

A CEN Workshop Agreement on soil characterisation for metal detector and ground penetrating radar performance

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Test and evaluation

- **Guidelines exist (CWA 14747) to test and evaluate metal detectors for humanitarian demining and include (but are not limited to):**
 - **Immunity to environment**
 - **Detection capability for targets buried in soil**
 - Minimum detectable target as a function of depth
 - Maximum detection depth for specific targets
 - Fixed-depth detection
 - Detection reliability test (blind test, number of detected and missed targets)
 - **Operational performance**
 - Target location accuracy
 - Resolution of adjacent targets
 - **Ergonomics**



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Objective

Criticisms of current guidelines

1. Soil effect on metal detector performance is not sufficiently characterised
2. Guidelines for GPR missing
3. (Too many tests)

Objective

Complement CWA 14747 with a second part that would include the characterisation of the effects of soils on metal detectors and GPR



What has changed in CWA 14747

Before

CWA 14747
Humanitarian Mine Action
Test and Evaluation –
Metal detectors



Now

CWA 14747
(Humanitarian?) Mine Action
Test and Evaluation

part 1
Metal detectors

part 2
Soil characterisation for MD
and GPR performance



Content of the document

- **For field operators (demining companies, field managers)**
 - Assessing effects of soils on metal detectors
 - Assessing effects of soils on dual sensors
 - Clues to recognise ‘difficult’ soils for metal detectors
 - Clues to recognise ‘difficult’ soils for dual sensors
- **For people testing equipment (scientists)**
 - List of soil properties expected to affect performance (but no simple link between properties and effects)
 - Guidelines to determine and report them
- **Background information**
 - How soils influence performance of metal detectors
 - How soils influence performance of GPR



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For field operators (demining companies, field managers)

For metal detectors

- **Determining if test targets buried at certain depths can be detected**
- **Ground reference height**
 - Soil-detector distance when the detector starts giving an alarm when brought to the soil
- **Clues to recognise potentially ‘difficult’ soils**
 - GRH,
 - Reddish colour,
 - Use of magnet,
 - Saline soils

For dual sensors

- **Determining if test targets buried at certain depths can be detected**
- **Clues to recognise potentially ‘difficult’ soils**
 - Same as for metal detectors
 - Surface roughness,
 - Wet soils (?) and small-scale spatial variations in soil water content,
 - Soil inhomogeneity, roots, stones, voids, etc.



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For people testing equipment (scientists)

| Soil properties to report | Metal detector | GPR |
|-----------------------------------|----------------|-----|
| Susceptibility at two frequencies | X | |
| Ground reference height | X | |
| Conductivity | X | X |
| Permittivity | | X |
| Attenuation coefficient | | X |
| Soil impedance | | X |
| Wavelength in soil | | X |
| Surface roughness | X | X |
| Soil water content | | X |
| Texture | | X |
| Vegetation | | X |
| Roots | | X |
| Rocks | | X |
| Cracks | | X |

Rough soil classifications

| Soil effect | Ground reference height (cm) |
|-------------|------------------------------|
| Neutral | Below 1 |
| Moderate | 1 to 10 |
| Severe | 10 to 20 |
| Very Severe | Above 20 |

| Most metal detectors | |
|----------------------|--|
| Soil effect | Susceptibility frequency variation (10^{-5} SI) |
| Neutral | Below 5 |
| Moderate | 5 to 15 |
| Severe | 15 to 25 |
| Very Severe | Above 25 |

| Continuous wave metal detectors using one frequency | |
|---|--------------------------------|
| Soil effect | Susceptibility (10^{-5} SI) |
| Neutral | Below 50 |
| Moderate | 50 to 500 |
| Severe | 500 to 2 000 |
| Very Severe | Above 2 000 |

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Limitations

CWA 14747-2 does **not** provide:

- A pass/fail test for a detector on a given soil
 - Although fixed-depth detection tests could be seen as a 'fail test'
- Methods to predict GPR performance based on soil properties
 - No consensus among GPR specialists as to which properties create the dominant effect (soil electromagnetic properties or soil surface and spatial variations of properties?)

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Timeline

- **Mid-June to Mid August 2008**
 - two-month public enquiry
- **Last week**
 - resolution of comments
- **This week**
 - final draft sent to AFNOR
- **Mid-September**
 - final draft sent to CEN (and the European Commission)

