



CPT Rail Rig - VAB Certified

INTRODUCTION

The majority of ground investigations for railway projects have to be carried out during track possessions at night or over the weekend. The duration of these possessions is often limited, which dictates that the maximum amount of information needs to be obtained within a fixed period of time.

Fugro Limited offer a range of geotechnical and geophysical investigation services which due to their rapid speed of operation are ideally suited to the railway environment. Very often these geotechnical and geophysical techniques are complementary to each other and are combined into a comprehensive ground investigation.

GEOTECHNICAL INVESTIGATIONS

Fugro Limited have for many years offered specialist geotechnical tools for ground investigation mainly using insitu testing techniques and, more recently, high quality rapid sampling systems. The techniques of most value on railway projects are :

- Soil characterisation using Static Cone Penetration Testing (CPT) (including piezocone and seismic cone)
- Installation of push-in gas and water monitoring wells
- Mostap sampling (using CPT equipment)
- Insitu penetration vane testing
- Geoprobe soil, water and gas sampler.

STATIC CONE PENETRATION TESTING (SCPT)

Most of Fugro's geotechnical investigation techniques have been developed around static cone penetration testing. The basic principle involves pushing an electrically instrumented probe (the cone penetrometer) hydraulically into the ground at a standard and constant rate of penetration.

Technical details of the friction cone are presented overleaf.

In addition to the cone and friction readings, pore water pressure measurements can be made with the piezocone and shear velocity (and hence shear modulus) with the seismic cone.

The electric cone is a very accurate and rapid soil stratification tool. Given unrestricted access, up to 150m of testing can be carried out per day on site.

For railway applications, lower production rates are generally achieved due to the restricted working time available, particularly when working under track possessions. However, the technique still far outperforms conventional percussive boring and window sampling techniques, enabling possession utilisation to be maximised.

All Fugro's site personnel are fully PTS trained with experience of working in the railway environment.

The Fugro Group is an international organisation with around seven thousand staff in over fifty countries. Our major disciplines are Geotechnics, Environmental Services and Survey.

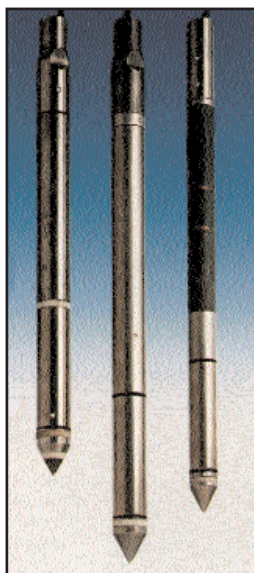
CPT TECHNICAL DATA

Dimensions of Detached Unit

Length	3.7m
Width	1.8m
Height	2.6m when travelling 3.95m when operating

Thrust Capacity

2 tonnes (own weight)
18 tonnes (when mounted on railway wagon)



Rate of Penetration

Average 2cm per second
Range: 1.8-2.2cm per second

Maximum Penetration

Depends on soil conditions, but 30m of rods normally available.

Performance Rates

Typically 1 test per hour, depending on travelling time between tests.

GEOPHYSICAL TECHNIQUES

Various geophysical techniques can be deployed for ground investigation purposes both along existing tracks and for proposed new routes. The most commonly used techniques are:

- Ground Penetrating Radar
- Micro-gravity
- Seismic refraction
- Resistivity imaging

TYPICAL APPLICATIONS

The techniques described here are particularly applicable to a variety of rail projects such as :

- Overhead gantry
- Foundation design
- Embankment and cutting stability
- Bridges
- Tunnels
- Building foundation design
- Track ballast assessment-thickness and condition
- Ground contamination assessment

CASE HISTORY



As part of a re-signalling scheme in the south east of England, signal posts and gantries had to be founded on piles due to the variable nature of the sub-soils. The length of the piles to be installed was governed by the thickness of soft alluvial clays overlying chalk within which the piles would gain their design capacity.

Cone tests were performed from a rail mounted CPT unit to provide data on the soil conditions adjacent to the signal location. The bogie wagon carrying the CPT unit was ballasted to provide 18 tonne of reaction, ensuring that tests would achieve a maximum required penetration of up to 20m.

On-site interpretation of the cone data was used to identify the length of the piles required at each location. The piling contractor was thus able to pre-cut the piles prior to mobilising the piling train to site. This resulted in a significant time and cost saving due to more efficient use of available track closures.

Fugro Engineering Services Limited

Fugro House
Hithercroft Road
Wallingford
Oxfordshire OX10 9RB
Tel: +44 870 4021 400
Fax: +44 870 4021 499
Email: wallingford@fes.co.uk

Armstrong House, Unit 43
Number One Industrial Estate
Medomsley Road, Consett
Co. Durham DH8 6TW
Tel: +44 1207 581120
Fax: +44 1207 581609
Email: consett@fes.co.uk