

# AMAS 16

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## Mechanical Assisted Clearance Operations

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### **Warning**

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## **Mechanical Assisted Clearance Operations**

### **16.1 Introduction**

16.1.1 Mechanically assisted clearance is an essential tool for mine/Unexploded Ordnance (UXO) clearance operations in Afghanistan. Mechanically assisted clearance shall be part of an integrated approach with the associated organisational structure, logistics and administrative support, in order to provide sustainability and allow interoperability with Demining Teams (DT) and Mine Detection Dogs (MDS) assets.

16.1.2 Mechanical Demining Units (MDU) assets can often significantly reduce the time spent on tasks and therefore increase production rates. This will reduce the overall costs of clearing contaminated areas, when integrated correctly into the overall demining process. Mechanical application primarily supports DT and MDS operations by preparing ground in order to accelerate clearance or clearing ground by subjecting the soil to a process.

16.1.3 MDU assets can be utilised as a means for rapidly determining the extent of hazard within a suspected hazardous area (SHA) by conducting verification operations. MDU assets can also be used to confirm cleared areas as part of the Quality Assurance (QA) process so long as the MDU asset is capable of achieving the default clearance depth of 13 cm.

16.1.4 The introduction of mechanical assets into the overall clearance process shall be controlled and the performance measured, to ensure the assets are being used safely, effectively and efficiently.

16.1.5 MDU's carrying out operations within the Mine Action Program Afghanistan (MAPA) will work in support of clearance assets and Explosive Ordnance Disposal (EOD) teams unless configured to work independently.

### **16.2 Scope**

16.2.1 This chapter covers the minimum requirements for the conduct of mechanical assisted mine clearance operations within Afghanistan.

### **16.3 Concept of Operations**

16.3.1 The general Concept of Operations adapted in Afghanistan to clear minefields, is to deploy DT into the area that actually contains hazard as expeditiously as possible. This is accomplished by using MDU and MDS assets to provide access routes through the SHA to the perimeter of the area identified as containing hazard. DT's are used to breach into the area containing hazard in order to clear the area. MDU assets can be used to assist MDS or DT in clearing or verifying the peripheral areas outside of the actual area containing hazard but inside the original SHA.

16.3.2 During clearance, MDU assets can be used to prepare the ground within the actual area containing hazard in order to increase efficiency within DT's. MDU assets can also be used to clear ground using approved procedures and processes.

16.3.3 In areas encompassed within an SHA where there is no evidence to suggest the existence of hazard, MDU flailing/tilling/rolling can be conducted as a verification/community confidence building operation. The MACCA operations department may authorize MDU

flailing/tilling/rolling without a second asset clearance on a site-by-site basis. Ground treated in this manner is not handed back as cleared but released/cancelled due to low or negligible risk of the ground containing hazard.

## 16.4 MDU Operations

16.4.1 MDU assets maybe deployed as individual machines employing one or more tools or a number of machines employing a variety of tools, the latter being termed a 'system's approach'. The term 'intrusive' machine refers to those machines designed and used forward of a baseline in un-cleared ground, while the term 'non intrusive' machine refers to those designed and used from behind a baseline on safe ground.

16.4.2 MDU operations within Afghanistan fall into 3 categories.

- a) Ground Preparation
- b) Ground Processing
- c) Verification Operations

16.4.3 **Ground preparation** involves reducing or removing obstacles that impede clearance operations. Ground preparation activities are carried out in order to assist in improving productivity of a clearance asset. The following actions typically fall under ground preparation:

- a) Removal of natural or manmade obstacles,
- b) Tripwire removal
- c) Vegetation removal
- d) Metal contamination removal
- e) Ground loosening
- f) EOD support operations
- g) Threat reduction operations

16.4.4 Ground preparation operations can be carried out using both intrusive and non-intrusive methods. Ground preparation does not clear ground. Typical activities carried out in order to prepare ground include but are not limited to:

- a) Flailing
- b) Rotary tilling
- c) Raking (scratching/pecking)
- d) Ripping (includes scarifying)
- e) Rolling
- f) Lifting/removing obstacles etc

16.4.5 Ground preparation progress shall be reported in M<sup>2</sup>

16.4.6 **Ground processing** is the practice of removing soil, subjecting it to an approved procedure in order to separate the soil from hazard. The following actions typically fall under ground processing:

- a) Sifting
- b) Crushing
- c) Excavation

16.4.7 Ground processing operations can be carried out using both intrusive and non-intrusive methods. Ground processing operations are carried out in order to clear ground. Typical activities carried out in during ground processing include but are not limited to:

- a) Excavation for inspection or process using a excavator/bucket backhoe/FEL
- b) Gill/ALLU bucket operations
- c) Skeleton bucket operations
- d) Star basket use

Note: Gill, skeleton and star basket buckets are buckets designed to sieve contaminated soil. ALLU buckets are modified commercial rock crushers designed to fit FEL's.

16.4.8 Ground processing progress shall be reported in M<sup>3</sup>

16.4.9 **Verification** is the practice of confirming that ground does not contain hazard. Verification can occur during area reduction operations and/or concurrently within clearance operations. The following MDU actions can be carried out in support of verification operations:

- a) Rolling
- b) Flailing
- c) Rotary Tilling

16.4.10 Verification operations are carried out using intrusive capable machines. Verification operations are not carried out within the area defined as containing hazard unless it is undertaken after a clearance asset has cleared the ground, and is carried out as part of QA.

16.4.11 Verified ground is not handed back to the community as cleared but released/cancelled due to low or tolerable risk of the ground containing hazard.

16.4.12 Verification shall be reported in M<sup>2</sup>

## 16.5 **Follow Up**

16.5.1. The requirement for follow up action on mechanically worked ground is as follows:

- a) Ground Preparation – Follow up action required – **YES**
- b) Ground Processing – Follow up action required – **YES**
- c) Verification - Follow up action required - **No**

## **16.6 Quality Checks (QC)**

16.6.1. All mechanical work is to be subjected to an objective, formalized and regular QC regime to ensure the intended outcome of the mechanical work has been realized. The following standards are to be met in regards to QC;

- a) Internal QC is to occur on a daily basis,
- b) QC is to be documented within the task dossier,
- c) Ground prepared under 'surface' ground preparation operations, has all obstacles that impede the follow up asset reduced/removed,
- d) Ground prepared during 'sub-surface' ground preparation operations, is penetrated to or below stated clearance depth requirement,
- e) Ground processed by a ground processing operation is free from hazard, and
- f) Ground verified by a verification operation is free from hazard.

## **16.7 Limitations**

16.7.1 MDU flails are not to be used in a verification application unless authorized by the MACCA operations department.

16.7.2 MDU flail/tiller/roller assets are never to be used as a sole clearance tool, but shall be followed by manual or MDS clearance.

16.7.3 MDU assets such as the front end loader, loader/excavator/sifter combination can be used for primary clearance of contaminated earth spoil and rubbish piles so long as the sifting device is fitted with grating designed to capture the smallest form of hazard expected on the site or, additional procedures are implemented to achieve this. DT or MDS assets can be employed.

16.7.4 When MDU operations involve excavation to locate deep buried UXO, excavation shall not occur closer than one (1) metre from the indicated item from any direction. The MACCA operations department may authorize variance of the 1 metre rule on a site by site basis based on recognition of precise locating technology and/or type of excavation equipment.

## **16.8 Vehicle Protection**

16.8.1 Minimum specification for protective plating for use on a machine designed to be operated from it's cabin within an area containing hazard is not less than 8mm armoured plating, (or 16mm mild steel) and 53mm bullet proof glass. Lesser thickness material(s) can be used if it can be proved by the user that their use by either design, type of material and construction methods meets or exceeds protection as afforded by the afore mentioned materials.

## **16.9 Mechanical Test and Evaluation**

16.9.1 The aim of a Mechanical system test and evaluation is to trial and assess any Mechanical asset for suitability in its intended role. The CEN Workshop Agreement (CWA) 15044:2004 provides standardized methodology for T & E provides standardized evaluation for testing Mechanical demining machines

16.9.2 The CWA is to be applied in part or whole on a case by case basis to all mechanical assets prior to their introduction to operations within the MAPA.

16.9.3 Parameters for each systems approach will vary, but in general, each system shall:

- a) Be safe for the system operator and be adaptable in order to cater to the specific mine threat and specific ground conditions.
- b) Have an internal organisational structure in order to be able to integrate fully with other clearance assets as required.
- c) Be designed and structured in such a way that it accelerates mine clearance operations in a safe, cost effective and productive manner.
- d) Attain accreditation from MACCA as qualified to undertake demining operations within Afghanistan.

16.9.4 The development and employment of MDU assets shall take into account the following factors:

- a) The specific mine/UXO threat.
- b) The simplicity of design and operation.
- c) The maintainability and sustainability of the equipment in the area of operations.
- d) The ability to deploy itself, or be deployed to the clearance site.
- e) The adaptability of the MDU assets in differing terrain conditions.
- f) The requirement for detailed and accredited SOP's.
- g) The ability to achieve the clearance depth requirement of 13 cm.
- h) The requirement for the training of national operators in order to maintain a national capacity if required.

## **16.10 Site Plan**

16.10.1 Prior to any Mechanical work being carried out, a MDU site plan should be drafted. If the MDU asset is working in support of a clearance asset, the MDU site plan will form part of, and support the DT/EOD site plan.

16.10.2 If the MDU asset is working independently of DT/EOD, an MDU site plan shall be compiled that supports the issued MACCA task objective. The MDU site plan shall be approved by the MACCA operations department prior to being implemented.

16.10.3 The MDU site plan shall be located on site for both internal and external QA evaluations. All MDU work/site operation plans shall include the following:

- a) Full details of the MDU work to be completed.
- b) Full details of the follow up clearance required.
- c) Full details of the QC requirements

## 16.11 General Safety Precautions

16.11.1 The following safety precautions shall always be adhered to:

- a) Safety distances as stated in Table 10, this chapter unless written approval has been given by the MACCA operations department for variance
- b) All sites operating MDU assets shall have a designated Control Point. This can be collocated with another asset.
- c) All mines or mine parts that include a fuse component that are discovered during flailing/rotary tilling or roller operations are to be destroyed in-situ.
- d) A thorough investigation of the mine/UXO threat in the area prior to the deployment of a MDU asset shall always be carried out.
- e) Worked lanes should be as straight as possible and include an overlap.
- f) Flails and rotary tillers shall be at operating depth prior to passing the start point and shall continue past the finish point before lifting.
- g) During flailing/rotary tilling or roller operations, all detonations and visible throw-outs shall be recorded.
- h) When conducting MDU support operations, all minefield markings damaged or destroyed by the MDU asset shall be replaced once MDU clearance is completed. This should be completed prior to follow-up DT/MDS/EOD moving into the area in order to ensure that these assets know the boundaries of previously worked areas. This will also assist the follow up clearance assets in determining the overlap clearance required.
- i) Areas worked by MDU assets shall be marked at all times to prevent personnel moving into the area until total clearance has been conducted.
- j) Where the MACCA operations department has authorized MDU flailing/tilling/rolling without the follow up second asset clearance to occur, safe lanes shall always be cleared using manual or MDS assets prior to entry into the area by demining personnel.
- k) If the machine is being used for QA confirmation on previously manually cleared areas then the confirmation clearance depth shall be 13 cm.
- l) All other safety precautions as detailed in clearance organisational SOP's and supporting SWP/AMAS

## 16.12 Vehicle EOD Checks

16.12.1 When ceasing MDU operations and prior to the machine returning to its park area, an inspection shall be carried out in order to establish the machine is free from landmines and UXO which may have become entangled with the machine. The area this inspection occurs in is known as the EOD inspection area.

16.12.2 In regards to EOD inspection areas, the following should always be adhered to:

- a) Before commencing MDU operations a designated EOD inspection area shall be established. This area shall be free from hazard, clearly marked and situated at least 100m from the Control Point.
- b) The MDU TL shall ensure that on completion of all MDU operations the vehicle is checked and cleared of all hazardous items. This is achieved by positioning the vehicle within the designated EOD inspection area and visually checking by a qualified deminer or EOD Technician in full PPE
- c) Only once the EOD inspection has been completed and the vehicle has been deemed as “clear” of mines and UXO can it be brought closer to the CP.
- d) In the event of an item such as a mine or piece of a mine or a UXO being located within the working parts of the vehicle, the mine clearance operator shall inform the MDU TL immediately. Only a qualified EOD Technician shall deal with the item.
- e) All MDU assets and attachments are to be cleaned of accumulated spoil and an EOD check conducted prior to being moved between sites.

### **16.13 Vehicle Recovery Drills**

16.13.1 Vehicle recovery drills should be conducted on a monthly basis for each individual MDU asset. The recovery should be conducted as if the vehicle was immobilized in un-cleared ground, regardless of whether the machine is of the intrusive type or not. These drills are to be logged in the Daily Work Diary of the team being supported and the vehicle logbook.

16.13.2 It is not a requirement for this drill to be conducted during live operations. This drill can be conducted during stand-down, training days or during site set up. Recovery drills do not have to be conducted on every new minefield unless the site or mechanical application presents challenges that necessitate a different recovery approach from normal practice.

16.13.3 The damaged or unserviceable vehicle can be cleared up to using DT or MDS assets or reached by another MDU of adequate ballistic protection for the purpose of attaching recovery stops. All personnel involved in the recovery operation are to be at a safe distance from the operation or inside of the machine cabin during machine movement inside an un-cleared area.

16.13.4 If the casualty machine is stuck in un-cleared ground and the recovery machine is required to excavate/manoeuvre in and around the immediate location of the casualty machine, all ground affected by the movement and excavation carried out is to be regarded as not cleared and is to be rechecked. Under no circumstance are personnel to dismount into un-cleared ground.

### **16.14 Casevac Drills**

16.14.1 In the event of injury to personnel (other than the operator) the machine will stop work and return to a designated parking area. CASEVAC drills shall be carried out as per standard demining accident CASEVAC procedures.

16.14.2 All MDU operations are to have medical support on site or within 5 minutes from the area of operations. The medical support maybe provided by a DT/EOD operating on the same site if required.

16.14.3 Each MDU asset shall have CASEVAC drills conducted involving the operator prior to the commencement of MDU operations on each new site and then at a minimum on a monthly basis should the clearance task last longer than 30 days. The CASEVAC drill can be incorporated into the machine recovery drill.

16.14.4 CASEVAC drills shall be conducted whenever there are changes to personnel within the MDU. This shall ensure that any new personnel within the unit are familiar with CASEVAC procedures.

16.14.5 CASEVAC drills shall be logged in site documentation. Emphasis shall be on the extraction of the operator from the vehicle and not on the clearance up to the vehicle (clearance to the vehicle will follow normal mine clearance drills).

## **16.15 Personnel**

16.15.1 In order to achieve effective mechanical application within clearance operations, personnel involved with MDU operations shall be qualified, possess a thorough understanding of mechanical demining and be competent in its application.

16.15.2 All MDU operations conducted on a site will be under the control of the DT/EOD TL being supported although the MDU TL retains technical control over the utilization of the machine.

16.15.3 In addition to normal site requirements, MDU operations must not proceed if the DT/EOD TL in control of the site is absent from the site. Any changes to this level of supervision shall be authorised by the MACCA and shall be requested in writing from the clearance organisation. If the MDU is configured to work independently, work can commence under the control of the MDU TL.

16.15.4 An MDU TL shall possess a thorough understanding of all mechanical demining applications and be competent in reporting MDU activities as per MACCA reporting format requirements.

16.15.5 A machine shall be operated manually or remotely by a competent and diligent operator. An MDU mechanic shall be equipped and capable of carrying out field servicing and basic machine maintenance.

16.15.6 All MDU assets shall have available, DT/EOD support to conduct EOD check drills and CASEVAC operations. This support can be in various capacities depending on the asset.

16.15.7 DT/EOD personnel tasked to work with MDUs shall be conversant with ground preparation and ground processing procedures.

16.15.8 When a MDU asset is operating independently and without the support of a DT/EOD, the MDU shall be configured to include medical staff, a minimum of 2 (two) deminers and sufficient personnel to carry an injured person from the scene of the accident to an ambulance or safety vehicle.

16.15.9 Personnel shall not approach working machines and shall remain outside the working danger area. Personnel shall not ride on the outside of working machines, except in a

casualty evacuation situation. Personnel shall remain alert and maintain safety distances when operating around working machines.

16.15.10 Machine operators should stop work immediately if unauthorised personnel, vehicles or animals enter its working danger area.

16.15.11 All personnel shall wear PPE when working with contaminated soil. Operators working in armoured cabins shall have PPE with them inside the cab but do not have to wear PPE unless stipulated by MACCA operations department.

## **16.16 Safety Shelters**

16.16.1 Table 10 of this chapter contains minimum acceptable safety distances for MDU operations within Afghanistan. For some MDU operations, positioning an observer close to the operation is advantageous from both a productivity and safety point of view. This can be achieved by use of special shelters designed to protect demining personnel from landmine or UXO detonation. The following types of shelters are authorised for use:

- a) Ballistic protective shields that have been approved for use by MACCA
- b) An excavation, construction or effective use of existing ground that provides adequate protection for a minimum of 2 x personnel.

## **16.17 MDU Support to EOD**

16.17.1 MDU support to EOD Teams will generally be the conduct of excavation in order to assist in locating deep buried UXO or clearance of obstacles and ground processing in support of collapsed bunker clearance operations.

16.17.2 The machine will play a supporting role in either operation. The EOD team being supported will control the site however the MDU TL will retain technical control over the machine.

16.17.3 Deep buried UXO excavation

- a) Excavation in order to facilitate the location of deep buried UXO shall be overseen by the EOD TL. The EOD team being supported is responsible for the placement of all marking.
- b) Excavation shall be carried out in layers and the ground checked by metal detection equipment and confirmed clear before further excavation takes place. The depth of layer shall not exceed the detection depth of the metal detection equipment.
- c) Where indications are received using a metal detector, excavation shall be carried out manually until the source of the indication is removed. When magnetometers or any other electronic depth finding means is employed, MDU excavation shall not occur closer than 1 metre from the indicated item from any direction.
- d) The MACCA operations department may authorize variance of the 1 metre rule on a site by site basis based on recognition of precise locating technology and/or type of excavation equipment.

- e) Where excavation is deeper than 1.5 metres, measures shall be undertaken to ensure the soil of the face of the excavation remains stable under all conditions of work and weather whilst personnel are engaged in operations within the excavation.

#### 16.17.4 Collapsed Bunker Support

- a) MDU support provided to EOD Teams will be removal of obstacles and soil that prevent EOD team members from detecting buried UXO. Munitions identified by the EOD team as safe to move by bucket can be transported using MDU means to a central storage area.
- b) All MDU activities conducted in support of an EOD operation shall be under the control of the EOD TL. The EOD team being supported is responsible for the placement of all marking. Access from safe ground to the point of excavation shall be free from landmines and UXO.
- c) If used, the inspection area should consist of two separate inspection bays; one bay for un-cleared soil and one bay for building debris and obstacles not considered dangerous. The inspection areas shall be situated on known clear ground.
- d) Inspection areas shall have perimeters marked and contain clear internal marking showing what soil remains un-cleared. For inspection purposes, the un-cleared spoil shall be levelled with the bucket, to a maximum depth of each lift/layer no greater than 13cm prior to checking by EOD. Each lift/layer shall be inspected prior to the placement of the next lift/layer. If rakes are being used, rake tines shall be spaced close enough to detect fuses and AP mines.
- e) Personnel within inspection teams shall remain in shelters in accordance with safety distances stated in table 10 during movement and tipping of contaminated soil.
- f) During excavation, bucket operation shall be carried out in a slow deliberate manner intended to limit the chance of detonating buried UXO. If UXO is seen by the machine operator, bucket operation shall cease and EOD informed,
- g) The EOD team is responsible for identifying what ordnance is dangerous and what ordnance is safe. Munitions identified by the EOD team as safe to move by bucket can be transported using MDU means to a central storage area.
- h) Medium FEL's can be used to assist in EOD/Bunker clearance operations when it is known there is no threat from HEAT or ammunition larger than 82mm. Subject to MACCA approval, suitably up-armoured heavy FEL's can be used to assist in EOD/Bunker clearance operations where there is a threat from HEAT or ammunition larger than 82mm.

### 16.18 MDU Assets in Afghanistan

16.18.1 This section provides guidelines on the application of mechanical demining assets within the MAPA. Table 10 specifies minimum safety distances that pertains to all mechanical demining assets.

### 16.19 Flails and Rotary Tillers

16.19.1 Flails and Rotary Tillers are intrusive assets which when applied correctly, are effective tools in assisting DT to expeditiously identify and gain access to areas containing

hazard. Flails and Rotary Tillers can be used to assist DT by loosening ground to enable less effort to be expended during manual excavation. Flails and Rotary Tillers can assist in increasing productivity of MDS assets by reducing vegetation and other obstacles that impede MDS output.

16.19.2 Ground treated by flailing and or rotary tilling is required to have follow up action by a clearance asset before being regarded as clear.

16.19.3 In areas encompassed within an SHA where there is no evidence to suggest the existence of hazard, mechanical flailing/tilling can be conducted as a verification/community confidence building operation. The MACCA operations department may authorize mechanical flailing/tilling without a second asset clearance on a site-by-site basis. Ground treated in this manner is to be subjected to internal QA checks. Ground treated in this manner is not handed back as cleared but released due to low or negligible risk of the ground containing hazard.

16.19.4 A flail is defined as a machine using a rotating axle, shaft or drum with attached lengths of chains-link along its surface that impart violent impact to the ground when rotated at speed. Flails can be tracked or wheeled, manned or remote controlled. A Rotary Tiller is defined as a machine using a rotating axle, shaft or drum fitted with overlapping rows of steel alloy teeth or bits. The teeth grind and chew up the ground as the tiller is lowered to a selected depth. Tillers are generally tracked and can be operated from the cab or remotely.

Note: For excavators fitted with a flail or rotary tiller attachment, see 'Armoured Excavators'

## **16.20 Soil Depth Analysis**

16.20.1. Prior to any flailing or rotary tilling operation taking place on a new site or on an existing site where a significant change of ground has been encountered, and when the intention of the operation is for tooth or boot ground penetration, a soil depth analysis (test strip) shall be undertaken. A soil depth analysis determines boot or tooth penetration.

16.20.2. The soil depth analysis shall be carried out over a 50m run and measured at equally spaced intervals. Penetration will be determined by use of profile boards made of 3 – 6mm plywood or other like material. The profile board shall be at least 10% wider than the working drum width and be at least 300mm tall.

16.20.3. The profile board shall be buried in the ground level with the natural ground surface. Forward speed of machine, drum RPM and number of passes shall be recorded in the machine log book. The stated average soil depth penetration achieved will be the depth the profile board has been broken away over 90% of its length. This depth shall be incorporated into the clearance plan and will be representative of what depth can be expected to be achieved during operations.

## **16.21 Ground Preparation**

16.21.1 Ground preparation can be in the form of surface ground preparation or sub-surface ground preparation.

- a) The objective of surface ground preparation shall remove vegetation and tripwires. It is permissible to remove the hammers from the flail chains to carry out surface ground

preparation. Conduct of surface ground preparation is usually carried out in support of MDS operations or fire break construction.

- b) The objective of sub-surface ground preparation shall remove vegetation, tripwires and penetrate the ground to a certain depth. Conduct of sub-surface ground preparation is usually carried out in support of MDS and DT operations or as part of a verification operation. Machines fitted with a metal removal mechanism carrying out sub-surface ground preparation have the potential to bring about significant increases to DT productivity.

16.21.2 The following guidelines shall be adhered to when utilizing flails or rotary tillers in ground preparation activities;

- a) A thorough investigation of the mine/UXO threat in the area prior to the deployment of a flail or rotary tiller asset shall always be carried out.
- b) Control measures shall be in place to prevent foot/vehicular traffic from entering the work area whilst flailing or rotary tilling is taking place.
- c) Intrusive operations shall start and end in known safe ground.
- d) Start points and end points shall be clearly marked.
- e) Flails and rotary tillers shall be at operating depth prior to passing the start point and are to continue past the finish point before lifting.
- f) Worked lanes should be as straight as possible and include an overlap.
- g) Allowance and a procedure for taking care of throw outs shall be taken into account within any clearance plan.

## 16.22 Verification

16.22.1 Eliminating areas within an SHA by using a systematic mechanical approach can allow efficiencies to be realized by clearance assets. A flail or rotary tiller deployed during a technical survey operation can quickly reveal the existence of hazard.

16.22.2 Guidelines specified for flails and rotary tiller operation in ground preparation operations pertain to flails and rotary tillers used in a verification role.

## 16.23 Summary of Restrictions for Flail and Rotary Tillers

16.23.1. Flails and rotary tillers shall not be operated from the machine cabin in AT minefields unless the machine has undergone successful operator and machine survivability trials. The onus of proof is on the organisation operating the flail or rotary tiller,

16.23.2. Flails and rotary tillers can be operated in AT minefields by remote means,

16.23.3. Ground treated by flailing and or rotary tilling is required to have follow up action by a clearance asset before being deemed clear,

16.23.4. Safe lanes shall always be cleared through flail or rotary tilled ground using DT or MDS assets prior to entry into the area by demining personnel,

16.23.5. Flail and rotary tillers are not to be tracked or driven across un-cleared ground unless the ground has been subjected to an action that lessens the chance of the machine detonating a mine with its tracks or tires.

16.23.6. For operations using flails or rotary tillers that fall outside of the outlined activities above, authorisation from MACCA is required prior to task commencement, and

16.23.7. A qualified and accredited operator shall operate the flail and/or rotary tiller.

## **16.24 Armoured Front End Loaders**

16.24.1 Armoured front end loaders (FEL) are a multi-role MDU asset, which have proved to be extremely versatile in conducting ground preparation, ground processing and stockpile excavation. Armoured FEL's can be employed in a standalone role or part of a systems approach. Ground excavated by FEL's is required to have follow up action by a clearance asset or approved bucket system before being regarded as clear. An armoured FEL is defined as a wheeled or track mounted machine that is fitted with a front facing materials handling bucket. An FEL is designed to excavate, haul, and dump spoil and return. Traxcavator operation falls into the category of FEL.

## **16.25 Ground Preparation**

16.25.1 Ground preparation using offset ripper/cultivators;

- a) Control measures shall be in place to prevent foot/vehicular traffic from entering the work area whilst ripping is taking place. FEL's shall work from known clear ground only.
- b) Start points and end points shall be clearly marked.
- c) Offset rippers/cultivators shall be at ripping depth prior to passing the start point and shall continue past the finish point before lifting.
- d) Ground prepared by offset rippers/cultivators should be checked by metal detector prior to manual checking.

16.25.2 Other;

- a) FEL's can be used in the construction of access routes outside of any SHA and removal of debris and large rocks from the site after clearance.
- b) FEL's can be equipped with rollers in order to carry out ground verification/community confidence building operations. For FEL's used in this capacity, see 'Rollers'

## **16.26 Ground Processing**

16.26.1 Excavation

- a) The FEL shall commence excavation in safe ground. The FEL shall be level with bucket at required clearance depth prior to passing the baseline.
- b) When widening a lane, adequate bucket overlap shall be maintained in the previously excavated lane in order to prevent loose un-cleared soil from spilling into the previously excavated lane.

- c) The excavation shall be flat and free from remnants of loose soil. If an obstacle prevents the excavation from not being to required depth, this area shall be cleared using DT or MDS assets.
- d) Ground excavated to the required clearance depth is regarded as clear, and
- e) Marking showing cleared and un-cleared ground shall be clear, unambiguous and be present during all phases of excavation.

## 16.27 Haul Roads

16.27.1. The route used to haul un-cleared soil to the inspection area shall be smooth, clearly marked and free from loose soil. Any loose soil will be assumed to be spillage from the bucket and shall be cleared immediately, and

16.27.2. Personnel crossing the haul road should do so on cleared lanes or avoid walking on obvious spillage.

## 16.28 Inspection/Stockpile Areas

16.28.1. The stockpile area can be an area selected to bulk store un-cleared soil for further handling i.e. dumped into a crusher etc, or an area where stockpiling and inspection by clearance assets occur. In either case, it shall be located on known clear ground.

16.28.2. The stockpiling/inspection area shall have its perimeter marked and contain clear internal marking showing what soil remains un-cleared

16.28.3. For inspection purposes, the un-cleared soil shall be levelled with the bucket, to a maximum depth of each lift/layer no greater than 13cm prior to checking by DT or MDS assets,

16.28.4. Each lift/layer shall be inspected prior to the placement of the next lift/layer. If rakes are being used, rake tines shall be spaced close enough to detect fuses and AP mines,

16.28.5. Personnel within inspection teams shall remain in shelters during movement and tipping of contaminated soil, and

16.28.6. Soil excavated for processing shall be returned to original location unless dispensation is given by MACCA operations,

## 16.29 Bucket Systems

- a) All Gill/Grate systems shall be fit for purpose and constructed and operated in a manner that does not allow the expected threat to slip between the Gill/Grating.
- b) Regular internal QA checks are to occur in order to verify the cleared status of all processed soil.

16.29.1 Gill bucket: Ground suspected of containing AT mines shall employ a 'Gill' bucket system for excavation. Soil that passes the Gill in ground suspected of containing AT only, is deemed clear.

- a) Large stones/debris trapped above the Gill that prevents the spotter(s) from observing the presence of landmines/ordnance shall be placed in a separate inspection position in order to be inspected.
- b) Landmines/Ordnance discovered during Gill basket operations can be destroyed in situ or removed to a CDS for destruction if deemed safe to move.

#### 16.29.2 ALLU bucket/Star/Front basket

- a) Ground suspected of containing AP mines shall employ an ALLU or a fit for purpose Star/Front basket. Soil that passes through a Star/Front basket is deemed clear. Soil that passes through the ALLU bucket is deemed clear.
- b) Large stones/debris trapped above the Star/Front basket that prevents the spotter(s) from observing the presence of landmines/ordnance shall be placed in a separate inspection position in order to be inspected.
- c) Landmines/Ordnance discovered during Star/Front basket operations can be destroyed in situ or removed to a CDS for destruction if deemed safe to move.
- d) Landmines/Ordnance discovered during ALLU bucket operations shall be destroyed in situ.

### **16.30 Summary of Restrictions for Front End Loaders:**

16.30.1. ALLU and Star/Front basket buckets shall not be used in ground suspected of containing AT mines.

16.30.2. Gill buckets shall not be utilized in ground suspected of containing AP mines unless a follow on inspection procedure for AP mines is incorporated.

16.30.3. FEL's shall always be operated from cleared ground or ground that has been subjected to an action that lessens the chance of the machine detonating a mine with its tires.

16.30.4. FEL shall not be deployed in areas where there is a threat of large Booby Traps, Directional Fragmentation mines and HEAT projectiles.

16.30.5. Tractor mounted bucket/backhoe machines such as Komatsu WB93's, CAT426/428's shall not handle unclear spoil with the front mounted materials handling bucket.

16.30.6. Tractor mounted bucket/backhoe machines such as Komatsu WB93's; CAT426/428's shall not work in areas suspected of containing AT mines.

16.30.7. For operations using FEL's that fall outside of the outlined activities above, authorisation from MACCA is required prior to task commencement.

16.30.8. A qualified and accredited operator shall operate the FEL.

### **16.31 Armoured Excavators**

16.32.1 Armoured excavators are a multi-role mechanical asset, which have proved to be extremely versatile in conducting ground preparation, ground processing and deep excavation. Armoured excavators can be deployed to support clearance assets or as part of a systems approach. Ground excavated by and armoured excavator is required to have follow

up action by a clearance asset or approved bucket/sifting system before being regarded as clear. An armoured excavator is defined as a wheeled or track mounted machine designed to excavate and dump spoil from a stationary position using a slew motion. Backhoe operation falls into the category of excavator.

### **16.32 Ground Preparation**

16.32.2 The excavator shall be positioned on safe ground with the center of the slew motor no closer than 2m from the baseline. If using the teeth of a bucket to break hard ground, the ground should take on an even corrugated appearance with no stockpiles of soil.

16.32.3 If using a rotary tiller or flail to break hard ground, the ground should take on an even ploughed appearance with no stockpiles of soil. Under no circumstance is spoil from prepared ground to be allowed to be dragged back behind the baseline.

### **16.33 Ground Processing**

16.33.1 The excavator shall be positioned on safe ground with the center of the slew motor no closer than 2m from any baseline, Marking shall be clear, unambiguous and take into account not only the spoil inspection area but also the bucket swing route.

16.33.2 If not stockpiling as part of a 'system's approach', the unclear spoil shall be levelled with the bucket, with a maximum depth of each lift/layer no more than 13cm and subjected to a follow up clearance procedure.

16.33.3 Soil excavated for processing shall be returned to original location unless dispensation is given by MACCA operations.

### **16.34 Summary of Restrictions for Excavators:**

16.34.1. Excavators shall not be deployed in areas where there is a threat of large Booby Traps, Directional Fragmentation mines and HEAT projectiles.

16.34.2. Excavators operated from the cabin are not be used for the clearance of AT mines or UXO unless the machine has completed successful operator and machine survivability testing for AT operations.

16.34.3. Excavators shall be operated from previously cleared or designated safe areas. Excavators are only to traverse over cleared ground, designated safe areas or ground that has been subjected to an action that lessens the chance of the machine detonating a mine with it's tracks or tires.

16.34.4. For operations using armoured excavators that fall outside of the outlined activities above, authorisation from MACCA is required prior to task commencement.

16.34.5. A qualified and accredited operator shall operate the Excavator.

### **16.35 Armoured Bulldozer**

16.35.1 Armoured bulldozers are primarily used in open area clearance operations. Armoured bulldozers are generally used as part of a systems approach. An armoured

bulldozer is defined as a wheeled or track mounted machine designed to excavate and push spoil short distances using a front mounted blade.

16.35.2 Armoured bulldozers can also be used in the construction of access routes outside of an SHA and removal of debris and large rocks from the site after clearance.

16.35.3 A typical operation carried out by an armoured bulldozer is stockpiling or windrowing un-cleared soil, as part of a systems approach in support of a ground processing operation. Ground excavated by armoured bulldozers is required to have follow up action by a clearance asset or approved bucket/sifting system before being regarded as clear.

### **16.36 Ground Preparation**

16.36.1 Armoured bulldozers can be equipped with offset rippers in order to carry out ground preparation operations. For armoured bulldozers used in this capacity, see FEL - Ground preparation using offset ripper/cultivators.

### **16.37 Excavation In Support Of Ground Processing Operation**

- a) The armoured bulldozer shall commence excavation in safe ground and be level with blade at required clearance depth prior to passing the baseline.
- b) When widening a previously excavated lane, the overlap cut shall be carried out in such a way that no spillage of contaminated soil occurs into previously excavated ground.
- c) The excavation shall be flat and free from remnants of loose soil. If an obstacle prevents the excavation from being flat or not to required depth, this area shall be cleared using clearance assets.
- d) Marking showing cleared and unclear ground shall be clear, unambiguous and be present during all phases of excavation. Soil excavated for processing shall be returned to original location unless dispensation is given by MACCA operations.

### **16.38 Summary of Restrictions for Armoured Bulldozers:**

16.38.1 Armoured Bulldozers classified as light (<5t) shall not be used in AT operations.

16.38.2 Armoured Bulldozers shall not be deployed in areas where there is a threat of large Booby Traps, HEAT or Directional Fragmentation mines.

16.38.3 Armoured Bulldozers are not to be tracked on ground suspected of containing AT mines unless conducting excavation or other steps have been taken to minimize the machine detonating a mine with its tracks.

16.38.4 For operations using armoured bulldozers that fall outside of the outlined activities above, authorisation from MACCA is required prior to task commencement.

16.38.5 A qualified and accredited operator shall operate the armoured bulldozer.

## 16.39 Rollers

16.39.1. Rollers are primarily used in open area verification operations and threat reduction activities. Rollers can be towed behind mine proof vehicles, controlled remotely by winches or pushed from behind by an armoured push unit or excavator arm.

16.39.2. Rollers do not clear ground as they only have the potential to activate functioning mines. Ground subjected to MDU rolling will normally be followed up by a clearance asset.

16.39.3. The MACCA operations department may authorize MDU rolling without a second asset clearance on a site-by-site basis. Ground treated in this manner is not handed back to the community as 'cleared' but released due to negligible risk of the ground containing hazard.

## 16.40 Ground Preparation

### 16.40.1 Excavator mounted roller

- a) The excavator shall be positioned on safe ground with the center of the slew motor no closer than 2m from any baseline.
- b) Rolling shall commence or cease in safe ground.
- c) Lane overlap should be  $\frac{1}{2}$  the width of the effective rolling unit.
- d) Marking showing rolled and un-rolled ground shall be clear, unambiguous and be present during all phases of rolling, and

### 16.40.2 Winch controlled roller

- a) Rolling shall commence and cease in safe ground.
- b) Lane overlap should be  $\frac{1}{2}$  the width of the effective rolling unit.
- c) Personnel shall stand clear of by Steel Wire Rope under tension and not be positioned directly in the path a roller would travel downhill, due to cable failure.
- d) All detonations shall be recorded.
- e) Marking showing rolled and un-rolled ground shall be clear, unambiguous and be present during all phases of rolling.

## 16.41 Verification

16.41.1. Rolling shall commence and cease in known clear ground.

16.41.2. Lane overlap should be  $\frac{1}{2}$  the width of the effective rolling unit.

16.41.3. A rolling pattern which allows for a minimum of 4 passes from 4 different directions should be utilized.

16.41.4. If an obstacle or lay of the land prevent the roller from making full contact with the surface of the ground, the area shall be marked for clearance by a clearance asset.

16.41.5. Marking showing rolled and un-rolled ground shall be clear, unambiguous and be present during all phases of rolling.

16.41.6. If a detonation takes place during an area reduction rolling operation, rolling should stop, the roller extracted and clearance assets deployed.

16.41.7. Safe lanes shall always be cleared through rolled areas using DT or MDS assets prior to entry into the area by demining personnel.

16.41.8. The MACCA operations department may authorize MDU rolling without a second asset clearance on a site-by-site basis. Ground treated in this manner is not handed back to the community as 'cleared' but released due to negligible or tolerable risk of the ground containing hazard.

## **16.42 Summary of Restrictions for Rollers**

16.42.1. Rolled ground does not guarantee the ground is cleared,

16.42.2. The MACCA operations department may authorize MDU rolling without a second asset clearance on a site-by-site basis. Ground treated in this manner is not handed back to the community as 'cleared' but released/cancelled due to low or tolerable risk of the ground containing hazard.

16.42.3. Rolled ground shall be cleared using DT or MDS means if demining personnel require access. This is regardless if the land is going to be released due to negligible or tolerable risk of the ground containing hazard.

16.42.4. Rollers are not to be used in areas where there is a likelihood of HEAT UXO.

16.42.5. For operations using rollers that fall outside of the outlined activities above, authorisation from MACCA is required prior to task commencement

16.42.6. Only qualified and accredited operators can operate rollers within a MDU rolling operation.

## **16.43 Armoured Haul Machines**

### **16.43.1 Material Handling**

- a) Armoured haul machines are used to transport un-clear spoil from excavations to inspection/processing areas and return cleared soil back to point of origin. Armoured haul machines are generally truck based vehicles and used as part of a systems approach.
- b) Armoured haul vehicles shall have provision for protecting the driver/operator should a munitions detonation occur within the tray.
- c) The deck shall be cleaned down between loads of different materials i.e. un-clear soil, cleared soil.
- d) The haul vehicle shall be loaded in such a way, no spillage of un-cleared soil occurs during transit.

- e) The operator shall remain in the cabin of the haul vehicle or away in a designated waiting place that conforms to site safety distance requirements.
- f) When using an armoured excavator/clamshell grab crane to load the haul vehicle, the load shall not to be swung over the cabin of the haul vehicle.
- g) Armoured haul machines shall only be driven on clear ground.
- h) For operations using armoured haul vehicles that fall outside of the outlined activities above, authorisation from MACCA is required prior to task commencement.
- i) An accredited operator shall operate the armoured haul machine.

#### **16.44 Armoured Cranes**

16.44.1 Armoured clamshell grab cranes have proved to be extremely useful in conducting deep excavation in places too deep for general excavation machines or in places where increased standoff are desirable. Armoured clamshell grab cranes are generally used as part of a systems approach. Ground excavated by an armoured clamshell grab crane is required to have follow up action by a clearance asset or approved bucket/sifting system before being regarded as clear. An armoured clamshell grab crane is defined as a track mounted machine fitted with a clamshell grab bucket designed to excavate and dump spoil from a stationary position using a slew motion.

#### **16.45 Ground Processing**

16.45.1. The armoured clamshell grab crane shall be positioned on safe ground with the center of the slew motor no closer than 15m from the point of excavation.

16.45.2. Marking shall be clear, unambiguous and take into account not only the spoil inspection area but also the bucket swing route.

16.45.3. Under no circumstances is a bucket containing unprocessed spoil be allowed to swing over cleared ground.

16.45.4. If munitions detonate during the excavation/swing cycle, the cycle shall be completed. Once the clam bucket has been emptied, the clam bucket and cables shall be inspected for serviceability.

16.45.5. If not stockpiling as part of a 'system's approach', the unclear spoil shall be levelled, with a maximum depth of each lift/layer no more than 13cm prior to checking by manual or MDS assets.

16.45.6. Soil released from the clamshell bucket shall be released at a height no higher than 1 meter from the ground surface/stockpile.

16.45.7. Soil excavated for processing shall be returned to original location unless dispensation is given by MACCA operations.

#### **16.46 Summary of Restrictions for Armoured Clamshell Grab Cranes:**

16.46.1. The armoured clamshell grab crane shall work from levelled clear ground.

16.46.2. The armoured clamshell grab crane shall be positioned on safe ground with the center of the slew motor no closer than 15m from the point of excavation.

16.46.3. Armoured clamshell grab cranes are only to traverse over previously cleared ground, known clear ground or steps have been taken to minimize the machine detonating a mine with its tracks.

16.46.4. An accredited operator shall operate the armoured clamshell grab crane.

### **16.47 MDU Sifting**

16.47.1 MDU sifting is a technique used in sifting contaminated earthen spoil and rubbish. The use of MDU assets in this type of clearance greatly reduces the risk to DT members and MDS assets who maybe required to clear areas where mines have been disturbed from their original position. Mines that have been moved by previous MDU disturbance or by nature's elements maybe more sensitised and therefore more dangerous to manual or MDS clearance assets. All sifting systems shall be fit for purpose and constructed and operated in a manner that does not allow the expected threat to slip between the Gill/Grating. Regular internal QA checks are to occur in order to verify the cleared status of processed soil.

- a) The use of MDU sifting methods is an acceptable means of clearance of areas containing AP mines only. MDU sifting is not to take place on areas that contain AT mines or large UXO.
- b) Mechanically sifted ground is deemed clear, and
- c) All MDU sifting whether it is by MDU attachments or independent table sifts shall undergo an in-country test and evaluation prior to use or, produce objective evidence of successful operation in another mine action program.

### **16.48 Whenever Conducting MDU Sifting Operations the Following Factors Shall be Considered:**

16.48.1. An assessment of the extent of the area to be sifted shall be conducted and procedures implemented specific to each site. The exact requirements of any sifting operation shall be stated in a written clearance plan approved by the MACCA. The plan shall include what size grating/grill is going to be utilized,

16.48.2. When incorporating DT or MDS assets into the sifting process these assets shall be fully conversant with all safety procedures associated with that machine,

16.48.3. Mechanical assets involved with conducting sifting operations are only to traverse over previously cleared ground, known clear ground or steps have been taken to minimize the machine detonating a mine with its tires or tracks, and

16.48.4. If an AT mine or UXO greater in size than 82mm threat exists then MDU sifting is not to be used.

## **16.49 Actions on Detonation during Sifting Operations**

16.49.1. If a detonation occurs during any sifting operation then the machine shall stop immediately and the machine or sifting table shall be inspected. If the machine or table is damaged then sifting operations will stop until the damage is repaired.

16.49.2. If the machine or sifting table is not damaged then the supervisor may continue operations.

## **16.50 Manual Clearance of Sifted Material**

16.50.1. As well as normal mine clearance safety procedures the following rules apply when manually clearing sifted processed material:

16.50.2. Only trained deminers and personnel shall be employed when dealing with mines located during MDU sifting.

16.50.3. Personnel dealing with mines located during sifting operations shall wear full PPE. The handling of all located items shall be kept to a minimum, due to the possible increased sensitivity of the mines or parts of mines and fuses.

16.50.4. Where ever possible mines shall be moved by remote means to a demolitions pit to reduce the risk to manual deminers.

16.50.5. Ballistic protective shields that have been approved for use by MACCA or purpose built observation dugouts shall be used by deminers when observing sifting operations.

## **16.51 MDS Clearance of Sifted Material**

16.51.1. As well as normal MDS clearance safety procedures the following rules apply when clearing sifted processed material by MDS:

16.51.2. MDS assets used for searching sifted material shall be accredited for checking mechanically processed ground.

16.51.3. MDS clearance of sifted material shall be no sooner than 2 days after the sifted material has been laid out and provided it has rained during this period or 5 days or longer if not.

16.51.4. Sifted material to be cleared by MDS shall be no deeper than 13 cm in one layer.

16.51.5. All MDS indications shall be investigated by DT means prior to the next sifted layer being applied.

16.51.6. When using MDS all sifted spoil shall be laid out over previously MDS cleared areas only.

## **16.52 MDU Crushers**

16.52.1 MDU crushers are not currently used in Afghanistan for mine clearance however these assets maybe employed in the future. Any introduction of this type of MDU asset into

Afghanistan will require field-testing and evaluation by the MACCA prior to accreditation for operational use. Safety precautions test and evaluation criteria will apply as for all other MDU assets in country.

The following additional rules apply for MDU crushers:

- a) Any MDU crusher shall have approved SOP's prior to operations,
- b) Any MDU crushers used in Afghanistan shall be set and operated in a manner that does not allow the expected threat to slip between it's jaws. Regular internal QA checks are to occur in order to verify the cleared status of processed material.
- c) All crushers shall have sufficient armoured protection to withstand blast and Fragmentation from AP blast and Fragmentation mines as well as non-metallic AT blast mines,
- d) UXO over 60 mm in diameter shall not be processed through any crusher systems in Afghanistan,
- e) Metallic encased AT mines shall not be processed through any crusher system,
- f) Although crusher processed material is deemed clear, it must be subjected to internal QA checks. This can be done by manual or MDS.
- g) Only trained deminers and personnel shall be employed when dealing with mines or explosive items located during MDU crushing operations.
- h) Personnel dealing with mines or explosive items located during crushing operations shall wear full PPE. The handling of all located items shall be kept to a minimum, due to the possible increased sensitivity of the mines or parts of mines and fuses located during the MDU process.
- i) Where ever-possible mines or parts of fuses and mine shall be moved by remote means to a demolitions pit to reduce the risk to manual deminers.
- j) Ballistic protective shields that have been approved for use by MACCA or purpose built observation dugouts shall be used by deminers when observing crushing operations, and

### **16.53 Communications**

16.53.1. All MDU assets operating shall be fitted with appropriate communications means to allow immediate communications between the MDU operator and the MDU TL for work and other instructions.

16.53.2. Vehicle communications shall be such that the operator can hear any commands over the machines operating noise.

16.53.3. All communications shall be tested at the Control Point before any machine moves into the danger area.

### **16.54 MDU Assisted Demining Operations Site Layout**

16.54.1 When opening a new clearance site and the first asset to commence clearance operations is an MDU, the site layout will be as that of any other clearance site. For example:

- a) A Control Point will be cleared and set up in the same manor as that of any other clearance site.
- b) All marking will be as per company SOP's and AMAS
- c) A designated EOD check area will be cleared and constructed no less than 100m from the CP.

**Annex (A) SUMMARY OF THE MINIMUM SAFETY DISTANCES TO BE OBSERVED WHEN OPERATING MDU ASSETS WITHIN AFGHANISTAN**

<b>Ser</b>	<b>Anti Personnel Blast &amp; Fragmentation (all machines except Flail/Tiller Operations)</b>	<b>Distance</b>
1	Admin area to EOD vehicle checkpoint	100m
2	EOD Vehicle checkpoint to working machine	25m
3	Admin area to working machine	100m
4	Personnel in PPE <u>without</u> protective shelter to working machine in AP Blast SHA	25m
5	Personnel in PPE <u>without</u> protective shelter to working machine in AP Fragmentation SHA	50m
6	Personnel in PPE with protective shelter to working machine in AP Blast SHA	10m
7	Personnel in PPE with protective shelter to working machine in AP Fragmentation SHA	10m
8	Armoured machine/vehicle to armoured machine/vehicle	50m
9	General public to MDU work area	100m

<b>Ser</b>	<b>AP Blast/Fragmentation Minimum safety distances for Flail/Tiller Operations</b>	<b>Distance</b>
1	Admin area to EOD vehicle checkpoint	100m
2	EOD Vehicle checkpoint to working machine	25m
3	Admin area to working machine	100m
4	Personnel in PPE <u>without</u> protective shelter to working machine in AP Blast SHA	50m
5	Personnel in PPE <u>without</u> protective shelter to working machine in AP Fragmentation SHA	75m
6	Personnel in PPE with	25m

	protective shelter to working machine in AP Blast SHA	
7	Personnel in PPE with protective shelter to working machine in AP Fragmentation SHA	50m
8	Armoured machine/vehicle to armoured machine/vehicle	50m
9	General public to MDU work area	100m

Ser	AT mines Minimum safety distances	Distance
1	Admin area to EOD vehicle checkpoint	250m
2	EOD Vehicle checkpoint to working machine	50m
3	Admin area to working machine	250m
4	Personnel in PPE <u>without</u> protective shelter to working machine in AT SHA	100m
5	Spotter/remote operator/deminer in PPE <u>with</u> protective shelter to working machine in AT SHA	75m
6	Armoured machine/vehicle to armoured machine/vehicle	50m
7	General public to MDU work area	250m

Ser	MDU support to EOD operations	Distance
1	Admin area to EOD vehicle checkpoint	150m
2	EOD Vehicle checkpoint to working machine	150m
3	Admin area to working machine	300m
4	Personnel in PPE with protective shelter to working machine	50m
5	Armoured machine/vehicle to armoured machine/vehicle	150m
6	General public to MDU work area	300m