

# In situ investigations on soil anchors

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## In Situ Investigations on Soil Anchors

Examen in situ de bêches d'ancrage

In Situ Untersuchung von Grundankern

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On the occasion of an important tunnelling project in Belgium (Liefkenshoektunnel, Antwerpen), a building excavation has been carried out with an anchored steel sheet piling. The wall anchorage is realized by means of steel soil anchors with tendons. In order to do some tests in situ, three of the steel soil anchors are replaced by GRP soil anchors. The construction is of a temporary nature (about 18 months).

The lab tests turned out to be very promising. The in situ investigations will be continued until the end of 1990. However, the first results prove to be very promising.

### 2. PROPERTIES OF THE ANCHORS

The soil anchors consist of 15 mm or 10 mm GRP rods made of glass fibre reinforced vinylester.

#### 2.1. Test anchors in lab

Pull tests were carried out on two different types of anchors, i.e. :

- 1 anchor consisting of 19 x 10 mm rods;
- 1 anchor consisting of 12 x 15 mm rods.

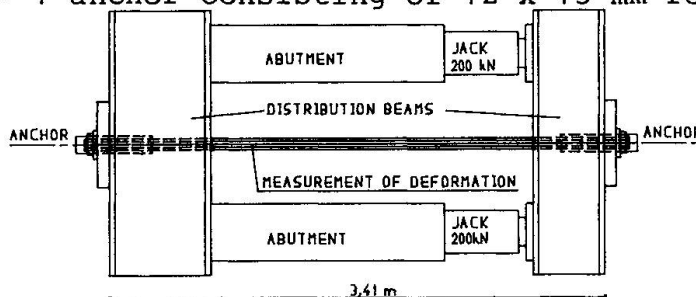


fig. 1: test alignment scheme

The rods were anchored in a purpose-made anchor head. This required a special mixture of resin and fillers. The test anchors were about 3.50 m long. In the middle of the free rod length some strain gages were applied (see fig. 1).



The tensile force was gradually increased; at a loading rate of approximately 50 kN per minute. Each loading step was followed by a pause of about three minutes. When a total load of 600 kN had been achieved, a 15 minutes' pause was introduced.

The first test has been carried out on the 12-rods system, the second test on the 19-rods system. The load-deformation diagrams are shown in fig. 2 and fig. 3.

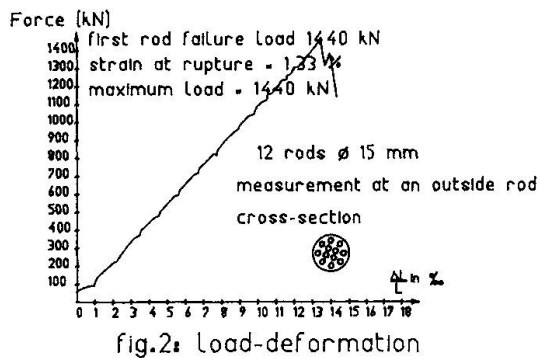


fig.2: Load-deformation

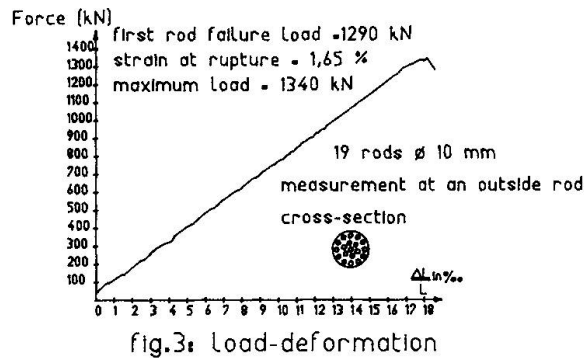


fig.3: Load-deformation

## 2.2. Test anchors in situ

The fabricated anchors are of the same type as those described in

- 2.1 :
- 1 anchor of 19 10-mm rods;
  - 1 anchor of 12 15-mm rods;
  - 1 anchor of 3 15-mm rods + 16 10-mm rods.

The anchors are to withstand a useful tensile force of 570 kN (see fig. 4). Soil anchorage is realized by means of VHP (very high pressure) grouting (see fig. 4).

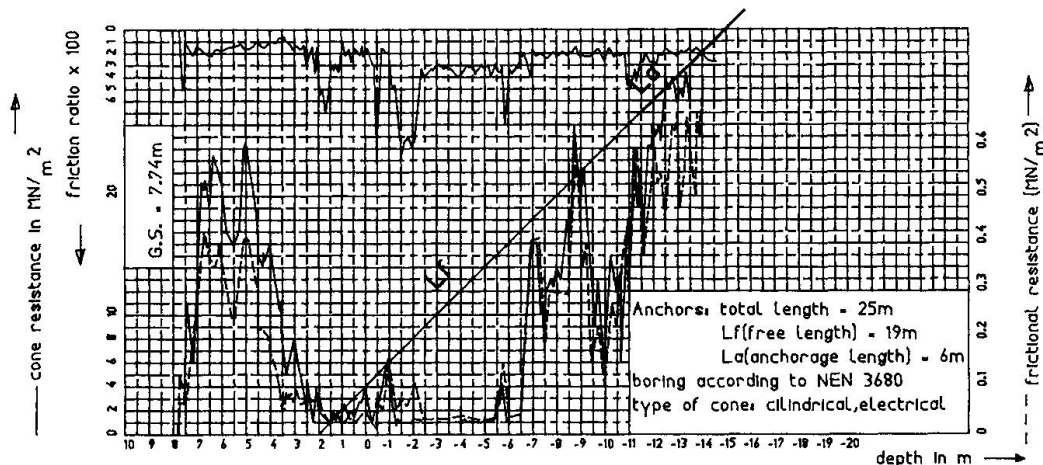


fig.4: cone penetration test with measurement of the local side friction

The anchors have been placed in the beginning of May 1989 and tightened at the end of the month. They have been tightened up to 1.5 times the service load and fixed at 1 time the service load. Early January 1990, one anchor has been checked and a remaining tensile force of 600 kN has been measured ! When increasing the force to 1,130 kN, the anchor did not fail (the theoretical maximum value is 1,200 kN). So, this first result means there has been no degradation in strength of the anchors. Further results will be available by mid 1990.