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## Manual Mine Clearance

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## Introduction

The aim of humanitarian mine clearance is to locate, identify and remove all mines from a specified area to a specified depth. This aim is achieved by employing various techniques and various means to clear the mines from the hazardous areas. The most effective method however is through manual mine clearance techniques but it is also a very slow process.

The techniques of manual mine clearance currently employed in Sri Lanka are by utilising a metal detector, by full area excavation using hand tools and by implementing the rake excavation detection system (REDS).

# Manual Mine Clearance

## 1 Scope

Manual mine clearance is conducted by all the clearance agencies working in Sri Lanka. Although different techniques are used the procedures used by the agencies shall be fully explained in step-by-step detail in the SOP of the agencies. The following are established manual mine clearance procedures and standards and shall be recognised as the minimum standards required in Sri Lanka.

All manual mine clearance operations are to be conducted using drills and procedures that ensure the safety of demining personnel and that maintain an acceptable productivity rate.

## 2 General requirements

### 2.1 Clearance Depth

The minimum depth when conducting mine clearance shall be 15 cm except when a deeper depth is specified in the Task Dossier. The depth is measured from the surface of the ground to the top of the landmine.

### 2.2 Clearance Lane

A manual deminer shall clear a one meter wide lane using one of the following recognised manual clearance techniques. A one meter clearance lane shall not exceed 25 meters where after it shall be widened to 2 meters.

- a. Metal detection technique.
- b. Full area excavation technique.
- c. Rake Excavation Detection System (REDS) technique.

### 2.3 Site Layout

The lay of the ground and geographic features will often determine the layout of a mine clearance task site, but in all cases the conduct of the operation will be dictated by principles of mine clearance operations. The zones, datum point, lanes and demarcation points will be enforced within every task site.

The mine clearance worksite shall be designed to:

- a. provide a clearly visible separation of hazardous areas including fragmentation zones, cleared areas, useable areas and unknown areas of and around the worksite (see Annex A);
- b. control the movement of deminers and visitors (including members of the public) at the worksite;
- c. limit the number of deminers and visitors allowed into the blast and fragmentation hazard zones;
- d. during the controlled destruction of mines and UXO, take all reasonable precautions to exclude deminers, visitors and members of the local population from the blast and fragmentation hazard zones, or provide suitable protection inside buildings, bunkers or mobile structures; and
- e. include measures to prevent structural and environmental damage.

## 2.4 Marking of Hazardous Areas

Safe and hazardous areas within the worksite shall be separated by providing clear and consistent marking. (See Annex A and B)

## 2.5 Control of entry into blast hazard or fragmentation hazard zones

The clearance agency shall develop and implement procedures for controlling the entry of unauthorised persons into mined areas, onto the mine clearance worksite and into blast and fragmentation hazard zones. This should be achieved by:

- a) informing the local population, deminers and worksite visitors of the extent of the worksite, and the blast and fragmentation hazard zones; and
- b) physically controlling entry into the hazard zones during the mine or UXO hazard destruction processes by warning signs and positioning sentries. Warning systems should include the following.
  - Warning signs on approach routes (roads, tracks or paths) informing people that they are entering a fragmentation zone. Signs should include information on the nature and extent of the fragmentation zone.
  - Awareness education through briefings or signs or information sheets to people living or working near a demining worksite, and to the local authorities in the area. The briefings and/or information sheets should include information on the audible warning methods used to advise workers and the local public of the demolition of mine or UXO hazards and hazardous material.
  - Awareness education, including site dangers, and the implications of ignoring the directions of demining workers appointed to control access into fragmentation zones.

## 2.6 Safety Distances

The following table details the minimum safety distances to be enforced at a manual mine clearance worksite:

<b>MINIMUM DISTANCES FOR A MINE CLEARANCE WORKSITE</b>		
Serial No.	Situation	Minimum Safety Distance
a	b	c
1	Adjacent manual deminers in working lanes in a hazardous area where only anti-personnel blast mines P4 Mk1 & 2 are suspected.	10 metres
2	Adjacent manual deminers in working lanes in a hazardous area where any other types of anti-personnel mines are suspected	25 metres
3	Adjacent manual deminers in working lanes in a hazardous area where anti-tank mines are suspected	50 metres
4	Adjacent manual deminers in working lanes in a hazardous area where personnel stake, bounding or directional fragmentation mines are suspected	50 metres
5	Between the explosive storage point, hazardous area and other designated areas.	50 metres

a	b	c
6	Between designated safe areas that are occupied while clearance is being conducted and the hazardous area	100 metres
7	Between personnel/people not wearing PPE and manual deminers in working lanes	100 metres
<p><b>1. Any reduction to these safety distances shall only be authorised by the DMAO on a case by case basis and it shall be required to be included in the detail relevant implementation/operational clearance plan for the worksite.</b></p> <p><b>2. These safety distances shall be increased when required in accordance to the mine/UXO threat.</b></p> <p><b>3. Encroachment of the safety distances in serial no's 1 to 4 will be acceptable in order to conduct supervisory/QA functions at times when it is not possible to conduct it from the listed safety distances due to terrain or other conditions and situations. The supervisor/QA personnel should avoid remaining static for too long and not disturbing the deminer's concentration too much. For the purpose of giving advice or for corrective action, instructions or comments the deminer should be told to cease work and if necessary be withdrawn to a relevant safer area.</b></p> <p><b>4. Full PPE shall be worn by all personnel at all times regardless of role or purpose of crossing the designated PPE HOTLINE towards the working lanes. The PPE HOTLINE shall always be a minimum of 100 metres from the nearest working lane.</b></p>		

**2.7 Control Areas**

The clearance agency shall establish effective control of the worksite. This can be achieved by establishing and clearly marking a number of areas for safety and administration. Such areas shall be outside the relevant safety distances from all contaminated areas, clearance activity and explosive storage.

**2.7.1. Control Point**

The control point acts as an administration and briefing area and is the point from where the clearance task is managed and where all visitors shall arrive. Ideally it should be on level, well drained land and have vehicle access and preferably some shade. The control location of the control point shall be a minimum of one hundred metres from the baseline of the hazardous area. This distance shall be increased dependant on the perceived threat that may result from fragmentation should a high order detonation occur. This can be calculated by using the EOD Fragmentation & Evacuation formula of:

$$\left[ \sqrt[3]{NEQ \text{ kg} \times 2.2} \right] \times 100$$

e.g.

$\left[ \sqrt[3]{10 \text{ kg} \times 2.2} \right] \times 100$	$\left[ \sqrt[3]{22} \right] \times 100$	$2.8 \times 100 = \underline{280\text{m}}$
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or

$\left[ \sqrt[3]{5 \times 2.2} \right] \times 100$	$\left[ \sqrt[3]{11} \right] \times 100$	$2.2 \times 100 = \underline{220m}$
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### 2.7.2. Vehicle Parking Area

The vehicle parking area should be close to the Control Point and large enough to provide safe parking for the clearance team and visitor's vehicles.

The boundary of the parking area shall be clearly marked and sign posted. The parking area sign posting should indicate directions to the worksite and visitor reporting area.

### 2.7.3. Visitors reporting and briefing area

The visitor reporting and briefing area is normally in the Control Point.

### 2.7.4. First Aid Post

Each demining worksite shall include a first aid post, organised and equipped as described in SLNMAS 9. The first aid post shall:

- be identifiable and clearly marked;
- be equipped with appropriate first aid and medical supplies and equipment;
- where appropriate, be attended by suitably qualified and experienced medical or paramedical staff; and
- provide easy access to the clearance area of the worksite and easy access for ambulances.
- The ambulances shall be parked in such a manner that they can easily exit the area in case of a casevac.

### 2.7.5. Rest Areas

The worksite shall include clearly identifiable and marked rest areas for the deminers. Rest areas should be located outside the fragmentation zone and should be equipped to provide staff with protection from adverse or extreme weather conditions. Drinking water will also be provided in the rest area.

### 2.7.6. Helicopter Landing Site

Where casevac by helicopter is arranged by the clearance agency, helicopter-landing sites (HLS) should be established on suitable ground near the worksite. The HLS must be clearly marked and signposted.

### **2.7.7. Explosives Storage Area**

Explosives or mine and/or UXO hazardous material may be stored on a worksite. Explosives used in the demolition of mines and UXO at the worksite should be stored in a container approved for the type and quantity of explosive being stored, which will be located outside the fragmentation zone of the demining worksite. Where provision of this standard of container storage is impracticable, the clearance agency shall be responsible for providing adequate safety measures (protective works, safety distances, physical security etc.) and should include protection against environmental factors in accordance with explosive manufacturers' instructions. Such storage should be considered as a temporary measure only.

### **2.7.8. Stores and equipment Area**

An area where all equipment is securely stored shall be identified and marked accordingly.

### **2.7.9. Metal Collection Pit**

This should be at a convenient location away from the mined area. All metal removed from the mined area should be placed within the metal collection pit.

### **2.7.10. Mine/UXO Debris Pit**

This should be at a location away from the mined area. All mine/UXO debris removed from the mined area should be placed within the mine/UXO debris pit and is to remain there until certified as Free From Explosive (FFE) content.

### **2.7.11. Latrines**

To prevent people inadvertently straying into mined areas, and for hygiene purposes, latrines should be designated for each worksite. Latrines should be located in the vicinity of the rest area and at least twenty-five metres from the hazardous area. They should be adequate for the number of personnel on the site.

## **2.8 Site Layout and Reference Points**

See Annex A for an example of a typical worksite layout.

## **2.9 Mine Clearance Marking System**

The mine clearance marking system that shall be used is detailed in Annex B. Pickets and mine warning tape are to be maintained continuously. Pickets are to be upright and tape is to be tightened and replaced whenever necessary. Tape is susceptible to damage from the wind and may sometimes be blown away. In order to minimise damage, tape between pickets in clearance lanes and other areas where visibility from long distance is not required should be fixed close to the ground. Plastic tape used for marking should be a maximum 50 millimetres wide.

## **2.10 Personal Protective Equipment (PPE)**

All deminers and supervisory personnel shall wear PPE when clearance is being conducted and being inside the fragmentation zone of the worksite.

## **2.11 Working Hours**

A manual deminer shall not work for longer than sixty (60) minutes before taking a break of at least ten (10) minutes. The working time may vary between clearance agencies and specific situations (e.g. climate and vegetation), however the aforementioned times shall be adhered to.

A normal working day for a manual deminer shall not exceed 6 hours actual mine clearance work a day. In excessive climatic conditions, the working hours may be reduced or the daily routine changed. A safe and sensible approach shall be made by the clearance agency's supervisor in order to achieve the best possible mine clearance results without compromising the safety of demining personnel.

### **3 Manual Mine Clearance using Metal Detectors**

By using metal detectors the whole area under clearance is systematically searched for mines/UXO where after it is removed when found. Generally the following stages should occur during manual mine clearance when metal detectors are used.

- a. Visually and manually inspect the area in front of the Base Stick for tripwires, UXO, surface-laid mines, protruding fuses or suspicious objects
- b. Using a tripwire feeler to search for tripwires if the minefield is covered by vegetation.
- c. Clear vegetation as required, using a small pruning tool or garden shears.
- d. Carry out controlled sweeps with a metal detector over the entire width of the clearance lane and forward to a maximum of 50 cm. Ensure that the search epicentre of the detector covers the full width, but no more, of the Base Stick width. Care must be taken to ensure that the detector head is not allowed to move into any area not previously inspected in accordance with sub-paragraph a & b, above.
- e. If the detector gives no signal, move the base-stick forward a maximum of 50 cm with 10 cm overlap and repeat the process from sub paragraph (a).
- f. Lane marking is to be placed at a maximum every 1m, as the clearance lane progresses and is to be placed at each end of the red painted 1m spacing on the base stick and not outside the white 10cm overlap. Thereby creating a 1m wide marked cleared lane.
- g. If the detector gives a signal, mark 15 cm or half of the detector's search head on the safe side of the signal with a mine-marker and use a manual prodder to locate the source of the signal. Once the object is located, a hand-trowel or similar tool is used to excavate the earth sufficiently to reveal its identity.
- h. If a mine or UXO is uncovered and specified a mine marker shall be placed close the object on the safe side of the object. The deminer will stop mine clearance in this lane and notify the team leader/supervisor.
- i. The team leader/supervisor shall identify the mine and/or UXO and he/she shall do one of the following:
  - Task the deminer to close the lane and to start a new lane. Leaving the mine/UXO for disposal later in the day.
  - Stop clearance activities on the clearance worksite; withdraw all the deminers to a safe distance and dispose of the mine/UXO.
- j. All other metal objects found should be collected in the deminers' pouch/bucket and delivered to the metal collection point at the completion of the deminers' shift or as required.

This is an outline procedure only; it is not a detailed drill. All procedures and drills used in clearance operations are to be fully explained in step-by-step detail in the individual Standing Operational Procedures provided by each clearance agency.

### 3.1 General Principles

Only deminers internally trained and tested in the use of the specific model of detector can be used to perform metal-detector search procedures with that detector.

There must always be absolute confidence in the metal-detector's ability to locate the target device at the required depth before metal-detector clearance procedures are used. Because equipment and deminers can both be at fault, it is essential to confirm that the metal-detector and its operator can locate the anticipated target. To determine whether the detectors can be used, metal-detector Test and Calibration areas should be established.

At the start of the working period, or after any period when the detector has been turned off, the detector must be switched on and set-up. The deminers must follow metal-detector turning-on and set-up procedures as outlined in the manufacturer's instructions.

### 3.2 Detector calibration area

The calibration area is needed for carrying out Ground Compensation (GC). This is the same thing as the "Ground Learning Function" referred to in the some metal-detector manuals.

The GC must be set-up as described in the manufacturers' documentation. To do this, a metal-free calibration area of one metre square shall be prepared close to where the deminer will work. The area should be moved forward as work progresses so that it is always within 100 metres of the place where the deminer will work. Usually the calibration area will be close to the detector test-area. Both areas can be inside access lanes as long as those lanes are at least two metres wide and the areas are marked by white painted pickets/stones (this is permitted because the test and calibration areas can be stepped into if necessary in an emergency).

It is the Section Leader's responsibility to ensure that all calibration areas are metal-free and that calibration and GC procedures are followed. When a metal-detector cannot compensate for the electromagnetic properties of the ground and continues to signal or signal erratically where there is no metal, it must not be used at that task work site.

### 3.3 Detector test area

In hazardous areas where the P4 Mk1 and/or T72A anti-personnel mines are expected a metal-detector Test area shall be used to ensure that the detector can reliably signal on a target mine at the required depth. After the detector has been set-up with appropriate Ground Compensation, its ability to detect a target mine must be checked at all task work sites where the task assessment has identified the possible presence of the abovementioned mines. Each detector's ability to signal the presence of a target mine at the required clearance depth must be confirmed.

The deminer should NOT use a metal-detector manufacturer's test piece as a reliable simulation of a real mine target especially where the abovementioned minimum mines are suspected. Target mines that accurately reflect the electromagnetic signature of the mine that is most difficult to locate at the task work site must be used. This is usually a real mine that has been rendered safe by an EOD Operator.

**NOTE:** *A minimum-metal mine that has been rendered safe for use as a metal-detector target is NOT Free From Explosive (FFE) because the detonator is generally present. They must not be marked as FFE but as "Detector Targets". They should be transported and stored as "detonators". They should be clearly marked (painted red) to avoid any confusion.*

The mine clearance organisation should provide and control all target mines, ensuring that they are recovered when they are no longer required and stored in the explosives storage area.

The target mines must be buried in metal-free detector test areas close to where the deminers will work (usually within 100 metres). Each target mine should be concealed in a marked area measuring at least 0.5 metres on each side. The target mine must be buried so that the top of the mine is at the required Clearance depth (minimum 15 cm) at the task work site. The photograph alongside shows the depth of a test mine being measured.



Ensure that the metal-detector Test areas are metal free before the target mine is placed and that target mines are placed at the required depth. The detector Test area is often positioned alongside the detector Calibration area but need not be. Both areas must be clearly marked.

### **3.4 Using the Detector calibration area and the detector test area**

The deminer shall set-up the detector in the calibration area and then uses it over the detector test area to check that the detector signals on the test mine. If the metal-detector does not give a distinct signal over the test mine, the detector should be set-up (with GC) again and a second attempt made by a Section Leader. If there is any ambiguity about the signal, the Section Leader must repeat the test with other detectors. If the problem is repeated, the Section Leader must report that clearing the area with metal-detectors is not appropriate and the senior supervisor should ensure that the Task Release Plan is adjusted appropriately.

If the Section Leader can detect the test mine but the deminer cannot, the deminer must not be allowed to work with a metal-detector until he/she has been trained to use the detector again.

If the Section Leader cannot detect the test mine but can detect it with other detectors, the metal-detector must be withdrawn from service immediately.

## **4 Full Area Excavation Technique**

The full area excavation technique is where the whole area that needs to be cleared is excavated by manual deminers to a specified depth to ensure that all mines within the area to the specified depth are found and removed.

The full area excavation technique should be used in sand, soft soil or in areas where water is available to soften the ground. A hand trowel or scraping tool is used to remove the soil in front of the deminer's base stick to a minimum depth of 15 cm and to a minimum width of 1,2 meter.

The front edge of the clearance lane will be a trench (depth and width as above) which will move slowly forward by the continual removal of the front layer of the soil. Mines will be located by being struck gently on their sides with the digging tool.

Generally the following stages should occur during manual mine clearance when the full area excavation technique is used.

- a. Visually and manually inspect the area in front of the base line/base stick for tripwires, UXO, surface-laid mines, protruding fuses or suspicious objects
- b. Using a tripwire feeler to search for tripwires if the minefield is covered by vegetation.

- c. Clear vegetation as required, using a small pruning tool or garden shears.
- d. Position the base stick inside the known area, at least 30 cm behind and parallel to the base line in order to establish the size of the excavation starting trench.
- e. Between the base line and the base stick dig a starting trench of one meter (minimum) wide, 25 cm (minimum) long and 15 cm (minimum) deep. This initial trench may be dug by using a spade or any other digging tools since the trench is inside a non-hazardous area. The soil from this starting trench should be placed behind the deminer.
- f. Drive to short red-top pickets into the ground at the base line inside the edges of the trench, indicating the one meter wide working lane. Cut the base line marking tape and tie it to the bases of the two starting pickets. Keep the base stick between the deminer and the starting trench.
- g. Start excavating by holding the trowel or scraper horizontal and using sideway motions to scrape the front face of the trench. Remove the soil carefully and move the loose soil backwards to behind the base stick.
- h. Move the base stick forward as the excavation progress. The base stick needs to remain between the deminer and the front edge of the excavation trench. The base stick should remain approximately 25 cm behind the front edge of the trench.
- i. Keep the left and right inside edges of the trench (side of lane depth trenches) free from soil as excavation progress to assist with depth measurement by internal QA personnel. The deminer shall spread and level the soil in the middle of the trench behind the base stick.
- j. The clearance lane shall be marked by short red-top pickets every meter on both sides.
- k. The deminer to continuously check the excavation depth on the front edge of the excavation trench using a measuring stick specifically made for this purpose.
- l. When a mine/UXO or any other suspicious object is encountered the deminer carefully removes enough soil until he can identify the object. He will stop excavation and notify his immediate supervisor.
- m. The team leader/supervisor shall identify the mine and/or UXO and he/she shall do one of the following:
  - Task the deminer to close the lane and to start a new lane. Leaving the mine/UXO for disposal later in the day.
  - Stop clearance activities on the clearance worksite, withdraw all the deminers to a safe distance and dispose of the mine/UXO.

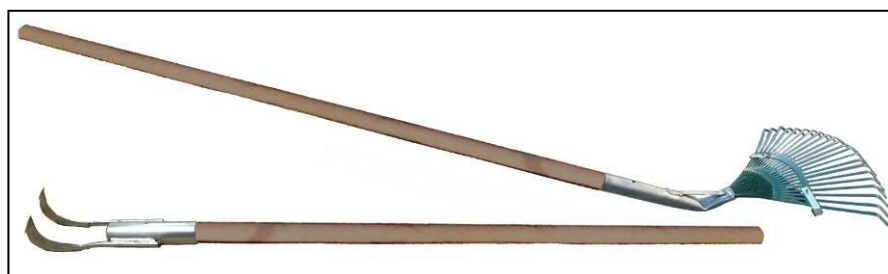
This is an outline procedure only; it is not a detailed drill. All procedures and drills used in clearance operations are to be fully explained in step-by-step detail in the individual Standing Operational Procedures provided by each clearance agency.

## 5 Rake Excavation and Detection System (REDS)

The Rake Excavation and Detection System (REDS) uses two simple raking tools to excavate and sift the ground to the required depth. One is a Brush-rake and the other has two curved tines to loosen the ground like a Harrow. Conventional demining site markings are used, and the side of lane depth trenches allow effective internal QA. A "Base-trench" across the front of the lane marks the extent of the processed area. Loose soil is brushed from the un-cleared area into the Base-trench, and then packed to the rear of the trench. When the use of the Brush-rake becomes ineffective, the Harrow-rake is used to scarify the ground, allowing the Brush-rake to be used again. The Base-trench rolls forward as work progresses, which can be surprisingly fast in ideal ground conditions.

Generally the following stages should occur during manual mine clearance when the REDS is used.

- a. To start a lane, a base-trench is dug to the required Clearance depth, 120cm wide and at least 20cm from front to back in a known safe-area at the start of the lane. The distance front to back of the base-trench may be varied according to ground conditions but should never exceed 50cm. When the first base-trench is made, it should always be entirely inside the safe-area. Because it is inside a safe-area, it can be dug with other tools than the rakes.
- b. The soil from the initial excavation should be moved out of the base-trench and to the rear until the process is under way.
- c. The area (up to) 50cm forward of the base-trench is visually checked and cleared of vegetation and loose stones. The light rake is then used to move all soil in the 20-50cm by 120cm area to the front. The loosened spoil is brushed towards the back of the base-trench. The light rake is used as the main excavation tool and, when possible, is used to excavate to the required depth, exposing any mines/devices in the process. When the rake comes into contact with a mine, the sound of it scratching the device is often heard, alerting the deminer to the presence of the mine before it is visible.
- d. The heavy rake should be used only when the light rake becomes ineffective. The heavy rake scratches the ground, loosening it so that the light rake can be effective again. The head of the heavy rake is placed to the front of the base-trench and pulled back towards the deminer. The rake tines then plough back through the soil to the rear of the area being cleared. The deminer must not hack at the ground with the heavy rake.



The light and heavy rake

- e. The heavy rake ploughing action is repeated across the width of the base-trench. The deminer may change between using the light and heavy rake several times until he/she is able to excavate to the required depth with the light rake.
- f. Water may be used to soften the ground or damp-down dust if required.

- g. As the clearance lane progress short red-top pickets shall be placed on both sides of the lane every meter.
- h. When a mine or ERW is discovered, it should be exposed using an approved hand-tool. When the device can be clearly seen, the deminer must close the lane and alert the Section Leader who will inform the EOD Operator. Work in the lane must not continue until the mine or ERW has been removed or destroyed. Generally the deminer should start another lane and continue working.
- i. As the base-trench at the front of the lane moves forward, side-trenches to the full excavation depth are left at the sides of the lane in the area marked as "Overlap". These side-trenches mean that the internal QA can ensure that the required depth has been consistently maintained.
- j. The deminer to continuously check the excavation depth on the front edge of the excavation trench using a measuring stick specifically made for this purpose.
- k. Section Leaders must use QA markers to show the extent of the lane to which the depth of the side trenches has been checked, and the side-trenches must be maintained until this has occurred. The senior supervisor should periodically QA the work of the Section Leaders, checking that they are measuring the depth of all lanes regularly and that depth has genuinely been maintained.



Demonstrating the light rake

This is an outline procedure only; it is not a detailed drill. All procedures and drills used in clearance operations are to be fully explained in step-by-step detail in the individual Standing Operational Procedures provided by each clearance agency.

## 6 Using water to soften ground

Water may be used to soften the ground or damp-down dust when necessary. A bucket or hose delivery system may be used to transport the water to end of the lane where the water should be splashed over the required area. All safety requirements at the Task should be observed during the watering process with working-distances maintained and PPE worn.

The deminer must close the lane and work in another lane while the water is allowed to soak into the ground. No signal investigation or excavation should be conducted until the surface water has gone.



When a water bowser is available, water should be applied the day before the area is cleared. A dedicated bowser that is narrow enough to be driven along two metre wide lanes is ideal.



Example of a water bowser that is cheap and versatile

## 7 Action on locating a mine or UXO

When the EOD Operative determines that it is safe to do so, mines and ERW may be moved for destruction outside the minefield. Damaged or unstable devices should be destroyed in-situ.

On locating a mine or ERW during any procedure, deminers should expose enough of the device to be sure that it is a mine or ERW and then close the lane. The deminer must inform his/her Section Leader who will inform the senior supervisor. The senior supervisor will instruct an EOD Operator to deal with the device. If there is a delay dealing with the discovered device, the Section Leader must instruct the deminer to start work in another area. The deminer should not return to the lane until the device has been removed or destroyed.

The approved render safe procedures for the mines found in Sri Lanka should be documented in the clearance organisation's SOPs.

**NOTE:** Mines or devices that are damaged or cannot be identified should not be moved.

## 8 Tripwire location

When the site assessment indicates a possible threat from tripwire operated mines with functional fuses, the operational plan for the hazardous area may include the use of machines for mechanical preparation of the area.

When it is necessary to use a manual demining tripwire detection procedure, the search shall be made using the eyes, hands and a tripwire feeler.

After conducting the tripwire location procedure, the deminer must take great care not to cut vegetation ahead of the area that has been searched for tripwires.

### 8.1 Action on locating a tripwire

When a tripwire is found, the deminer must stop work and notify the Section Leader. The Section Leader should decide where the wire is likely to lead. Generally, the wire should be marked and the lane closed. Another lane must be started in order to find the anticipated mine. When it is not clear where the mine may be, the second lane should run parallel to

the tripwire. Because AP blast mines may be placed along tripwires, the lane must always be subjected to a full Clearance procedure regardless of the Task Release Plan. Because the wire will run between an anchor (usually a stake) and the mine, Clearance in both directions should be conducted.

When a tripwire operated mine is located, the Platoon Commander should be informed immediately if the mine was not anticipated in the site assessment.

When a tripwire is taut, the tripwire must not be moved or disturbed until the ends are exposed and the threat identified. When a tripwire is slack, it may be cut at the discretion of the senior supervisor and in the interests of safety.

When the type of mine is not known and its condition is uncertain, a working distance of 50 metres should be enforced until the ends of the tripwire have been located and the device identified.

## 9 Collection of mines and UXO

**Deminers** may NOT handle or move mines or ERW unless trained to do so. When mines or ERW are safe to move, they should be moved by an EOD Operator to clearly marked and separated areas. Under the direction of an EOD Level 3 Operator, the mines and ERW must be destroyed using one or more approved procedures.

## 10 Pulling of mines

Anti-tank mines and mines where anti-handling devices shall be pulled remotely before being rendered safe for moving it to a mine/UXO pit for later disposal.

The clearance organisations shall define the pulling procedure clearly in their SOPs.

Only qualified EOD Level 3 operators shall conduct the pulling of mines.

## 11 Removal of vegetation

Whenever there is significant vegetation, the use of mechanical assets to cut the vegetation in front of manual demining should be considered. Whenever the site assessment indicates both the presence of vegetation and active tripwire activated devices, mechanical assets should be used to remove the vegetation whenever possible.

When mechanical assets are used to cut vegetation, minimum ground disturbance is necessary. Cut vegetation that is lying on the ground may be removed using a light rake as the follow-up work progresses as long as intact tripwires or active tilt-operated fuzes are not anticipated in the area.

The tools approved for vegetation removal are listed below. It is the responsibility of the clearance agency to ensure that deminers are always issued with appropriate tools for the task and have access to strong "gardening" gloves.

- Shears;
- Secateurs (pruners);
- Sickle (hook);
- Saw (one-handed);
- Wire-cutters;
- Light rake;
- Petrol-driven Strimmer (long-handled).

Deminers do not have to wear "gardening" gloves but they should be available whenever vegetation includes thorns, is sharp, or has stinging or skin-irritant properties. The gloves protect against the cuts and scratches that can occur during vegetation cutting.

**NOTE:** *All tools can be used in a dangerous way, but some are hard to use in a safe way at any time. The following tools shall NOT be used in any area that has not yet been declared safe (or presumed safe): machete; scythe; chainsaw; axe/hatchet. This is because the user cannot reliably control the tool (or the vegetation it cuts). These tools may be used in safe-areas, but should never be inside the SHA/CHA during mine clearance.*

## 12 Removing obstacles

Common obstacles are:

- Rocks;
- Barbed wire;
- Fences;
- Vehicle wrecks;
- Ditches/trenches;
- Abandoned or destroyed buildings; and
- Fallen trees.

### 12.1 Rocks

Some areas are littered with rocks of various sizes. In other places, piles of rocks and low-walls of rocks are found. All these impede demining. If there are many rocks, the use of mechanical demining assets that process the ground can be unwise because the rocks will cause a high level of wear to the machine and can prevent the machine processing the ground to a constant depth.

When using manual demining procedures, surface rocks that are small enough to be easily lifted should be removed. The deminer may reach in front by 30-50cm to lift the rocks. Rocks that are too large to be removed, or that resist lifting because they are partly buried, should be left in place until cleared around. Removed rocks should be transferred to an area behind the deminer that has been subjected to internal QA. They should be moved out of the lane *before* continuing to search.

When larger rocks have been cleared around so that the deminer can stand beside the rock, the deminer may try to move it again. This is because the rock may impede easy access in the lane and should be removed when possible. If the rock is moved, the area beneath it must be searched to ensure that no devices are present. If the rock cannot be easily moved, it should be left unless there is reason to believe that devices were placed beneath large rocks.

When piles or walls of rocks are encountered, the operational plan should allow for the lanes to be diverted around the obstruction. When the area around the obstruction(s) has been cleared, the senior supervisor must re-evaluate the site assessment and decide whether the piles must be moved and searched. When MDD assets are available, it may be appropriate to use them to search the piles of rocks.

If the rock obstruction must be moved, appropriate mechanical assets may be used to assist.

## 12.2 Fences and wires

Some minefields were originally fenced with strands or coils of barbed wire. In other areas, security and agricultural fences may be inside the area to be cleared. All broken fences should be removed and the area beneath them searched. Intact fences may be left unless their presence restricts the use of mechanical assets or prevents necessary access. When the area around an intact fence requires full Clearance, MDD may be used. If the metal-detector and the operator are capable of searching close to the fence reliably, metal-detectors may be used. When MDD and metal-detectors are unavailable or inappropriate, the area around the fence must be excavated using the full area excavation technique.

Wire obstructions can be cut cautiously using efficient wire-cutters. The wire must then be removed in sections and placed in a metal-collection pit. The senior supervisor may order that entanglements or buried wires are pulled using manual or mechanical means. Generally, the area surrounding the wire should have been searched first.

## 12.3 Vehicle wrecks

When wrecked vehicles are found in the CHA/DCA, it must not be presumed that ground beneath the vehicle is safe. The remains of wrecked civilian vehicles should be pulled onto a known safe-area using mechanical assets.

Wrecked military vehicles should only be approached over ground that has been searched. They must be individually assessed by an EOD Operative who must presume that:

- there may be booby traps in and around the wreck;
- there may be ammunition in and around the wreck;
- there may be mines surrounding the wreck; and
- there may be mines between the wreck and any nearby route.

## 12.4 Ditches and trenches

Ditches and trenches should be carefully approached and cleared. The clearance of ditches and trenches shall be clearly defined in the mine clearance agency's SOPs and the clearance method shall be determined on a case-by-case basis.

## 12.5 Abandoned and destroyed buildings

If the building has been used by people and animals, the risk of booby trapping may be low. When a building has been destroyed in battle, there is a high chance that there may be UXO in and around the building.

If the building is known to have been booby trapped, the time since the devices were placed may be relevant. Battery operated or improvised devices usually have a short operational life but may still be dangerous.

When manual Clearance must be conducted, lanes should be marked using painted stones. When there is rubble inside the building, the deminers should be issued with strong buckets to move the rubble outside. Intact walls may provide protection and allow a reduction in working-distances between deminers. Material on the floor should be removed until the search has reached the original floor level. Metal-detectors can be used in some areas but there may be a lot of scrap metal among the debris. Excavation using rakes or hand-tools may be more appropriate in some parts of the building.

Where booby traps are expected a clearance plan shall be compiled and implemented by qualified EOD personnel.

## 12.6 Fallen trees

Fallen trees and branches in the SHA/CHA must be moved so that the area underneath them can be searched. When conducting manual or MDD procedures, the area leading to the obstruction must be cleared along its entire length.

If the tree is to be moved manually, a rope can be securely attached around it. This often means that the area on both sides of the tree must be cleared to allow safe access. Sometimes it is appropriate to cut away smaller branches and move them out of the way.

If the tree is to be moved using a mechanical asset to lift it or pull it, the area leading up to the tree must be cleared and marked in a lane at least two metres wider than the machine unless the machine is able to process that approach itself.

The tree or branch must be moved into a safe-area. When it is moved by machine, mechanical safety-distances must be applied. When it is moved by manual pulling, the distance from the tree to the nearest man must be the working-distance at the Task site. Several deminers can stand behind each other pulling the rope. All deminers involved must wear PPE and work under the strict supervision of the Section Leader.

The place from which the tree or branch was before it was removed must be searched and cleared.

## 13 Dealing with human remains

All findings of human remains must be reported to local police and the SLNMAC and DMAO immediately, using telephone or radio networks. A written report shall be made as soon as possible to the nearest police station and a copy thereof submitted to the DMAO.

Work in the area immediately surrounding the remains must stop. Mechanical demining must not be conducted within a 25 metre radius of the human remains.

Although the anticipated human remains that may be located during mine action activities often date from the time of known conflict, human remains that are much older may be found. It is also possible that human remains that are more recent will be located. Whatever the origin of human remains, they must always be treated with respect and dignity by everyone involved in their recovery.

### 13.1 Recording the finding of human remains

As a minimum, the following details must be recorded:

- a. the time, date, and place where the human remains were found. This should include a detailed description of the location and a grid reference obtained using a GPS;
- b. the name and contact details of the person(s) doing the recording;
- c. a unique identification number must be assigned to each separate set of human remains. If the human remains are too mixed to identify which body parts belong to each individual, a single identification number can be assigned pending investigation by specialists. Any files, bags or boxes used for artefacts associated with a set of human remains should be clearly marked with the same reference number;
- d. a description of the scene, including the location and distance of the remains in relation to any features and landmarks. The description should include any obvious disturbance to the human remains. Photographs should be included whenever possible;

**NOTE:** *When photographing human remains, place a paper showing the identification number assigned to the remains so that it will be shown in the photograph.*

- e. state what Task was being conducted when the remains were found;
- f. state whether the human remains are inside a SHA/CHA;
- g. state whether the remains appear to be complete. If they are not complete, the report should make a statement giving a degree of confidence over whether they are human. For example, if a human skull is visible, the confidence may be given as “certain”. If there are only scattered bones, the level of confidence may be “possible” or “uncertain”;

**NOTE:** *When it is uncertain whether the remains are human, they should be referred to as “possibly human” in the report.*

- h. state whether the remains appear to be ancient, dating from known conflict, or recent. The way in which the remains are investigation and removed will depend on their age. Include a detailed description or a photograph; and
- i. when possible, state whether the remains appear to be those of an adult or a child, and a male or a female.

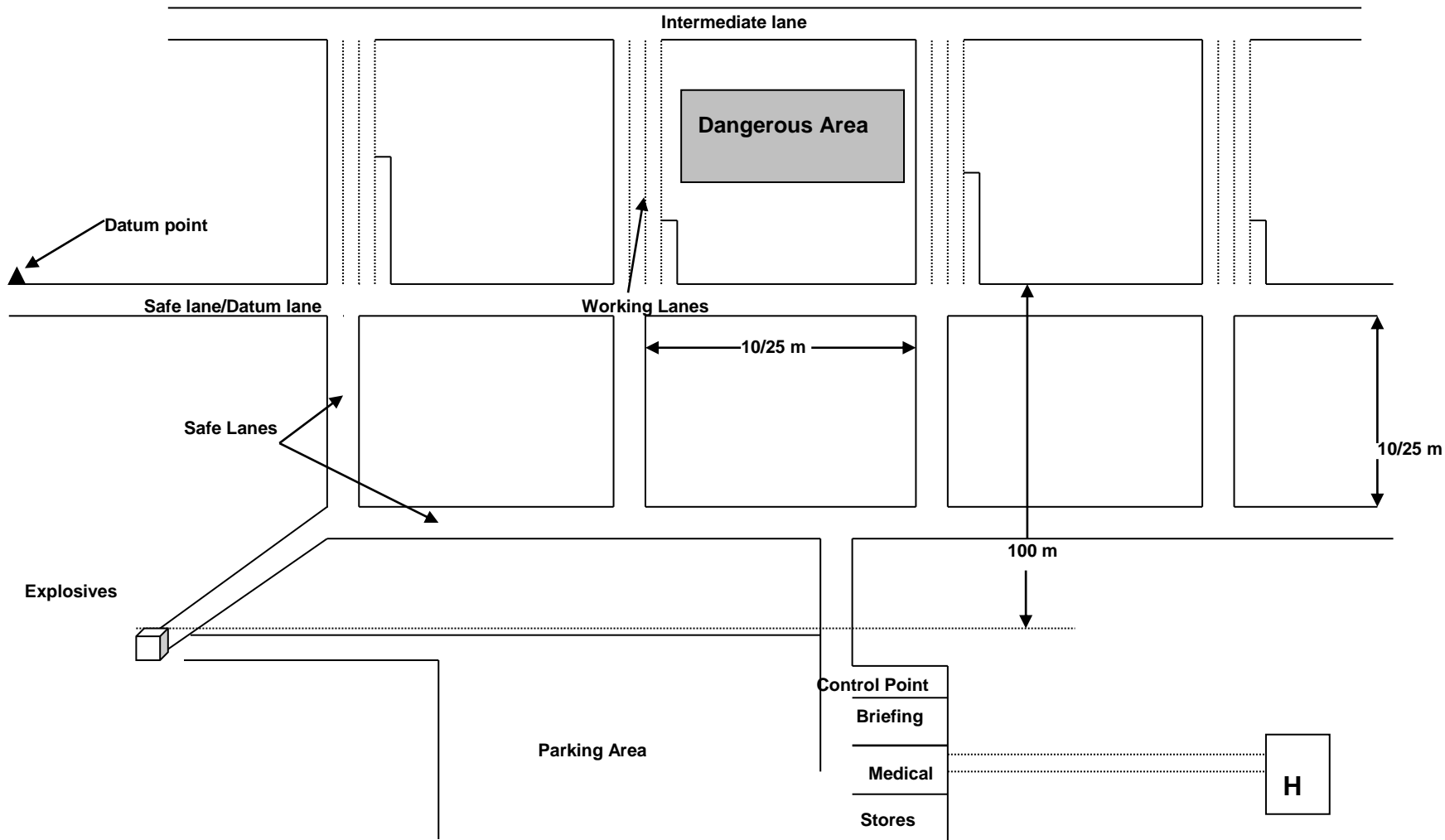
The report should be signed, dated and delivered to the local police and the DMAO as soon as possible.

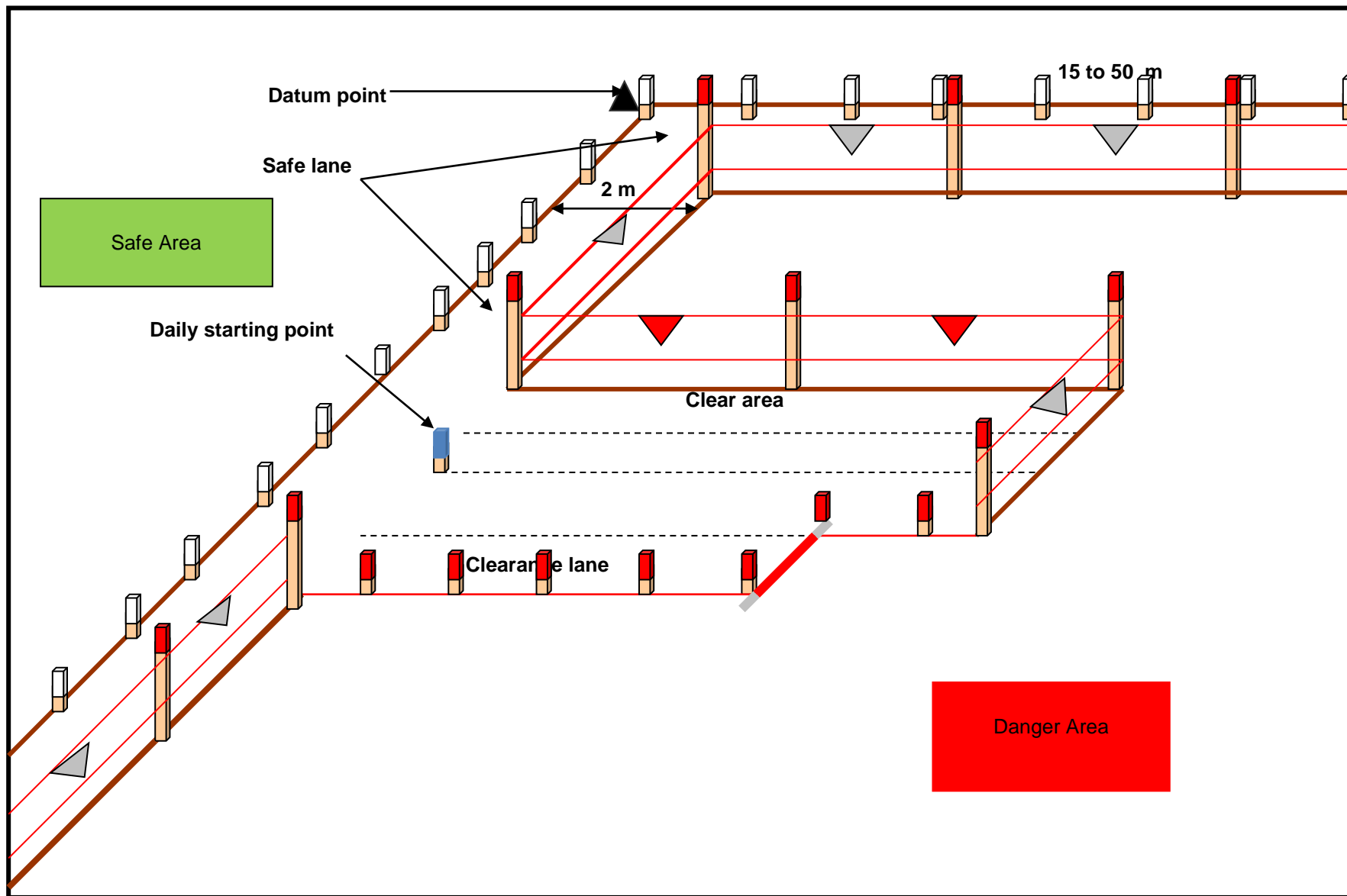
## **14 Area Clearance by BAC**

When no mines and pressure or movement sensitive ERW are anticipated in an area and the site assessment indicates that there may be other ERW on the ground, the senior supervisor may authorise areas to be subjected to a visual Battle Area Clearance (BAC) search.

See SLNMAS 04.60 for Battle Area Clearance.

## Annex A Worksite Layout







## **Annex B**

### **Dealing with visitors to mine clearance worksites**

#### **1 General**

Mine clearance activities attract a range of visitors from the donor community, government and other officials and the media. These visitors should not be discouraged from visiting mine clearance sites as they can assist in much needed advocacy and resource mobilisation for the mine action programme in Sri Lanka.

#### **2 SOP**

The mine clearance organisation shall develop and maintain documented procedures for dealing with visitors to demining worksites. These SOPs should include:

- a. procedures for establishing and maintaining signs that:
  - provide warning that the visitor or public are approaching or entering a demining worksite blast hazard or fragmentation hazard zone;
  - direct visitors to a safe vehicle parking area; and
  - direct visitors to a reporting area.
- b. safety briefing including information on:
  - the site layout, safety marking system and any restrictions, this may include restriction on movement, the use of equipment that may be an RF hazard (mobile telephones, radios etc) and the use of other electronic equipment or cameras;
  - the requirements to wear PPE; and
  - action to be taken in the event of a demining incident or accident.
- c. liabilities in case of accident.

#### **3 Insurance**

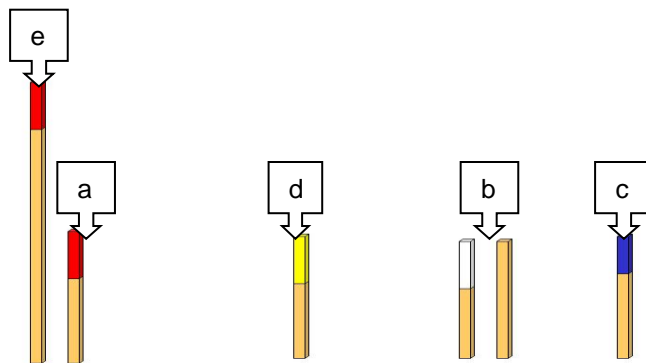
The demining organisation shall have third party liability insurance to cover risk of harm to visitors to demining worksites. This should cover liability not only to the mine clearance organisation, but also to its employees.

## Annex C Sri Lanka Mine Clearance Marking System

### 1 Marking Pickets or Posts

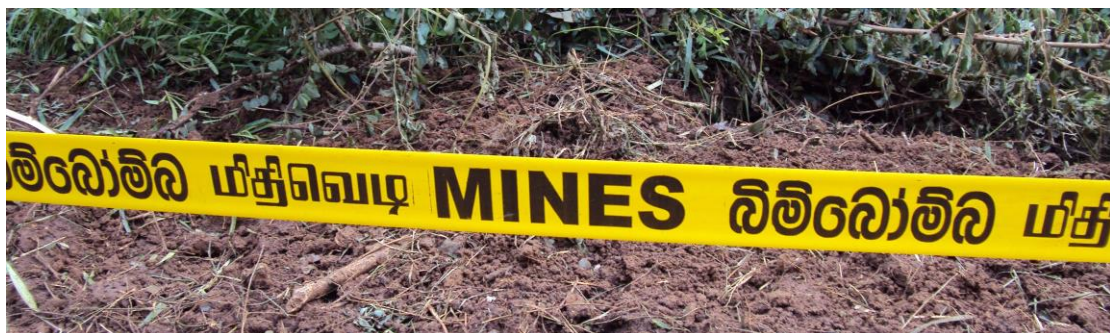
Boundaries between all designated areas, lanes and points in mine clearance operations shall be marked with wooden pickets or posts. All pickets shall at least have a minimum length of 0.5 metres above the ground. The following minimum colour indications shall be used:

- Red topped Posts. These posts indicate the boundary between safe and unsafe areas. They are to be spaced at a maximum of two metre intervals.
- White or unpainted Posts. Indicate all boundaries within safe areas.
- Blue topped Posts. Indicate the start of daily clearance by the manual deminer.
- Yellow topped Post. Indicate the position where a mine/UXO was found.
- Long Red topped Posts (1.2m). Indicate the boundary of the un-cleared area. A mine warning sign is normally positioned on this post.



### 2 Mine marking tape

Mine marking tape should also be used to indicate the boundary between safe and hazardous. The tape could be strung on the ground between the short red topped pickets on the start lines of the work lanes and also between the other red topped pickets on the work site.

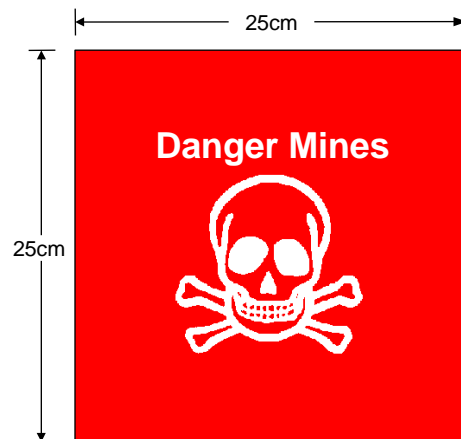


Mine marking tape used in Sri Lanka

**Note:** All mine clearance worksites shall be clearly marked to ensure that there is no confusion between cleared and mined areas. Supervisors are to ensure that marking is checked before the start of each day to ensure that all areas are clearly identified.

### 3 Mine marking signs

Red and white mine marking signs are used to mark mined or dangerous areas, or a point where a mine/UXO is located. Mine signs are to be placed on each edge of an area, spaced at a maximum of fifty metre intervals, with the written side facing the cleared/safe area and the white or blank side facing the hazardous area.



Mine marking sign

### 4 Base sticks

Base Sticks are normally 1.2-metre long wooden sticks, painted white at each end (100 millimetres) and red in the centre. These sticks are used by deminers to mark the boundary between the cleared/uncleared areas as the deminer is working. **The rule is that the area behind the stick is safe (cleared of mines), and in front of the stick it is unsafe (not cleared of mines).** The middle 1 metre part of the stick marks the correct lane width. The white ends (100 millimetres each) serve as a reminder to the deminers to overlap their clearance area into the adjoining lanes.

