

## Use of Mag-03 in Cone Penetration Tests

### Objectives

To locate magnetic anomalies in the ground that are associated with the presence of buried features such as UXO (unexploded ordnance) cables or pipes, without the need for drilling.

### Instrumentation

- Mag-03 precision three-axis fluxgate magnetic field sensor
- Data logging unit

### Applications

- Cone Penetration Test (CPT)
- UXO clearance

### Background

CPT is a method of soil investigation used in Civil Engineering. A thin cylindrical tool is pushed hydraulically into the ground, removing the need for boreholes to be drilled. Boreholes may still be used if the ground contains rocky layers and is too hard to push through.

CPT allows soil parameters to be determined, to help plan a building's foundations. Magnetometers can also be integrated into CPT tools to detect magnetic anomalies

associated with buried objects. This may be either in conjunction with a surface survey or where a surface survey may not be possible.

### Method

A Mag-03 sensor is integrated into a CPT tool, which is made of non-magnetic material. As the tool is pushed further and further into the soil, the signal from the Mag-03 is sent back to the logging unit at the surface. Any buried ferromagnetic object will cause a change in magnetic field intensity as the tool passes nearby. The magnitude of the magnetic field variation detected will be affected by distance and orientation, as well as the nature of the soil.

This method enables the direct detection of an object at a given point, without the need to drill first and then lower the Mag-03. (A Mag-03 cannot be integrated into a drillhead as the vibration and the spinning of the metallic drill head will disrupt the sensor's readings. Therefore, because the sensor can usually detect objects through 1m of soil, drilling is done in 1m increments, with the drill withdrawn and the Mag-03 lowered down each time.) The CPT method enables an efficient assessment of threats and obstacles so that ground can be cleared and made ready for the laying of foundations of future buildings in a timely manner.

