

Railway work

Piles

GAUTRAIN PROJECT

GAUTENG PROVINCE - SOUTH AFRICA



Large diameter piles in dolomite for the foundations of a railway viaduct



Constructing piles on pier no 12b

Gautrain is a high-speed train project (80 kilometres - including 15 underground) between Johannesburg and Pretoria, built by the Bombela Civil Works Joint Venture. Dura Solétanche Bachy has been awarded the foundations subcontract for 13 piers of a viaduct located in the north of Centurion. The contract involves 76 large diameter piles anchored in dolomitic rock.

THE CLIENT:	GAUTENG PROVINCIAL GOVERNMENT
LEAD CONTRACTOR:	BOMBELA CIVILS JOINT VENTURE (BOUYGUES TP, BOMBARDIER, MURRAY & ROBERTS JV)
SUBCONTRACTOR:	DURA SOLETANCHE BACHY
WORKS DURATION:	FEBRUARY 2008 TO JUNE 2009

MAIN QUANTITIES:

- 76 x 900 to 1,300mm diameter piles
- 991 linear metres drilled in unconsolidated ground
- 681m drilled in rock formations (boulders and various obstructions, pinnacle slopes, bedrock)
- 2,287m³ of concrete poured
- 420 tonnes of steel installed



Hard rock coring tool with rotary cutters



BG 36 drilling rig

Geology

Ground conditions in the dolomitic area located to the north of Centurion are extremely heterogeneous and, in places, the dolomite may have a resistance of 600 MPa. The dolomite substrate has a pinnacle morphology: pinnacles are very irregular columns that can be more than 50m in height. This substrate is covered with heavily weathered ground comprising boulders and voids. The risk of void formation is very serious and capable of generating major subsidence.

Preliminary boreholes

A preliminary site investigation was carried out between October 2006 and May 2007. Up to 5 drilling rigs were mobilized to carry out approximately 450 boreholes (up to 5 boreholes for the same pile). The aim of these preliminary surveys consisted in optimizing the type of foundation required for each pier and, for those built on piles, the position and length of these piles.

Piles anchored in the rock

The foundation slab that bears each pier is founded on 1,300mm diameter piles drilled and anchored into sound rock.

Pile depth ranges from 20 to 50m with various anchoring lengths for the same pillar. All piles are equipped with sonic and coring tubes which are used to check pile quality and, subsequently, to ensure good contact is made between the concreted base of the pile and sound rock.

Drilling

The equipment used includes a BG 36 drilling rig capable of applying a 40 tonnes force and reaching a rotary torque of 36 tonnes-meters. The pile drilling rig is equipped with several types of drilling tools used according to the conditions encountered (progressive rock auger, classic corers, various buckets). In the case of rock that has a hardness of up to 600 MPa, a coring tool is used. This is a tungsten tipped coring tool with rotary cone cutters and bearings that travels over the rock surface and cuts by crushing and grinding on the pile perimeter.

The pile is bored inside a casing oscillated into position (1.5m in diameter). Once the casing is in place and drilling is completed, the reinforcement cage is lowered into position and the pile cast in concrete.



Lowering the reinforcement cage equipped with sonic tubes