



REFERENCE DOCUMENT 13

PERFORMANCE TESTING

Performance testing

This Reference Document looks at the testing, evaluation and accreditation of equipment and methodologies used in road clearance. In observing a number of mine clearance operators in programmes, both when coordinated by the UN or under management of national authorities, it became clear that the various tools applied in the search for mines and ERW were rarely performance tested against realistic targets in real conditions or in soil similar to the working environment. Based on these findings, there is a need to institutionalise tests that can prove the performance of methodologies and technologies of demining machines and detector systems against realistic targets in relevant soil conditions.

Mine clearance machines

IMAS 09.50: Mechanical Demining outlines the definition of machine types, responsibilities and general requirements for mechanical operations. One essential requirement is the testing, evaluation and accreditation process that each machine needs to go through to demonstrate the clearance capabilities and safe operation of the system.

Extract from IMAS 09.50: Mechanical Demining

Each machine shall be Tested and Evaluated (T&E) to determine its suitability for the task(s) it is expected to carry out in the conditions in which it will work.

The operation of each machine shall be assessed and confirmed as safe for the operator and any other person on the worksite. The protection level for machines shall be established through a risk assessment; and Standing Operating Procedures (SOPs) shall be developed for each machine. These SOPs should include general mechanical operating procedures, procedures specific to the machine and, where necessary, procedures for the integration of the machine with other machines or demining operations.

Three major requirements are:

- Operational accreditation of a machine in accordance with the requirements of IMAS 07.30 should also be based in part on fulfilling the requirements of this clause of this standard.
- Machines should not be used with tools, or on tasks, or in conditions for which they do not have operational accreditation.
- Prior to the deployment of any machine to a programme an assessment should be made of the in-country infrastructure and support systems to ensure that a machine can be operationally maintained in the areas where it will be used.

The European Committee for Standardisation (CEN) has, together with the mine action community, developed a CEN Workshop Agreement (CWA) for the T&E of demining machines (CWA 15044:2004). This CWA provides standardised methodology for T&E of demining machines. It gives technical criteria for the following:

- a) performance test: a test to establish whether the machine and its tool(s) is capable of performing the role for which it is intended under comparable and repeatable conditions, and to evaluate the manufacturer's specifications;

- b) survivability test: a test to verify that the machine survives the explosive forces used as design criteria; and
- c) acceptance test: a test to ensure that a machine is able to work in the environment where it is intended to be used.

The CWA also establishes the requirements for the test targets to be used in the performance and acceptance tests. Further information can be found at www.mineactionstandards.org or www.itep.ws.

Demining machines deployed in a mine action programme should adhere to the minimum testing requirements described in these two standards (IMAS 09.50 and CWA 15044:2004). Most demining machines have, however, already undertaken a full test by the International Test and Evaluation Program for Humanitarian Demining (ITEP) in accordance to CWA 15044:2004 and require only an acceptance test of the machine and operator by the national authorities in the country of operation.

Such an acceptance test can be easily performed under field conditions, requires limited recourses and comes at a minimum cost to the programme. The most common way to ensure the performance of a demining machine is to conduct a time and motion study (including a performance test) examining the ground penetration by carefully sweeping aside the loose soil using normal brooms/brushes being careful not to dig out additional, undisturbed soil. Then one can examine the effects or measure and decide if the performance is acceptable or not. This method works well on hard ground. In softer ground, one can use wooden fibre boards dug into the test area as witness panels.

If fibreboards are used, it is critical that they are installed using the pizza-slicer technique shown below. If the fibreboard trenches are even the width of hand-shovels, the validity of the fibreboard data is questionable. Where it is possible to simply sweep aside processed soil and measure directly, this is preferable and, in fact, quicker and easier!



Pizza slicer (cutter). © CCMAT



Fixture and fitting of the fibreboard into the ground. © CCMAT



Result after the processing by a demining machine. © CCMAT

CWA 15044:2004 also describes the use of test targets in various ground conditions. It is worth mentioning that burying simulated mine test targets in hard ground might create a situation where the soil used to cover the holes made for the test targets is softer than the test ground and thereby creates a false performance indicator of the ability of the machine to clear mines in hard ground. The hard-soil/soft-hole problem exists even when the surrounding soil is not rock hard – and should be considered when setting up a test site. Weathering the test site by spraying it with water and letting it sit for a few days might help overcome this problem.

Detector Systems

As with demining machines, it is critical that the various metal detectors, ground-penetrating radar (GPR), dual sensors and other sensor systems applied in road clearance have been tested against the targets one can expect to find on the sectors of road subject to clearance. Performance testing of detector systems has taught us valuable lessons about the impact soil characteristics have on detectors. Without being specific in regard to the various soil types and their impact on detector systems, it is nonetheless essential that the mine being searched for must be buried or tested in the most difficult (i.e. least cooperative) soil conditions likely to be confronted during clearance operations.

Below one can see two examples of performance testing methodologies of a UPEX 740M “large loop” metal detector. The first picture shows how one can build a semi permanent ramp for testing a number of detectors on a variation of targets, whereas the second shows how a confidence test of the detector system is carried out while clearing a road.



A semi-permanent ramp for testing a number of detectors on a variation of targets.



An example of performance testing methodologies of a UPEX 740M.

Accreditation and testing procedures

Conditions between countries, mined areas and roads differ, therefore it is important that options are researched. If demining machines or metal detectors are in current use or have been used before in the proposed area or country of operations it would be sensible to critically evaluate their past effectiveness. Countries apply different rules and regulations for road clearance. If the requirements exist, find out what they are, and find out what testing will be required before deploying a machine to a country.

Test reports on various machines and detectors also exist and can be found on the ITEP website. The test reports provide assessments of the performance under specific conditions. If the conditions in the area of operations are not similar to the test conditions, a performance test will be required. The machine has to show its performance under these specific conditions. The expected performance must be in line with the achieved results. Testing on the site in the area of operations is also a part of the quality assurance procedures.