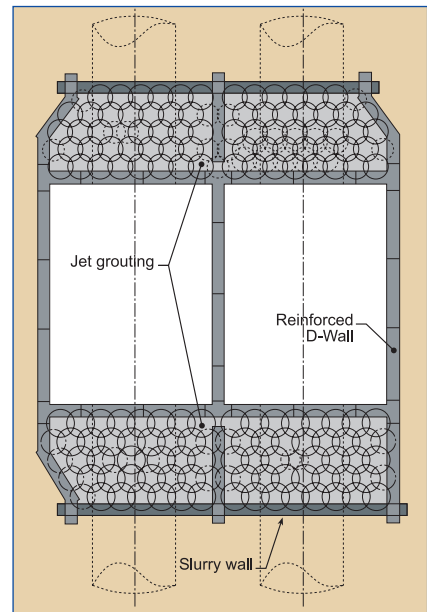


Diaphragm wall for Attaba TBM arrival shaft being built under fly-over

A noteworthy feature was the jet-grouted arch where No. 2 underground railway line, built a few years earlier by the same consortium, passed over the road tunnel. The fly-over foundations and sewers near the diaphragm walls and tunnels were protected by appropriate grouting methods combining jet grouting or Microsol grouting, to suit project requirements and local geology.

The Port Said ventilation shaft chalked up two world records, for:

- Deepest (87m) retaining wall in an urban setting, 1.5m thick, built in separate panels.
- Greatest density of ground-level plant, i.e. one KS 3000, one Hydrofraise 4000 with 40m capability, one Hydrofraise 8000 with 90m capability, two general purpose cranes,



Jet grouted break in and break out at El Hussein station

two 450 m³ desanding units, and one Puntel drilling rig, all working in perfect harmony on an area of only 2000 m² closely surrounded by residential buildings, a mosque and working fly-over.



Diaphragm wall under construction at Port Said station - As-built typical section

