National Defence / Défense nationale

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ENGINEER FIELD MANUAL

MOBILITY SUPPORT—ROUTE AND AREA CLEARANCE

(ENGLISH)

This document supersedes relevant portions of B-GW-320-010/FP-001 dated 1991-07-26.

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Issued on the Authority of the Chief of the Land Staff

Canada

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Canada

FOREWORD

1. This doctrine publication is issued under the authority of the Directorate of Army Doctrine (DAD) on behalf of the Chief of the Land Staff (CLS).

2. This document supersedes relevant portions of B-GW-320-010/FT-002 *Mines and Boobytraps* (Interim 1985).

3. All Canadian Land Force elements preparing for international operations, all Land Forces, and the Canadian Forces School of Military Engineering (CFSME) are to adopt the principles and procedures contained herein, forthwith.

4. Unless otherwise noted, masculine pronouns apply to both male and female.

5. Published on the authority of the Chief of the Land Staff by the Army Publishing Office, Fort Frontenac, Kingston, Ontario.

PREFACE

BACKGROUND

1. For more than a decade mines and other unexploded explosive ordnance (UXO) have posed one of the most significant threats to Canadian Forces (CF) troops deployed on overseas operations. Mines and other UXO constitute a continuous and a significant hazard, which must be addressed using available tools, equipment and prescribed procedures.

2. To date, all standard light vehicles encountering mines have resulted in catastrophic consequence; conversely, relatively few casualties have resulted as a consequence of armoured vehicles striking mines. However, this is not a realistic expectation because the current generation of the Light Armoured Vehicle (LAV) fleet is not designed to fully protect the crew from the effects of anti-tank mines (figure 1-1). The Eritrea (Op ECLIPSE) and Jowz Valley (Op ATHENA) mine strike Boards of Inquiry recommendations have provided sound recommendations that have been taken into account in the production of this manual.

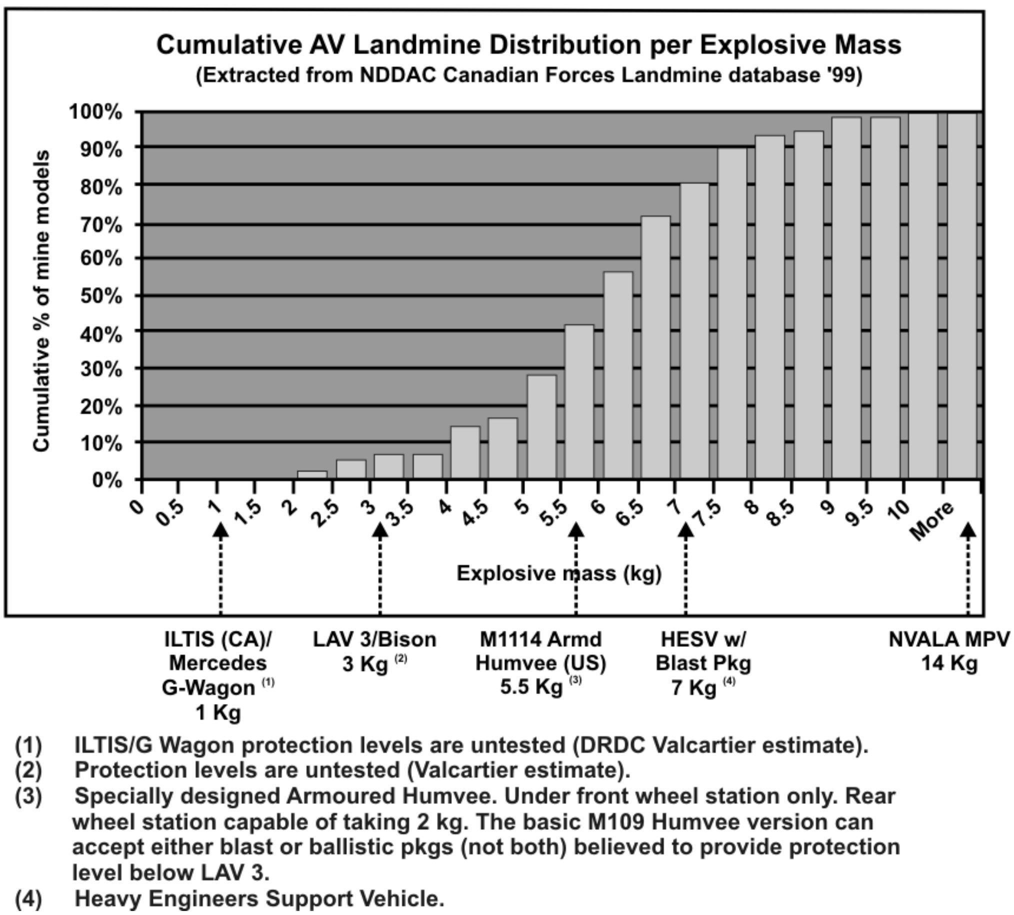

Figure i-1: Landmine Distribution and Typical Protection of Vehicles

3. The introduction of new doctrine and equipment has in some respect been out paced by the evolving nature of contemporary operations and threats. This reality challenges the engineer

and the supported commander's (often a task force commander) ability to address the threats posed by mines and other UXOs - specifically concerning route and area clearance.

PURPOSE

4. This document is primarily designed to provide the doctrine for countermine: route and area clearance. Adherence to the principles and procedures in this publication will guide all leaders to a more consistent and precise ability to:

a. integrate risk management during the planning of formation/unit tactical manoeuvre requirements;

b. define the initial mine and other UXO risks associated with a particular route or area;

c. properly identify and propose the appropriate risk control measures;

d. define the risk associated with performing the actual clearance operations and effect control measures;

e. plan, conduct and supervise clearance operations; and

f. perform other related duties (plan and conduct UXO strike incident response).

5. Of greatest importance, the engineer leader will be able to do all this in a consistent manner. This will allow supported commanders to better balance the risks associated with increasing mobility in support of the overall mission. Commanders must ultimately make the critical decisions, and they will do so supported by engineer advice.

KEY CONCEPTS

6. For the purposes of clarification and emphasis, the following notes are provided:

a. There is always residual risk following a clearance operation; there are no 100% guarantees.

b. Unless a route is under direct surveillance it may be re-mined or targeted.

c. Risk assessment is inherently a subjective process/tool that supports but does not replace the actions of intelligent, intuitive and professional soldiers. This document describes a command driven process, supported by engineer advice, which helps to weigh UXO related risks against the tactical situation and against overall mission requirements.

d. The current generation of LAV do not provide adequate crew protection against anti-tank mines.

e. Clearance procedures that are conducted to reduce risk are inherently risky themselves. Complacency, which often develops over time, is a concern.

f. Permissive environments (no overt threat) ordinarily allow for "adequate" time, thus it is anticipated that the need to accept UXO related risk will normally be significantly reduced.

g. For the purposes of this manual all UXO incidents, whether mine, IED, or other UXO related, will be referred to as a "mine strike."

h. Even though doctrinal procedures and methods are described in this manual, the Deputy Chief of the Defence Staff (DCDS) Direction for International Operations (DDIO) for each particular overseas operation provide the policy and authority to execute these activities.

i. While doctrine is not meant to be prescriptive, deviation from the basic procedures and drills described in this manual must be approved by the delegated level and agency of authority and/or subject matter expertise. There is increased risk of mishap if personnel and equipment are employed in a manner that is neither proven nor rehearsed in prior training. Notwithstanding, a flexible approach will always be required in mine and other UXO clearance operations, and engineer commanders are expected to adapt to the realities of each theatre of operations in a logical and supportable manner. However, if any doubt exists, it is imperative that commanders seek higher authoritative advice and approval.

MANUAL LAYOUT

7. The manual can be considered a two-part document. The first part, chapters one to four, provides the doctrine necessary to effect planning and risk management to provide mobility support through clearance. The second part, the remainder, provides details on the various tactics, techniques and procedures available to operators to conduct clearance.

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CHAPTER 1
INTRODUCTION

ENGINEER SUPPORT TO MOBILITY

1. In general, a commander develops a concept of operations with a supporting scheme of manoeuvre with a view of achieving desired effects. Accordingly, the commander or his staff will designate mobility corridors, routes or areas[1] that are required in support of this plan. Forces rely on the ability to move rapidly and freely to effectively execute tasks. Under combat conditions, forces combine a full range of effects including conventional fire and movement to achieve intended outcome and advantage over the threat forces. Even in less intensive peace support operations, mobility is equally important, as it enables forces to project the necessary presence required to accomplish their mission.

2. The engineers are charged with the responsibility to provide mobility support. The engineers must deal with known and unforeseen restrictions to mobility. This includes overcoming a multitude of existing and reinforcing obstacles. The overall steps in providing mobility are:

a. planning;

b. detection of restrictions to mobility; and

c. maintaining mobility by either (figure 1-1):

(1) bypassing obstacles; or

(2) defeating obstacles.

3. Operations will frequently not be distinguishable in terms of operations other than war or warfighting. A wide range of military activities will be required simultaneously to manage full spectrum operations, rather than a single focus or sequential progression. Mission success depends on understanding such simultaneity and how it affects the planning and conduct of operations. Mobility support is therefore better executed in terms of simplifying the operational environment as either permissive or non-permissive in nature. The level of permissiveness and risk tolerance dictates the manner in which mobility support tasks are executed (figure 1-1). Permissiveness is a relative term, conveying the degree of overt tactical threat but can also include the expedience (time restriction) in which a task must be completed. When encountering an obstacle, where possible, economy of effort dictates that a bypass be found. However, if no bypass is possible or worthwhile, the obstacle must be defeated.

[1] This includes the requirement for establishing static bases and facilities

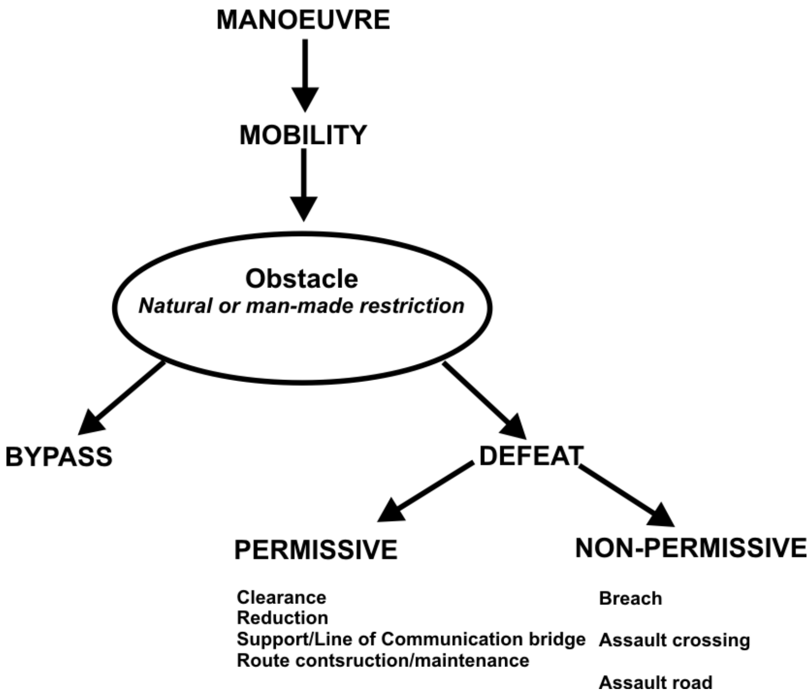

Figure 1-1: Maintaining Mobility

4. Mobility support can be categorized into four main sub-tasks (table 1-1): countermine, counter-obstacle, gap crossing and enhancing movement. These sub-tasks are often conducted concurrently, for example, in the defeating of a composite obstacle that includes a minefield, ditch and berm or a crater group "seeded" with mines. As was stated above, the threat environment influences the manner in which the mobility sub-tasks are executed.

MOBILITY SUB-TASKS		
	PERMISSIVE	**NON—PERMISSIVE**
COUNTERMINE	Clearance[2]	Breach
COUNTER-OBSTACLE	Obstacle Reduction	Breach
GAP CROSSING	Support/Line of Communication Bridging	Assault Crossing
ENHANCING MOVEMENT	Route Construction/Maintenance	Assault Road

Table 1-1: Mobility Support Tasks

5. More specifically, where restrictions, obstacles or hazards are encountered the following general options exist:

---

[2] This document is specifically designed to address mobility support—countermine—route and area clearance operations.

a. **Bypass**. Bypassing an obstacle by finding an alternate route or area which is less resource intensive and/or less risky, yet remains acceptable to the commander.

b. **Defeat**. The manner in which obstacles are defeated depends on the nature of the obstacle and whether the conditions are permissive or not.

(1) **Countermine**. The reduction or elimination of obstacles composed primarily of mines and other unexploded explosive ordinance (UXOs).

(a) **Clearance**[3]. Clearance describes the detection and removal of mines and other UXO threats in a defined area or along a route to allow a military operation to continue with reduced risk. Clearance operations are conducted in a tactically permissive environment, are normally not time restricted, and are inherently deliberate thus permitting the employment of a full range of countermine systems. Clearance operations support a tactical commander but normally clearing is just an engineer task (with administrative support).

(b) **Breaching**. A breach is a synchronized combined arms operation, in direct support of a manoeuvre commander, conducted to create a lane through an obstacle under non-permissive tactical conditions. A passage is formed through an obstacle to advance forces to the far side. A breach may be hasty or deliberate, and in the case of a composite obstacle several engineer capabilities may be required.

(2) **Counter Obstacle**. The reduction or elimination of obstacles (other than those composed primarily of mines and other UXOs).

(a) **Obstacle Reduction**. Obstacles may need to be removed in order to restore mobility along a route or in an area. This may involve the removal of mines and other UXO. Obstacle reduction drills are designed for use in a permissive environment and are inherently deliberate. Engineers may often execute obstacle reduction independently (with administrative support) or as part of a combined arms element tasked with “clearing" a route or area.

(b) **Breaching**. Same as breaching above.

(3) **Gap Crossing Operations**. The crossing of gaps and waterways under assault and/or permissive conditions may also be required alone or in conjunction with the other sub-tasks.

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[3] This is not to be misconstrued as the tactical task that requires the removal of all enemy forces and eliminates organized resistance in an assigned area.

(4) **Enhancing Movement**. Freedom of movement may also be enhanced through construction and/or maintenance of routes and in some cases, other facilities.

MINE AND OTHER UXO THREATS

6. The spectrum of potential threats and hazards includes all types of UXO for example anti-personnel and anti-vehicle mines, booby traps, conventional munitions and improvised explosive devices. These items can be found on routes or near by (off-route mines). They can be remnants from previous conflict or employed specifically to target friendly forces, alone or even in conjunction with an ambush. The variety of ordinance and the ways in which they can be employed are virtually limitless.

THREAT LEVEL UNCERTAINTY

7. In the contemporary non-linear, non-contiguous operating environment it may be difficult to determine the exact level and nature of threat. At any given time, there can exist asymmetry in the threat environment throughout the area of operations (AO). One sector may be relatively stable and supportive of friendly forces, while an adjacent sector may remain embroiled in conflict and outwardly hostile. Care must be taken to ensure that the employment of risk management processes keep pace with the changing environment. In some instances perceived or defined threats, if not managed properly, could result in risk avoidance rather than management, and thus immobilize a mission and/or overburden scarce engineer resources. In lower threat situations constant vigilance by the chain of command is essential to reduce the potential for complacency, especially in light of a situation that could quickly escalate.

FORCE PROTECTION, RISK AND MISSION SUCCESS

8. Some degree of unconstrained mobility is essential to mission success; however, to establish and maintain the required mobility exposes friendly forces to hazards. Force protection can be compromised through active targeting by threat forces or by indiscriminate hazards such as UXOs. In combat operations, the need to maintain tempo to defeat the threat forces exposes friendly forces to increased dangers and casualties but the consequence of not achieving a mission objective, presumably, outweighs the discrete risks encountered by individuals. In non-combat operations, the situation will seldom dictate that the tempo be such that discrete risks be taken without employing a number of mitigating controls. Nonetheless, risks associated with restricted mobility frequently outweigh those risks associated with improving mobility. Regardless of the nature of operation, the overall risk to friendly forces must be minimized.

RESPONSIBILITIES AND AUTHORITY

9. **General**. Planning from the strategic to the tactical levels must support the development and maintenance of force mobility. Mobility planning must be considered at all phases of an operational deployment.

a. **Strategic**. During the preliminary phases of an operation (warning, strategic reconnaissance and mounting) J3 staff with the J3 engineer or designated planners and coordinators—as the strategic planning level—will endeavour to define the threats to mobility within the intended AO. In response to those threats, and with command authority, force generators will be instructed to prepare the appropriate capabilities (a prime means of implementing risk control measures) for deployment. Strategic decisions will have a fundamental impact on defining the force's operational capabilities. It is therefore key that engineers have adequate participation on early reconnaissance missions and provide the appropriate advice in the formulation of the plan and force employment capabilities. Specific guidance should occur within the following areas:

(1) determining requirements and standards for engineer specific, and combined arms training;

(2) determining what is required to counter threats/hazards and ensure the necessary capabilities are made available. This may include various equipment-based capabilities (eg. mine protected vehicle), and organizations (eg. Improvised Explosive Device Disposal teams);

(3) issuing relevant policy, doctrine and standard operating procedures (SOPs);

(4) arranging for force employment self-sufficiency in essential capabilities; and

(5) provision of guidance concerning risk tolerance.

b. **Operational**. The extent and nature of a national operational level headquarters (HQ) involvement depends on the mission. This could range from a fully operational joint task force HQ to only a national command element. In either case, the mandate of the engineer advisor, or task force engineer, at that level must be specifically defined (command and/or technical control responsibilities). No matter what the case, this level of HQ is expected to provide some degree of oversight of the tactical level, and to provide connectivity between the strategic and the operational/tactical levels. They also play a direct part in the planning and ultimately the mitigation of risk.

c. **Tactical**. Over the past decade the most common tactical deployment has been that of a battle group (BG), assigned in an AO within a coalition formation. The degree of cooperation and coordination between the formation and the BG varies and must be defined. Nevertheless, the BG with its supporting engineer squadron is ultimately responsible for their own mobility requirements within their AO. It is imperative that the appropriate operating procedures are defined, understood and rehearsed prior to deployment. Engineers will, in turn, be tasked to execute clearance of routes and areas and will therefore conduct their own necessary battle procedure, including risk management. There must be a regular appreciation of the threats to mobility as well as the attitude of personnel to the threat. BG personnel must be aware of risk tolerance of higher command and the level at which certain risk decisions are authorized. The tactical players must communicate shortfalls in equipment, personnel and doctrine.

PRE-DEPLOYMENT CONSIDERATIONS

10. **General**. Force generators build the appropriate force employment structure prior to a deployment to enable a mission to have the necessary freedom of movement. This begins by defining potential mobility challenges in the future AO that jeopardize mission objectives. A force structure is built by providing the force with capability.

11. **Training**. Training is probably the single most important aspect in preparing personnel for a mission. Training introduces personnel to mission specific threats and provide a baseline standard in skills and knowledge. It is an opportunity to ensure all personnel have an updated comprehension of current doctrine and that any outdated doctrine and practices are excised.

a. **Personnel—All Arms**. Personnel must be trained in:

(1) mine and other UXO awareness (this is required pre-deployment training);

(2) terrain management control measures (route/area designation), SOPs, standards, threat posture levels;

(3) overview of clearance and breaching procedures; and

(4) "MINE STRIKE" reaction procedures from individual through collective levels.

b. **Combined Arms**. Maintenance of mobility is a combined arms effort; consequently, the combined arms team must be familiar with the following procedures:

(1) clearance and Obstacle Reduction;

(2) terrain management control measures (route/area designation), SOPs, threat posture levels;

(3) standing operating procedures and standards used by coalition partners;

(4) breaching; and

(5) “MINE STRIKE" reaction procedures.

c. **Leaders**. Leaders must discuss the concept of mobility and how to manage the threats to movement. These discussions could be supported through the use of scenarios which address:

(1) threats and hazards to mobility (natures of UXO including mines and improvised explosive devices (IEDs));

(2) commander's guidance and policy on risk tolerance and levels of authority for approving movement off designated routes and areas;

(3) methods in which to request route and area clearances;

(4) multinational and coalition operating procedures and to what degree they will be adopted;

(5) methods to be used in "opening" routes/areas (obstacle reduction, UXO clearance) and what support the engineers require/provide;

(6) immediate mobility requirements (breaching); and

(7) "MINE STRIKE" scenarios under various conditions.

d. **Engineers**. Engineers must be familiar with the mission specific threats and the reduction, clearance and breaching procedures that will be employed in the theatre of operations, as well as, what coalition, host nation and other support will be available and a measure of its reliability and responsiveness.

THE NATURE OF THE AREA OF OPERATIONS

12. **Theatre Activation or Entry**:

a. **New Area of Operations**. Activating or entry into an area not previously occupied by friendly forces is a complex situation often typified by limited knowledge of the exact nature and extent of threats and hazards. Upon theatre entry, a commander will want to immediately project a presence, and therefore may accept a higher level of risk before the engineers begin to designate and clear routes and areas. Engineers will have to provide advice and make the appropriate route/area designations based on "remote" analysis. The commander will have to be selective and list mobility priorities. Risk tolerance will be dictated by the degree of permissiveness wherein it may be necessary to conduct a forced occupation or seize control.

b. **Relief in Place or Follow Through**. Entering an area previously occupied by friendly forces will require a detailed passage of information concerning the threats and the areas that have been previously cleared or breached. It will be incumbent on the incoming commander to decide on the reliability of the information and the methods used to open routes/areas by previous terrain owners. The level of reliability will be relative to the degree of standardization and interoperability between gaining and losing formation/unit.

13. **Changing Threat Levels**. Continual monitoring of threat levels from threat forces intent on jeopardizing the mission is required to ensure friendly forces develop and maintain situational awareness on the status of routes and areas.

14. **Other Agencies**. During operations other than war, other agencies may already be conducting clearance and reconstruction within the AO, agencies such as former warring factions, non-government organizations (NGOs), contractors and coalition partners. These players should be considered in all planning and could be very beneficial to the overall effort. Military efforts will be in support of operational requirements where as civilian agencies can assist in humanitarian and local government needs. Where friendly forces intend to utilize areas cleared via these means, it is essential that intelligence, planning and risk management be conducted; nothing should be assumed.

MULTINATIONAL COALITION OPERATIONS

15. Although long-standing alliances, such as NATO, and programmes, such as ABCA, have worked toward addressing issues of interoperability there continues to be various interoperability gaps. The gaps are greatest in cases where a coalition is formed where there has not been any prior basis or foundation. It will usually be the responsibility of the lead nation—those responsible to formulate the higher HQ—to establish standard operating procedures. Canadian Force deployments must be prepared to prescribe their own procedures in at least their assigned AO and other places where they are required to operate and be aware of standards, designation and procedures used by other nations.

CHAPTER 2
RISK MANAGEMENT IN CLEARANCE OPERATIONS

SECTION 1
INTRODUCTION

GENERAL

1. *Risk* is an expression of possible loss stated in terms of *probability* and *severity* of an event.

2. *Risk Management* is the process of identifying and assessing risks arising from operational factors, and implementing reasonable controls to reduce threat and hazards. Commanders, leaders and soldiers must decide if the remaining risk (residual risk) and potential costs outweigh mission imperatives. Proficiency in applying risk management is critical to force protection and the conservation of resources. Risk management is integral to the operational planning process and decision/action cycle. The process is an important means of enhancing situational awareness. If it inhibits flexibility and initiative then it is not being effectively employed.

3. ***The objective of managing risk is not to eliminate all risk, but to identify and remove unnecessary risk***. Risk management must be fully supported by the chain of command. Commanders should not expect that all missions will be accomplished free from errors and/or flaws, or expect perfect performance. Demanding such rigid standards leads to over supervision and paralysis; it produces timid leaders, afraid to make tough decisions in crisis and unwilling to take risks necessary for success in military operations. Commanders accept that things may go wrong, even with the certain knowledge that a subordinate has done all within their power to prevent an incident. Conversely, Commanders must be vigilant to inexperience or complacency. Some individuals become susceptible to overestimating their ability to respond to or recover from a hazardous incident, or to underestimating the level of risk posed by a hazard. The commander must address risk in his “commander’s guidance”. It is here that the Commander gives direction on the risk tolerance he is willing to accept by delegation; otherwise subordinates must seek authority. Subordinates seek the Commander’s approval to accept risks that might imperil higher intent. Commanders compare and balance risks against mission requirements and accept risk if the benefits outweigh the potential costs or implement mitigating measures.

4. Risk management procedures apply to all situations and environments across a wide range of Army operations, activities, and processes. When planning freedom of movement in an area of operations, risk management is a necessary procedure in assessing and mitigating the risks. Establishing and assuring freedom of movement is a mission imperative and an ever present and ubiquitous task for engineers. Foremost, routes must be evaluated for threats and designated according to understood and defined standard operating procedures (SOPs). Where the assessed risk is unacceptably high, restricting usage or conducting active route/area clearance must be applied to mitigate the risk.

RISK MANAGEMENT PRINCIPLES

5. It is important that individuals understand and apply risk management. The basic principles of the risk management process are:

a. **Accept No Unnecessary Risk**. An unnecessary risk is any risk that, if taken, will not contribute meaningfully to mission accomplishment. The other way of looking at this is "accept the necessary risk" required, otherwise no mission or task will be successfully completed. For engineers this can be construed to mean:

(1) Engineers, both as leaders and advisors, must assist the chain of command in identifying, assessing and developing controls to reducing the threat and mitigate the risk.

(2) Engineers must adopt appropriate controls to mitigate risks to their own personnel in executing route/area clearance operations.

b. **Make Risk Decisions at the Appropriate Command Level**. The appropriate command level for risk decisions is the one that has the ability to eliminate or minimize the threat, implement controls to reduce the risk, or accept the risk. Engineers are responsible for advising their respective commanders at all levels to enable them to make appropriate risk decisions. A commander must ensure that subordinates know the risk threshold and how much risk subordinates can accept and when to elevate the decision to a higher level. Ensuring that risk decisions are made at the appropriate level establishes clear accountability.

c. **Accept Risk When Benefits Outweigh the Cost**. The process of weighing risks against opportunities and benefits helps to maximize mission success. Balancing costs and benefits is a subjective process and must remain a command decision.

d. **Anticipate and Manage Risk by Planning**. Integrate risk management into planning at all levels. As advisers, engineers must dedicate time and resources to effectively apply risk management in the planning process. This is the moment where risks can be readily assessed and managed. Integrating risk management into planning as early as possible provides engineers the greatest opportunity to make well-informed decisions and provide the best advice to implement effective risk controls. As decisions are made on what areas and routes need to be available to support manoeuvre forces (within tolerable risk levels), engineers will conduct the analysis to provide the necessary support.

RISK MANAGEMENT PROCESS—THEORY

6. Risk management involves assessing and mitigating risk through a five-step process that identifies and controls exposure to threats. The steps are integrated into the planning process and must recognize that each situation is unique. The process is applied in sequence and is cyclical.

The process is represented in the figure below. A detailed explanation of this process can be found in B-GJ-005-502/FP-000 *Risk Management For CF Operations*.

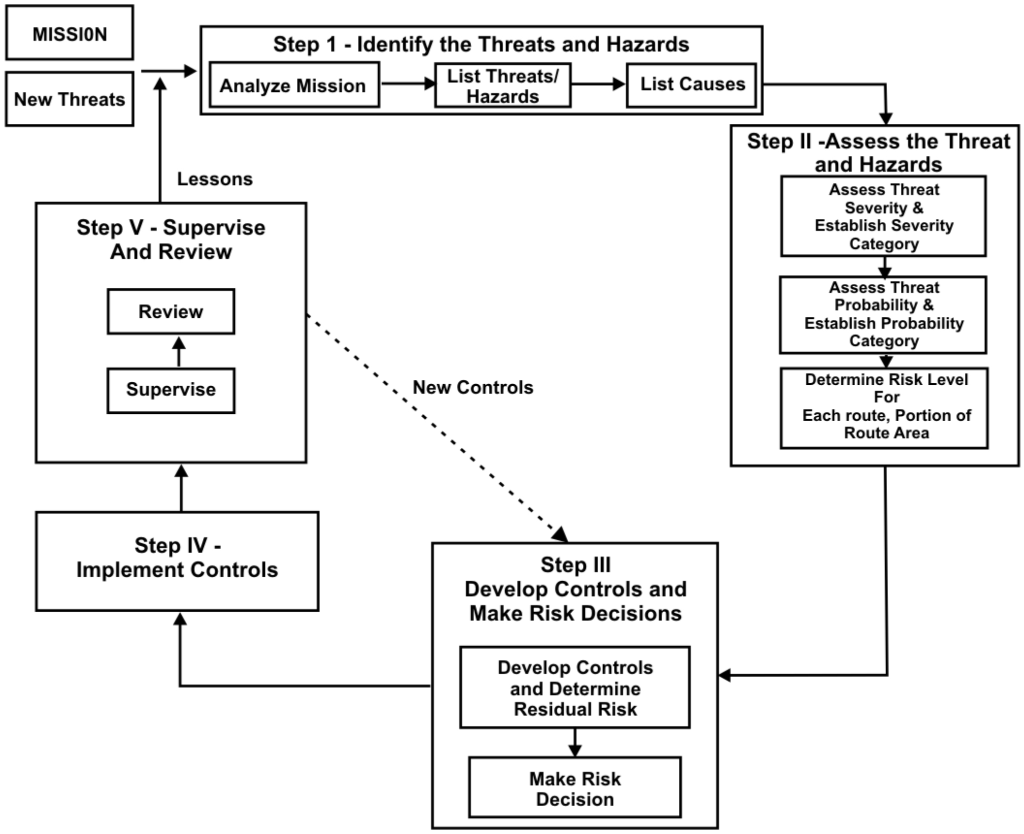


Figure 2-1: Risk Management Cycle

SECTION 2
APPLICATION OF THE RISK MANAGEMENT PROCESS TO ROUTE AND AREA CLEARANCE

7. The Risk Management Process must be applied in concert with the planning and execution of all operations. Engineers are able to determine the specific threats, develop controls and understand the residual risks that are inherent in a specific operation. In consultation with the commander it must be decided what the tolerable risk levels are and the means in which the levels can be mitigated including the time and effort required. This varies for each mission, route and/or area. The following explanation of the risk management process is specifically oriented towards route and area threats in a mission or operation.

RISK ASSESSMENT

8. **Step I—Identify the Threats and Hazards**. Identify the sources of known and potential danger and the possible impact on freedom of movement. Intelligence gathering and reconnaissance will be required to obtain accurate data. Gathering such information is most successful when done directly from local sources rather than remotely. There are three distinct sub-steps to identifying the threats and hazards:

a. **Analyze Mission**.

(1) What are the manoeuvre plan, mobility requirements, and desired objectives? Determine if the mission requires passage through areas with existing threat/hazard (mines, UXO, IED, obstacles etc) or if alternative routes achieve the same intent.

(2) Establish route and area priorities.

(3) Is the requirement immediate or routine?

(4) What is the intended use of the route/area? Will use be frequent or one time? Is it patrol presence or static surveillance, vehicle (type of vehicle?) or foot patrols etc.

(5) What is the potential threat from threat forces?

b. **List Threats and Hazards**.

(1) List all threats and hazards to movement and associated factors based on the mission vulnerabilities. As part of the overall tactical assessment this includes listing the various natures of mines and other UXOs (fuse types and mass of explosives) and the method that they were emplaced (surface/buried, mechanical/hand, off route, scatterable/pattern). How will these potentially affect the mission? Information and intelligence should be gathered from all possible sources (coalition partners, United Nations (UN) or related agencies, non-government organizations (NGOs), local authorities etc). The intelligence staff can assist in assessing the reliability of the intelligence obtained.

(2) An important aspect of threat and hazard identification is deduction: where are the hazards and who is the threat. Consequently, terrain, demographic and cultural information must be analyzed. This is tied to interpreting the battlespace. Does the terrain have any tactical relevance? Earlier records may be available such as a reported Obstacle Report (for example NATO E303).

c. **List Causes**. For each threat and hazard, list the associated causes. It is preferable to control the root cause, if identified. As an example, it may be more beneficial to deal with threat forces prior to their laying mines than dealing with mines individually after being laid. For example:

(1) Is the hazard a result of friendly fires? In this case, data can be obtained as to locations and natures.

(2) Identify threat forces that had/have the means and motives to employ mines and other explosive ordinance.

(3) Is the UXO a result of conventional threat factions and consequently are minefield records available? Did/do the threat forces follow doctrine that would allow development of a template that would help define their likely actions?

(4) Is UXO a result of non-conventional threat factions? In this case the threat is likely to lack doctrine or records.

9. **Step II—Assess the Threats and Hazards**. As with Step I (Identifying Threats/Hazards), intelligence gathering and reconnaissance are essential for accurate threat assessment. The outcome of the threat assessment will be a quantifiable risk level. Risk is an expression of potential loss or negative mission impact derived from the likely *severity* and *probability* of an event. In the realm of mobility support, each route and area is assessed for severity and probability of an incident. Assessing the threat/hazards is possibly the most difficult step because it requires cognitive ability utilizing both objective (intelligence) and subjective (experience and intuition) analysis.

NOTE

An area or route threat assessment is unlikely to be homogeneous and therefore a route or area should be segmented accordingly when assessing threat. This assists in prevention of "excessive" clearance operations while reducing the tendency to under-classify risk in order to preclude significant clearance operations.

a. **Assessing Threat/Hazard Severity**. Severity is the expected consequence of a UXO strike, should it occur. The severity category can be determined by considering these potential impacts:

(1) degree of injury;

(2) loss of or damage to equipment;

(3) collateral effects (physical or other); and

(4) mission impeding factors.

b. **Risk Severity Categories**. When assigning Risk Severity Categories, there are a number of factors that should be considered when assessing the possible consequence to personnel, equipment and the mission. These factors include:

(1) nature of suspected munitions (anti vehicle mines, anti personnel mines, other UXOs);

(2) intended method of movement through the area (mounted or dismounted);

(3) protection level offered by the vehicle vice the explosive yield of likely mine and other UXO threat;

(4) the capabilities of the quick reaction force to respond;

(5) the capabilities of the medical resources to provide treatment;

(6) potential for threat forces to interfere and compromise remediation or mitigating attempts;

(7) the capability to repair or replace damaged equipment, particularly mission essential equipment; and

(8) ability to remedy collateral effects.

c. Table 2-1 outlines the severity categories.

RISK SEVERITY CATEGORIES	
CATEGORY	**DESCRIPTION**
CATASTROPHIC	Death and/or severe disabling injury Destruction of mission-critical systems/equipment Destruction of major systems and equipment Environmental/collateral damage beyond remedial capability of force
CRITICAL	Severe injury and disability Degraded or temporary loss of use of mission-critical systems/equipment Loss or badly damaged major systems and equipment Environmental/collateral damage that heavily taxes remedial capability of force
MARGINAL	Injury and/or temporary disability, requiring medical treatment. Damage to systems /equipment, property but repairable or replaceable Environmental/collateral damage but within capability of force to remedy
NEGLIGIBLE	Minor injury to personnel, requiring first aid or minor medical treatment Slight damage to equipment or systems but still operable Negligible environmental /collateral damage that can be readily repaired

Table 2-1: Risk Severity Categories

d. **Vehicle Protection Level Effect on Severity**. The level of severity is proportional to the relative crew protection levels and the capability of the vehicles to withstand damage. Vehicles are designed with survivability of the crew as a major criterion even though the vehicle may be vulnerable to significant damage. Although a mine protected vehicle may increase the survivability of the crew (decrease severity), vehicle vulnerability (mobility kill) is still very likely[4]. Relative protection levels are a comparative assessment between protection level of a vehicle and the explosive contents of the threat mine or other UXO. An accepted standard of indicating protection levels is expressed in STANAG 4569 Land (edition1) *Protection Levels for Occupants of Logistic and Light Armoured Vehicles* (Table 2-2).

LEVEL		**GRENADE AND BLAST MINE THREAT**	
4	4b	Mine Explosion under centre.	10 kg (explosive mass) Blast anti tank (AT) Mine
	4a	Mine Explosion pressure activated under any wheel or track location	
3	3b	Mine Explosion under centre.	8 kg (explosive mass) Blast AT Mine
	3a	Mine Explosion pressure activated under any wheel or track location.	
2	2b	Mine Explosion under centre.	6 kg (explosive mass) Blast AT Mine
	2a	Mine Explosion pressure activated under any wheel or track location.	
1	Hand grenades, unexploded artillery fragmenting sub-munitions and other small anti personnel explosive detonated anywhere under the vehicle.		

Table 2–2: STANAG 4569 Protection Levels for Occupants of Logistic and Light Armoured Vehicles

NOTE

Although the STANAG provides guidance on protection thresholds there are no standards defining the blast conditions. There are many variables that can affect the effects of a blast of a fixed quantity of explosives, including soil type, moisture content of soil, depth of explosives, the manner in which vehicles are loaded, etc.

[4] There exists a subtle but significant difference between survivability and invulnerability. Wherein the latter is nearly impossible to achieve, survivability can be and is thus what we strive for.

EXAMPLE

The Risk Severity Category of a LAV III (~ 3 kg blast protection) within an anti-personnel minefield could be assessed as **negligible** for both the vehicle and crew. There would be minor damage to equipment, and it is unlikely that personnel would be injured. On the other hand, A LAV III (~ 3 kg) has a Risk Severity Category of at least "**critical**" for both the crew and vehicle against a 4 kg blast AT mine. The G-Wagon (~ 1 kg blast protection) is rated **catastrophic** for both the vehicle and crew against any AT mine. **Employed properly** a mine-protected vehicle (up to 14kg blast protection) can be considered **marginal** for personnel but **critical** for the vehicle against most blast AT mines.

NOTE

These are "risk assessment" planning guidelines only - the individual results of any mine strike can be serious or fatal in virtually any vehicle or equipment type depending on the circumstances

e. **Assessing Threat/Hazard Probability**. It is necessary to determine the probability that a UXO strike may happen. Probability may be estimated through thorough evaluation of intelligence sources, experience, intuitive analysis, and through reconnaissance.

f. **Risk Probability Categories**. When assigning Risk Probability Categories of a mine strike there are a number of factors that should be considered. These factors are history, route classification, overall threat level, threat activity, terrain analysis, previous clearance methods, UXO types and intelligence reliability. These factors must be assessed using all available means. There are no specific rules as to how the factors should be weighted or combined; consequently, there is a degree of subjective deduction. The Table 2-3 outlines Risk Probability Categories and provides guidance in their assignment based on the factors listed above.

RISK PROBABILITY CATEGORIES AND DEFINITIONS

CATEGORIES / FACTORS	FREQUENT Can assume a UXO strike will occur	LIKELY Can assume a UXO strike will likely occur	OCCASIONAL Can assume a UXO strike might occur over time	UNLIKELY Can assume a UXO strike will not occur but not impossible
History	Area/Route was knowingly mined and/or targeted during conflict	Area/Route was likely targeted	No known targeting of area	Known that no targeting or conflict happened in area
Prior Friendly Traffic along route or through area	No reported passage through area, or Single passage with report of possible hazards	Single recce detachment passage during initial entry or area activation but no detailed report on route/area	Several small detachment passages during entry or area activation with a report of no hazards.	Route/area has had multiple passes by lead elements with initial report that route/area looks "safe"
Local Inhabitant Activity	No known activity in area perhaps only grazing animals. Locals avoid area. Locals speak of a likelihood of mining or other UXOs	Some "cautious" use by locals. Pattern avoidance of certain areas.	No known irregular patterns in local activity	Heavily trafficked by local population. Used extensively by Friendly Forces
Expected Level of UXO Pollution	Significant quantities of UXOs expected	UXO expected	Few UXO expected	No UXO expected
Soil Characteristics (how well do UXOs hide and ease of placement) weathering and time effects on soil must be taken into account	Unconsolidated surface gravel and sand with some vegetation Tilled lands	Mix of unconsolidated and compact gravel and sand with vegetation Tilled land	Compact Gravel and sand with vegetation Tilled land	Hard consolidated or compacted soils no vegetation
Route or Area Characteristics (also relates to ease of clearance)	Single small dirt track or road -A key link into area of importance Rocky, uneven and overgrown area. Unkempt	Open dirt road Facilitating access to important region/area Open area with rocky, uneven and overgrown areas. Unkempt	Well maintained dirt road or paved road in poor condition one of few routes leading into important area Flat, open area	Paved route or hard standing area in good condition
Overt Threat Level	Very High	High	Medium	Low
Tactical Terrain Analysis	Terrain is ideal to support the use of mines. Very few alternatives in local area permitting travel. Area represents tactical "vital ground." Defile	Terrain supports the use of mines. Few alternatives in local area permitting travel. Area represents tactical "key terrain." Defile	Terrain could support the use of mines. Area is of some tactical value	Terrain does not support the use of mines. Terrain has no defining features of interest

CATEGORIES / FACTORS	FREQUENT Can assume a UXO strike will occur	LIKELY Can assume a UXO strike will likely occur	OCCASIONAL Can assume a UXO strike might occur over time	UNLIKELY Can assume a UXO strike will not occur but not impossible
Previous Clearing Method	No prior clearance	Possible clearance by “qualified” locals (eg former military)	Clearance has been conducted by other Friendly Forces but not necessarily to mutually accepted standards	Clearance has been conducted by our forces, Friendly Forces or supervised forces to accepted standards
UXO/Mine Type (also relates to ease of clearance)	Multiple fuse and mine types, "scatterable", advanced IEDs including command detonated	Multiple fuse and mine types, "scatterable", IEDs	Simply fused blast mines, crude IEDs	Small arms/caliber
Intelligence Reliability	Reliability of intelligence sources is very low	Reliability of intelligence sources is low	Reliability of intelligence sources is uncertain	Intelligence sources are very reliable

Table 2-3: Risk Probability Categories

EXAMPLE

The probability of mounted patrols striking anti-vehicle mines, in a secluded area separating warring factions (“no man’s land”), along a dirt track leading to a key area, rumoured by locals to have been mined in the past is “**Likely**.”

g. **Determine Risk Level**. Risk severity and risk probability Categories are combined to form an initial risk assessment for each route, portion of route, or area. The Risk Assessment Matrix (Figure 2-4) is used to evaluate this level of risk. The Risk Assessment Matrix can be used as a guide for any follow on decisions to be made. The matrix can also be used to prioritize resources, standardize threat notifications and/or set response actions. Severity, probability, and Risk Assessments must be recorded to serve as a record of the analysis for future reference.

NOTE

In assigning risk level to a route, analysis will have established a probability category, which will remain unchanging until mitigation actions take place. The severity category, however, is not fixed and could vary according to what level of protection the likely vehicle offers. In other words, a light vehicle replaced by a mine protected vehicle will result in a decrease in severity to the crew, thus lowering risk to personnel. Although, a mine protected vehicle may increase the survivability of the crew, vehicle remains vulnerable (mobility kill).

RISK ASSESSMENT MATRIX				
	PROBABILITY			
Severity	**Frequent**	**Likely**	**Occasional**	**Unlikely**
Catastrophic	**E**	**E**	**H**	**M**
Critical	**E**	**H**	**M**	**L**
Marginal	**H**	**M**	**L**	**L**
Negligible	**M**	**L**	**L**	**L**

Table 2-4: Risk Assessment Matrix

h. **Risk Definitions**:

(1) **E—Extremely High Risk**: Without clearance (or other control measure) the Tactical Commander *must* anticipate that a UXO strike *will* occur with fatal and/or *severe consequences* to personnel and/or destruction of equipment when using a particular area or route.

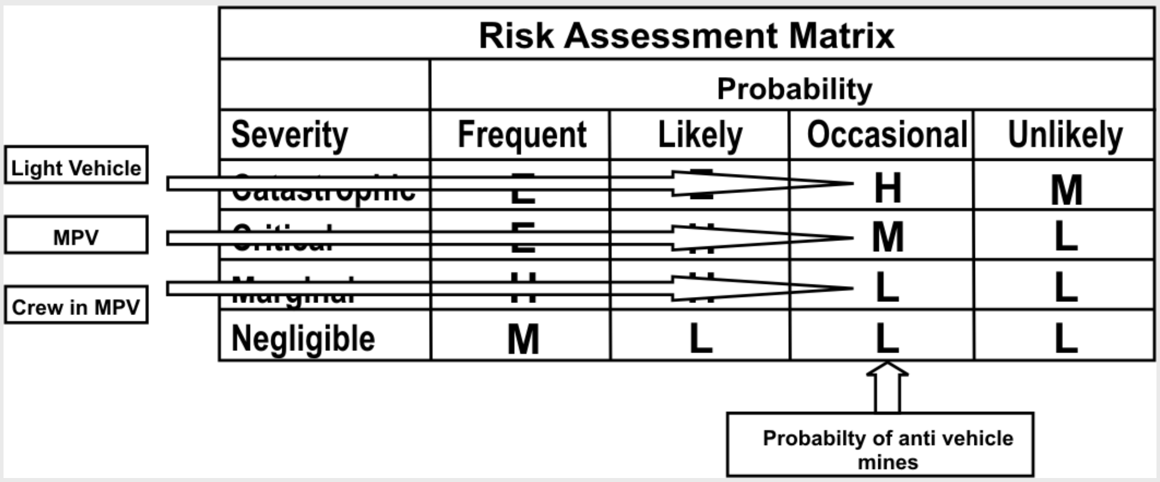
(2) **H—High Risk**: Without clearance (or other control measure) the Tactical Commander can anticipate that a UXO strike *will likely* occur with severe and/or *serious* consequences to personnel and/or resulting in destruction or badly damaged equipment when using a particular area or route.

(3) **M—Moderate Risk**: Without clearance (or other control measure) the Tactical Commander can anticipate that a UXO strike *may* occur with serious and/or *moderate* consequences to personnel and/or resulting in badly damaged equipment when using a particular area or route.

(4) **L—Low Risk**: Without clearance (or other control measure) the Tactical Commander can anticipate use of a particular area or route is *unlikely* to result in serious injury and/or significant damage.

EXAMPLE

A BG, equipped with **light vehicles**, operating in an area with an **Occasional** probability of having anti vehicle mines (+6 kg) would put its vehicles and crews at **High** risk unless controls were placed into effect. However, a **mine protected vehicle**, in the same environment, would likely have **Moderate** risk (so long as it was not mission critical or could be replaced/repaired) while the crew would have diminished risk of **Low**.



i. **Commander's Decision for Initial Route/Area Designation**. The risk level output will enable the engineer to initially give a route, portion of a route or an area a recommended designation (table 2-5). The commander must then be advised of the results and the potential impact to freedom of mobility when the designations are applied. The engineer must be prepared to justify and explain the logic behind the recommendations. The commander decides whether to apply the recommended designations, and what possible restrictions may be required and how they may affect subsequent course of action. If the results do not adequately support mission requirements, then mitigation is required or continuing operations with the acceptance of existing risk. The commander is responsible for all subsequent actions whether they are assignment of route designation, permitted or curtailed mobility or clearance operations.

Risk Level	Initial Designation (See chapter 4 for definition)	Remark
Extreme	**Closed**	Only the commander can authorize use - if deemed operationally necessary
Moderate to personnel and mission essential equipment	**Closed**	Only the commander can authorize use- if deemed operationally necessary
Moderate to specific vehicles	**Restricted** It should be noted within the restriction that: *the Designation is based on an Intelligence and risk assessment of Moderate and no route confirmation or clearance has yet been conducted*	Restricted use should only be authorized by commander, for example: *reconnaissance only—mounted in a "specified" vehicle type*
Low	**Restricted** It should be noted within the restriction that: *the Designation is based on an Intelligence and risk assessment of Low and no route confirmation has yet been conducted*	Restricted use should only be authorized by commander
Low	**Open**	Cannot be assigned without certainty and should not normally be assigned until after a route confirmation

Table 2-5: Guide to Correlating Risk Level and Initial Route/Area Designation

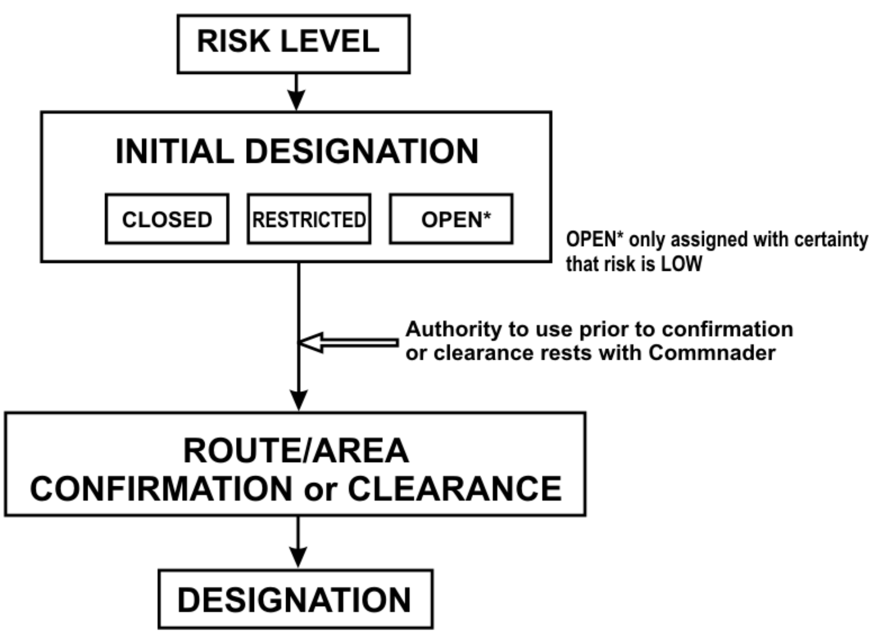


Figure 2-2: Risk Levels and Subsequent Implications

RISK MITIGATION

10. **Step III—Develop Controls and Make Risk Decisions**. The initial "Risk Assessment" output, and the resulting initial route/area designation, is the key starting point in developing overall controls. Further control options will be developed and discussed with the commander. At this point, the discussions may take the form of a decision brief. If the assessed risk levels are too high (resulting in a lack of mobility or undue threats/hazards to personnel) the commander must then initiate the implementation of controls wherein residual risk against the mission requirements is acceptable.

a. **Control Options**. There are a variety of controls which may be employed:

(1) A "Designated Ground Trace" must be promulgated (discussed further in Chapter 4). This is the primary means of promoting situational awareness. No route should be traveled until properly assessed and labeled with a designation. Route restrictions must be well understood (vehicle types, dress states, convoy rules, rules for travel by day and night, etc). The capabilities of a Geomatics Support Team should be used in the production of these traces.

(2) SOPs and tactics, techniques and procedures (TTPs) on movement are developed and promulgated. These should include the incorporation of route hazards and risk awareness into patrol/convoy movement orders.

(3) There is always a risk of UXO strikes and therefore an appropriate reaction force is created to deal with UXO incidents. Contingency plans must be in place and rehearsed with the combined arms team. These should begin during pre-deployment training.

(4) Plans to employ available assets to support immediate mobility requirements (breaching). There may be an urgent operational need to use a route or an area that has not been designated or cleared. In this case, the engineers may have to provide immediate mobility support that may include abbreviated risk management, remote designation followed by either clearance or breaching support.

(5) Designation and/or provision of specific vehicles to be used to increase protection of personnel involved in higher risk activities (eg. engineer confirmatory reconnaissance).

(6) Conducting surveillance and reconnaissance to discourage tampering with previously cleared routes or areas.

(7) Continuous training and education programs.

(8) The active closure of routes and areas through marking and possible use of barricades or sentries.

(9) The conduct of clearance operations by engineers. Clearance is the most intense control implemented because of the resources, personnel and methodical procedures involved. If clearance is the method of control chosen, then it falls upon the engineers to recommend on the method of clearance that is most appropriate. Planning clearance operations is discussed in detail in chapter 3.

NOTE

There is risk to the engineers in the conduct of clearance operations, which must be communicated to the commander prior to making a decision. This risk will be directly related to the availability and selected clearance methodology. As part of the selection of a clearance method, the engineers must utilise the Risk Management tools. The determined level of risk should be expressed to the commander in terms of Risk Definitions (Extremely High Risk, High etc). In other words, the engineer must advise the commander on both the risk level associated with using a route or area and also the risk to the engineers associated with its clearance.

b. **Risk Decisions**.

(1) The engineer advisor briefs the commander on the specific route/area. He is advised on the current assessed risk (and resulting initial designation), and the recommended controls required in mitigating the risk and what residual risks may remain. This is to include the risk the engineers may be exposed to during the application of certain controls (clearance). It is at this point (subject to higher directives and mission specific restrictions) that the Commander can make an informed decision as to how, and whether to proceed.

(2) Should the residual risk or the controls not be appropriate, the commander may have to request additional resources from his superior to attenuate the residual risk; request a change of mission from his superior; or declare the route/area closed.

11. **Step IV—Implement Controls**. Once the decision is made on “what” risk controls are to be implemented, the “how” to implement controls must be made and assets must be made available. Control implementation is tasked accordingly.

12. **Step V—Supervise and Review**. Controls are monitored by all levels of headquarters during implementation and for as long as they remain in place. Mission personnel must be provided—as a matter of routine—with the necessary information to give them situational awareness on route and area restrictions; this must be continually reinforced to avoid complacency. As new threats come to light—perhaps a heightened security threat such as deliberate targeting of friendly forces by minin—the mission analysis must be reassessed, and in turn the supporting risk analysis is reviewed. Engineers must assist their supported headquarters with supervision and review, by providing expertise and active monitoring on the ground.

Engineers, as part of routine practices, will continue regular monitoring of the area of operations particularly routes and areas that have been cleared, as well as, ones that may need to be cleared in future.

a. **Supervise Controls**. The following should be monitored:

(1) **Control Implementation**. All controls that are enacted must be monitored to verify that they are implemented correctly, effectively and remain in place. This includes ensuring the correct route restrictions are marked on maps and routes are signed, and if required, blocked. As an example, there may be routes that exist in the area of operation but are not—initially—shown on a map, therefore the database must be amended. It must be absolutely clear as to which routes have been authorized for use.

(2) **Changes in Situation**. Any change in situation that may compromise current practices or risk levels may require another risk management cycle for a single route or even the entire area of operations. As an example, there may be a change in personnel, equipment, or new operations. There may be a change in weather patterns; heavy rains or desert winds often may reveal previously buried mines or UXOs.

(3) **Ineffective Controls**. Action must be taken to correct any controls that may prove to be ineffective. For example, the cleared portion of a route reported to be difficult to follow should quickly be marked.

b. **Review Controls**. A review must be conducted to ascertain if there is a balance between residual risk, mitigating effort and the mission requirements through the controls that have been applied.

(1) **Balance**. The commander must determine what effect the risk controls have on the mission. Some controls may be seen as too restrictive and hinder mission progress. The commander must determine whether or not the balance between force protection and mission restriction is correct. If the balance is not correct, the controls may have to be changed.

(2) **Measurement**. To permit evaluation on the effectiveness of controls, in removing threat or reducing risk, a means of conducting measurements should be established. Patrol/convoy debriefs, After Action Reports, surveys, quality control assessments, and in-progress reviews are some methods that may lead to quantifying success or failure.

CHAPTER 3
BATTLE PROCEDURE, CLEARANCE OPERATIONS AND OTHER CONTROLS

SECTION 1
GENERAL

INTRODUCTION

1. As was stated in chapter 1, the task force's requirements for manoeuvre drives mobility requirements. Route and area clearance operations are by definition deliberate in nature in support of valid and essential mission requirements. They could be conducted within a static area of operations wherein with each passing day greater familiarity and situational awareness is gained or in a dynamic battlespace wherein uncertainty is the norm. Planning for clearance operations can benefit from the Risk Management Process (see chapter 2) and help effectively guide commanders, staff and engineers to select the preferred methods of clearance. The degree of risk influences the methods and thus the rate at which areas may be cleared, with every task having its own set of complications and nuances.

RISK MANAGEMENT AND CLEARANCE PLANNING

2. *Risk* is an expression of possible loss stated in terms of *severity* and *probability* of an event. In the realm of mobility support, engineer clearance operations are expressly designed to modify the *probability* by endeavouring to eliminate the threat (UXOs). *Severity*, too, can be modified but this is usually not an engineer responsibility. The engineers have a range of clearance procedures that can detect, identify, mark, neutralize and destroy/remove UXOs (inclusive of all natures of ordnance) threatening an area or route. **All procedures once engaged are designed with the intent to remove all UXO threat; there are no partial measures**. In other words, it does not matter if the assessed risk of UXO is high or low, once the decision is made to conduct a clearance operation all methods are designed to detect and remove all UXO and minimize the **residual risk** to as close to nil as possible; nevertheless, no method is infallible but some procedures are recognized to be better because they are inherently more precise.

SECTION 2
STEPS IN PLANNING AND COORDINATING A CLEARANCE OPERATION

GENERAL

3. Risk management is not a stand alone or pivotal activity that dictates the outcome of battle procedure. Rather, it is complementary and must be considered as an integral part of battle procedure; like all other factors and considerations it leads to enlightened decisions and actions.

4. The commander is responsible to specify what areas and routes are required to support operations as a whole, while likely authorizing subordinate commanders to make decisions within their respective areas of operations. However, this authority may be somewhat hollow

unless the subordinate has, or is given, the requisite capabilities for freedom of action. The fact of the matter is, the level at which mobility support planning and coordination must begin is the level which is capable to do so; consequently, preliminary planning may be centralized higher but the eventual detail and clearance is coordinated with the tactical organization requiring the support. This is in keeping with the engineer principle of centralized coordination at the highest appropriate level (Battle Group and Field Squadron) with responsibility for execution decentralized to the lowest practicable level (Company/Squadron and Field Troop).

NOTE

Engineer Squadron HQ is the base level that can provide the required experience, knowledge, capability and access to resources needed to conduct the analysis of threat and planning for clearance. Although Squadron HQ resides at Battle Group HQ it will coordinate with requesting sub-units.

a. **Planned Mobility Support Requirements**. Higher HQ (battle group or higher), will identify mobility needs during the operational planning process. Wherein operations are decentralized, subordinate HQs, without requisite resources, could submit demands for areas and routes to be opened. Planned mobility tasks, such as these, normally provide sufficient lead-time and preparation. Requests are staffed by means of a standard operating procedure request format on an appropriate map overlay and are the start point for subsequent planning and coordination. The request and overlay should be in the format provided at Annex A, chapter 4. Within a coalition, a clearance task could be assigned by means of a standard message format (for example NATO E113 message).

b. **Routine Route and Area Security and Maintenance**. Although an area or route may have been opened for use, it must be monitored routinely to discourage or detect illicit activities and possible intentional targeting. Equally, the nature of the route/area may change with time as a result of environmental changes or traffic. Monitoring of routes/areas is not just the responsibility of engineers; it is an all arms responsibility to maintain situational awareness and presence within the area of operations. The intelligence, surveillance, target acquisition and reconnaissance (ISTAR) process coordinates these activities. The engineers must participate in the ISTAR process by contributing to the "patrol framework" whilst benefiting from the “eyes and ears” of the other arms gathering information.

c. **Immediate Mobility Requirements (not forecasted)**. A situation may necessitate entry or use of an area/route not previously opened or assessed for use. Time available for planning and coordination is minimal; consequently, standard operating procedures, as well as tactics, techniques and procedures, best address the situation. Higher levels of risk may have to be accepted. Threat and urgency may necessitate breaching operations.

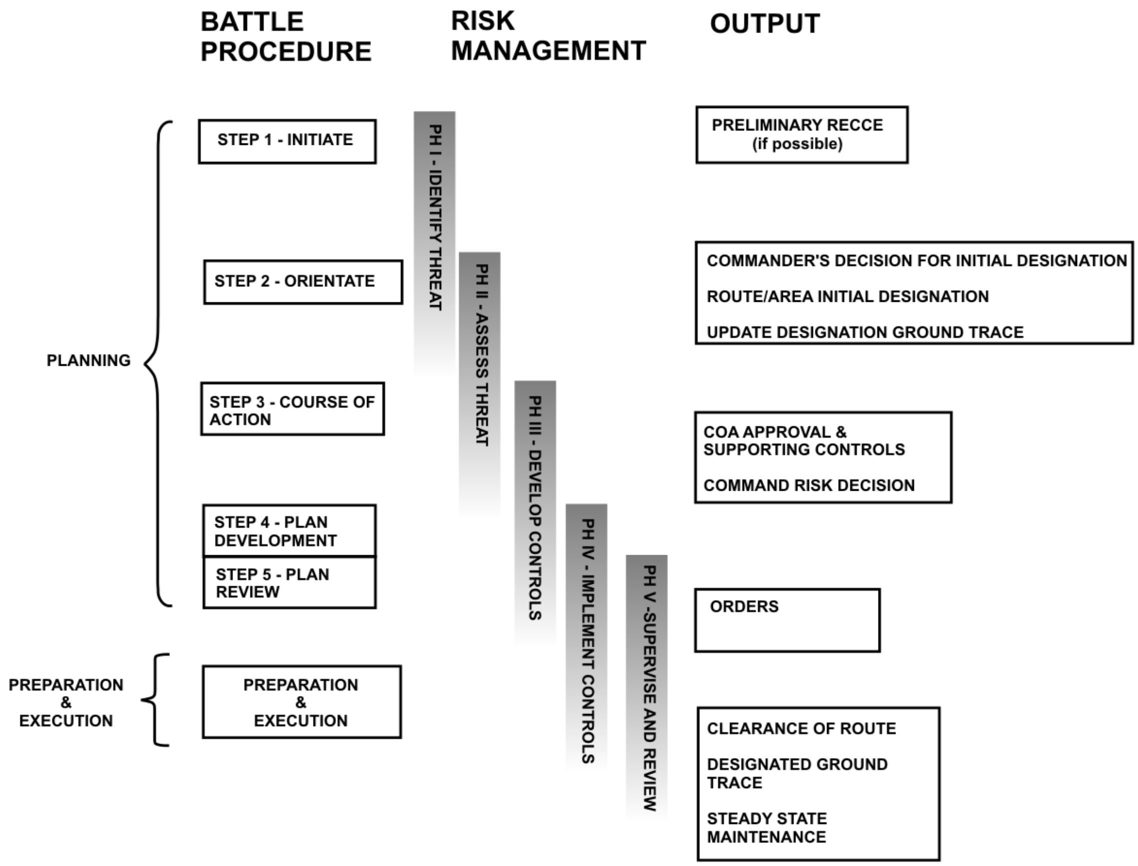


Figure 3-1: Integrating Battle Procedure and Risk Management

NOTE

The risk management process can compliment whatever form of decision and planning process is adopted, be it the full deliberate operational planning process (OPP) or a more intuitive commander's decision process. The following steps provides guidance on how risk management and OPP are conducted together.

STEP 1—INITIATE BATTLE PROCEDURE AND IDENTIFY THREATS AND HAZARDS

5. **General**. As much information as possible should be obtained to assist in the planning and risk management process. The mobility support tasks may be generated within the framework of a linear or non-linear, contiguous or non-contiguous area of operations.

a. **Intelligence and Information Sources**. All conceivable sources and methods should be utilized to research the overall situation, the potential threats/hazards, (see Annex A). The engineers must not work in isolation but capitalize on the synergy of the entire combined arms team; the formation ISTAR Coordinator or unit Intelligence staff can assist through ISTAR sources; civilian military cooperation (CIMIC) or human intelligence (HUMINT) teams may have a good network of civilian and other agencies; engineer liaison can obtain intelligence from coalition sources and UN de-mining agencies. The engineer geomatics support team is also an important source of information.

b. **Remote Analysis**. This method can be used in support of operations that preclude the use of own ground reconnaissance. As such, decisions have to be made based on the best available data and intelligence through various sources. This method has particular use during initial entry or theatre activation where reconnaissance is not able to match demand.

c. **Preliminary Reconnaissance (ground/air)**. Engineers may conduct a reconnaissance of the ground (without physically travelling the area or route in question), to gather local information that assists in developing the risk assessment by observing the volume and type of traffic over the ground, the ground's surface (i.e. asphalt, concrete, compacted gravel, etc.) and any physical indicators for mines and other UXO. A preliminary reconnaissance report is completed (in accordance with Appendix 3, Annex A, chapter 4).

d. **Documentation**. A Route/Area Record is started to document decision action cycle for any route and area to be investigated and opened for use.

OUTPUT

- Route/Area Record starts
- Intelligence Information gathered and assessed
- Preliminary Reconnaissance Report (if possible)

STEP 2—ORIENT AND ASSESS THE THREAT

6. During the orientation phase of battle procedure, threats are assessed to determine risk levels. The assessed risk level can be used to assign an initial route/area designation (see Table 2-5).

OUTPUT

- Risk Level (of the Route or Area)
- Commander's Decision for Initial Route/Area Designation
- Initial Route/Area Designation (Chapter 2, Table 2-5) and update of Designated Ground Trace
  - **Closed**
  - **Restricted—***the Designation is based on an intelligence and risk assessment of Low(or Medium). No route confirmation or clearance has yet been conducted*
  - **Open** *

*—Unless it is certain to be free of mines and other UXO (Low risk), no route or area should be initially deemed to be **Open** until a route confirmation is conducted.

STEP 3—COURSE OF ACTION AND DEVELOPMENT CONTROL

7. The tactical element develops its Courses of Action (COA), including a scheme of manoeuvre or a movement plan. Initial route/area designation may support the COA or further mitigating controls may be required. The engineers estimate their own COAs in support of the mission including developing controls to mitigate the risk to movement. Depending on the threshold of risk tolerance and mission imperatives, there may be occurrences where the risk may preclude certain tactical COA; conversely, the risk considerations and control measures may be secondary to mission needs and only supportive to the best tactical COA.

a. **Control Measures Criteria**. When choosing and comparing the control measures several criteria should be considered:

(1) **Residual Risk**. What is the estimated level of residual risk remaining? How effective will the controls be and can they be emplaced and enforced easily?

(2) **Effort and Resources**. How efficiently can controls be executed and can they be done within a reasonable amount of time? Risk cannot be totally eliminated or controlled; consequently, there is a point of diminishing returns where additional resources and time no longer make appreciable gains in mitigating the risk levels.

(3) **Risk to Effect Controls**. Employing certain controls may increase risk to those who execute the controls. Engineers who are required to clear routes/areas may be confronted with a high level of risk during the

clearance operation. Patrols projecting a presence along a route are exposed to threats. These risks cannot be underestimated or disregarded.

b. **Choice of Clearance Procedures as a Control**:

(1) Engineer Commanders should consider all available detection methods and clearance procedures when planning operations. A combination of available methods can minimise risk to soldiers and maximize confidence in cleared routes or areas. Effectiveness and redundancy can be achieved by employing manual methods, whereas speed and protection are achieved by employing mechanical methods. Therefore, methods other than manual procedures are employed wherever possible, as the greatest risk to soldiers occurs while trying to manually detect mines because of their level of exposure.

(2) No two situations will prove to be the same; hence, there exists several doctrinally proven and accepted procedures that when employed provide the engineers with effective means of removing UXO threats. There are several factors that must be considered when choosing a clearance procedure.

(a) **Resources Available**. All procedures are equipment, terrain and personnel dependent. Choice of clearance procedure may be limited to the resources available and the technical proficiency of users.

(b) **Nature of Threat**. UXO type and threat environment complicates efforts to clear routes and areas. For example, mines with minimum metal components will be more difficult to clear. The threat may dictate the use of blast suits by personnel, which would affect clearance efforts.

(c) **Time Available**. More deliberate procedures require more time; however, operational requirements may dictate one method over the next because of time constraints. This is permissible if it creates an acceptable level of residual risk.

(d) **Equipment Limitations**. Terrain and environmental conditions are often limiting factors as to the performance of equipment. All equipment has limitations and therefore under certain conditions may not provide the level of clearance required. Operators must employ equipment within tolerances.

(e) **Level of Assessed Risk**. In general, if the probability of encountering a threat/hazard is high (high risk) then a more deliberate clearance procedure should be used.

(f) **Ground/Terrain/Weather**. The nature of the ground, terrain and weather can restrict and degrade clearance.

(g) **Intended Use**. If the route is to be used over the long term by various types of vehicles and users as a main supply route then the clearance may have to be wider in scope.

NOTE

Authorized clearance procedures/drills are described in this manual. If the procedures do not provide a solution, technical expertise must be sought to establish permissible deviation from these procedures. The tactical commander must be advised if non-standard procedures are being applied and what additional risks may be borne. Ad hoc procedures must be avoided because they have no empirical validation, will lead to unintended use of equipment and moreover may overly expose personnel to unnecessary risk.

c. **Benefiting from Risk Assessment in Choosing Clearance Procedures**.

(1) A benefit derived from risk assessment is to capitalize on the fact that Low Risk—by default—indicates a low probability and/or negligible severity in encountering UXO. This does not warrant that an area or route be automatically declared open. As a prudent measure, engineers must “route/area confirm” that the risk assessment of Low is correct.

(2) Medium risk is rather nebulous and although engineers routinely face moderate to high risk in the conduct of their tasks there are few clearance procedures that strictly cater to this level of risk. In other words, most procedures are optimized or designed to work within either Low (“confirmation” procedure) or High risk (“deliberate” procedure).

(3) Conversely, when the risk assessed is High or Extreme the probability and severity in encountering UXOs is higher and therefore engineers adopt the necessary procedures and precautions in anticipation of encountering this threat.

d. **Clearance Procedures/Equipment**. Various types of clearance procedures (manual, mechanical, chemical) and equipment are doctrinally recognised. In some cases, the procedure centres upon a specific detection method, supplemented by manual neutralization or disposal tasks. Each has particular strengths and limitations that must be understood in order to employ them correctly, mitigate risk and improve force protection. Further details and employment drills are found in Chapter 5.

METHOD	KEY STRENGTHS	MAIN LIMITATIONS	RATES	REMARKS
Route/area Confirmation	- rapid - economy of effort	- suitable for Low/Medium Risk assessments - not a direct detection system (reliant on the experience and observation capabilities of the confirmation team)	- terrain dependant	A route/area confirmation may be conducted with a view to confirming that an area or route is Low Risk. Engineers conduct a visual and active search and gather further intelligence.
Manual Clearance	- most thorough, detects all mine types - use in verification of other procedures - highly adaptable to terrain	- time and resource intensive - increased exposure / risk to sappers - mine detector effectiveness can be defeated/degraded under certain conditions (eg high soil metal content) - only suitable for a permissive environment	- See Annex B, Chapter 5 for guidance	Manual clearance includes the process of detection, neutralization and destruction
Improved Landmine Detection System (ILDS)	- remote operation up to 2 km - multi-sensor detection system - detects all mine types	- line of sight operated (communications link) - suitable only for flat surfaces such as roads or paths - heavy logistic support for parts maintenance and transport - PV susceptible to buried mines - sensors affected by environmental conditions - only suitable for a permissive environment	1 – 3 km/h (terrain dependant)	Only a detection system. contacts must be cleared manually
Mini-Flail	- removes light vegetation and trip wire threat - remote operation up to 300m - explodes surface and buried anti personnel (AP) mines, booby traps and scatterable munitions	- Use is limited to small areas or paths - Operates in the same frequency range as communication equipment may result in loss of control when radios are used - not suitable for rocky terrain, heavy vegetation or steep gradients - only suitable for a permissive environment	4 – 8 km/h	
Flail (AARDVARK)	- removes vegetation, trip wires and mine threat - operates across severe terrain and adverse weather	- area should be swept for explosive debris after flail operation - use restricted by loose ground wire, wire fences, ditches and other obstacles - debris can be thrown up to 250m. Protection from collateral damage may be required. - reduced visibility due to wind and dust - cannot defeat blast over pressure resistance mines - significantly disrupts terrain - heavy logistic support for parts maintenance and transport - only suitable for a permissive environment	- 100 – 330 m/h - - Beaten path - 3m - Effective path - 2.5m	Flails are available which are suitable for use in non-permissive areas
Full Width Mine Roller	- relatively rapid removal of buried and surface mines - detonates all mine types less double impulse - suitable for non-permissive environments if mounted on a protected vehicle	- limited clearing utility. Used as area reducer or to confirm the existence of mines - terrain features can degrade performance (eg potholes, uneven surfaces) - clears by detonation therefore collateral damage is a consideration	Terrain/vehicle dependant	Not currently in the Canadian inventory
Full Width Mine Plough	- relatively rapid removal of buried mines - suitable for non-permissive environments if mounted on a protected vehicle	- requires a powerful platform to employ - significantly disrupts terrain - not suitable for rocky/hard surfaces		Not currently in the Canadian inventory
Surface munitions clearance devise (SMCD) 'Pearson Mine Plough"	- suitable for non-permissive environments if mounted on a protected vehicle - relatively rapid	- suitable for relatively level, hard surfaces - **only** removes surface mines/UXOs and trip wires	- As fast as vehicle and operator are capable. Increased speed decreases effectiveness.	The ILDS PV mounts an SMCD which can be employed remotely thus reducing exposure to personnel
Earth Moving Equipment	- normally available - can reduce other obstacles	- in some applications considerable amounts of earth must be moved and then remains contaminated posing an even greater hazard for future clearance - not recommended for small areas	- Varies on type of being used	- Armoured dozers, Zettlemeyer FEL, MPEV - only if fitted with purpose designed buckets/blades
Explosive Detection Dogs	- very good tool in conjunction with manual clearance methods - very good tool for the conduct of a search	- dog/handler fatigue/unpredictability - degraded effectives if ground is saturated with explosives - specialised team has a number of administrative requirements	Varies	Not currently in the Canadian inventory
Other Agencies	- reduced risk to own troops - reduced resource requirements - may expand mission capability (humanitarian demining)	- quality of procedures and standards not known - difficult to maintain C2		Includes other military forces and civilian agencies

Table 3-1: Summary of Clearance Methods (strengths and limitations)

e. **Commander's Risk Decision**. The engineer commander makes recommendations to assist the tactical commander to decide on the type of controls to implement in support of the tactical course of action; this may involve clearance or a number of other controls (see Chapter 2 Risk Mitigation). The tactical commander considers the complete risk assessment, the adequacies of the initial designations, the subsequent recommended controls, the risk to implement the controls, the immediacy and nature of the operational requirement and the resources available.

OUTPUT

- Control options developed which support the tactical COA
- Commander's Risk Decisions

STEP 4 AND 5—PLAN DEVELOPMENT AND PLAN REVIEW

8. With decisions rendered the engineers now commence detailed planning for the implementation of the engineer related controls.[5] The most involved control is a decision to conduct clearance operations. Planning includes the requirement for the support by other arms including medical, logistics and infantry/armour for security, as well as, coordinating the support of host nation agencies, Judge Advocate General (JAG), etc.

9. **Engineer Risk Management and Orders**. Engineer commanders must use their own risk management process when planning a clearance operation based on the selected controls or chosen clearance method. The process is the same as that described in Chapter 2. The result is the integration of specific risk controls within the orders for the clearance operation. Procedures and equipment are inherently designed with safety as a key factor, but orders could also include safety distances, protective personal equipment, route closures, emergency response procedures and other types of support. Sample orders for a clearance operation are contained at Annex B.

OUTPUT

- Clearance Plan
- Engineer Orders
- Coordination with other arms and support elements

[5] Other, non-engineer related controls, are planned and implemented by other agencies. Invariably, the tactical commander and staff monitor the implementation.

PREPARATION, EXECUTION, CONTROL IMPLEMENTATION, AND REVIEW RESULTS

10. **Engineer Task Site Reconnaissance**. The fundamental requirement for the efficient conduct of clearance operations is an accurate reconnaissance of the task site. This reconnaissance is carried out by the element that has received the clearance task. The reconnaissance should take place as early as possible in the battle procedure. Unlike the preliminary reconnaissance effort which was intended to provide information required in formulating a risk assessment and in COA development, this reconnaissance is conducted to provide information to assist in detailed planning of the clearance operation.

11. **Execution of Clearance Operations**. As a normal part of battle procedure, during execution, there should be an iterative reassessment of the situation, including risk, to ensure that procedures (or controls) being implemented are suitable. As an example, as a clearance operation makes progress along a route, if the nature of the route is not the same as was expected by earlier intelligence, then there should be reassessment of the task.

12. **Rates of Clearance**. Rates are influenced by numerous factors:

a. The magnetic properties of the soil and material used to construct the route or area that may negatively influence the operational capacity of mine detectors.

b. The amount of ferrous metal pollution that has come to rest on verges and shoulders increases the false alarm rates on detectors. Each signal must be investigated which will therefore slow down progress.

c. The number of trip wires found across a route or area that are investigated.

d. The number of crossing sites and corners that increase the area that must be cleared or navigated if mechanical assets are used.

e. Ground material or vegetation in the area that may make prodding and excavation difficult.

f. Environmental factors such as light conditions or temperature. What cannot be seen cannot easily be searched or cleared, and high temperatures reduce rates of clearance and safe daily output.

g. Operator efficiency.

13. **Ground Designation**. Upon the successful completion of any required engineer work the Tactical Commander may authorize a ground designation of OPEN or RESTRICTED (see Chapter 4 for definitions). An amendment to the designated ground trace (DGT) is then issued as described in Chapter 4.

OUTPUT

- Cleared Route/Area
- Updated DGT

SECTION 3
OPERATIONS TO SUPPORT IMMEDIATE MOBILITY REQUIREMENTS

14. There may be operational imperatives that demand access into an area, or along a route, not yet authorized for use. The route or area may not yet be assessed; or it may be designated accordingly but with a risk too high for routine use. This is the most complicated of situations wherein time is short and information is slim. Nevertheless, nothing should be left to chance alone. Planning and decisions must still be made on what information is available. The options are straightforward: go with risk; or enact contingency options to modify risk. The engineer advisor should completely understand the breadth of his capability to conduct immediate mobility requirements and to have generated the necessary contingency plans. If there is any doubt with respect to the threat that may be encountered, then this type of event should be considered to be a breach.

15. In permissive and non-permissive environments, compressed decision action cycles are best addressed with contingency plans and rehearsed tactics, techniques and procedures. Contingency plans—in themselves—are controls and thus mitigate risk even though the threat and risk may not be wholly defined. A patrol, for example, that is tasked to react to an event (casualty evacuation) but requires movement along a route that had not been previously opened for use would unlikely be aware of the nature and level of threat. Alone, the patrol would find it very difficult to mitigate the risk of mines and other UXO because it has very limited capability. However, a contingency plan could identify a course of action that links engineers to assist by breaching or clearing the route in support of the patrol. In short, if there is a compelling reason for movement into an area not previously cleared there must either be:

a. a chain of command acceptance of the possibility of high risk; or

b. contingency support to the mission by providing rapid mobility support.

16. Contingency response plans require an allocation of resources and force elements that can be made available at short notice.

SECTION 4
MOBILITY SUPPORT IN UNSTABLE SECURITY ENVIRONMENTS

17. **General**. In unstable threat areas or situations, wherein there are directed hostilities against coalition forces, clearance operations may be less effective except where continual surveillance of an area/route can be guaranteed. In other words, the risk of tampering of the route/area would negate clearance efforts. The threat environment can be exacerbated where the

threat is non contiguous and launched by non-conventional forces that easily meld with the local population and perhaps work from a demographic base of popular support.

18. **Response**. The benefits of clearance are no longer as reliable; consequently, other controls will be emphasized that can be supported by engineers.

a. **Patrol/Convoy Composition**. The composition of the manoeuvre element is very important in its ability to cope as well as in projecting a deterrence message to a potential adversary. Engineer support could involve an engineer detachment with explosive ordnance disposal (EOD) expertise or being employed in a vanguard sweep of a route/area. Composition also includes the ability to react, as well as, vehicle protection.

b. **Tactics, Techniques and Procedures**. Convoy/Patrol TTPs are extremely important because response to threat depends on the immediate response abilities of personnel. Even the simple aspect of spacing and navigation is extremely important.

c. **Command and Control**. Command and control are important not only within the patrol/convoy but also between the patrol/convoy to higher HQ and other friendly forces. Rules of Engagement govern the response to threats.

d. **Contingency Response**. The ability to respond by other force assets to assist a convoy/patrol that encounters a threat beyond its ability to cope is instrumental to force security. It projects deterrence, and instils confidence in personnel. Response must include the ability to dispatch a quick reaction force that includes medical support, and engineers, and requires proper rehearsals, including the deployment by helicopters—if available.

ANNEX A TO CHAPTER 3
INTELLIGENCE AND RECONNAISSANCE

INTRODUCTION

1. Intelligence and information gathering are important endeavours that facilitate, decision-making and maintaining situational awareness in order to prepare the manoeuvre plan and to sustain support to mobility.

   a. **Manoeuvre Plan**. Commanders and staff will develop the operational plan and designate what routes, avenues or axes of manoeuvre and, areas are required. The courses of action and manoeuvre options will be influenced by what the terrain (including meteorology) will permit and by what the threat forces have done to modify or influence it. Engineers will gather information and develop the required intelligence to assist in selecting the best manoeuvre corridors or routes to achieve commander's intent.

   b. **Mobility Support**. Intelligence, surveillance and reconnaissance gathering will address mobility requirements and obtain details about specific routes and areas. Routes will be examined to identify impending mobility support tasks including reducing existing and reinforcing obstacles, improving existing lines of communication and establishing new routes.

2. Freedom of movement is essential for operational success; consequently, engineers are not the only arm responsible to resolve mobility issues. Engineers are active participants in the intelligence, surveillance, target acquisition and reconnaissance (ISTAR) process and must tap into the network of available sensor resources. Coordination will begin at the Engineer Support and Coordination Cell (ESCC) at respective levels of command and control. Reconnaissance (recce) is but one means of gathering current information about an area of operations. Recce is a limited asset and works best if carefully planned, coordinated and employed under the auspices of an overall recce plan—sub set to the ISTAR plan. Engineers are effective contributors to the overall recce effort and bring with them a technical expertise that is specialized in gathering engineer related information.

3. Success will be measured by how much ISTAR efforts can forewarn manoeuvre forces as to impending obstacles, thus enabling proactive grouping of capability and planning counter actions.

INTELLIGENCE PREPARATION OF THE BATTLE FIELD[6]

4. Terrain analysis will be the start point in the intelligence preparation of the battlefield (IPB) process. The Geomatic Support Team (GST) within a headquarters (HQ) has the resources

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[6] Reference IPB manual for in depth information on IPB.

and expertise to conduct the analysis; however, the engineers of the respective ESCC will interpret the results with a view to advising respective commanders and staff on the potential impacts on manoeuvre; moreover, how existing terrain can be modified or used (offensively or defensively) by friendly or threat forces to support their intentions. The engineer analysis will be conducted in conjunction with the G2 staff, which will be analyzing and developing courses of action available to the threat forces. The G2 will require engineer input on terrain affects and how they will influence threat course of action (COA).

5. A product of the IPB process will be the Event Template; it represents a sequential projection of events, over time and space, which indicate the threat forces' ability to adopt a particular COA. By knowing when and where threat force activity is likely to occur provides a list of key indicators to watch for that will promote visualization of their intentions. As the threat visualization process develops, a number of critical locations will become apparent where significant events are likely to happen. These areas are known as Named Areas of Interest (NAI). NAI will provide guidance as to where ISTAR capability should focus its attention.

6. The ISTAR Coordination Cell (ISTAR CC) will coordinate ISTAR sensors. NAI will be prioritized and assets tasked to collect information. The engineers must identify information requirements during IPB or approach the ISTAR CC staff for inclusion in the collection plan. Engineer information may be collected and reported by all arms, ISTAR assets, as well as integral engineer recce. Many items of engineer intelligence are of interest to other agencies, and similarly, many items of combat intelligence or information are of interest to engineers. Engineer recce, as scarce as it is, should be fixed on the NAI requiring engineer expertise.

7. IPB is effective in both planning for war fighting and peace support operations. Terrain analysis and visualization provides the "foundation" for IPB, therefore engineers can leverage their planning by utilizing the process to register NAI with respect to terrain (bridges, defiles, routes, etc).

SITUATIONAL AWARENESS

8. Not only do the engineers provide the required advice on terrain analysis Brown Situational Awareness (SA) but also contribute Blue and Red SA. The engineers provide expert advice on both coalition (Blue) and threat (Red) "engineer" related capabilities and will provide this advice to the G3 and G2 staffs respectively during planning and current operations. Actions by blue and red may equally affect mobility. Coalition bombing air operations, for example, will leave residual unexploded explosive ordnance (UXO) hazards. Engineers can advise on battlefield damage assessment. Engineers assist the G2 to template threats to friendly forces from a technical (mines, improvised explosive devices (IED), etc) and doctrinal perspective.

RECCE PULL

9. IPB will provide planning and define the purpose, whilst ISTAR will provide the method. The best and most conclusive method will be recce on the ground supported by other intelligence

gathering efforts. Recce assets will "pull"[7] forces forward as a result of higher HQ deductions/interpretation (intelligence) that arise from what is observed and reported. Recce is not launched blindly but should build upon or confirm earlier information/intelligence. Recce is an arduous and risky affair, often characterized as not being available in the quantities required, and always constrained by time. The tempo and momentum of recce will be related to the spectrum of war and the nature of the operation.

a. In combat operations, recce will be conducted under complex circumstances. It is spurred on by a need to maintain momentum of forces but complicated by threat forces counter-recce efforts. Swarming recce assets forward, of various types and generated from different levels and units, increases the probability of success. Momentum trumps caution; consequently, risk tolerance is high for the recce elements so that follow-on forces will utilize the designated mobility corridors. Recces in non-permissive environments often are constrained by the "fog of war" and therefore may rely on a degree of subjective analysis.

b. In operations other than war, recce is no less important; however, its activities are likely conducted within a framework as well as being within the static boundaries of a defined Area of Operations. Within static areas of operation, over time, the requirement for recce will be substituted by routine patrols. Nevertheless, efforts are no less challenging wherein threats can be less evident. Risk tolerance, in general, will be lower and therefore recce or patrols may be constrained. Recces in permissive environments are usually objective and conclusive.

RECCE FOR MOBILITY SUPPORT

10. The purpose of a route recce is to obtain specific information on a route, obstacles, threat and adjacent terrain that could affect movement. Dependent upon the type of operation and the task given to the recce, it may be necessary to emphasize the recce of the enemy over that of the terrain, or vice versa. Engineer recce of routes will tend to focus on technical analysis not in the purview of other arms.

11. The objective of recce, conducted in support of mobility, will be to concentrate on:

a. What will impede mobility and how must the forces *Act*? HQs will be able to plan for the appropriate mobility response:

(1) bypass; and

(2) defeat.

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[7] Pull—The mission of reconnaissance elements would then be to find gaps in the enemy disposition and *pull* combat power through them in order to strike at his critical assets thereby striking at his centre of gravity. This is the concept of *reconnaissance pull* wherein information transmitted will lead forces to move in a direction or take action

b. What will threaten force protection and how must the forces *Shield*? HQs will be able to assess the threat and risk and emplace the appropriate controls to enhance protection and mitigate risk.

12. As has been explained in the preceding paragraphs, recce is not a stand-alone activity but rather a fundamental component in a broader framework. The approach to recce will follow certain philosophies:

a. Preliminary and concurrent activity is conducted to support ground recce to maximize its efficiency and to promote economy of effort. Firstly, IPB leads to guidance as to where to "look;" the recce plan subsequently coordinates recce assets and will ensure efficiency.

b. Reinforcing success of recce by allowing it to "pull" by either influencing decision making or by essentially having follow on forces follow on the heals of the recce assets.

c. The risk environment and the mission imperatives (proportional to spectrum of conflict) will dictate the level of risk tolerance of recce and therefore the approach.

(1) High mission imperatives will permit higher risk tolerance. Being methodical and more cautious, to lower risk, takes time and this maybe counter productive because it will permit time sensitive situations to deteriorate and threat forces to gain the initiative; paradoxically resulting in more risk to friendly forces.

(2) Where mission imperatives are less pressing and tolerance for risk is low, time will be taken to ensure a methodical approach to minimize risk.

RECCE OF ROUTES AND AREAS

13. The information collected on routes and areas should cover all aspects of both the route/area and the immediate vicinity that could have a direct effect on its use. Normally, it will be expected that existing routes will be the preferred option, vice cross-country, for speed and momentum. In developed countries it is possible that there will be a choice of routes available to the force. In less developed areas this choice will diminish, and route options will be reduced.

ROUTES INFORMATION REQUIREMENTS		
SERIAL	**INFORMATION REQUIREMENT**	**TYPICAL REPORTING DETAIL**
(a)	**(b)**	**(c)**
1	Route information	Road and route type, surface type, road classification (MLC), width, gradient, constrictions (width and height), sharp curve or junction, ford, verges.
2	Bridge information	Overhead clearance, bridge classification, number of carriageways, carriageway width, total width.
3	Tunnel information	Tunnel height, length and width, bends in tunnel.

Table 3A-1: Information Requirements for Routes

ANNEX B TO CHAPTER 3
SAMPLE ORDERS FORMAT CLEARANCE OPERATION

1. **Situation**. The situation awareness described herein will be extracted from earlier planning and risk assessment:

   a. **Ground**:

      (1) **General**. Terrain, nearby towns, location of friendly forces, demographic profile, hospitals, rendezvous (RVs) and any possible danger areas.

      (2) **Site details**. Detail the likely and known locations of obstacles and mined/unexploded explosive ordnance (UXO) areas, task site boundaries (if different), locations of hard or previously cleared areas, position of base tape, vehicle parks, safe routes, and the location of other hazards.

   b. **Situation**:

      (1) **Threat Forces/Warring Factions**. Current locations, history of confrontation in the area.

      (2) **Nature of Munitions**. Types of munitions known/believed to be used in the area and methods of employment. Known markings and methods and patterns of employment.

      (3) **Other Clearance Operations**. Locations and types of other clearances being done by friendly forces or civilian organisations.

      (4) **Local Civilians**. Background, attitude and knowledge of local civilian population, including details on any casualties known to have occurred in the area or mining by others.

2. **Mission**. A clear statement of the area/route to be cleared and by when it must be cleared.

3. **Execution**:

   a. **General Concept**. States the reason a route/area must be cleared. Provides the assessed risk and designation of the route/area and how the area is to be cleared. For example the area is to be cleared primarily by manual means but supported by other methods as appropriate.

   b. **Higher Concept**. Include the Higher Commander's Intent and risk management guidelines as well as the pertinent factors that may affect the clearance operation.

   c. **Groupings and Tasks**. Personnel shall be allocated specific tasks as applicable, including:

(1) clearance parties;

(2) security parties;

(3) recovery party;

(4) demolition party;

(5) proving party; and

(6) liaison party.

d. **Coordinating Instructions**[8]:

(1) timings;

(2) RV/control point;

(3) routes to and from task site;

(4) layout of the clearance;

(5) security party locations as situation dictates;

(6) priority of work;

(7) selection of most suitable detector and technique;

(8) action on finding a mine or other munition;

(9) action on finding other specifics such as boobytrap, tripwire, anti-handling device, IED;

(10) fencing and marking procedures;

(11) action on hand over;

(12) rehearsals;

(13) medical;

(14) ammo point; and

(15) reporting and recording.

e. **Safety Instructions**:

---

[8] **Note:** These headings are for guidance only. Other information or instructions may be added where appropriate.

(1) how personnel not involved with the task enter the site;

(2) action on finding an unknown mine or UXO;

(3) action on accident;

(4) authority to conduct demolitions;

(5) radio frequency restrictions;

(6) actions on straying by standard humans and animals; and

(7) work/rest cycle.

4. **Service Support**:

a. **Dress**. Whether or not additional personnel protective equipment such as mine clearance suit or body armour and blast boots is to be worn by the personnel. A minimum of helmet, ballistic eye protection and flak jacket is normally worn by all personnel conducting clearance operations.

b. **Equipment**. State what and how special equipment will be used.

c. **Medical**. Ensure that all personnel know the details on the nearest medical first aid and surgical centres and that Medical Assistants know what to do in the event of a mine/UXO incident. Medics should recce main and alternate evacuation (evac) routes and ensure they are marked on all maps. They must also be aware of immediate actions on site (ie. do not run into the danger area).

d. **Administration**:

(1) water; and

(2) feeding.

5. **Command and Signals**:

a. **Chain of command**. State the on-site chain of command, and where appropriate, details on the higher headquarters responsible for the task.

b. **Signals**. To include details on:

(1) radio frequencies;

(2) call signs to be used during the task;

(3) other stations on the net;

(4) requirements for on-site communications; and

(5) the requirement for on site liaison.

CHAPTER 4
CONTROL, AUTHORITY AND TERRAIN MANAGEMENT

INTRODUCTION

1. Commanders, at all levels, are responsible for ensuring that adequate force protection measures are in place during any operation. Methods of ensuring adequate force protection, in an area that poses a significant threat from mines and other UXO, are: to provide personnel with situational awareness; and to control the use of routes and areas by imposing restrictions, and in some cases, reserve use authority. Normally, once adequate controls are in place, a commander delegates the authority to use certain routes but retains the authority to open new areas and routes. Situational awareness and route and area control can be communicated through the promulgation of a designated ground trace (DGT), which is a graphic overlay of the area of operation that provides information on route and area designations.

2. Authority for designating and authorizing ground use should be centralized at the appropriate level of command. The appropriate level is the level at which a commander has full authority over an area of operations and the necessary assets grouped to him to facilitate mobility needs.

DESIGNATION OF AREAS/ROUTES

3. It is important to understand the designation of areas and routes. These designations must be promulgated in accordance with SOPs and displayed on the DGT:

a. ***Open***—A designation given to ground that is authorized for use **without any** restrictions. For example, an ***Open*** route is a route that may be travelled on foot or by vehicles of any type as long as the movement is kept to the route. An ***Open*** area could relate to the marked confines of a camp where anyone could go about their business without restriction.

b. ***Restricted***—A designation given to ground that is authorized for use but **with** restrictions. The nature of the restriction must be listed. Departure from the restrictions can only occur under the authority of the commander. For example, if after the conduct of the initial intelligence and risk assessment, the assessed risk is Low, a route can be designated as ***Restricted*** until the conduct of a route/area confirmation and a permanent designation. As another example, a route may be authorized for armoured fighting vehicles (AFV) only, or in another situation, a certain route could be open only for foot patrols.

c. ***Closed***—A designation given to ground that is **not** authorized for use because of known threats/hazards that are not yet removed, or the ground has not yet been properly evaluated and designated. Use of the ground must be authorized or directed: acceptance of the risk rests with the commander. Use will normally be in support of a mission imperative and with appropriate engineer support.

ROUTE/AREA RECORD

4. The engineer staff initiates a route/area record that documents the steps and decisions made in designating routes and areas. This record assists in communicating the decisions rendered and moreover the background to those decisions. Such a record provides ease of handover during relief/rotation. The designated ground trace can be considered a product of the entire process, where as the route/area record is the history behind the designated ground trace. The route/area record also contains any subsequent data such as the conduct of route maintenance. A sample format and contents of a route/area record is provided at Annex A.

DESIGNATED GROUND TRACE

5. One of the most important control measures that a force can adopt is to create and maintain a DGT (see annex B). The DGT depicts all of the authorized routes and areas that have been designated for use by the force. The engineers maintain the master trace and updates are sent out on a regular basis as changes occur. All members of the force must have access to a copy of the DGT (i.e. posted in sub-unit HQ or preferably resident in electronic data base) to avoid travelling in potentially dangerous areas. The DGT can be maintained manually or, if geomatics support is available, it can be maintained and updated electronically. The commander approves all updates and authorizes the most current DGT for use. This completes the cycle: the commander approves requests for a new area and route; the engineers conduct clearance operations; the route/area is designated and recorded for use.

GROUND MARKING CONVENTIONS

6. Physical marking on the ground should be in accordance with coalition SOPs or other known conventions. Consideration must be made as how to prevent the tampering of marking resources (e.g. wire, pickets, etc), which can be pilfered by locals, and not as a result of maliciousness but rather for personal need or benefit.

a. **Marking Hazardous Areas**. Areas that pose a danger to friendly forces should be marked. Marking hazardous areas will usually involve establishing a perimeter barrier with hazard markings. The barrier can be either an existing feature (hedge, fence, etc) or an erected fence. If a perimeter barrier is not practical then at least markings (mine hazard signs) should be placed at obvious approaches. Lanes passing through the hazardous area are known as safe lanes and will be marked accordingly[9].

b. **Marking Routes**. Global positioning systems are becoming increasingly accurate and available; however, their accuracy and utility may not be suitable particularly at intersections, forks and braided trails. There is an inherent margin of error—although small—it still maybe too large. There could be confusion as to which

---

[9] In accordance to SOPs.

route is the one designated for use. Therefore there must be a suitable designation such as instructions or on site markings.

GEOMATIC SUPPORT

7. A geomatics support team (GST), supporting a task force, brigade, or battle group, has access to satellite and digital terrain maps of the operational area. Using these resources, the GST is able to provide a detailed ground analysis on specific area of operations (AO). The GST fulfills several major functions, in addition to the provision of paper or digital maps.

a. **DGT**. The collation, updating and production of traces to facilitate the dissemination of DGT information.

b. **Maintaining a Database**. Once the location of a threat area is known, the boundaries can be put into a geomatic database. The GST can then incorporate minefield/threat locations into terrain and movement overlays for presentation during risk analysis of a given area. If the extent or composition of a minefield changes, the database can easily be updated.

c. **Specialized Studies**. The GST is capable of conducting special studies to assist in risk assessments and planning. They can assist in determining how the geology, hydrology, cultural factors and population might affect operations.

ANNEX A TO CHAPTER 4
ROUTE/AREA RECORD

ROUTE/AREA RECORD

1. A route/area record is a compilation of detailed information on a specific route or area. It highlights the critical decisions made during planning and clearance as well as all subsequent work and maintenance through out its use. It can exist in paper copy, or preferably in a computer database, for quick reference and update. It consists of several components.

a. **Part 1—Route/Area Mobility Support Requirement**. Mobility requirements could arise as a result of: an operational order; or as a request (see appendix 1) submitted by sub units through unit HQ where they are approved and prioritized before tasked to the engineers. Where the requirement arises from an operational order, then a copy of the order's map trace and reference to the order is required. The order, within a coalition, may even arise from a standardized message format (example NATO E113A *Minefield Breaching/Clearance Order*.)

b. **Part 2—Planning and Risk Record**. A Planning and Risk Record summarizes, in sequence, the key elements of the planning and risk management process conducted during the decision action cycle. The start point is the gathering of intelligence. Intelligence may be supported by a preliminary reconnaissance report (appendix 3). It is important to include all references or information relevant to the planning and risk management associated with the task.

c. **Part 3—Clearance Orders**. A copy of the clearance orders should be retained.

d. **Part 4—Route/Area Reconnaissance Report**. All routes should be evaluated by a reconnaissance. Route reconnaissance is in accordance with NATO[10] Route report and if required reported via the appropriate message (for example, E110B R*oute Reconnaissance Report*).

e. **Part 5—Route/Area Maintenance**. An account of all maintenance done to the route and/or area.

---

[10] Defined in B-GL-332-006/FP-001 Part 8 Engineer Insert 805.12

APPENDIX 1 TO ANNEX A
ROUTE/AREA OPENING REQUEST

ROUTE/AREA OPENING REQUEST

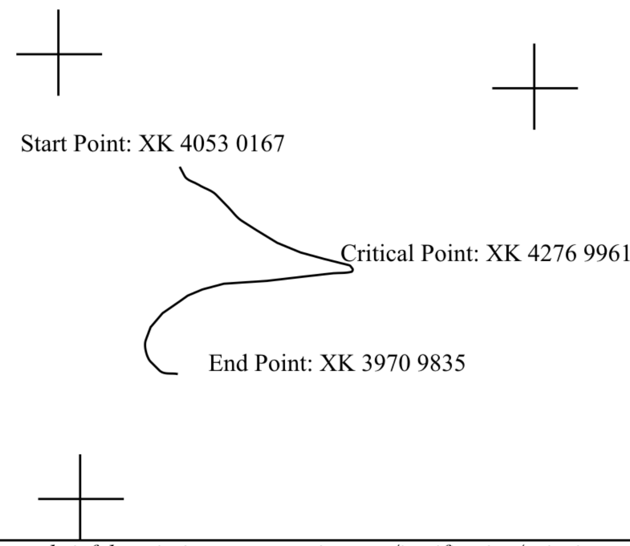
CLASSIFICATION

Date submitted: 21 March 2000

ROUTE/AREA OPENING REQUEST - FILE # ________

References:
A. "Map" 1:50,000
B. DTG

Legend: *Ground requested is defined as follows:*



Statement of Operational Requirement < *brief description as to requirement/justification/priority*>

Route/Area Required by - <*DTG*>

Information and Intelligence <*known thus far*>

Submitted by: I.M. Dashing Capt, 2IC A Coy	Signature:
APPROVED/NOT APPROVED	Priority: HIGH / MEDIUM / LOW
I.M. Staff Maj BG Ops	Signature:

CLASSIFICATION

APPENDIX 2 TO ANNEX A
PLANNING AND RISK RECORD

PLANNING AND RISK RECORD

CLASSIFICATION

PLANNING AND RISK RECORD

File:	Date:

References: A. *Mine Map*

B. *Mine Database including IMSMA *UN Mine Database) or coalition targeting information*

C. *Map*

D. *Op Order*

E. *Route/Area Opening request* (App 1, 4A)

F. *INTSUM*

1. **Statement of Operational Requirement**. *<brief description in terms of requirement and use. Make reference to Op O if applicable>*

2. **Information and Intelligence**. *<to include a summary of known facts and references used to assess the risk. The following facts should be listed>*

    a. terrain analysis;

    b. nature of threats and hazards including UXOs (friendly and threat forces);

    c. history of area;

    d. all other information from all sources (coalition, G2, NGOs, etc.); and

    e. etc.

3. **Preliminary Recce**: REQUIRED / NOT REQUIRED
(attach Preliminary Recce Report)

Signature Block: OC, Engr Sqn	Date:

4. **Vehicle/Method of Passage in Area/Route** *<list methods of travel and types of vehicles to be used. Include, if possible, the value of blast protection offered>*

5. **Assessed Risk**.

   a. **Threat Severity** *<to vehicles and personnel>*

   b. **Threat Probability**

   c. **Risk Assessment** **L** **M** **H** **E**

6. **Initial Route/Area Designation**. CLOSED / RESTRICTED[11] / OPEN[12]

Signature Block: Comd	Date:

Note: — Designated Ground Trace is to be amended

7. **Further Action Required**. *<Further actions required to provide support to the operational course of action. No action may be necessary? Initial route/area designation may be sufficient>*

8. **Risk Decisions**. *<A list of the controls to be implemented. If a clearance operation is to be one of the controls then provide detail as to the method>*

   a. Route/Area Confirmation; or

   b. Method of Clearance; and

   c. Other mitigating controls.

Signature Block: Comd	Date:

9. **Task Completion**. Designation following control implementations

Route / Area Designation

OPEN[11] / RESTRICTED[11] / CLOSED[12]

If **RESTRICTED** list nature of restriction.

10. **DGT Updated** YES / NO

---

[11] See Chapter 2, Table 2-5

[12] See Chapter 2, Table 2-5

11. **Miscellaneous**

a. Follow-up Maintenance Routine—<*what will be the routine to maintain the designation*>

b. After Action Review (AAR) points

Enclosures:

Trace of route 1:50,000 scale

Preliminary Recce Report

etc.

CLASSIFICATION

APPENDIX 3 TO ANNEX A
PRELIMINARY RECONNAISSANCE REPORT

CLASSIFICATION	
Date PRELIMINARY RECONNAISSANCE REPORT FILE #	
Date of Reconnaissance	
Route start Grid	
Road Characteristics	Asphalt ☐ Concrete ☐ Gravel ☐ Soil ☐
Shoulder/Verges description	
Width (m)	
General state of road	
Volume and type of traffic observed	
Observation time (min 1 hr)	
Visual contact distance (m)	
Other Detail Hydrology UXO indicators vegetation	
Route end grid	
Type of Road	Asphalt ☐ Concrete ☐ Gravel ☐ Soil ☐
Shoulder/Verges description	
Width (m)	
General state of road	
Volume and type of traffic observed	
Observation time (min 1 hr)	
Visual contact distance (m)	
Other Detail Hydrology UXO indicators vegetation	
Photos Attached Sketch Attached	
Preliminary Recce Comd's recommendation	

Preliminary Recce Comd's signature	
Engr Ops Recommendation	
Engr Ops Signature	
Engr Comd's recommendation	
Further action required:	
Engr Comd's signature	
Notes: 1. If possible, a minimum of two digital photographs (start point and end point) must be included with this report. 2. During a Preliminary Recce the route in question will not be travelled but should not be limited to just the start and end points of routes. Additional information gathered from other locations, such as from authorized routes on hills with clear line of sight of the target route/area, are encouraged. 3. If the route or area is designated Low (L) risk following the Preliminary Recce, a Route/Area Confirmation may be authorized where the route will be travelled in its entirety. CLASSIFICATION	

ANNEX B TO CHAPTER 4
DESIGNATED GROUND TRACE

GENERAL

1. The tactical HQ will promulgate the DGT. The HQ is responsible for reproduction and internal distribution of copies to subordinate command posts. The engineer advisor will coordinate the production and ensure accuracy.

2. The tactical HQ will issue amendments to the DGT as the status of routes/areas change. All force elements holding traces are responsible to ensure that overlays are promptly and properly updated. Copies of all amendment lists will be held at each level of HQ to permit cross-referencing and subsequent verification.

3. The DGT should be viewed along with the "Mine Map"[13] to provide a better situational awareness of the mine and other UXO threat. By observing both simultaneously, generalized trends and sources of threats/hazards become more evident.

ELEMENTS OF THE DGT

4. The DGT must abide by existing staff duties. Figure 4B—1 is the recommended format for a DGT. The key convention that all DGTs must communicate are:

   a. Legend with marking conventions (see discussion below); and

   b. Route matrix (see Table 4B-1) that defines restrictions for respective route and areas.

MARKING CONVENTIONS

5. A map marking convention must be established that will permit easy recognition of route and area categories. The convention must be established prior to deployment and be instructed to all personnel. Some guidance:

   a. Routes and areas should be labelled for ease of reference. Either a numbering system (e.g. route 23) or nicknames (e.g. CLUB) or combination would be sufficient.

   b. Interoperable or standardized in accordance to coalition theatre SOPs if they exist.

   c. Simple to use because in some cases it may have to be transferred by hand from a master trace to the user's map.

---

[13] A Mine Map is an engineer intelligence product that is a collation of data indicating the known or possible location of mines and other UXO. It is valuable in projecting a common picture of the threat and a good indicator of trends.

d. Minimize colours, which could lead to confusion. For example, Restricted Routes may be restricted for various reasons but that does not mean each type of restriction requires its own designator.

SAMPLE DGT FORMAT

CLASSIFICATION

Date submitted: 21 March 2000

Copy ___of___

DESIGNATED GROUND TRACE AS OF (EFFECTIVE DTG)
(Supercedes DGT as of DTG)

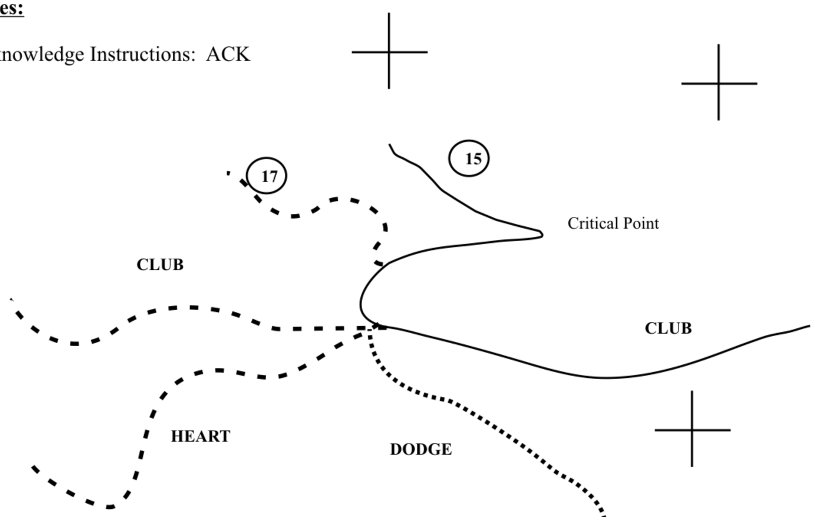
References: A. Map (Series, sheet, name, edition of applicable 1:50,000 maps)
B. B-GL-331-003/FP-001

Legend: *<example only>*
Open route - Solid Black line
RESTRICTED route - Dashed black line
CLOSED route Dotted Black line

General Restrictions:
Nil

Notes:

Acknowledge Instructions: ACK



I.M. Commander
LCol
BG Comd

Distribution List

Copy No

Authentication

I.M. Advisor
Maj
OC Engr Sqn

CLASSIFICATION

Figure 4B-1: Sample DGT

ROUTE MATRIX

ROUTE ID	START POINT	START POINT	DESIGNATION	CRITICAL POINTS	GRID	RESTRICTIONS
CLUB	34109755	39709835	RESTRICTED			shoulders not cleared
	39709835	45169660	OPEN			
15	40530167	39709835	OPEN	narrow bridge (one lane) crossing	42769961	
DODGE	39709835	43208750	CLOSED			
17	3823016	39729923	RESTRICTED			
HEART	3970835	34208790	RESTRICTED			The Designation is based on an Intelligence and risk assessment of Low and no route confirmation has yet been conducted—users must obtain authority

Table 4B-1: Route Matrix

ANNEX C TO CHAPTER 4
REPORTS AND RETURNS

GENERAL

1. It is essential that when dealing with mines and UXO, all parties use the same standard of reports and returns to avoid any confusion. Effective reporting will reinforce situational awareness and initiate the required response. The reports and returns act as a record and a tool for promulgating information and decisions.

2. Reports are most effective if they are standardized at all levels. In other words, the same report can be initiated at the tactical level (platoon or troop) and be forwarded up the chain and built-on at each successive level amending the original report with additional, or updated information, as well as, initiating any further action. This holds true, not only within a Canadian deployment, but also within the context of a multi-national deployment. On a multi-national coalition operation it will be the lead nation's responsibility to standardize the essential reports and returns. This does not preclude a BG from utilizing additional reports and returns for their own network. Standardization already exists in the case of NATO member nations and can be referred to in the applicable STANAGs[14].

a. **STANAG 2485**. Counter Countermine Operations in Land Warfare (Annex A and B "Mine Clearance Record")

b. **STANAG 2221 (AEODP-6)**. EOD Reports and Messages

(1) **EOD incident report (EODINCREP)**. This report is meant to gather the appropriate information from all arms and report it to appropriate headquarters.

(2) **EOR task report (EORTASKREP)**. Part 1 is gathered from the EODINCREP or from other reports to become a reconnaissance order. The element conducting the EOR confirms the information, identifies the UXO and completes Part 2 to report the information to its higher HQ.

(3) **EOD task report (EODTASKREP)**. Part 1 serves as orders issued by the appropriate HQ to the element conducting the EOD based on the information gathered from the EORTASKREP. Part 2 of the EODTASKREP serves as a completion report and for recording purposes

c. **STANAG 2430 (AEngrP-02(B)**. Land Force Combat Engineer Messages, Reports and Returns

---

[14] At the time of writing this manual NATO was conducting an extensive review and updating of its information exchange requirements.

(1) E110A. Route Reconnaissance Order.

(2) E110B. Route Reconnaissance Report.

(3) E113A. Minefield Breaching/Clearing Recce Order.

(4) E113B. Minefield Breaching/Clearing Recce Report.

(5) E113C. Minefield Breaching/Clearing Execution Order.

(6) E113D. Minefield Breaching/Clearing Completion Report.

(7) E 303A. Obstacle Report

3. The reports contained in the appendices of this annex provide examples of reports and returns that have proven to be successful on past Canadian deployments but are not standardized in multi-national messaging.

APPENDIX 1 TO ANNEX C
INCIDENT REPORTS

INITIAL INCIDENT/CONTACT REPORT

1. **Initial Contact Report**. The immediate reporting of a mines/UXO incident can be done in a standard contact report format. It should be followed up by the more detailed report. An example of the contact report format is as follows:

INITIAL MINES AND OTHER UXO CONTACT REPORT		
	FORMAT	**EXAMPLE**
1.	Call sign reporting	11 THIS IS 11A, CONTACT.
2.	Description of contact	MINEFIELD/UXO GR 245796. NO DETONATION, TWO C/S IN MINED AREA.
3.	Own action	AM ASSESSING. ADVISE ENGRS AND MED. WILL ASSESS IF DRAWBACK IS FEASIBLE, USING SELF-EXTRACTION DRILL. WAIT OUT
4.	Time of contact	1035 HRS.

Table 4C1-1: Initial Contact Report

INCIDENT RESPONSE REQUEST REPORT

2. **METHANE Report**. The contact report is followed up by a more detailed report once an assessment is made in situ as to what has occurred and what action needs to be taken. METHANE is a pneumonic that is derived from each of the required line serials. It is a generic operational report used to inform, in the event of an incident, and initiate higher response.

		FORMAT	EXAMPLE
		METHANE REPORT	11, THIS IS 11A, METHANE REPORT
1.	M	My name, appointment, call sign or telephone number and local	11A
2.	E	Exact location of the incident (grid and description)	WX 2455 7965
3.	T	Type of incident	TWO VEHS OFF ROUTE BY 30M IN MINED AREA, MLVW G32 AND LAV I3 G32 STRUCK BY MINE
4.	H	Hazards at the scene, potential hazards (e.g. fire, mines, weather)	UNMARKED MINE AREA VEHICLE TRAFFIC
5.	A	Access to the scene and loc of Helicopter Landing Sits (Grid once available)	APPROACH FROM NORTH TO PRIMARY ROUTE, LANDING SITE GRID WX 2450 7955, PARKING GRID WX 2452 7963
6.	N	Number and type of casualties. Once you have details of their injuries, tell G3 Ops - e.g. breathing difficulty, trapped casualty.	SEVEN CASUALTY TOTAL ALL TRAPPED IN VEHICLE AND REQUIRE EXTRACTION TWO PRIORITY 1, TWO PRIORITY 2, AND THREE PRIOR 3
7.	E	Emergency services already at the scene and those needed, e.g. whether Immediate Response Team helicopter needed	HELICOPTER REQUIRED FOR FOUR CASUALTIES WITH AMBULANCE FOR THREE AND 1 MRT FOR MLVW AND LAV

Table 4C1-2: METHANE Report

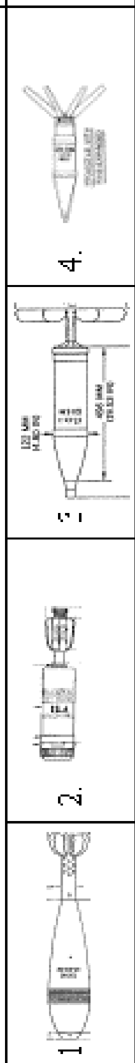
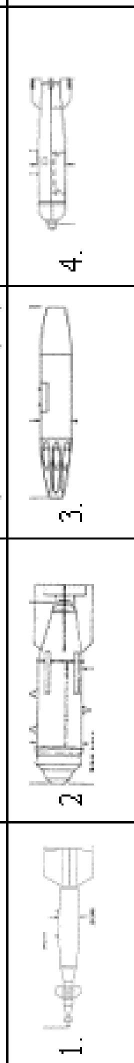
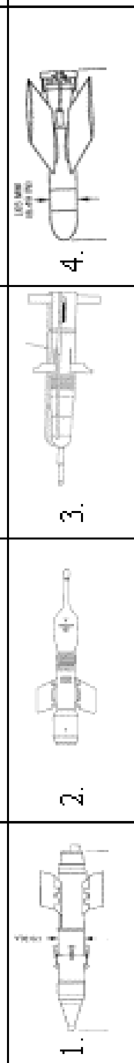
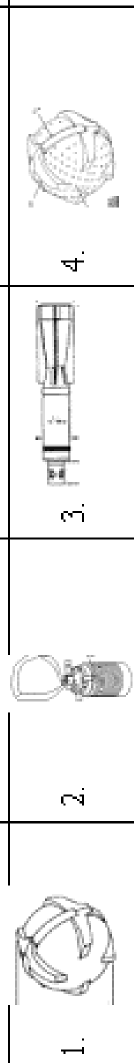
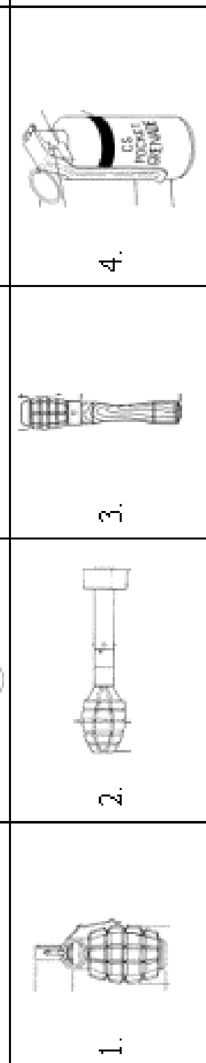
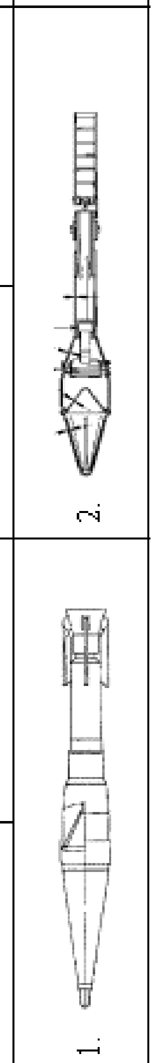
APPENDIX 2 TO ANNEX C
INCIDENT REPORTS

1. **Request for EOD Assistance**. In the course of their duties, the all arms team, particularly patrols and reconnaissance, will sight and receive information on UXO within the area of operations. As an aid to initiate the required specialized response the following report format is recommended:

ALPHA	Grid of item/area to be cleared		
BRAVO1	UXO-Type (Examples see backside)		
BRAVO2	Description of UXO	Length (mm)	
		Diameter (mm)	
		Width (mm)	
		Height (mm)	
		Color	
		Markings	
		Additional parts	
CHARLIE	Quantity of UXO		
DELTA	DTG of attack / discovery of UXO		
FOXTROT1	Measure of evacuations		☐ no ☐ ongoing ☐ ready
FOXTROT2	Cordon fixed		☐ NO ☐ YES
HOTEL	Report from	Unit	
		Name	
		Rank	
INDIA1	Point of contact		
INDIA2	Description to grid of item / area		
LIMA2	Remarks		
YANKEE	Urgent or otherwise critical		☐ NO ☐ YES
Pictures attached as Annex			☐ NO ☐ YES

BACKSIDE OF REQUEST FOR EOD ASSISTANCE FORM

Help to identify / Erkennungshilfe

Ordinance / Munition	Picture / Bildliche Darstellung /	Min Distance
Projectile A Geschosse		100 M
Bomb B Bombe		200 M
Missile C Flugkorper		100M
Bomblets D kleinbomben		50M
Grenade E Granaten		50M
Mines F Landminen		50M
Unknown G unbekannt		200M

CHAPTER 5
CLEARANCE PROCEDURES

INTRODUCTION

1. In the Canadian Army only engineers are qualified to conduct clearance operations. There exist several clearance procedures, all of which endeavour to rid an area of all mine and other UXOs. Some clearance procedures, first, rely on the detection of mines and other UXO, followed by their in situ destruction or neutralization and removal (for later destruction). Other clearance procedures do not require detection but rather are designed to defeat the UXO by its displacement, detonation or destruction. An additional procedure, proofing, may be used wherein the confidence level of the clearance operation must be verified.

2. Clearance procedures are normally grouped in accordance with the following systems which can be employed individually or in combination:

a. **Manual Systems**. Manual procedures include the visual and physical (hands, prodders and mine detectors, etc) searching of an area, marking and eventual disposal of explosive ordnance. Dog teams are included in this grouping. Manual techniques involve a greater degree of risk due to the direct exposure of individuals to the related threats and hazards but are generally the most thorough and versatile.

b. **Explosive Systems**. There are a number of devices which work on the principle of disrupting the mine or mine fuse by detonation or blast effects. The use of bangalore torpedo and an explosive line charge are examples of explosive methods, but are usually employed in breaching operations.

c. **Mechanical Systems**. Mechanical systems rely on the employment of equipment that is designed to detect (e.g. ILDS), displace (e.g. plough), disrupt or detonate (e.g. roller, flail) mines or other UXO. They are generally faster but less flexible and have associated collateral effects and limitations.

d. **Other**. Other technologies are emerging such as energy beams and chemical detection but remain unreliable at this time.

ROUTES

3. Route is a generic term used to define all paths, tracks, and roads used to support movement of vehicles and/or foot traffic.

a. **Components of a Vehicle Route**. A route intended to carry vehicle traffic can consist of three main components: Travel surface, shoulders, and verges. All three components may be relatively evident and distinguishable from one another or not.

(1) **Travel Surface**. The travel surface is the main portion of the route intended to carry traffic. It may have one or several lanes: a lane being the width required to carry one line of traffic. The traveled surface could be as little as a rudimentary rutted dirt track or a soundly constructed hardened (i.e. concrete and asphalt) surface.

(2) **Shoulders**. Shoulders are extensions of the travel surface beyond what is required to support lanes of traffic. Shoulders are constructed for several reasons including structural stability of the road and added space to support the flow of traffic. Shoulders can be hardened, if the traveled surface is, or more commonly it is an extension of the sub-base. Not all routes have shoulders.

(3) **Verges**. Verges are the areas beyond the travel surface and shoulders–if shoulders exist. Verges typically consist of rough ground and have ditches to facilitate water drainage. Verges are frequently littered with debris and can have a lot of vegetation growth.

(4) **Other Elements**. Other elements that are commonly associated with routes that must be considered with respect as to how they may affect clearance operation:

(a) intersections;

(b) sidewalks;

(c) overpass;

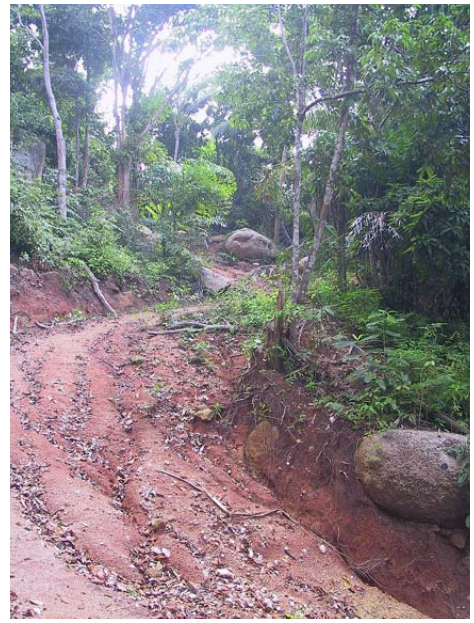
(d) on and off ramps;

(e) parking and halting areas; and

(f) other infrastructure (bridges, culverts, medians, barriers, etc).

b. **Types of Routes**:

(1) **Footpaths/Trail**. Footpaths are typified by a narrow defined track able to sustain foot movement by individuals or groups. Footpaths are usually abundant in less developed countries and are the usual means of communication where vehicle travel is the exception, particularly in rough terrain. Footpaths are created out of necessity by local populations and not by any form of higher authority. Locals can therefore be a good source of information on the location and status of the footpaths (trails). Trails frequently will not be shown on maps, therefore sketches or locally produced maps will be required.



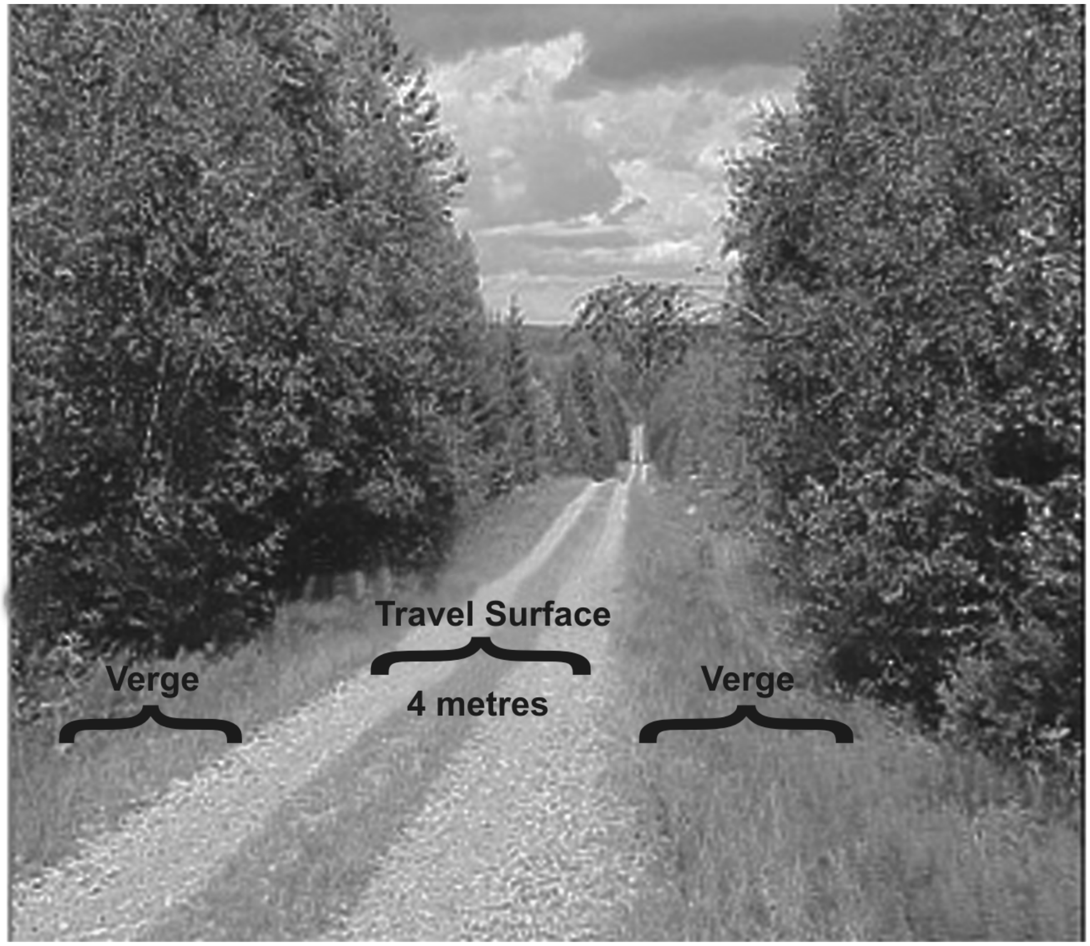
(a) **Threat**. Threats to footpaths are anti personnel related mines, munitions and booby traps. They frequently involve trip wires.

(b) **Challenge to Clearance**. Choice of clearance method is limited by the terrain and vegetation. Manual clearance may often be the only means.

(2) **Tracks (Un-surfaced routes)**. These are rudimentary vehicle routes that are usually narrow and do not have hardened travel surfaces. There are usually no shoulders. Tracks may or may not be shown on maps but geomatic support teams can update maps.

(a) **Threat**. Tracks are susceptible to buried mines or embedded UXO because digging and other tampering with the surface can be concealed easily and if narrow the track could be rigged with trip wires. The many ruts and potholes associated with tracks could conceal threats.

(b) **Challenge to Clearance**. Differentiation between the travel surface and shoulder or verge is usually indistinguishable. Choice of clearance method is limited by the terrain and vegetation. Manual clearance may often be the only means; however, mechanical methods should not be discounted.



(3) **Hard surface routes**. Many main and heavily trafficked routes are constructed with a hardened travel surface. The surface can be made of a compacted aggregate or a flexible pavement such as asphalt (bitumen) or a very rigid material like concrete. These routes frequently have shoulders. These routes typically have two lanes or more. Hard surface routes will be featured on maps but must be verified for accuracy and currency.

(a) **Threat**. Due to the nature of the hardened travel surface, concealing mines and other UXOs is difficult. Consequently, the threat is likely to be surface laid or restricted to the shoulders, verges or a vulnerable point and may come as an IED or off route munitions.

(b) **Challenge to Clearance**. The challenge to clearance will likely be the shear scope of the task, particularly for wide routes with more than two lanes, wide shoulders, and substantial verges.

(4) **Lateral Routes**. Lateral routes must be considered because they will be required as a means to egress/ingress. Such access will increase mobility options as well as assist in clearance operations. They may not be an initial priority but must be considered at a later time.

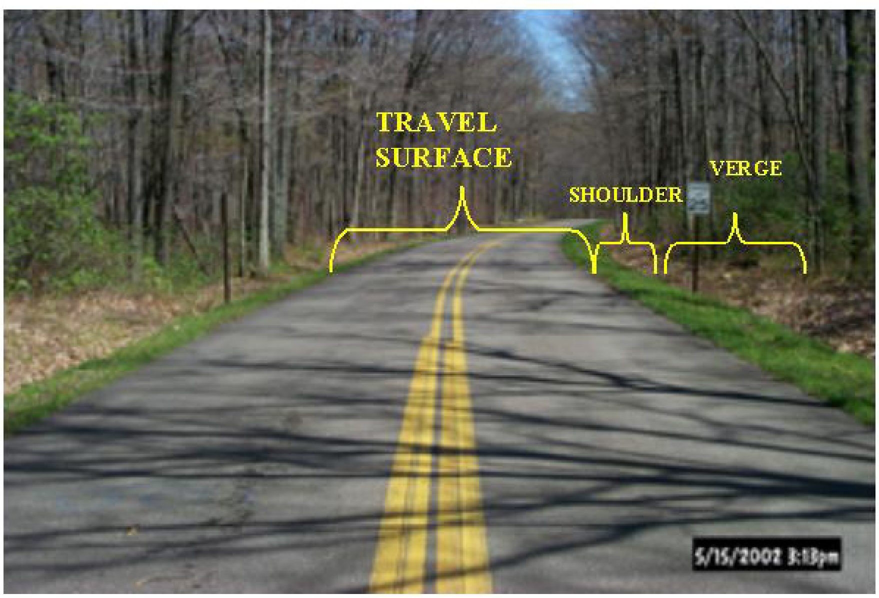
VULNERABLE POINTS

4. Similar to our own tactics and procedures, threat forces employ their resources and time in a manner where the concealment, probability and effect of impact is greatest. These areas can be designated as vulnerable points and can be identified if considered from the perspective of a potential emplacing element. In all clearance operations, extra precautions of vulnerable points must be taken to verify them as being clear of hazards. Due to the nature of vulnerable points, most can only be cleared manually. Examples of vulnerable points include:

a. culverts;

b. bridges;

c. fords;



d. overpasses;

e. tunnels;

f. rail crossings;

g. defiles or narrow choke points;

h. areas adjacent to known mined or suspected mined areas;

i. high banks overlooking route/area;

j. junctions;

k. walls and guard rails/barriers close to the route;

l. abandoned vehicles, dead livestock;

m. washed out areas;

n. debris;

o. potholes; and

p. likely ambush positions.

AREAS

5. Areas, like routes, are only cleared if needed in support of operations such as camps, a road side check point, an observation/surveillance post, etc. As a rule, the military does not conduct humanitarian de-mining of areas. Prior to occupation, and the construction of necessary infrastructure, a clearance is conducted. The main characteristics that must be considered in area clearance operations are:

a. **Vegetation**. The type and quantity of vegetation (for example, heavy growth) makes manual and most mechanical clearance very difficult. Methods of clearing the vegetation will have to be considered prior to clearance (see paragraph 6).

b. **Size**. The size of an area influences the method of choice. Large areas are better dealt with mechanically while small areas may be better dealt with manually.

c. **Terrain**. Rough terrain or soft soil may not permit the use of certain mechanical methods.

d. **Contamination**. Areas may have large amounts of debris, containing metal, that can readily affect clearance. Waste management is frequently non-existent in underdeveloped countries; consequently, waste is dumped haphazardly.

e. **Digging Requirements**. Most clearance methods have limitations as to the depth they can reliably detect and clear mines and other UXO. Normally, depth limitation is a non-issue. In other words, if an UXO is beyond the capability of detection and clearance, the ground will meet the needs of most future uses; however, if there is intent to dig (defensive works, utilities, etc), extra measures will be required. There are specialized mine detectors that can penetrate to a greater depth or an armoured digger may be required. An excavation is best done in “lifts” or a layer at a time where between lifts the hole is checked by detectors.

NOTE

Verges should **not** normally be included in clearance because of the intense resource draw. Nevertheless, it must be decided if shoulder clearance will be the norm.

Once at depth, the excavation must be swept for UXOs; both the sides and bottom.

GENERAL CLEARANCE CONSIDERATIONS

6. **Clearance Mandate**. Economy of effort should be a guiding principle with respect to limiting the boundaries within which clearance should be conducted. Clearing takes time, resources and exposes engineers to risk; therefore, only that area which is required to support the mission should be cleared. However, if feasible, clearance operations can be spared the onerous task of constructing an obvious perimeter if clearance is conducted up to an existing feature that can act as a boundary and permit marking.

a. **Routes**. A decision must be made with respect to what portions of a route, beyond the travel surface, will normally be cleared. How wide will a lane[15] be and will shoulders, as a set standard, be cleared? Consequently, any deviation from the standard will be noted as a “Restriction” in the route’s designation. The standard must be decided upon early in the mission.

b. **Areas**. Only that area that is needed should be cleared; therefore, thorough planning is needed to forecast the exact need.

7. **Ground Vegetation**. Ground vegetation will have a big impact on all clearance efforts. If clearance of the area cannot be avoided then the vegetation may have to be removed. Removal can be achieved by several recognized methods.

a. **Burning**. A controlled burn of the vegetation, of the area to be cleared, is a feasible method but there are significant associated risks of collateral damage. For one, controlling the burn to a fixed perimeter is difficult because of the risk of mines and other UXO. Further, UXO become unstable. Sufficient time must be allowed for the burn to cool before clearance can begin.

b. **Cutting**. There are cutter attachments on hydraulic arms attached to armoured tractors that could be used to mow vegetation. The same arm would have to rake the vegetation. The tractor would move forward into previously cleared ground – cut- move back and permit further clearance.

c. **Scraping Surface**. The topsoil and vegetation can be scrapped off to the required depth using heavy equipment. The appropriate (armoured cab protecting

[15] A standard NATO safe lane is 4.5 m (STANAG 2036 ed 6)

operator) heavy equipment is required. The spoil that is piled up will have to be isolated and eventually cleared of potential UXO.

d. **Flail**. Depending on the density of the vegetation a flail could be used to remove it while concurrently clearing mines.

8. **Marking**. Marking of the outer boundaries of cleared routes is not a practical option because of the magnitude of the task, and unless the markings or fencing are under continual observation markings can be tampered with. Using distinguishable existing markings or features is preferable, as an example, the edge of the pavement could be considered a boundary. Marking and fencing of the outer boundaries of areas should be done if the area is to be occupied. An occupied area such as a camp boundary is likely to be observed and patrolled. See Chapter 4 for more information.

9. **Complacency During Clearance**. The force must always be conscious of and guard against complacency and fatigue in the face of a ubiquitous mine and other UXO hazards. Stress arising from the requirement for intense concentration for weeks on end can quickly wear down engineers. It is necessary to watch for any signs of a casual attitude or exhaustion caused by over exposure to mine clearing tasks. Regular breaks must be enforced at all levels of command. The danger is very real. While the tactical commander is ultimately responsible for all aspects of dealing with the mine threat in his AOR, all sub-unit commanders have an important role to play in day-to-day operations. The risk management must be routinely reviewed at the company/squadron/engineer troop commander level, with involvement by the tactical commander.

10. **Proofing**[16]. Proofing is a process following breaching, route or area clearance to further reduce the risk from mines or other explosive ordinance. Proofing is not quality assurance but is itself a clearance procedure chosen to counter the inherent weakness of the procedure that was used in the first instance. Typically, mechanical and explosive systems have inherent drawbacks that can result in residual risk. An example would be proofing an area with dog teams following a flail clearance (which are known to leave explosive debris) or manually inspecting potholes following the use of a surface mine clearance device or roller.

11. **Complex UXO**.

a. Personnel will perform those tasks for which they are trained and equipped, and on those munitions they are familiar with.

b. In the first instance, conventional mines and UXO are to be disposed of by blowing them in place. Conventional munitions that are not armed and are positively identified as such can be moved for disposal at an alternate time and place. If the situation warrants it and approval is granted, armed conventional munitions can be neutralized and be moved by qualified individuals to be destroyed later.

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16 See the Glossary for accepted definition.

c. EOD qualified specialists will deal with mines and other UXO, which because of their type or location are deemed to be beyond the technical capability of conventional field engineers. IED are an example as to when EOD specialists should be used.

12. **Safety Distances**. Safety distances must be considered and enforced for both engineers executing the task and all bystanders (military and civilian). There are safety distances for execution of the task as well as in the destruction of ordnance. Safety distances for the destruction of ordinance are provided in Chapter 7.

13. **Collateral Damage**. Collateral damage will be considered especially when operating in an urban environment. An engineer damage assessment must be conducted to estimate the repairs or construction that may be involved. An agreement proposal with the affected local population must be reached by the CIMIC cell and approved by the Judge Advocate General (JAG) (to determine whether we can execute the task within our mandate and would the local population be opposed to our plans), and other staff, as required. As in any orders, the commander must approve the final plan.

ANNEX A
ROUTE/AREA CONFIRMATION

SECTION 1
INTRODUCTION

1. A route/area assessed with a *low* risk in encountering UXOs does not warrant that an area or route be automatically declared open; however, this assessment can be exploited to gain economy of effort and employ the minimum, but essential, amount of resources necessary to confirm the route/area can be used safely. In many cases, it would be appropriate to conduct an engineer route/area confirmation. However, due to the potential level of exposure to the confirmation teams, the risk analysis assessment considerations are conducted differently. As will be explained, in the case of confirmation, the probability[17] category influences decision-making in as much as the assessed *low* risk level. Confirmation are intended to substantiate that:

a. the risk is in fact *low* and that the route/area can be designated as OPEN; or

b. the risk is *low* but there is a requirement to impose some constraints, therefore the designation would be RESTRICTED; or

c. the risk is **not** *low* but *moderate* or higher and that the route/area designation is CLOSED or RESTRICTED until deliberate clearance procedures are used to mitigate the risk.

2. The main factors to be taken under consideration when deciding if a route/area confirmation is appropriate are:

a. The risk to confirmation personnel should be mitigated to *low,* although it is acknowledged that engineers routinely face “moderate” risk in conducting their tasks.

b. The risk to vehicles (if confirmation team is mounted) should be *moderate* or less.

c. Route/area confirmation should not be used wherein the **probability** of hazards or threats is *likely* or higher.

d. It is within the Commander’s purview to accept greater risk if the mission necessitates it.

GENERAL

3. **Areas versus Routes**. Physical attributes and intended use are what differentiate a route from an area and in themselves account for the need to apply different procedures in both

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[17] High probability categories are bound to result in a “strike” and consequently justify clearance.

confirmation and clearance operations. Routes, for the most part, are traveled in a vehicle. An area, on the other hand, is likely to be used by dismounted individuals. This implies that in addition to the mitigating benefits of a confirmation if there were to be an omission the consequence may be less significant on a route relative to an area because the vehicle may offer a level of protection.

4. **Limitations**. The confirmation team is not intended to conduct EOD. Its exclusive mandate is to confirm that the route/area can be used, and to possibly make note of what future work must be done to improve the route or area. If the confirmation team encounters a threat or hazard, an assessment must be made to determine if the threat or hazard is significant enough to alter the original risk level. If the risk is no longer the same, the nature of the task has changed:

a. **Benign Threat/Hazard Encountered**. If a minor threat/hazard is encountered which does not alter the initial risk assessment, it is recorded, reported, marked and bypassed: to be dealt with at a later time. Confirmation should continue (for example a mortar round at the side of a route).

b. **Significant Threat/Hazard Encountered**. If a threat/hazard materializes which is likely to change the route/area assessment then the confirmation team must reassess its task.

(1) If the threat/hazard is confirmed as being isolated, to a discreet portion of the route/area, and that portion can be bypassed/isolated (for example, civilians are using a viable bypass), the decision must be made to either stop or bypass and continue the confirmation. In either case, the actions are reported; the threat recorded and marked so that it can be dealt with at a later time accordingly.

(2) If the threat/hazard cannot be defined, the confirmation team should halt and the task has to be reassessed and different procedures adopted.

5. **Confirmation Methods**. Confirmation can be conducted mounted, dismounted, mechanical or a combination of all.

a. **Mounted**. Mounted, the confirmation team is able to carry more equipment and has greater mobility and generally more protection for personnel but also should be considered when:

(1) time is limited; and

(2) long distance must be traveled.

b. **Dismounted**. Dismounted, the confirmation team has obvious mobility and protection limitations; however, more detail can be observed. Dismounted confirmation team should be considered when:

(1) detailed recce is required (example vulnerable points);

(2) route area is used for dismounted purposes only; and

(3) vehicle movement is not possible.

c. **Mechanical**. Mechanical equipment can be used to assist confirmation, e.g. it can remove vegetation. It can, in some instances, be used to lower risk wherein dismounted confirmation is to be conducted by confirming the existence of any possibility of the presence of mines. Rollers and flail are examples of mechanical equipment.

6. **Protection**. Personnel need to be adequately protected to safely conduct a route/area confirmation.

a. **Vehicles**. Vehicles specifically designed for recce roles are a fusion of several capabilities (mobility, protection, surveillance equipment, etc) and although good, may not provide adequate protection for route confirmation operations even in *low* risk route/areas. The nature of conflict and what types of equipment are deployed may dictate what vehicles are available. In areas where mines are the primary threat (not direct fire weapons) several mine protected vehicles (MPV) variants exist, specifically designed to protect occupants while providing them with good fields of vision. Other armoured vehicles are less resistant to mine blast but are better than "standard" patterned light utility wheeled vehicles. Figure 1-1 (preface) provides an indication of the preponderance of the threat while table 2-2 (chapter 2) provides an indication of the standardized protection values-thresholds.

b. **Personnel Protective Equipment**. In addition to issued personal protective equipment there is the option to wear engineer specific protective ensemble.[18] The confirmation team leader must assess the situation and make the necessary decision.

7. **Preparation**. The success of the confirmation is directly related to the level of preparation prior to the task.

a. receipt of orders that define the exact mandate and orient the confirmation team (eg. start/end point, on verges, other technical details etc);

b. reviewing information and intelligence gathered during the planning and risk analysis which should be noted in the Route/Area Record (see Annex A, chapter 4);

[18] The protective ensemble, although effective against proximity detonations, provides limited protection against detonations resulting from stepping on and triggering a UXO.

c. detailed map reconnaissance (e.g. topographic, road and bridge, mine maps, cross country movement, thermal imagery, infra red, satellite, etc) to identify possible vulnerable points and other features of interest; and

d. preparation of equipment.

8. **Confirmation Techniques**. Developing techniques of identifying potential threats/hazards and changes in the local environment will be beneficial; many changes are very subtle. A checklist of potential UXO hazard/threat indicators includes:

a. evidence of prior fighting positions (e.g. defensive digging works);

b. signs indicating the presence of mines (e.g. crossed sticks, rock piles), or actual mines or other UXO;

c. man made obstacles/obstructions;

d. vulnerable points of tactical significant (bridges, culverts, intersections, route restrictions, possible ambush locations);

e. vegetation cut or disturbed;

f. signs of erratic vehicle movement/destroyed vehicles;

g. local population movement habits/information;

h. undisturbed items of value;

i. arable land not being used;

j. dead animals and other carnage; and

k. explosions or signs of prior explosions.

9. **Vulnerable Points**. While conducting route/area confirmation, points of increased hazard must be thoroughly checked by dismounting. This may include visual and/or the employment of equipment/tools such as mine detectors or explosive detection dogs, if available.

SECTION 2
ROUTE CONFIRMATION

GENERAL

10. Confirmation team must employ techniques that balance thoroughness, speed and risk. Engineer recce is a specialized skill set that depends on experience and well-rehearsed techniques for route recce and would therefore be the prime choice for route confirmation. The recce team relies on its senses and to a degree intuition.

11. The confirmation team travels along the route watching for indicators and collecting information that may suggest the presence of UXO hazards and indicators of a threat that may question the validity of previously assessed risk. Travel is preferable in a mine protected vehicle but the situation may dictate using other means, including foot. As a matter of procedure, detailed sweeps must be conducted of likely or suspicious vulnerable points such as culverts, bridges, choke points, etc. The confirmation team gathers information about the route and if a threat or hazard becomes apparent the task and procedures must be revaluated. The indigenous population must not be overlooked as a valuable source of information or indicators.

NOTE

Route confirmation is a "positive" action. The route confirmation team uses their cognitive abilities to assess the hazards/threats and derive the risk level and hence the designation. Merely driving a vehicle up a route without investigating vulnerable points and concluding that if the vehicle completes its journey without incident the route is clear is a fundamentally flawed method.

GUIDANCE

12. It is essential to minimize the risk to the confirmation team. In assigning risk level to a route, during analysis, a probability category is established that remains unchanged until mitigation actions take place or occurrence of UXO is proven to be non-existent. The severity category is not fixed and could vary according to what level of protection is offered against a specified hazard/threat to those passing along the route. For example, a light vehicle replaced by a mine protected vehicle results in a decrease in severity, to the crew, thus lowering risk to personnel. The following figures exemplify this argument:

Light Vehicle and crew

Risk Assessment Matrix				
	Probability			
Severity	Frequent	Likely	Occasional	Unlikely
Catastrophic	E	E	H	M
Critical	E	H	M	L
Marginal	H	M	L	L
Negligible	M	L	L	L

Figure 5A-1: Implications of using Light Vehicle to Confirm

a. Figure 5A-1, by example, demonstrates the levels of risk to a light vehicle and its crew conducting route confirmation. The severity of a 5 kg mine strike would almost certainly be *catastrophic*. Even employing a light vehicle to confirm a route of *unlikely* probability comes at *Moderate* risk to both the vehicle and crew.[19] There are ways, nevertheless, to mitigate this risk if it is unacceptable without having to commit to a clearance operation (see subparagraph e. below).

LAV
Crew in LAV

Risk Assessment Matrix				
	Probability			
Severity	Frequent	Likely	Occasional	Unlikely
Catastrophic	E	E	H	M
Critical	E	H	M	L
Marginal	H	M	L	L
Negligible	M	L	L	L

Figure 5A-2: Implications of using LAV to Confirm

b. Figure 5A-2, by example, demonstrates the levels of risk to a LAV vehicle and its crew conducting route confirmation. It is assumed that the LAV provides a degree of protection to its crew that is better than a light vehicle. The severity of a 5 kg mine strike would probably be *catastrophic/critical* to the vehicle and probably *critical/marginal* to the crew. A LAV, therefore, can be employed to confirm route/areas that have an *unlikely* probability. However, confirming routes with *occasional* probability would be putting personnel at a *Moderate*/*Low* risk.

MPV
Crew in MPV

Risk Assessment Matrix				
	Probability			
Severity	Frequent	Likely	Occasional	Unlikely
Catastrophic	E	E	H	M
Critical	E	H	M	L
Marginal	H	M	L	L
Negligible	M	L	L	L

Figure 5A-3: Implications of using MPV to Confirm

c. Figure 5A-3, by example, demonstrates the risk levels to a MPV vehicle and its crew conducting route confirmation. A MPV is designed to provide significant protection to its crew. The severity of a 5 kg mine strike would probably be *critical* to the vehicle (higher if it was mission essential) and probably *marginal* to the crew. A MPV can be employed to confirm route/areas that have a probability of *occasional*. To use a MPV in an area of *likely* probability places the crew at *moderate* risk; in fact, route confirmation is no longer advised when the probability of hazards/threats is *likely* or *frequent.*[20].

[19] A Light vehicle is not recommended for confirmation tasks but remains a command decision based on mission exigency.

[20] Why attempt to drive down a route with such a preponderance of a strike occurring?

d. Similar analysis would be conducted for other circumstances (threat/hazard). An area of operations, for example, where there are no mines but only conventional munitions would have lower values of severity; as well, the probability of an event would be less because conventional munitions would be readily seen on the surface and if buried then less likely to detonate.

e. If the risk is considered too excessive although the probability is *unlikely* (the vehicle in theatre does not afford enough mine protection) there are mitigating controls that could reduce the risk such as having a roller advance up the route in advance of the confirmation team. Light rollers are specifically designed as equipment that could provide "warning."

PROCEDURE

13. **General**. The confirmation team drives or walks the route in a manner that permits the best observation of the route. If the route is wide it may have to be traveled more than once. A suggested layout of the organization is provided in Figure 5A-4. If mounted, the crew dismounts to investigate vulnerable points and other suspect areas.

14. **Organization**. Route confirmation remains a risky operation. The minimum number of personnel and resources should be put at risk, while remaining capable of properly conducting the confirmation. The leader of the reconnaissance party should be, as a minimum, a section commander qualified engineer, MCpl or above. Ideally, the minimum number of personnel in the lead elements should be three for dismounted and four for mounted confirmation.

a. **Confirmation Team**:

(1) Clearance Team Leader;

(2) 2 I/C;

(3) member; and

(4) driver.

b. **Other Supporting Elements**. Other capabilities may be required to assist the confirmation team. They may be deployed to the task site or placed on standby. These are likely to include:

(1) interpreter services;

(2) medical;

(3) engineer elements possibly including roller equipment or other;

(4) EOD/IEDD team;

(5) Quick Reaction Force;

(6) Maintenance and Recovery; and

(7) local protection.

15. **Equipment**. The equipment found within a recce detachment is sufficient.

16. **Layout**. The layout and organization depends on the urgency of the task, terrain, risk to task, and resources available. A possible layout could include just the confirmation team vehicle alone; however, it could be complemented by the support elements listed above.

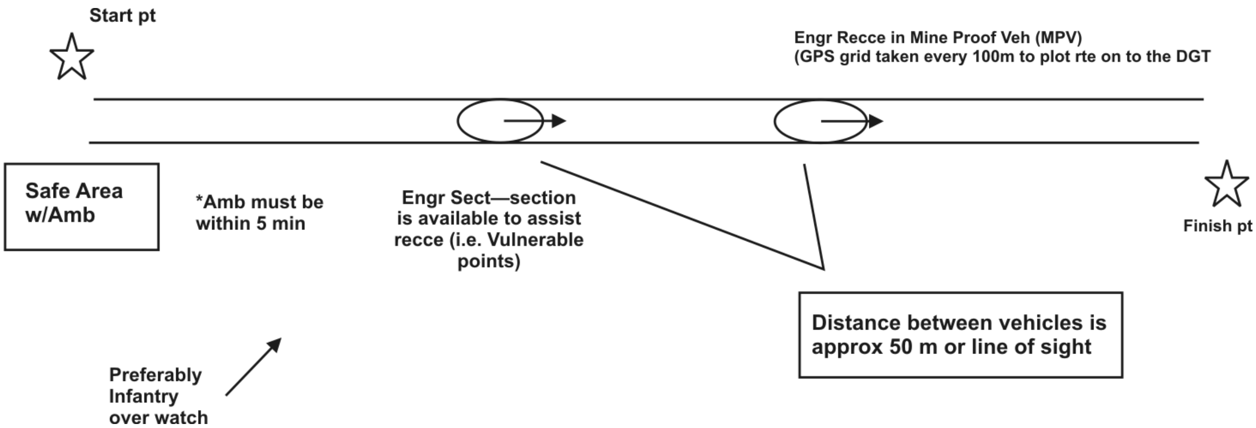

Figure 5A-4: Example of a Route Confirmation Layout

ROUTE RECONNAISSANCE FOCUS

17. As a normal parallel activity, because the route is being travelled for the first time, the confirmation team could conduct a route recce and classification and make note of critical features (width, grade, clearance, etc) along the route in accordance to the NATO classification system[21] and submit the necessary reports and returns.[22] The decision to conduct only a confirmation or both a confirmation and route classification has to be made well before the start of the task to permit for appropriate battle procedure. Time available is often the critical factor in deciding what can be achieved. Obviously, a classification has little merit if the route is not confirmed and designated first.

[21] Defined in B-GL-332-006/FP-001 Part 8 Engineer Insert 805.12.

[22] NATO Reports and Returns E110B Rte Recce Report and E111B Rd, Br and Tunnel Recce Report.

SECTION 3
AREA CONFIRMATION

> **NOTE**
>
> The greatest threat to an area confirmation is the threat of mines. Once the decision is made that mine detectors should be employed the operation becomes a clearance operation and thus must follow manual procedures accordingly.

GENERAL

18. **General**. Large areas that are to be occupied and are assessed as ***unlikely*** to have UXO must be confirmed before being declared open for use. Due to the layout of most areas a mounted confirmation is not likely to be precise enough. To conduct a proper confirmation the area must be "swept;" therefore, an area confirmation is best done dismounted. The term "swept" infers that the area is examined visually in search of signs that the area is **not** safe and **not** suitable for use without clearance operations. The procedures of an area confirmation are very similar to those conducted in a standard level-one range clearance[23] operation.[24]

GUIDANCE

19. **Primary Guidance**. The following guidance is provided for the conduct of Area confirmation:

a. There are similarities between the demands of a level-one area clearance and a dismounted area confirmation wherein both are employed as an effective and efficient process in sweeping an area—but only where the risk is minimal. The principal difference between area confirmation and level-one clearance is that there is no mine threat to the latter; the only hazard is that of conventional munitions (CM).

b. The overall risk to individuals performing a level-one range clearance is considered to be very low. In other words, the probability of finding CM can be very high but an incident is *improbable* because CM can be readily seen and avoided, although the level of severity—if something did go wrong—would certainly be *catastrophic*.

c. In a theatre of operations where there are mines, Figure 5A-5 demonstrates the potential risk to dismounted confirmation operations is *moderate,* even where it is

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[23] The aim of a Level One range clearance is to destroy all duds and remove scrap visible on the surface.
[24] B-GL-304-003-TS-003 "Range Clearance Handbook" 16 Mar 1981

assessed that the probability is *unlikely*[25], due to the *catastrophic* nature of the event-should there be one. Any probability above *unlikely* would result in a risk level of *high* or more.

d. As with route confirmation it is essential to minimize the risk to the confirmation team. Unlike a route confirmation, severity of an incident is difficult to mitigate because there are no vehicle protective aspects in dismounted operations. The options are as follows:

(1) **No Mine Risk in Area of Operations**. The risk and thus procedures are the same as with a level-one range clearance.

(2) **There is a Mine Risk in Area of Operations**.

(a) Conduct a substantive assessment on the probability of the area to be confirmed and although the probability category may be *unlikely* and risk may be *moderate* the risk has to be tolerated on behalf of mission requirements.

(b) Mitigate the risk to the confirmation by preparing the ground. Possible methods include the use of rollers and flails, which mitigate doubt by identifying mine threat. With the mine threat concern removed, the confirmation can proceed.

Dismounted Soldier ⇨ Catastrophic

Risk Assessment Matrix				
	Probability			
Severity	Frequent	Likely	Occasional	Unlikely
Catastrophic	E	E	H	M
Critical	E	H	M	L
Marginal	H	M	L	L
Negligible	M	L	L	L

Figure 5A-5: Dismounted Confirmation in an Area of Operations with a Mine Threat

PROCEDURE

20. **General**.

a. **Procedure**. As in clearance operations, the area will be confirmed by sub dividing the area into a series of lanes. A member is assigned to each lane. The width of lane varies between 1 to 2 m: the limit to what can be comfortably observed by the lane member, which is dictated by the terrain. All objects are identified and removed accordingly or marked for subsequent removal.

[25] Due to the complex nature of mines the probability cannot be assumed to be less.

b. **Setting out**. Area boundaries and control points must be established either through markings or designating reference points. A small advance party in advance of a larger organization could conduct setting out. For better control an area can be subdivided into sectors.

c. **Marking**. As confirmation progresses permanent markings should be put in place to permit future users to orient and remain within the confirmed area.

21. **Organization**. The composition of the organization varies according to the size and lay of the terrain.

a. **Main Body**. A section or recce detachment is the smallest feasible element due to the requirement for cohesive command and control; however, a troop (or more) is invariably better. Figure 5A-6 provides an example of a troop formation.

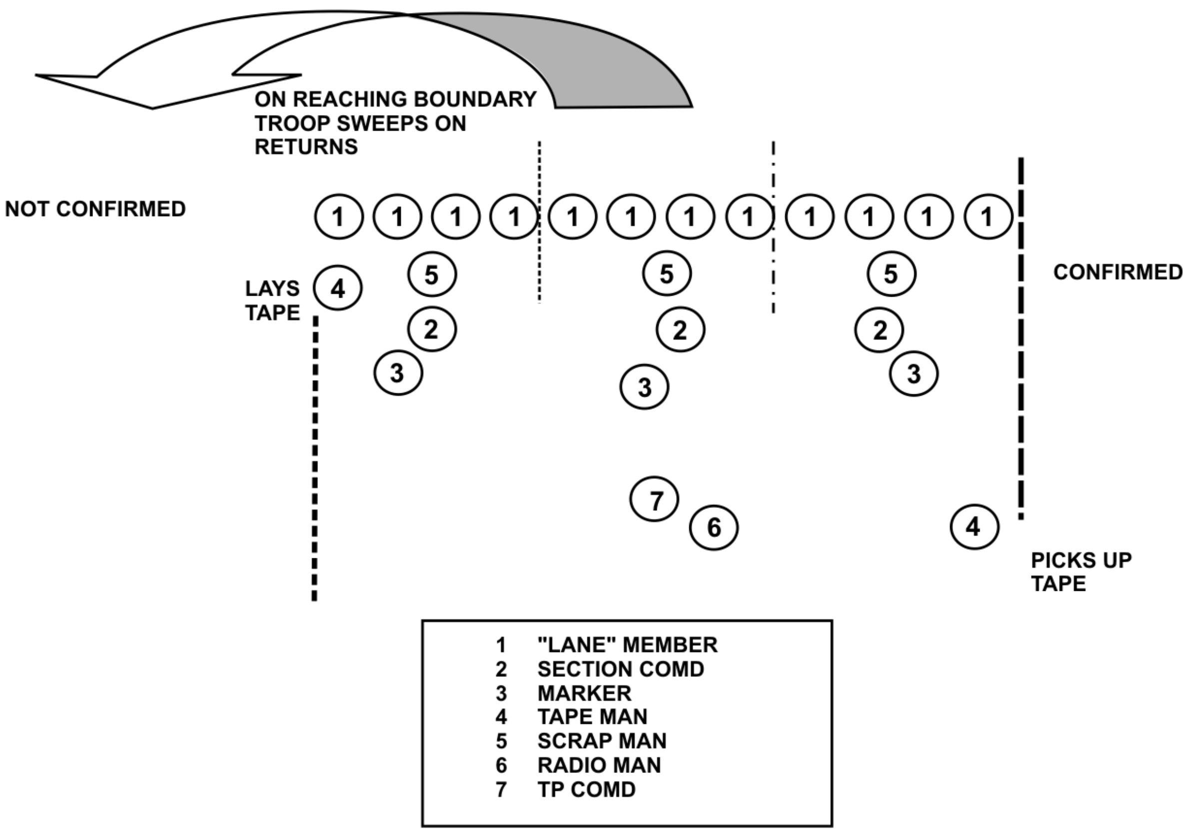

Figure 5A-6: Example of Area Confirmation Organization

b. **Supporting Elements**. Other capabilities may be required to assist the confirmation team. They may be deployed to the task site as required or placed on standby. These are likely to include:

(1) interpreter;

(2) medical;

(3) other engineer elements;

(4) EOD/IEDD team;

(5) quick reaction force;

(6) maintenance and recovery; and

(7) local protection.

MECHANICAL CONFIRMATION

22. In areas where it is desired to confirm that there is no presence of mines to minimize the risk to dismounted confirmation teams, a preliminary mechanical confirmation can be conducted. Mechanical methods of confirmation can include the use of rollers or flails. These systems in themselves are not full proof clearance instruments because of inherent limitations and therefore rely on dismounted confirmation to follow-up. Nevertheless, if there were mines the mechanical confirmation operations would reveal the threat. If the presence of mines is verified, direct clearance assets can be brought to bear; conversely, if no mines are verified dismounted area confirmation can be conducted. Respective procedures should be consulted for details.

ANNEX B
MANUAL CLEARANCE OPERATIONS

SECTION 1
INTRODUCTION

GENERAL

1. Manual clearance is considered to be the most thorough and flexible method available to clear routes and areas because it integrates detectors and other equipment with an operator's senses and cognitive abilities. It is frequently used to compliment other methods; however, there are significant drawbacks such as exposure of personnel to higher related risks and it is both resource and time intensive.

2. If during planning and risk management it is determined that the situation merits a manual clearance, this annex details the necessary procedures and drills.

3. The intent of a manual clearance is to find and eliminate all mines, booby traps, and other UXO along a specified route or within established area boundaries. Unlike other methods, which are optimized for specific conditions, dismounted engineers with detection equipment are able to make rapid and wide ranging adjustments to compensate accordingly to the conditions, terrain, environment, UXO and other threats and hazards.

MANUAL CLEARANCE FUNDAMENTALS

4. Clearance Organizational Hierarchy:

a. **Clearance Section (CS)**. Section level clearance organization, which in turn can be divided into parties with assigned responsibilities.

b. **Clearance Party (CP)**. A party is a sub-section clearance organization assigned a specific responsibility. A party can be further grouped into teams or single clearance members.

c. **Clearance Team (CT)**. A team consists of two persons assigned to a clearance lane. Traditionally, the two have been referred to as the No. 1 and No. 2. Depending on the situation the team could be employed as follows:

(1) The members could alternate leads. As one member conducts clearance the other rests. The member leading is able to sustain a rhythm, repeating drills, until a rest break is required.

(2) Each member could be assigned a set of specific drills to perform. Working together, each member moves forward as required to execute the drills they are responsible for. Spelling off the drills permits individuals to

carry less equipment, rest and to concentrate on specific drills, but the "flow" is interrupted with the continual rotation of members.

d. **Single Clearance Member**. Certain tasks may permit an individual sapper/member to conduct all necessary drills in one lane; however, fatigue must be a major factor to consider.

5. **Common Elements**. Although there are discernable differences, both area and route clearance share a number of common procedures and drills:

a. The formation of self-sufficient CS with the necessary level of resources, equipment and moreover a coherent command structure to manage and coordinate the task. The first instance where this is possible is at the field section level. A reconnaissance detachment is limited to small discrete tasks.

b. Manual clearance is predicated on the execution of a set of standard drills that are repeated in an exacting sequence. The drills enable the incremental confirmation that no mines or other UXO exist or, if found, the appropriate disposal occurs. Although the sequence of the drills never changes, there is some latitude to adjust the drills depending on the situation. The sequence of manual clearance (see figures 5B-1 and 5B-2) involves a set of five associated standard drills:

(1) visual scan;

(2) trip wire feeler drill;

(3) trip wire response drill;

(4) mine detector drill; and

(5) prodder drill.

c. Search "areas" are divided into parallel lanes assigned to a clearance team or a single clearance member. The standard lane width is 1 m. Large areas are first sub-divided into grid boxes wherein each grid box is then divided and cleared by lanes.

d. There are two primary manual clearance models: they vary according to the ability of the mine detectors to detect mines and other UXOs. This becomes an issue wherein the minimum metal detection capability of the detectors is not sufficient enough to detect threat mines[26] (other UXO are readily detectable) or wherein the ground is polluted with metal debris.

[26] Mines that had low metal content, as well as, certain soils could defeat former detectors; however, with current technology that is no longer a major concern.

(1) **Model 1**—When detector capability is not an issue, the mine detector drill findings dictate if the prodder drill follows next or the next bound is taken with a repeat of the drills from the start.

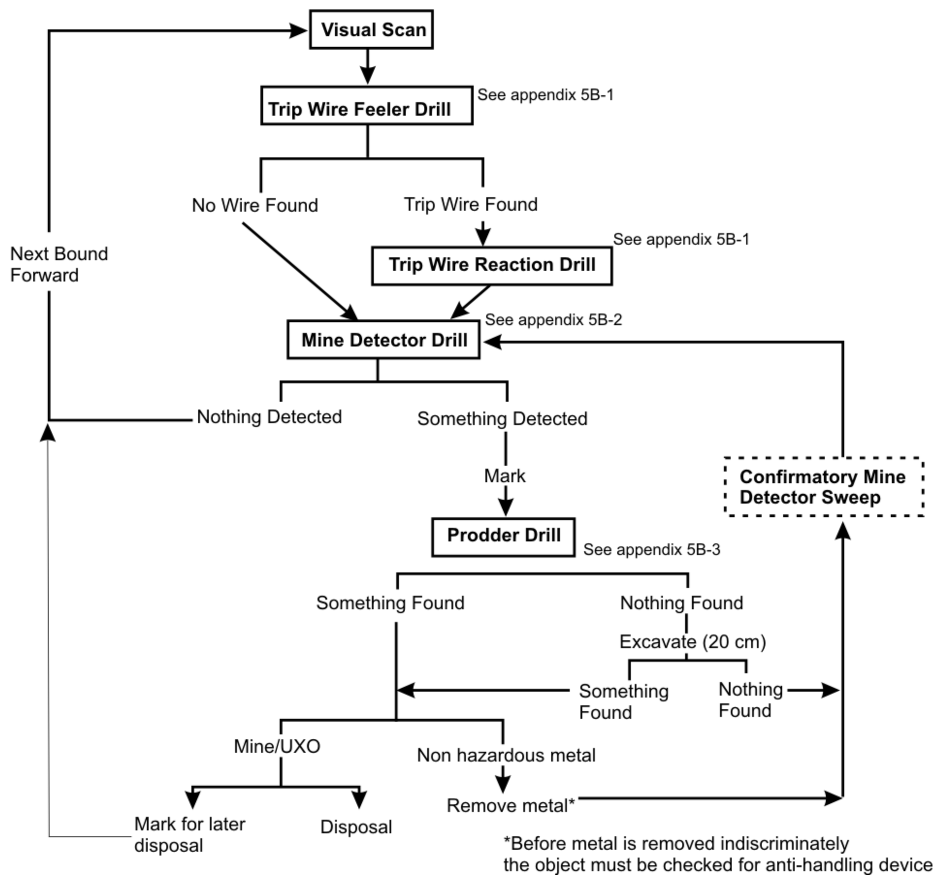

Figure 5B-1: Sequence of Manual Clearance Drills (detector is effective)

(2) **Model 2**—When detector capability is an issue, the prodder drill always follows the mine detector drill. This method is analogous to "humanitarian de-mining" procedures.

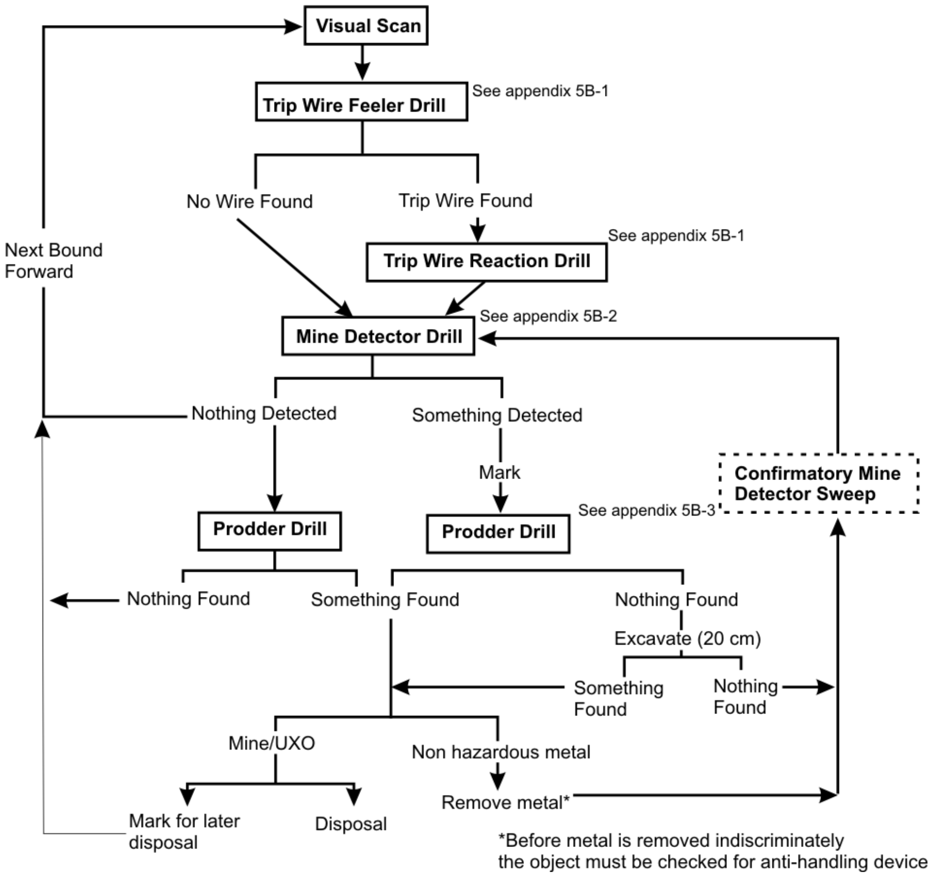

Figure 5B-2: Sequence of Manual Clearance Drills (detector effectiveness is an issue)

SECTION 2
MANUAL CLEARANCE DRILL SEQUENCE

EXECUTION OF THE SEQUENCE

6. **Team Clearance**. To minimize the exposure and fatigue of sappers, it may be decided that the drills be conducted by a team of two. Each sapper could take turns leading and execute all drills; or each is assigned a set of specific drills and as one sapper finishes their drill set they then rotate with the second sapper. The following demonstrates the latter (each member is assigned specific drills):

a. Visual scan is conducted.

b. No. 1 executes the Trip Wire Feeler Drill (Appendix 1)—out to no more than 1 m.

c. If No. 1 finds a trip wire, the Trip Wire Response Drill (Appendix 1) is executed.

d. Upon completion of the Trip Wire Feeler Drill, a "lane limit marker" is placed to one side of the lane to indicate the limit of forward search.[27] No. 1 signals forward the Mine Detector Operator (No. 2), and then moves back to the party's safe area, located a minimum of 20 m back from nearest clearance activity.

e. The No. 2 executes the Mine Detector Drill (Appendix 2) within the area where the trip wire drill was conducted. No. 2 marks the location of anything that is detected with a "mine cone."

f. Upon completion of the Mine Detector Drill, No. 2 moves back to the team's safe area and reports the results to No. 1. If something is detected the drills at subparagraph 6. f. (1) below are executed; if nothing is detected then the drills at subparagraph 6. f. (2) below are executed.

(1) **Something Detected**. If an item is detected and marked (mine cone) by No. 2, No. 1 executes the Prodder Drill (Appendix 3). In the case of model 1, No. 1 prods in the area marked by No. 2. In the case of model 2, No. 1 prods the entire bound but with additional scrutiny in the area marked by No. 2. The No. 1 marks the side(s)[28] of the lane as they move forward, through the suspect area, up to the end of the "lane limit marker." The end of the bound is marked as the start point for the next bound.

(a) If nothing is found by prodding in the location of the "mine cone," No. 1 has to excavate and prod down to 20 cm in that spot. On completion, No. 2 conducts a confirmatory sweep of the location where the item was initially detected and, if nothing is found, No. 1 returns and completes work in the lane.

(b) If an item is found by No. 1 while prodding, the following actions occur:

i. If a mine/UXO is found, and if not already marked, a mine cone is placed one hand-width behind its location on the ground. The item is then uncovered accordingly (Appendix 3); or

ii If the item found is only a metal fragment located on or beneath the surface, the fragment is taken back by No. 1 and put in the scrap metal pit located at the team's safe area and the mine cone is retrieved at the same time. Large metal objects should be treated as having anti-handling devices and therefore either be "pulled" before removal or

[27] The marker is placed to the side to avoid having to lean forward into an area not yet completely cleared.

[28] An adjacent CT that is further forward may already have marked one side.

blown in place. No. 2 rechecks the ground where the detection took place, confirming the ground is clear.

(2) **Nothing Detected**. If no item is detected by No. 2:

(a) **Model 1 (Figure 5B-1)**. The No. 1 marks the side(s)[29] of the lane up to the "lane limit marker." The end of the bound is marked as the start point for the next bound. The No. 1 reverts back to the Trip Wire Feeler drill along the next one m bound of the team's lane.

(b) **Model 2 (Figure 5B-2)**. The No. 1 executes the Prodder Drill (Appendix 3) up to the end of the "lane limit marker." The No. 1 marks the side(s) of the lane as they move forward, through the suspect area. The end of the bound is marked as the start point for the next bound.

i. If, while prodding, something is found then read subparagraph 6. f. (1) (b) above.

ii. If nothing is found then No. 1 reverts back to the Trip Wire Feeler drill along the next one m bound of the team's lane.

NOTE

As can be seen in the example above, a team of two that has each member assigned specific drills requires frequent rotation. Rotations can be minimized if each member of the team conducts all drills until relieved for rest by the second member.

g. On Encountering Mines or other UXO:

(1) On scene commander decides if:

(a) the hazard will be removed/neutralized later, but in the interim marked and bypassed and further clearance conducted in the lane; or

(b) work shall stop in the lane but continue in other lanes; or

(c) stop the CS and remove or destroy the hazard before any further work is done.

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[29] An adjacent CT that is further forward may already have marked one side.

(2) Any unfamiliar mines, markings, or packaging encountered shall be reported up the chain of command and through the engineer operational network.

7. **Single Clearance Member**. In less complex or small clearance operations, where the terrain is straight forward, a single clearance member can be assigned to a lane. They would be responsible to perform all the same standard drills as listed for the CT.

LIMITATIONS

8. **Operating Environment**. The nature of the task site (terrain, vegetation, metallic debris) and the operating environment (threat/hazard level) influences progress.

9. **Flooded and Snow Covered Areas**. It is highly unsafe and ill advised to conduct manual clearance operations in flooded and snow-covered areas. Most mine and UXO detection is done through visual clues that are denied to the searcher by the presence of water and snow. In cold conditions, it is impossible to prod and excavate frozen soil. These conditions make prodding and uncovering suspected mines very hazardous. Also, it is difficult to search for trip wires. An area may be cleared during a cold period and later after the soil thaws vehicles may cause rutting to depths that results in mine strikes from mines not detected during the initial clearance (most mine detectors used in clearance only detect the presence of metal to a depth of 20 cm to 30 cm).

10. **Operators**. Operator proficiency can be affected by many factors such as heat, cold, wind, dust, humidity, inexperience, mental fatigue, soil conditions and physical fatigue. These factors must be taken under consideration in the employment of personnel in clearance operations. Failure to plan for operator limitations can result in casualties due to operator error. Leadership is required to ensure personnel are alert, properly hydrated and rested on a regular basis. As a guide to planning:

a. **Maximum daily output**:

(1) **Above 30° C**: 5-6 hours of clearance. The clearance operation may have to be conducted just after first light and just before last light (3 hours each).

(2) **Between 0° and 30° C**: 7 hours of clearance.

(3) **Below 0° C**: Frozen ground makes prodding difficult, and may affect the mine detector. Frost in the mines/UXO mechanisms may cause them to be unstable. If the temperature gets too cold, clearance operations shall stop.

b. **Maximum weekly output**: Five days per week is the maximum of on-site clearance to allow for maintenance and rest (when feasible).

c. **Prolonged output**. Sections and/or teams should be rotated frequently during clearance operations. Periods of work should be followed by a period of rest and refresher training.

d. **Equipment**. The protective equipment worn and carried by personnel degrades performance because of its weight and restrictive nature. The additional weight of the ballistic visor induces greater stress on the user, as such, more frequent breaks, in the order of 5-10 minutes are required.

11. **Clearance Rates**. The planning rates for the conduct of manual clearance are displayed in the table below. These rates are affected by the factors mentioned above.

SERIAL	SITE DESCRIPTION	RATES OF CLEARANCE M/HR/LANE	CLEARANCE ORGANIZATION
1.	Concrete and tarmac routes	250 to 500	Clearance Team
2.	Hard packed gravel routes	50 to 200	Clearance Team
3.	Soft packed soil, light vegetation	50-100	Clearance Team
4.	Hard packed soil, heavily vegetation	25-50	Clearance Team
5.	Cross-country vehicle tracks	2.5 - 25	Clearance Team
6.	Footpaths	2.5 - 25	Three member section

Table 5B-1: Planning Clearance Rates

NOTE

Rates of clearance are only a guide: weather, soil condition and soldiers' physical and mental condition are all factors.

SECTION 3
MANUAL ROUTE CLEARANCE PROCEDURES AND DRILLS

CAPABILITY REQUIREMENT

12. **General**. A route clearance is conducted by advancing a CS along the axis of the route in a series of parallel lanes. An engineer field section can readily form a CS. For larger tasks, more than one CS could be employed under the auspices of a troop effort.

13. **Route Clearance Organization**:

a. **Personnel**. CS personnel are organized into the following clearance parties; however, the exact allocation of personnel and size of parties depends on the planned conduct. The decision to form teams or allocate a single clearance member to lanes is made based on the situation.

(1) **CS Commander (CS Comd)**—Commands all components and attachments of the CS.

(2) **Road Party (RP)**—Responsible to search the main travel surface of a route, can be divided into teams or single clearance members.

(3) **Side Party (SP)**—Responsible to search the flanks of the travel surface, which could include both the shoulders and verges, can be divided into teams or single clearance members.

(4) **Support Party (SpP)**—If available, responsible to provide additional support to the RP or SP.

(5) **Explosive Charge Party**—Appointed by the CS Comd accordingly (personnel double tasked).

(6) **CS 2IC**—Records the work and maintains communications with the higher radio network to send reports and returns.

b. **CS Attachments**. There is a requirement to have medical support, local security, translator, etc.

14. **Equipment**. The table below shows the equipment worn, carried, or obtainable by each member of the CS. A minimum of body armour, helmet with ballistic visor or glasses is worn. The decision to wear additional protective equipment lays with the engineer commander based on on-site risk analysis:

SER	POSITION	EQUIPMENT
1	CS Comd	Assorted safety pins, wire cutters, prodders, mine markers, radio, 1 x Global Positioning System (GPS), binoculars, first aid kit and personal protective equipment.
2	RP and SP	Detector, mine markers, trip wire feeler, prodder and personal protective equipment, lane marking accessories, assorted safety pins and personal protective equipment.
3	SpP	Detector (deep detector if possible), mine markers, trip wire feeler, prodder and personal protective equipment, lane marking accessories, assorted safety pins and personal protective equipment.
4		Additionally, team members must have access to trowels and paintbrushes to remove soil of suspect areas. cutting tool(s) to trim vegetation. Demolition stores and explosives as required to perform explosive charge party duties.

Table 5B-2: Route Clearance Section Equipment List

PLANNING AND EXECUTION CONSIDERATIONS

15. **Key Route Considerations**. There are several key considerations to assess if the clearance will be straightforward or complex. If the operation is analysed to be straightforward then a single clearance member per lane suffices; however, a complex operation may necessitate a team per lane. The CS organizes and conducts the clearance task accordingly. The following considerations can be combined with the "General Clearance Considerations" listed in chapter 5:

a. **Intelligence/Assessed Risk**. By knowing what the predominant nature of the UXO hazard and assessed risk are, personnel can adapt and respond accordingly.

b. **Visual Conditions**. Routes typically have negligible amounts of vegetation and offer un-obscured lines of sight. Such conditions can be exploited to the advantage of the CS. In other words, it is easier to observe where a route may have been tampered with: trip wires, for example, are easier to spot. This is particularly true of routes that are wide and have a hard surface. For this reason, under the correct conditions, it is acceptable to use visual search for trip wires vice employing a trip wire feeler. But as the conditions change so should the drills of the CS. Light conditions also affect visual distance.

c. **Economy of Effort and Concentration of Force**. An advantageous practice, depending on the scope of the task, involves employing more than one CS. Multiple CSs can either alternate leads, which permits teams to rest, or employ several CSs simultaneously along different segments of the route by approaching the route via adjoining lateral routes. If the route is wide, CSs could be staggered and work a greater frontage. It is preferable to clear a route in one pass rather than in several passes.

d. **Nature of the Route**. The nature of the route and its components has the greatest influence as to how the CS organizes and executes its drills. It dictates, for example, if it is sufficient enough for personnel to conduct just a visual search for trip wires or must use a trip wire feeler. A hard surface route can be cleared much faster than a narrow dirt track.

(1) **Travel Surface**. The more homogeneous, harder and uniformly constructed the surface, the easier it is to conduct a visual scan of the surface for signs of tampering and anomalies. Deploying the mine detector at suspect areas (e.g. pot holes in a paved route) suffices. Conversely, narrow tracks and dirt surfaces are more difficult to "read" and must necessitate a greater degree of caution.

(2) **Shoulders**. Unlike the travel surface, shoulders are more problematic to clear because they are usually made of loose aggregate which conceals mines and other UXO easily, thus visual scans are unlikely sufficient. Trip wire feeler may not be required but mine detectors certainly are needed. Shoulders that are of a poorer surface material degrade the speed at which a CT can advance. As well, the resulting additional search frontage may be too great and there may not be enough personnel in the CS to clear the whole route in one pass. A second pass or additional personnel may be required.

(3) **Verges**. Verges are not normally cleared unless there is specific direction to do so, even so, verge clearing should be limited to designated locations such as those that could be potentially dangerous to future traffic. The intent is to clear the route as quickly as possible; therefore, the CS cannot afford to get bogged down in clearing verges that may be rough going, littered with metal/garbage and overgrown with vegetation where trip wires are easily concealed. A preferable option may be considering marking-off verges as hazard areas. If clearance is required, employing area clearance procedures and drills is likely more appropriate for verge clearance.

PROCEDURES

16. **CS Procedures**. The complexity of the clearance task dictates if a single clearance member or a team is required in each lane. There may not be enough personnel to conduct a clearance in one pass; consequently, several passes or more than one CS may be required. Commanders decide on the overall procedures to employ and can vary them accordingly.

a. **Possible Configuration**. Safety and efficiency are the primary concerns with respect to what configuration should be adopted. An angled echelon (figure 5B-3) is, in most cases, the best method.

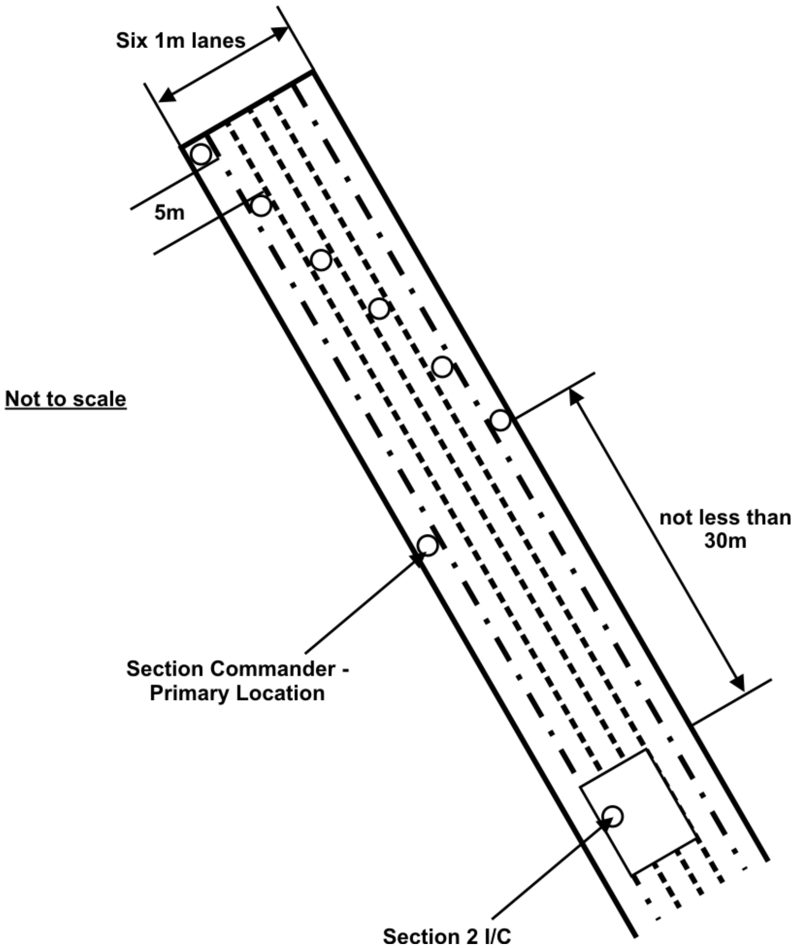

Figure 5B-3: Basic Configuration on Narrow Route

b. **Party Responsibilities**.

(1) **RP**. Starting from a marked baseline, the RP begins performing the clearance drills. The visual search, includes searching for wires, surface mines, breaks, humps, or depressions in the road surface. On asphalt and concrete surfaced roads, a mine detector is employed to check irregularities in the road surface or any other possible indicators. On gravel and dirt roads the RP must clear the road's entire surface using the Mine Detector Drill. The RP is responsible for searching the travel surface width within designated search lanes. The CS Comd supervises and assists the RP, and conducts a verification of its work. The search of the road surface may be conducted in any configuration, as determined by the CS Comd, as long as minimum safety distances between team members are observed and positive control is maintained; a staggered echelon is usually best.

(2) **SP**. The SP members perform the same drills as the RP (Visual Scan, Trip Wire Drill, the Mine detector Drill, etc). The SPs are working the flanks of the RP. The SP are likely searching the shoulders and therefore, as

required, employ the Prodder Drill to investigate mine detector signals (Appendix 3). Verges and ditches are to be searched only if required as part of the task; however, this may be too much for the SP and therefore assistance is required. The SP should also look for signs of off-route mines or other UXO that could endanger or target road traffic. The CS Comd co-ordinates the clearance performed by the SPs. The Comd is likely to queue and pace the whole CS based on the progress of the SP, which have the riskiest task.

(3) **SpP**. The SpP follows the CS at least 30 m behind. The SpP is prepared to support either the RP or SP. They could be used concurrently, as mentioned above, by placing them forward to widen the search frontage.

c. **Priorities and Bypass**. Shoulders and verges in particular can drastically slow down a clearance operation. If time does not permit a “full” clearance then in priority, clearance should focus on the travel surface then the shoulders and finally on the verges if necessary. Shoulders and verges can be marked off and returned to later.

d. **Safety and Control**:

(1) **Bounds**. The clearance operation is conducted in approximately 100m bounds along the length of the route, or less if the route is winding and visual contact is difficult to maintain.

(2) **Marking**. Marking is done to delineate responsibilities and to control clearance.

(a) **Start Line**. The start point of the 100 m section must be marked on the road.

(b) **End Line**. At first, a terrain feature, until reached, identifies the end point. It is then marked as a baseline for the next bound.

(c) **Lanes**. Where feasible, existing markings on the route (a centreline) surface could be used to orient the CS. Lane markers have to be placed for guidance.

(d) **Route Edge**. It may be necessary to mark the edge of the cleared route where there may be ambiguity to someone traveling the route and result in their straying into un-cleared areas.

(3) **Safety Distances**.

(a) The distance between sappers is not less than 5 m. This provides a safety standoff but also permits the sappers to communicate with each other and have a sense of what others are doing, hence the accepted risk.

(b) If more than one CS is employed (for example two halves of a route) then the CSs can be commanded by respective CS Comd so long as spacing between members remains no less than 5 m.

(c) The section vehicle following the clearance should be no closer than 30 m to the rear of any individual sapper conducting a clearance; however, 50 m is the norm. One vehicle is normally enough, even if more than one CS is conducting the clearance.

(4) **Other Safety Considerations**. No clearance operation commences or continues without the presence of standby medical support and a safety vehicle for medical evacuation, located at a safe distance behind the CS vehicle.

(5) **Movement and Span of Control**. It is the CS Comd who controls the movement of the CS and this is best done if all members are within visual and voice range. As well, the CS 2 I/C, usually located in the CS vehicle, must also be in visual contact of the CS, maintain communications with higher HQ, and be in a position to direct any attachments such as an ambulance, EOD detachment, etc. Other points include:

(a) CS should only advance as fast as its slowest elements.

(b) Search lanes are to be assigned to each individual and there are to be no lapses in the coverage area. There must be some overlap in the search pattern. Marking search lanes is a requirement to guaranteeing that no areas are overlooked.

(6) **Communications**. If at any time communications fail between the CS and the next level of tactical command or the designated medical evacuation element, the clearance operation ceases immediately. All local units are warned of the commencement of clearance operations and of any explosive disposal of mines or other UXO found during the clearance operation.

17. **Vulnerable Point Drills**. When a CS encounters vulnerable points they must adapt accordingly in searching the area for mines and other explosive devices. The CS employs a combination of route and area clearance procedures. The size of the area and method to be cleared is determined by the CS Comd but must be large enough to ensure the removal of any threat to future traffic on the route.

a. **Stage 1—Approach to Vulnerable Point**. If the terrain permits, a team (or teams) searches an area out to approximately 5m (twenty for road intersection) on each side of the road of the vulnerable point. They are searching for command wires, tripwires, etc. If a command wire or trip wire is found they carry out the Trip Wire Response Drills (appendix 1). If terrain does not permit easy clearance around the vulnerable point then only a path is cleared to a point where an inspection of the vulnerable point can be conducted. Area clearance drills may be more appropriate when clearing off-route, in the verges.

b. **Stage 2—Inspect of Vulnerable Point**. Once a 5m search area or path is cleared, the aim is to inspect the vulnerable point. The team checks the vulnerable point. If it is not possible to conduct a full visual from one side, a second approach may have to be made from the other side. After the vulnerable point has been cleared, the roadway clearance can continue.

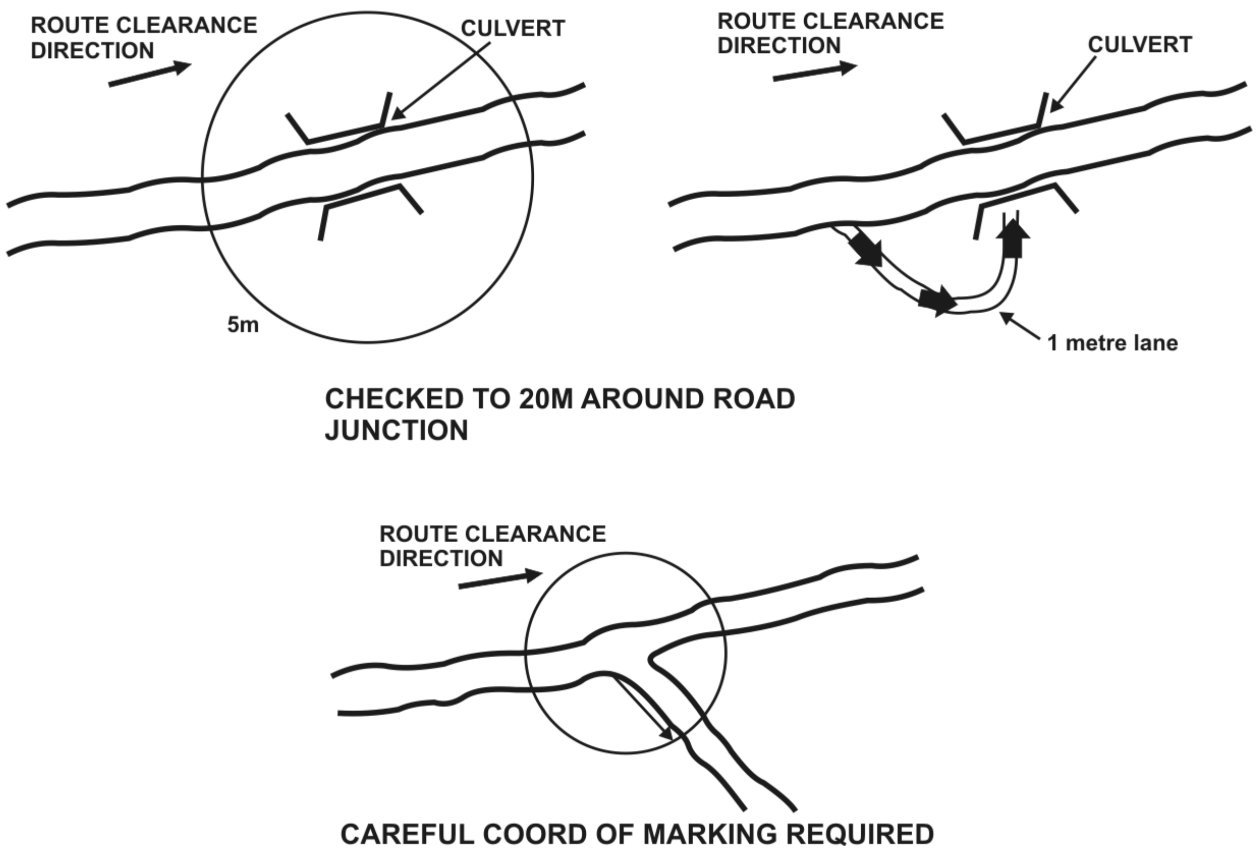

Figure 5B-4: Examples of Vulnerable Point Check

18. **Unique Considerations**.

a. **Lay-Bys/Passing Areas**. If the hard surfaced road is too narrow to support two-way traffic (less than 8m), then lay-bys for packet-sized units are cleared along the route, where needed and where possible, to permit vehicles to pass. The combined cleared width of the lay-by passing area and route must be a minimum of 8 m wide to permit vehicles to pass. It shall be marked.

b. **Intersections**. A 20m clearance radius is recommended but it depends on the lay of the ground.

c. **Bends and Corners**. During the clearance operation, special attention must be given to bends and corners located along the route. There is a tendency, however inadvisable, for drivers to cut corners and bends when making turns. Therefore, when clearing around corners, the inside lane will have two additional ms cleared in from the edge.

19. **Disposal**. All mines and other UXO found during the clearance operation are disposed of in accordance with approved disposal drills. Disposal should happen at the completion of each bound because it is a "natural" pause point; however, disposal can be sooner if need be. Any unfamiliar mines, markings, or packaging encountered shall be reported up the chain of command and through the engineer operational network. When the damage to surrounding structures, etc. caused by explosive disposal is unacceptable, the mines and other UXO may be neutralized and lifted after having been pulled using a hook and line. Neutralization or disarming of mines and other UXO involves greater risk to engineers than disposal by blowing in place; therefore, engineer commanders must seek and gain prior authority through the operational chain of command - if disarming mines in place is the only option. During route and area clearance operations, UXO destruction safety distances must be observed at all times (see Chapter 7).

SECTION 4
MANUAL AREA CLEARANCE PROCEDURES AND DRILLS

CAPABILITY REQUIREMENTS

20. **General**. Large open areas required for the establishment of various installations/camps can be cleared manually; however, by their very nature they would be better cleared by mechanical clearance methods complimented by manual methods to compensate for mechanical shortcomings and permit verification. Smaller, heavily vegetated or rough terrain areas, not able to take large mechanical clearance equipment, will have to be cleared manually.

21. **Area Clearance Organization**. Area clearance is normally a troop level (or greater) task but cleared through the efforts of the field sections designated as CS of eight personnel. A section is organised as follows:

a. CS Comd—Section Commander;

b. CS 2IC—records the work and maintains communications with the higher radio network to send reports and returns;

c. CP—responsible to clear assigned lanes or grids, will be further divided into teams or single clearance members;

d. Explosive Charge Party—appointed by the CS Comd accordingly; and

e. CS Attachments—there is a requirement to have medical support, local security, translator, etc.

22. **Equipment**. The table below shows the equipment worn or carried by each member of the CS. The decision to wear additional body armour or protective equipment lays with the on-site engineer commander based on on-site risk analysis.

SER	POSITION	EQUIPMENT	REMARKS
1	CS Comd	Assorted safety pins, wire cutters, prodder, mine markers, first aid kit, radio, binoculars, GPS and personal protective equipment.	
2	CP **Team of two** No. 1 Trip Wire Feeler/Prodder No. 2 Mine Detector **Single Clearance Member**	Prodder, trip wire feeler, lane marking accessories (mine tape), assorted safety pins, cutting tool(s), digging tool (trowel), paint brush, sandbags, 2 x lane marking sticks (1 m) and personal protective equipment. Detector, mine markers, and personal protective equipment. All the above.	One-handed shears may be required for grass, brush, cutting, etc.
3		Demolition stores and explosives, as required, to perform explosive charge party duties.	

Table 5B-3: Area Clearance Section Equipment List

PLANNING AND EXECUTION CONSIDERATIONS

23. **Key Area Considerations**. Several key factors help assess if the clearance is straightforward or complex. If the operation is analysed to be straightforward, then a single clearance member per lane suffices; however, a complex operation may necessitate a team per lane. The CS organizes and conducts the clearance task accordingly. The considerations can be combined with the "General Clearance Considerations" listed in Chapter 5:

a. **Intelligence**. By knowing what the predominant nature of the UXO hazard and assessed risk are, personnel can act and respond accordingly.

b. **Nature of the Area**. The nature of the area has the greatest influence as to how the CS should organize and execute its drills.

(1) **Soil Conditions**. To what degree hazards are obscured or hidden? The more difficult it is to find something; the more precaution must be taken. A "hard standing" surface area devoid of vegetation (tarmac) may only require a surface visual inspection.

(2) **Vegetation**. As above - how well can hazards be obscured or hidden? The more difficult it is to find something; the more precaution must be taken. Trip wires can be hidden and anchored in high grass.

c. **Visual Conditions**. Areas can have negligible amounts of vegetation and offer un-obscured lines of sight. Such conditions can be exploited to the advantage of the CS. In other words, it is easier to observe trip wires and other suspicious signs. Only slack trip wires on the surface need to be verified. Heavy vegetation growth, on the other hand, can hinder the use of prodders, mine detectors, etc. The vegetation may have to be removed, which will increase clearance time.

d. **Economy of Effort and Concentration of Force**. An advantageous practice, depending on the scope of the task, involves employing more than one CS. Multiple CSs can be employing simultaneously within different grids or set of lanes.

e. **Structures**. If not required, structures should be fenced off and avoided until a dedicated search of the structure can take place.

f. **Water Features**. Water features do not have to be cleared if not needed. They can be fenced off, to isolate them, if not required.

PROCEDURES

24. **CS Procedures**. The complexity of the clearance task dictates if a single clearance member or a team is required in each lane. Commanders decide on the overall procedures to employ and can vary them accordingly.

a. **Possible Configurations**. One of two methods can be utilized in clearing areas.

(1) **Lane Clearances**. In smaller areas, not too deep, and non-complex areas, the CS can advance in lanes - similar to a route clearance (Figure 5B-5). By setting out and establishing a baseline, the width of the intended clearance area, the CS can advance forward in a series of parallel lanes. The width of each lane is one m. There may not be enough personnel in the CS to conduct the clearance in one pass; consequently, several passes may be required or more CSs.

(2) **Grid method**. In more complex areas, the grid method should be used. The area to be cleared is divided into a series of 20 x 20 m grid boxes. The grid boxes are defined during the setting out by a series of break-in lanes and baseline lanes (see setting out paragraph below). The boxes, in turn, are cleared by a series of internal parallel lanes. A CT is assigned to each grid box (figure 5B-6).

(a) The CS usually employs two CTs at any one time. The third team is in reserve, allowing for a rotation of teams at the discretion of the CS Comd.

(b) CT start by being placed adjacent to an existing 1 m cleared break-in lane, and use the existing left (or right) hand tapes as guide tapes.

(c) CTs use the standard clearance drills, either one sapper leading at a time or two sappers rotating as drills are switched.

(d) CTs have a minimum 20 m separation.

(e) The clearance of successive 1 m lanes continues until the entire grid box is cleared. The CT then moves onto the next grid box and this continues until the entire area has been cleared.

(f) If a large area needs to be cleared, it is possible to employ several CS to clear simultaneously. This is normally a troop level operation. When several CSs are working in an area, only one Explosive Charge Party is formed, comprising of senior personnel appointed by the onsite Commander.

b. **Setting Out**. The first order of business, on site, is to define the perimeter of the area to be cleared. Natural or existing features used as reference points can assist. Fencing, although ideal, is not likely possible without clearing first; however, fencing of the perimeter is not necessary prior to the start but should be done in due course if the surrounding areas are still a hazard. Clearance starts by establishing a baseline lane (in a known safe area if possible). Break-in lanes are required if the grid method is to be used. All lanes are one m wide and are completed using the standard clearance drills. Under no circumstance should it be assumed that the threat is lessened if no mines are found while clearing the break-in lanes. Other baseline lanes are then created to provide a grid system of 20 m square boxes.

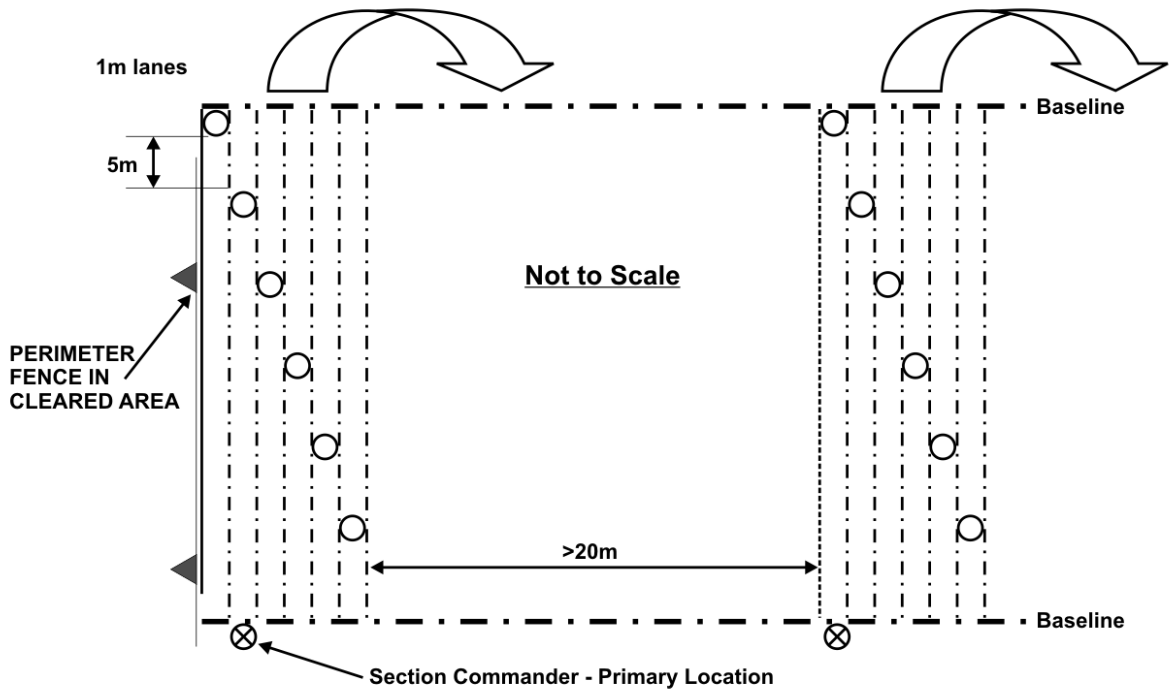

Figure 5B-5: Clearance of an Area using Lanes (two CTs are shown)

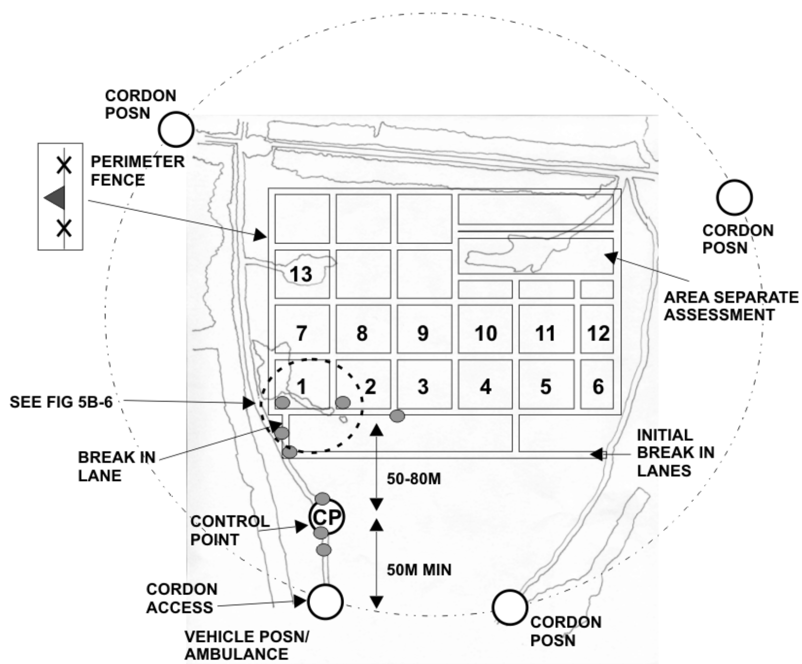

Figure 5B-6: Area clearance Grid Site Layout

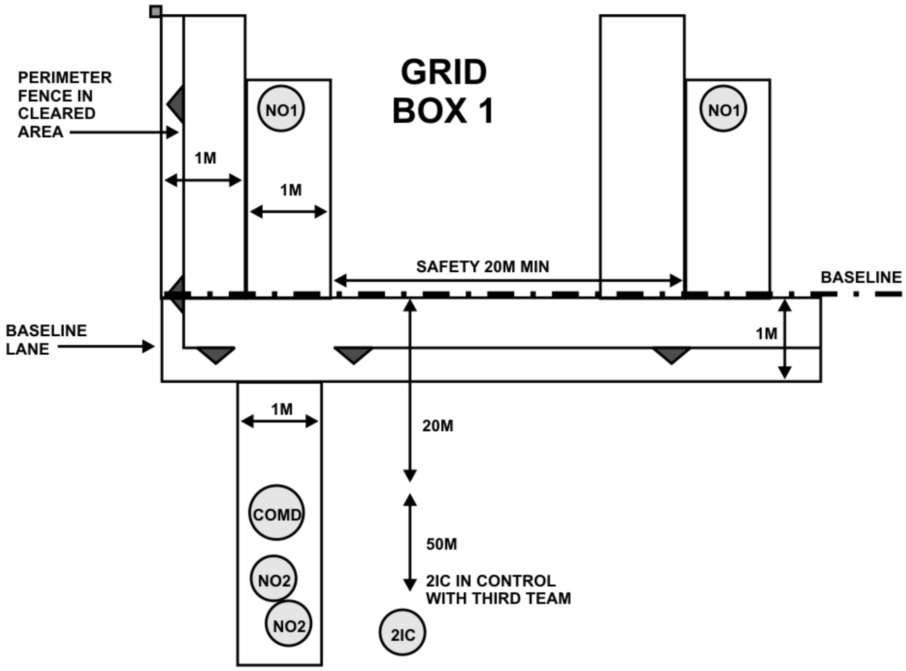

Figure 5B-7: Use of Clearance Parties and Teams in Grid Box

c. **Safety and Control**.

(1) **Lane Clearance Method**. Safety and control is the same as for route clearance.

(2) **Grid Method**:

(a) **Marking**. All the break-in and baseline lanes must be visibly marked.

(b) **Safety Distances**. Minimum safety distance between personnel is 5 m. The grid box standoff is 20 m between teams.

(3) **Other Safety Considerations**. No clearance operation commences or continues without the presence of standby medical support, a safety vehicle for medical evacuation, located at the access point.

(4) **Movement Control and Span of Control**. It is the CS Comd who controls the movement of the CS and this is best done if all members are within visual and voice range. As well, the CS 2 I/C, usually located in the CS vehicle or at the control point, must also be in visual contact of the CS, maintain communications with higher HQ and be in a position to direct any attachments such as an ambulance, EOD detachment, third CT, etc.

(5) **Communications**. The CS Comd and 2IC both carry radios. If at any time communications fail among the CSs, with the next level of tactical

command, or with the designated medical evacuation element, the clearance operation will cease immediately.

25. **Perimeter Marking**. The perimeter of the cleared area, if tactically viable, should be marked to ensure future users of the area are aware of the safe boundaries. Records are then updated and forwarded to the next higher level of command.

26. **Demolition/Disposal Phase**. All mines and other UXO found during the clearance operation are disposed of in accordance with approved disposal drills. Disposal of mines and other UXOs is usually done at the end of the day's work to maximize clearance efforts and when sufficient numbers have been found and uncovered. The CS Comd stops all CPs and removes them to a safe area. The ECP goes forward, places individual charges on the mines/UXOs, and connects these to a trunk line. After receiving permission to fire from the authorized commander and having issued warnings, the CS Comd detonates the charges. When the damage to surrounding structures, etc. caused by explosive disposal is unacceptable, the mines and other UXO may be neutralized and lifted after having been pulled using a hook and line. Neutralization or disarming of mines and other UXO involves greater risk to engineers than disposal by blowing in place; therefore, engineer commanders must seek and gain prior authority, through the operational chain of command, if disarming mines in place is the only option. Protective works may also be considered. Any unfamiliar mines, markings, or packaging encountered shall be reported up the chain of command and through the Engineer Operational Net. Safety distances must be observed at all times (Chapter 7).

APPENDIX 1 TO ANNEX B
TRIP WIRE FEELER DRILL

TRIP WIRE FEELER DRILL

1. **General**. The trip wire feeler drill must be employed wherein there is any doubt that trip wires can be detected visually.

2. **Minimal Vegetation**. Typically in vegetated areas where trip wires can be easily hidden but permit the use of a trip wire feeler:

   a. The sapper moves up to the start point which should be marked (mine tape or other) carrying the trip wire feeler, and other necessary equipment.

   b. The sapper places the equipment on the ground in a safe area, at the start point.

   c. The sapper adopts either the kneeling, squatting or prone position and searches the ground visually for trip wires or other evidence of mines and other UXO.

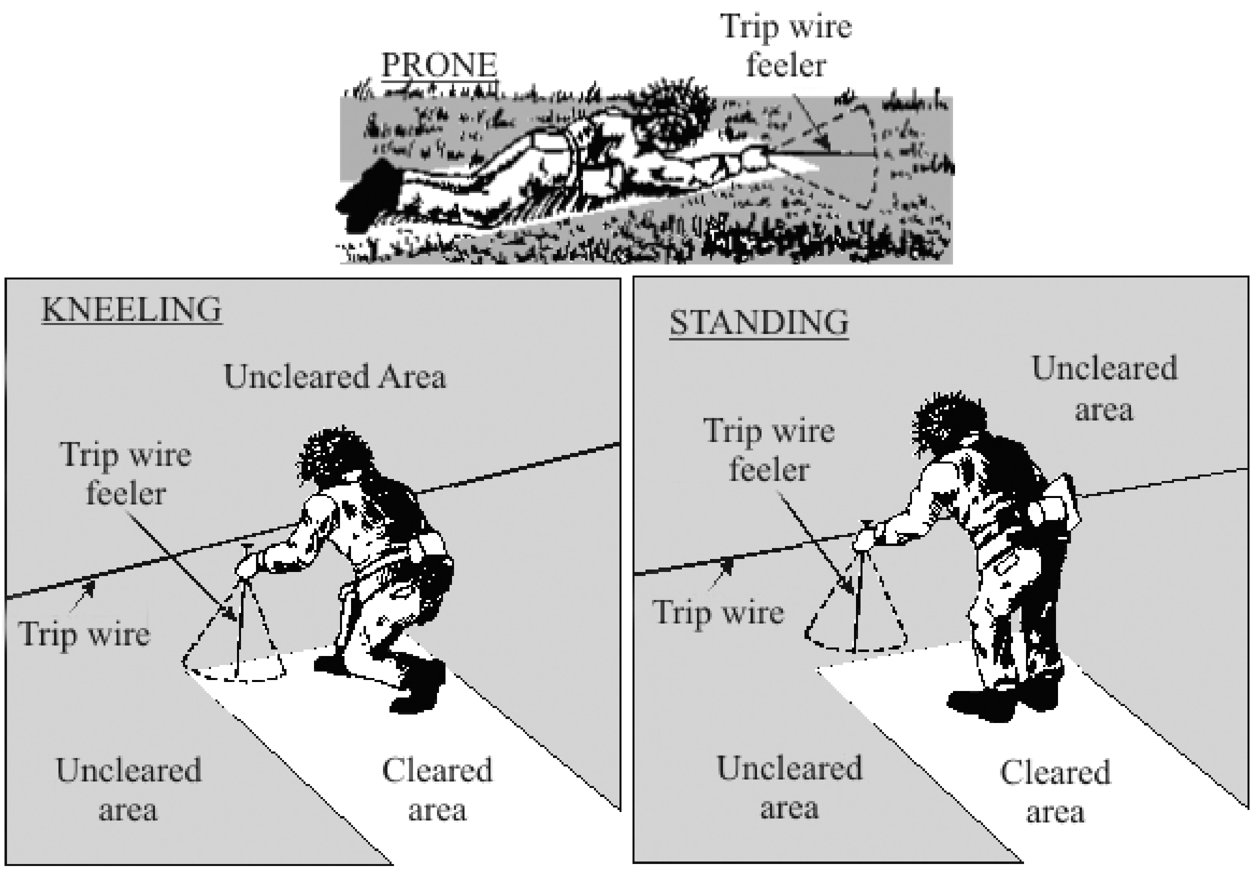

Figure 5B1-1: Using a trip wire feeler

   d. Still in the kneeling, squatting or prone position, the sapper picks up the trip wire feeler and searches the area of ground to the front.

e. Starting at the left side of the lane with the feeler canted downward at a slight angle, the sapper slides the trip wire feeler along the ground directly to the front in a straight line, out to one m, or as far as can be safely reached out in front. The trip wire feeler is then slowly lifted upwards until the sapper is in the standing position and the trip wire feeler has been brought up above the head. This action is repeated for the centre and right of lane.

f. In the case of loose sand, the feeler skims through the surface of the ground in search of slack non-metallic trip wires.

g. If vegetation restricts mine detector drills, it has to be trimmed to ensure proper use of the mine detector. This is done starting from the top and working down, 20 cm of vegetation at a time, until the vegetation is cut as close to the ground as possible (5 cm). The sapper then conducts a physical search of the de-vegetated area gently using their fingers to identify the presence of mines in the stubble of the vegetation.

h. On completion, the limit of forward search is indicated by a one m "lane limit marker" placed to one side,[30] gently, to mark the bound verified by prodder.

i. The necessary mine detector sweep can now be made.

3. **Dense Vegetation**. In Areas where the vegetation is too dense and heavy to use a trip wire feeler properly vegetation should be cleared first by mechanical means or burning.

TRIP WIRE RESPONSE DRILL

4. **General**. Upon detection of a slack or taut trip wire, the Clearance Section Commander is informed immediately. The Section Commander assesses the situation and, if required, moves the other section members to a safe area or another area to work until the trip wire is dealt with.

5. **Trip Wire Clearance**:

a. **Area Clearance**. The Trip Wire Feeler operator traces the wire to both ends, clearing a one m wide path, to positively determine what is at both ends of the wire. Any explosive ordnance found is destroyed in location rather than neutralized and marked, as long as the explosive is within the capability of the clearance section and collateral damage is not an issue. EOD specialists should be called to deal with complicated ordnance.

b. **Route Clearance**. The Section Commander must decide whether or not there is greater risk involved in:

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[30] The marker is placed to the side to avoid leaning forward into an area not yet completely cleared.

(1) Sending the trip wire operator off the route to search for the device(s) at the ends of the wire (i.e. because of heavy ground vegetation or there are other obstacles to movement and visibility);

(2) Pulling the wire from a safe distance without knowing what is at the ends, and therefore, not knowing what explosive(s) may be actuated. If the decision is made to pull the wire then the clearance team must be under cover (i.e. in the section armoured vehicle, with ramps and hatches closed, when pulling occurs). No action to pull trip wires should take place without fully searching within limits and fully assessing the consequences; and/or

(3) If required, the explosive ordnance is neutralized, and then the wire cut, and the ends removed from the trafficked area. For example, if the trip wire crossing a road is connected to a mine that is connected to another trip wire, the mine shall be neutralized, the trip wire cut and the mine left in place.

APPENDIX 2 TO ANNEX B
MINE DETECTOR DRILLS

MINE DETECTOR DRILL

1. **General**:

   a. The Mine Detector (MD) operator removes all metal objects that interfere with the operation of the equipment. (i.e. watches, rings, etc.). This may include the removal of all metal carried for clearance operations.

   b. The MD operator picks up the mine detector with the earphone secured and the electronic unit carried for operation. Testing of equipment is conducted away from other equipment and personnel in accordance with the user hand book/operators guide.

   c. The MD operator moves to the start point wearing the prescribed personal protective equipment and other related equipment for his searching task, i.e. mine marking cones, etc.

2. **Search Technique**. The MD operator searches the required increment of ground in his lane, which has been previously cleared visually and checked for a tripwire threat. The lane is systematically swept with the search head ensuring half the search head crosses each side of the lane. The detector is then moved forward with the search head close to the ground without contact. The forward movement is limited to half a MD search head at a time to ensure half search head overlaps per sweep. The operator must ensure that at all times he observes the location of the search head, ensuring that no vegetation or protruding mine fuses are struck. During all operations the detector must not be laid or placed forward of the operator.

3. **Action on Detection**:

   a. The MD operator determines the centre of a small detection signal or the closest edge of a large detection signal using the edge method of detection.

   b. A mine-marking cone is then placed one hand distance back from either the centre of the smaller signal or the closest edge on the ground in relation to a larger signal.

   c. The mine detector and the mine detector drill are less effective in the following circumstances:

      (1) The in-theatre threat mines contain a smaller amount of metal than the issue test piece. Mines with minimum metal content can however be detected at less than 105 mm with the in-service MD.

      (2) The ground area being searched contains metallic construction materials, i.e. reinforcing on a bridge span.

(3) The contamination of the ground contains so much metal as to create a continuous signal, therefore distorting the readings given by the equipment.

NOTE

Mines may be laid deliberately near sources of metal to defeat clearance efforts: care must be exercised by checking these areas using the prodder.

4. All detection signals are investigated before progress forward is made in the searched lane.

5. The in-service mine detector requires retesting for function throughout use during training and operations. The operator always carries the test piece.

NOTE

The present in-service mine detectors are the MINELAB F1A4 and F1A4 (MIMS). Refer to the user guide card in the issued carrying case.

APPENDIX 3 TO ANNEX B
PRODDER DRILLS

PRODDER DRILL

1. From the start point the sapper must carry a prodder, trowel, and paint brush.

2. At the start point, the sapper places the trowel and paintbrush on the ground in a safe area.

3. The sapper adopts the prone position, which is the norm, as it provides maximum safety and protection for the sapper from the effects of enemy fire when the threat exists and moreover the effects of exploding UXO. Standing, squatting and kneeling positions are acceptable for clearance operations but are not as safe.

4. The prodder is gently pushed into the ground at a maximum angle of 30 degrees from the ground.

5. Depending on the clearance model (see Annex B paragraph 5), the prodder drill may be carried out in the area marked because of a mine detector signal; or, the prodder drill is carried out deliberately along the width and length of the lane, up to the "lane limit marker."

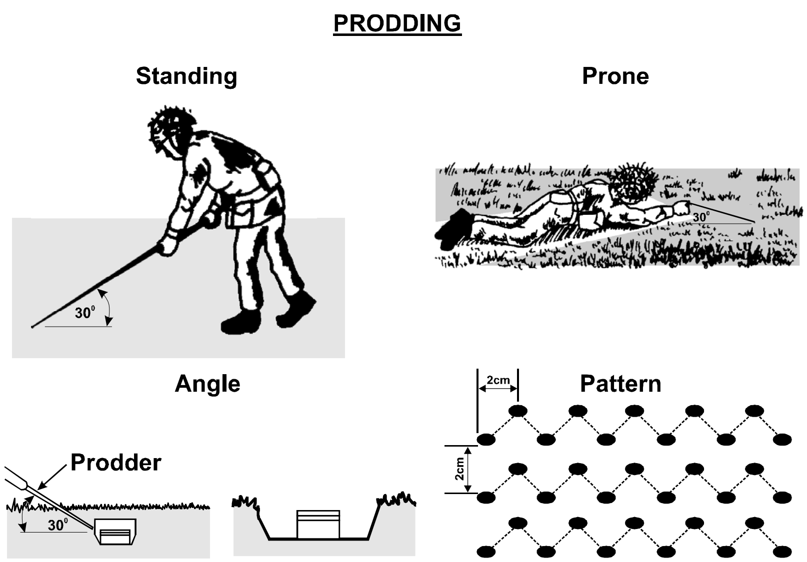

Figure 5B3-1: Prodding technique

6. The sapper proceeds to prod across the width of the lane, in a straight line, making sure to prod every 2 cm, until resistance is met. If resistance is met, further prodding is carried out to define the target.

NOTE

Prodding is to be performed gently. The prodder must not be forced into the ground. During dry seasons when the ground is dry and hard, water may be used to moisten and soften the ground to make prodding easier. The angle of prodding is reduced in cases where the ground is hard. This reduces the amount of effort required to push the prodder.

7. When it is believed that a UXO has been located, the following procedure shall be followed:

a. The sapper places the prodder on the ground and picks up the trowel and paintbrush.

b. Using the trowel, the sapper removes the earth (sieving through it for small fragments which may have caused the detector to signal, placing the earth on a sandbag) from the close side of the suspect target, very carefully exposing the closest edge, in order to identify the object and places a "mine cone."

c. The paintbrush is used only to remove loose ground from the exposed edge of the target in order to identify the object. As soon as the item has been identified, the sapper informs the party clearance section commander.

d. When the side of the mine or other UXO has been exposed sufficiently to permit marking, neutralization, or disposal, the sapper stands up, picks up all equipment and moves back to the team's safe area.

e. If only a metal fragment is found, and removed accordingly, the mine detector drill will be preformed again to determine if there is a signal indicating the presence of more metal in the area that has been excavated or in the pile of excavated earth.

f. If a mine or other UXO is found, the CS Comd may decide to dispose of the UXO before further clearance, or closes off the clearance lane and direct CS to start clearance in an adjacent lane, or in another area until the mine or other UXO is destroyed during the disposal phase.

8. If during prodding no resistance is met, in spite of an earlier mine detector drill detection signal, the following procedure shall be followed:

a. Using the prodder across the suspected area, the sapper prods and excavates the area to a depth of 20 cm, continuously searching for a metal fragment.

b. If no mine, other UXO, or metal fragment is found, the mine detector drill is performed again to determine if there is a signal indicating the presence of metal in the area that has been excavated or in the pile of excavated earth that was placed on a sandbag.

c. If no metal fragment is found within 20 cm of the surface, then the clearance party commander is to direct if further excavation is required depending on the likely threat and the strength of the signal being omitted.

d. All excavated holes are filled either once metal fragments are removed, or after disposal of mines and other ordnance to prevent injury or accident due to someone tripping on the uneven ground.

ANNEX C
FLAIL (AARDVARK)[31]

GENERAL

1. A flail unit is a self-propelled mechanical mine clearing system. Although most often associated with mine clearance, it is as effective in clearing all other UXOs in its path as well as removing vegetation to ground level or below. The aim of the flail device is to clear, and make a safe path, by disruption or detonation through ground containing mines and other UXO, as well as their associated anti-handling devices. The flail can reduce the time and effort required to clear mines from large areas of ground and reduces the risk inherent to manual clearance methods. Flails come in various sizes; larger machines are able to be more effective and aggressive. The flail is a valuable countermine tool with the following capabilities:

a. It provides safety and security for its crew from anti-tank and anti-personnel (AP) landmines while effecting area reduction. The belly plate consists of three sections each of 10 mm thick armoured plate. A resilient blast plate is attached to the flail rotor side arms to provide a protective barrier between the cab and the flail. The blast plate can absorb blast in excess of 10 kg of high explosives detonating beneath the rotor.

b. It strips vegetation (trees up to 200 mm in diameter, depending on the relative wood density) and removes trip wire threat.

c. The flail rotor clears a path of 3 m in one pass. Due to a required overlap of 1 m for successive passes, the effective path cleared by the flail is 2.5 m wide.

d. It operates in up to 100 mm of water.

e. It clears all known mines except blast overpressure resistant mines (current inventory flails have not been tested against these mines in particular but it is anticipated that it can defeat them).

f. It achieves variable depth settings (surface to 90 cm below surface) depending on the soil conditions and the nature of the terrain.

g. It operates year round, across a variety of terrain, and in adverse weather conditions.

2. The in-service mini-flail system, although available, has proven in trials to not be effective against most anti-personnel mines, neither is it useful in areas with light brush. It will not be further discussed.

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[31] The AARDVARK is the current in service flail system

CONCEPT OF EMPLOYMENT

3. **General**. Mechanical countermine flail operations must be tasked and coordinated with other clearance procedures. To ensure that the entire area is cleared of all mines and disrupted mine debris, mechanical clearance is not a stand-alone operation and will normally form part of a combined method involving manual clearance. Manual clearance will compensate for areas inaccessible to and thus not cleared by the flail. A flail will not detonate or disrupt 100% of all mines encountered. There is a 30-40% likelihood that partially disrupted mines will be left in the ground, or lifted and thrown clear of the flail. The beat pattern of the chain rotor has been designed to detonate production mines as small as 76 mm in diameter. As well, the flail unit can dig to a theoretical depth of 914 mm depending on the gear selected and the nature of the soil. Therefore, if detonation does not occur then disruption will be achieved. Fragments of disrupted mines are scattered by the action of the flail and must be cleared by subsequent sweep by a dismounted confirmation, which must be done within five weeks of the mechanical clearance operation. This will ensure that vegetation will not have grown back enough to hamper the manual efforts. If dogs are to be used following mechanical clearance then a waiting period of two weeks should be observed to allow scents from disrupted/exploded mines and fuel/oil spillage to disperse.

4. **Organization**. A clearance organization would include a task tailored security element, a flail detachment, and a command team. The flail detachment consists of one senior NCO as the detachment commander and two operators. The operators work in pairs in the cab to assist each other. As one operates, the other observes the first operator and watches for mine strikes, hazards, and trespassers within the minimum safety distance of 1000 m. It is recommended that two additional operators augment a team if the area to be cleared is in excess of $1000m^2$.

LIMITS OF EMPLOYMENT

5. Perhaps, the greatest limitation is that flails may in fact shred mines and other UXO thus leaving explosive contamination that will have to be removed. Other restrictions that degrade effectiveness include:

a. Areas with wire fences, loose ground wires, and mine tape.

b. Overpressure resistant mines may not detonate, although it is certain they would be disrupted if detonation were not achieved.

c. Zero visibility due to wind and dust. The gyro direction indicator as well as direct communications between the operator and an observer/controller can minimize this.

d. Close proximity of buildings, services or infrastructure that could be damaged by mine blast or stone and debris thrown by the flail. The recommended minimum safety distance to avoid collateral damage is 250 m (building windows open).

e. In areas with ditches and other excavations.

f. Frozen ground, very hard or very soft surfaces.

PLANNING DETAILS (AARDVARK)[32]

6. **Speed and Distances**. Clearance speeds vary depending on the terrain and the type and the quantity of mines encountered but likely maximum speed is listed as 330 m per hour to a depth of 10-15 cm in light to medium density soil. The flail can be operated over climbing gradients of 1:3 (34 %) and traversing gradients of up to 1:4 (25 %).

7. **Fuel Consumption**. The flail operates for approximately eight hours on 150 L of diesel fuel.

8. **Terrain**. The primary ground considerations for employment are as follows:

a. It should be free from lines or services running over or under the ground. If there are services present then they must be switched off at source while the flailing task is being conducted.

b. It should be generally flat or gently rolling ground. The maximum slope is to be no greater than 1:3 for climb and 1:4 for traverse.

c. It should be sparsely wooded regarding mature growth (scrub is not a problem).

d. It should be no less than the recommended minimum area of 50 m x 50 m unless there is good reason why a smaller area should be subject to mechanical clearance.

e. It must be accessible to in-service tracked or four wheel drive vehicles.

f. Heavily wooded or excessively rocky ground, areas of bog or swamp, or areas with ditches or dykes are unsuitable for flail clearance.

9. **Reconnaissance Requirements**. It is strongly recommended that the flail detachment commander accompany the reconnaissance team during the initial site survey. The detachment commander can then appropriately advise on the suitability of the flail and the extent of its use for the clearance operation. In addition, targeting ground that is suitable for use with flails is a significant factor in planning mechanical countermine operations.

DRILLS

10. **Clearance Drills**. The following drills are the standard to be used for every mechanical clearance operation:

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[32] The AARDVARK is the current in service flail system

a. The area to be cleared is to be isolated to ensure that people, vehicles, and animals are not able to enter the area during the flailing operation. It is the responsibility of the detachment commander to ensure the area is cordoned off.

b. An access lane is to be cleared (5 m wide except in turning or manoeuvrable areas) from the nearest cleared route/area. All access lanes are to be properly marked and maintained. The access lane may either be cleared solely by manual clearance; or by using the flail-followed by dismounted confirmation.

c. A baseline safe lane is to be established, sufficiently wide to allow the machine to turn through 180 degrees (10 m in the case of the flail). Start points and clearance lanes will start only from the safe lane and always perpendicular to it. The safe lane may either be cleared solely by manual clearance or by using the flail followed by dismounted confirmation methods.

d. The flail should commence work into the clearance area at an angle perpendicular to the baseline safe lane. See Figure 5C-1 for a diagram of the clearance process. The speed of flailing will depend on the clearance depth required.

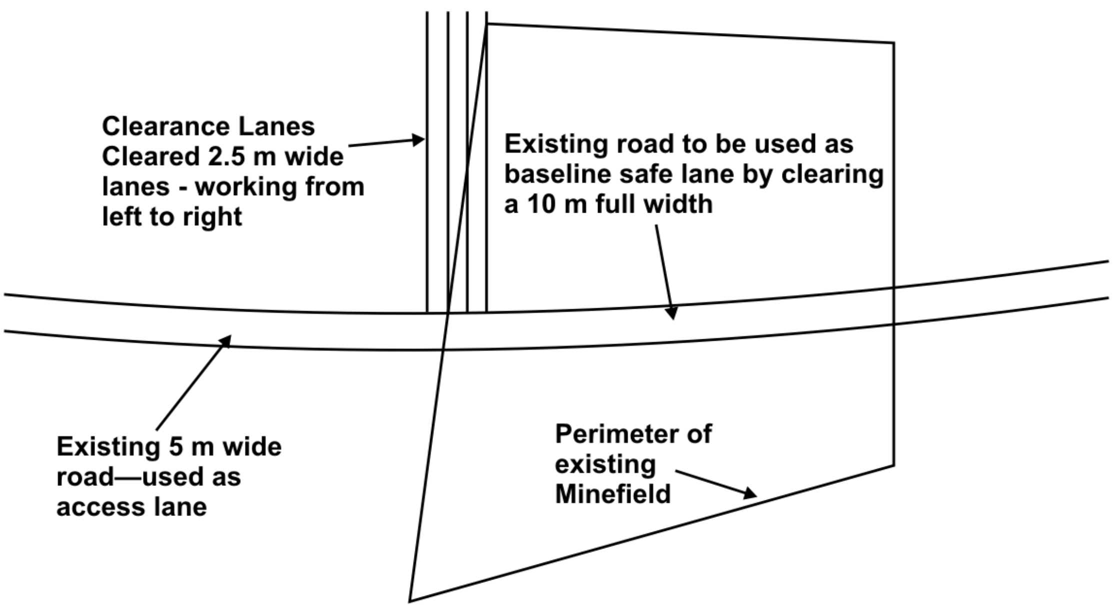


Figure 5C-1: Plan View of an Aardvark Clearance Operation

e. When the flail has reached the end point of the lane being cleared, the operator should reverse the machine back down the flailed path to the safe lane. The operator must take care not to stray into the un-cleared terrain.

f. Once the machine has returned to the safe area, the operator will line the machine up on a start point adjacent to the last cleared lane, ensuring that an overlap will be achieved. Clearance paths must always overlap adjacent paths by one m. This is achieved by keeping the left track in the rightmost track mark of the previously flailed path; consequently, the effective cleared width of each successive path is 2.5 m.

g. The machine continues to operate in each clearance path in turn until the clearance area is completely cleared. If large trees, immovable obstacles or ground that can not be flailed are encountered, the flail operator will proceed with one of the following options:

(1) The operator is to bypass by flailing as close as possible to the obstacle, link up again with the previously cleared lane and continue normal flailing. The area that has not been flailed must be noted to ensure it is cleared by a manual clearance team at a later time.

(2) If the obstacle is large the operator must reverse the machine and proceed with the next clearance path, record any missed flailed areas on a map and submit it to the detachment commander.

h. Flailed paths are recommended to be a maximum of 200 m long (with the exception of roads). For large areas, multiple baseline safe lanes can be cleared to break the area into manageable sections. In dense vegetation the distance may have to be reduced to avoid operator fatigue.

i. During clearance all detonations (including type and location if possible) are to be noted.

j. Multiple flails working within the same area of operation must not pass closer than 200 m to each other.

k. During all operations of the flail there must be a minimum of two qualified operators in the machine to assist each other in both operation and observation while working. The recommended maximum for duration of daily flailing operations is eight hours. Each operator should alternate shifts hourly between operation and observation.

l. Teams will conduct end-of-day routine that will include clearance around tracks prior to the operators dismounting from vehicle.

11. **Miscellaneous Drills**. The following actions are to be followed in case of:

a. **Action on Strikes**.

(1) **Anti-personnel mines**—continue flailing.

(2) **Anti-tank mines**—if detonation suspected, STOP/BACK UP/INSPECT. Depending on size and damage caused, continue flailing or conduct maintenance drill. If there is chain loss replace chains in a safe area. The crew is to inform the commander of all actions that are carried out.

b. **Action on Mechanical Failure**.

(1) The Aardvark may be able to recover itself in the case where the flail is damaged and either a cab wheel or one track is damaged.

(2) The machine may have to be repaired in situ depending on its distance from the baseline safe lane. If repair in situ is not possible and the Aardvark cannot recover itself, armoured recovery will be required. The clearance lane must be swept by dismounted confirmation before the recovery vehicle enters the area.

(3) A safe area at least 1 m wide will have to be cleared around the machine and clearly marked by a manual clearance team in order to provide a maintenance team access to the Aardvark if the machine is to be repaired in situ.

(4) Mechanics entering the area must wear personal protective equipment as dictated by the tactical situation.

(5) The flail operators must remain inside the cab until such time that they can be escorted out via a manually cleared safe lane.

(6) A thorough check must be made for mines that may have been caught on the vehicle before repair work can commence.

c. **Action after 30 Minutes of Operation**. STOP/BACK UP/INSPECT to ensure all chains are still in place, otherwise there will be skip zones.

SAFETY

12. All personnel involved with a mechanical countermine operation will adhere to the following safety provisions:

a. A clearance operation that incorporates concurrent manual and mechanical clearance procedures will require strict control and greater safety distances than those for current manual clearance operations. Manual clearance teams are not to be any closer than 1000 m to the flail. Therefore, due regard must be taken of the speed of mechanical clearance as compared to manual clearance to ensure safety distances can be calculated and maintained.

b. If they are behind appropriate protection or armour, all personnel at the task site where flails are operating are to be at least 200 m from (but never in front) the flail. Hearing protection is to be worn by all personnel.

c. Task site visitors will remain at least 1000 m from the machine while it is in operation. Clearance is to cease immediately when any person, vehicle or animal strays into the danger area.

d. Occupied buildings within 250 m of flail clearance operations are to have their windows opened to avoid the possibility of the windows being blown out during explosions in the clearance area.

e. No one will walk on the ground flailed by the machine until it has been declared clear after the use of manual clearance quality assurance teams.

f. Operators are to ensure that a manual prodder, mine markers, mine tape and maps are carried inside the cab.

SUBJECT	MINIMUM DISTANCE FROM THE FLAIL	REMARKS
Command vehicle	200 m	Armoured vehicle
Manual clearance teams	1000 m	In open
	200 m	Behind armour
Between Flails	200 m	
Observers	1000 m	
Administration Area	1000 m	
Building	250 m	All windows open

Table 5C-1: Minimum Safe Operating Distances for the Flail

ANNEX D
FULL-WIDTH MINE ROLLERS

GENERAL

1. The use of mine rollers (MR) to deal with buried pressure mines is a proven and established technique. The principle behind a roller is rather rudimentary: through ground pressure (equivalent or greater to that of a vehicle) exerted by the roller it is expected that a mine would be triggered and detonate. Rollers are designed with the intent to exert enough pressure to sufficient depths; however, effectiveness and the amount of pressure exerted through soil can be affected by several factors. Rollers are less effective against other UXOs due to issues of triggering detonation with fuses less sensitive.

2. A principle design aspect is the weight of the roller. Heavy "self-weight" mine rollers capable of surviving repeated mine blasts are fitted to heavy tracked vehicles such as a tank. They are too heavy to be pushed by a light vehicle such as the Bradley, M113 or LAV. There are lighter MR compatible with light vehicles and are low cost yet effective for countermine and proofing operations. The light MR is designed to detonate mines which otherwise would detonate under a vehicle's track or wheel, thus it reduces the risk of damage to the vehicle, its crew, or following vehicles. Protection against tilt rod and electro-magnetic influence fused mines can also be added to the MR system. As well, full width mine rollers (FWMR) are preferable to ensure a full lane is cleared.

3. A number of characteristics for light mine roller use:

   a. The MR has been proven to be effective at speeds up to 15 kph.

   b. The MR can be fitted to a wide range of vehicles with little modification.

   c. The FWMR detonates mines across the full width of the vehicle.

   d. Each wheel assembly is mounted on an individual swinging arm suspension, enabling the wheel to accurately follow the ground contours.

   e. The tires are solid polyurethane and are not easily damaged by anti-personnel (AP) mines.

   f. It is robust, compact, requires minimal maintenance, and designed to be easily repaired.

   g. It may be jettisoned from the vehicle should the need arise.

   h. All FWMR functions can be selected while the vehicle is moving.

   i. The same control box can also be used to control the surface mine plough described in the separate product specification

CONCEPT OF EMPLOYMENT

4. It has been found that rollers are not suited for direct mine clearance, but are a useful tool for confidence building, proofing and area reduction. Rollers typically consist of segmented, weighted plates, each turning separately on a central axle. As the attached vehicle moves forward, the roller contacts the ground. The roller follows undulations, bumps and rises with each independently rolling wheel. The roller should be used in a set pattern over a suspect area.

a. On routes the roller can be placed in the lead to confirm that there are no mines. If a mine is detonated then clearance or breaching operations can be conducted.

b. In areas where information regarding the location of mines is accurate, the roller need not be used for locating mines by detonating them. The roller can cover the ground at the expected clearance start line (baseline) in order to confirm that the ground is clear of mines before deploying an excavation vehicle or manual clearance team.

c. In areas where the location of mines is unclear and to reduce the potential search area, the roller can be deployed working in a set pattern to find mines. The use of the roller for area reduction in cases where mines are potentially laid haphazardly is inadvisable. Using the roller in this way could lead to accidents from a false sense of security, as the roller is not guaranteed to set off all mines. Once the presence of mines has been verified, direct clearance assets can be brought to bear in the smaller area where mines are actually laid.

d. In areas where it is desired to confirm that there is no presence of mines but not put at risk dismounted confirmation teams a preliminary mechanical confirmation can be conducted with rollers.

LIMITS OF EMPLOYMENT

5. It is important that the planners and operators understand the limitations of the roller they have. The terrain they are employed in and the nature of the mines will affect the degree of limitation. There are many mines and other UXO natures that are not readily triggered. Light rollers, for example, are used as a routine precautionary device, which are not designed to be a mine-clearing device in the same way as the heavy self-weight tank mounted rollers.

PLANNING DETAILS

6. Following planning and risk management it may be decided to use rollers.

a. **Routes**. The lead vehicle is mounted with a roller. Vehicle crew should be minimized where possible. The protection vehicle of the improved mine detection system, which can be remotely piloted, may be a good choice. Nevertheless, the crew of the vehicle must remain vigilant and observant to anticipate and avoid mine strikes where possible and deal with the mines by other clearance methods.

b. **Areas**. Areas require a detailed coverage by driving the roller in a fixed pattern. Figures below illustrate this.

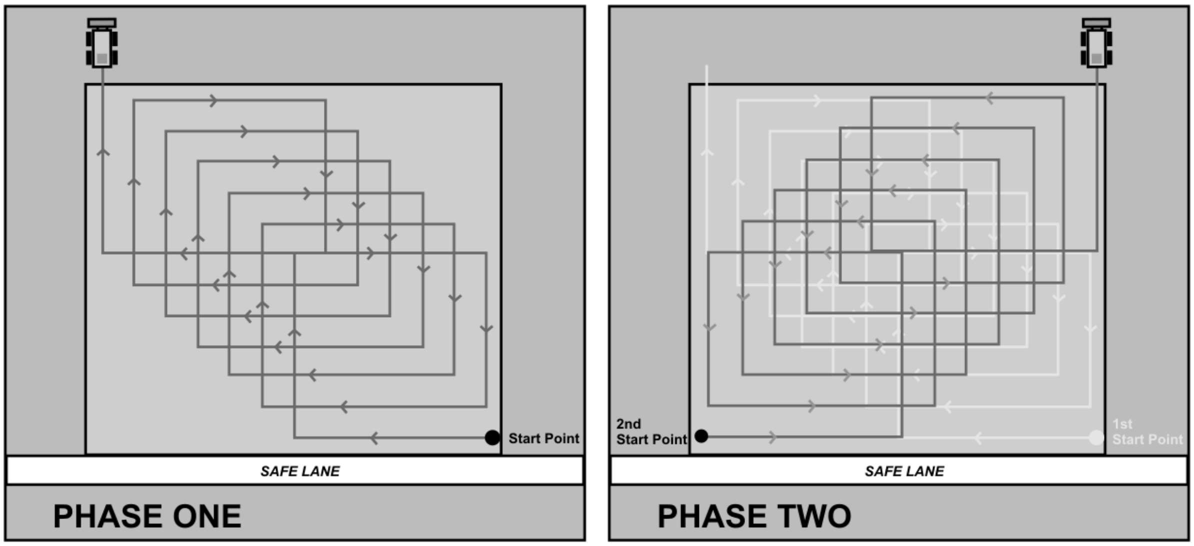


Figure 5D-1: Area Pattern for Confirmation

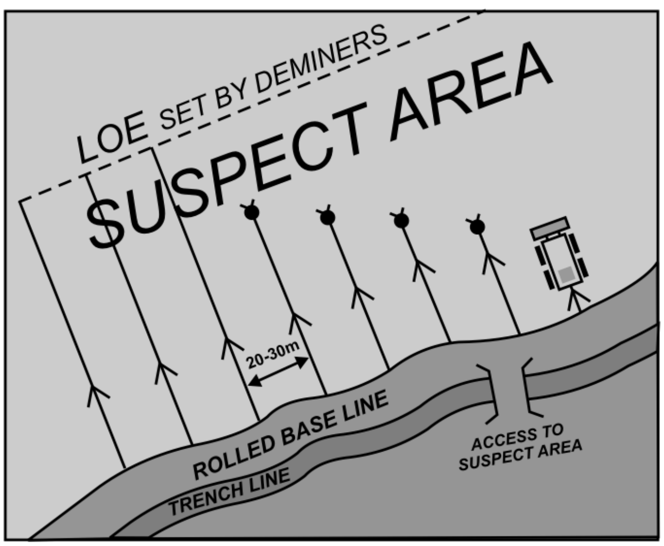


Figure 5D-2: Area Pattern for Area Reduction

Rolling in perpendicular lines from a baseline out to a pre-determined line of exploitation (LOE) in an area where mines are suspected. Once the roller has established the presence of, and approximate pattern of mines, clearance assets are deployed

7. Other attachments in support of the roller vehicle are possible such as security, engineer section, medical.

DRILLS

8. The light MR is operated from a simple control unit mounted within easy reach of the driver with the option of an additional control unit for the commander. The downward force required to activate mines is created by a hydraulically controlled mechanism. The MR uses weight transfer from the vehicle to achieve the required down force on the wheels without the vehicle having to carry the excessive payload of the self-weight rollers.

9. An independent suspension unit supports each individual wheel. Independent suspension on all wheels gives ground-countering capability and allows each wheel to discriminate between different heights of road surface. This effect is illustrated in figure 5D-3. Hydraulic preload of the roller sets gives resultant a wheel loading of 900 kg.

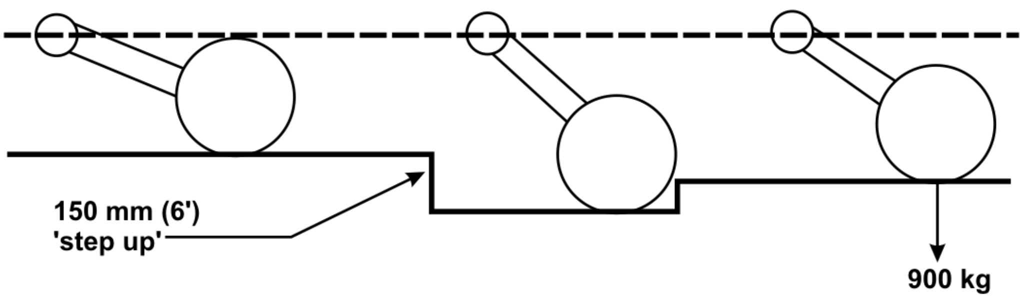


Figure 5D-3: Individual Wheel Suspension Movement

10. The hydraulic installation on the full width mine roller (FWMR) is identical to that of the surface mine plough. The hydraulic power can be supplied by either an engine driven system or a 24V electric power pack.

11. The mine roller is designed to be upgradeable to a full width mine roller system. All the most frequently serviced components used in the front rollers, i.e. suspension mountings, wheels, steer cylinders, etc. are identical to those used in the rear rollers. Figures 5D-4 and 5D-5 show the FWMR fitted to a tracked armoured personnel carrier (APC). The front roller assembly loads the area where the tracks run and the rear roller assembly loads the area between the tracks. This gives full width coverage.

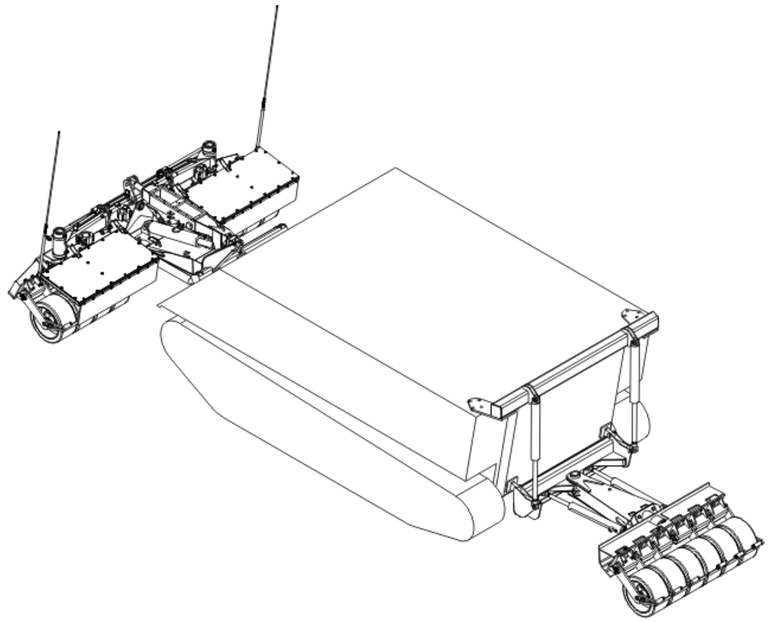


Figure 5D-4: Arrangement of FWMR assembly

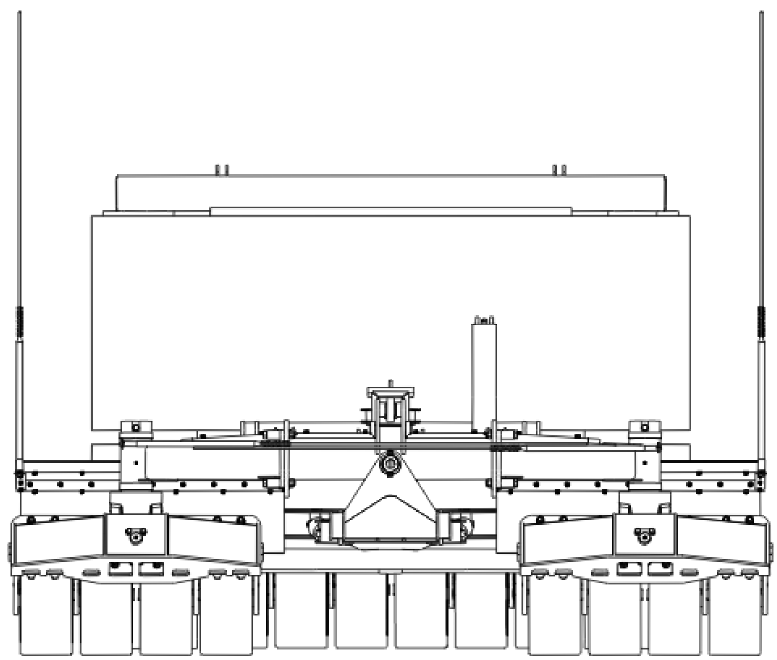


Figure 5D-5: FWMR assembly, front elevation

12. The rear roller assembly comprises a single set of six individually articulating solid wheels. The rear roller assembly also pivots both axially and vertically to enable the wheel preload to be constant when running on undulating terrain.

13. In order to fully cover the ground where the tracks will run the whole frame of the front roller assembly is hydraulically moved across as the vehicle turns. The degree of movement is

controlled by inputs from the rear roller assembly. The action of front and rear roller assemblies when turning is shown in figure 5D-6.

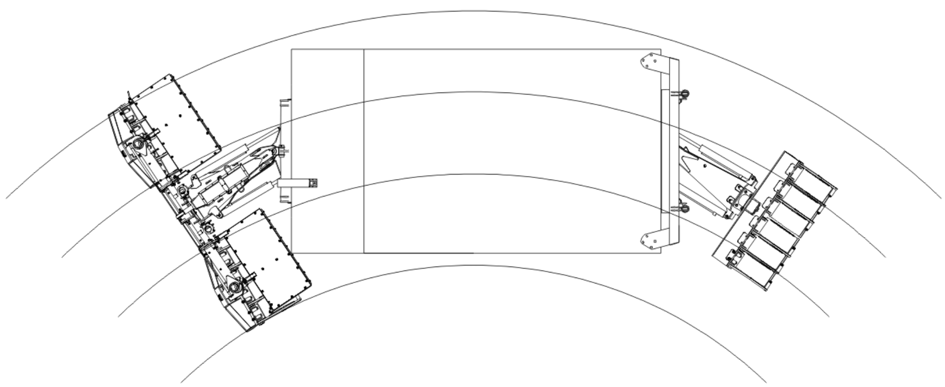


Figure 5D-6: Action of Front and Rear Roller Assemblies in a Turn

14. The rear roller assembly can turn through 90^0 about a vertical axis. When reversing the rear unit can be raised or locked in the straight position. Figure 5D-7 shows the FWMR assembly fitted to a wheeled LAV.

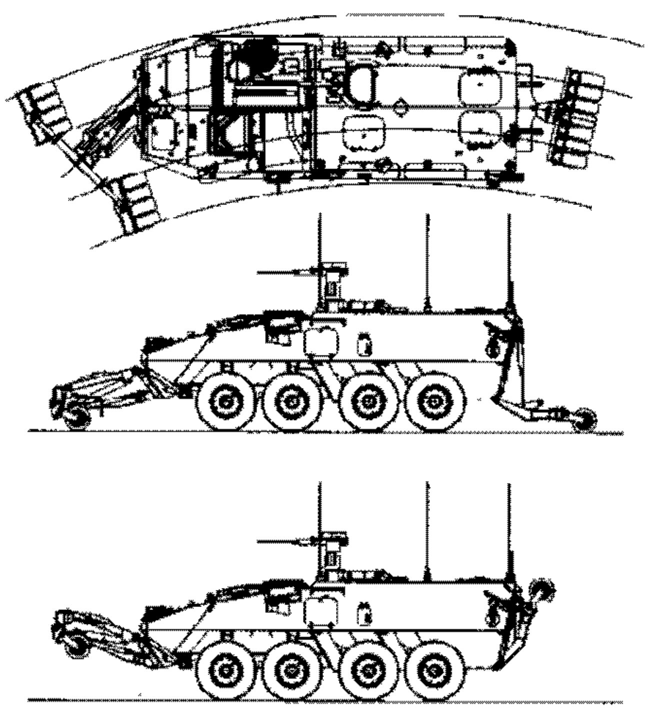


Figure 5D-7: FWMR on LAV

SAFETY

15. Primary concern is maintaining safety distance. Mine detonations should be expected particularly during area reduction operations.

ANNEX E
IMPROVED LANDMINE DETECTION SYSTEM

GENERAL

1. The improved landmine detection system (ILDS) is a multi-vehicle, tele-operated (line of sight), multi-sensor mine detection system capable of detecting buried anti-tank mines and other UXO on, or in, roads and tracks at speeds up to 3 km/h. Normal detection speed is 1km/h based on terrain. Combined with disposal procedures the ILDS provides a route clearance capability in permissive environments (no overt threat).

CONCEPT OF EMPLOYMENT

2. Each ILDS consists of three main components: a protection vehicle (PV), a remote detection vehicle (RDV) and a control vehicle (CV) containing the control vehicle stations (CVS), with both the PV and RDV being tele-operated from the CV.

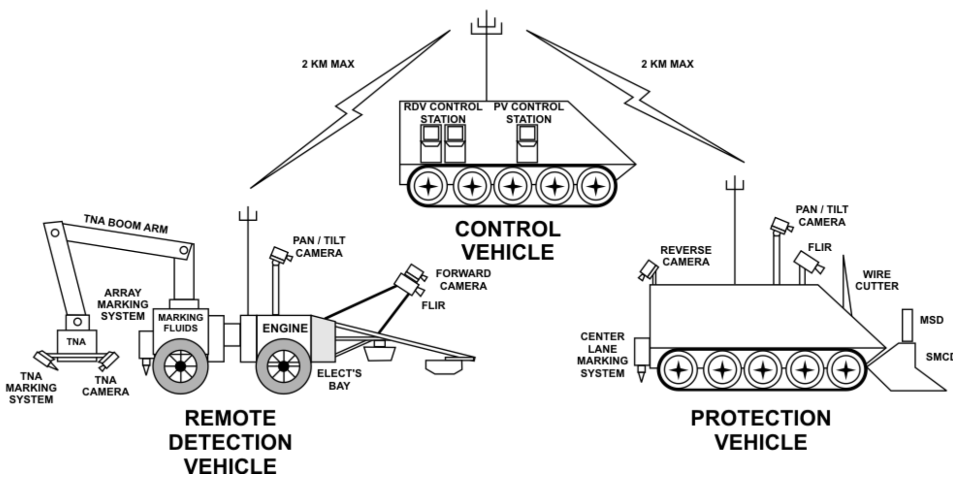


Figure 5E–1: ILDS Components and Systems

3. **Protection Vehicle (PV)**. The task of the PV is clearing the route of threats/hazards ahead of the RDV. The PV can be used in tandem with the RDV, or as an individual system for route reconnaissance (recce). The forward-looking infrared (FLIR) camera provides a moderate detection capability for any thermal anomalies generated by disturbances in the road surface and shoulders. The platform adopted is the M113A2 (Figure 5E-1). It includes a tele-operation suite and a portable remote control station. The M113A2 is equipped with the following payload:

   a. Pearson Engineering surface munitions clearance device (SMCD) or Pearson Engineering full width mine roller (FWMR);

   b. tripwire disrupter;

   c. Giat Demeter II magnetic signature duplicator (MSD);

d. AGEMA FLIR camera;

e. rear mounted driving camera;

f. pan and tilt driving camera; and

g. centreline marking system.

4. **Remote Detection Vehicle (RDV)**. The RDV is based on a purpose designed articulated 4X4 platform. The RDV has a 3 m sensor sweep width and is designed to have a light footprint: its ground bearing pressure under a wheel is less than that required to detonate **most** pressure activated anti-tank landmines. This vehicle is the key to the ILDS as it contains the detection suite comprised of:

a. Schiebel minimum metal detection (MMD) array.

b. Elta ground penetrating radar (GPR).

c. AGEMA FLIR camera;

d. Thermal neutron activation (TNA) confirmation sensor mounted on a hydraulic boom arm. The TNA has a camera and two marking nozzles.

e. Pan and tilt driving camera.

f. Forward driving camera.

g. Marking system for left and right of swept path and target marking on the fly.

5. The RDV is a robotic system, consisting of a tele-operation suite and two portable control stations. The system can cruise at a pre-determined speed and mark targets on the fly, or stop and interrogate a target with the TNA. If the ground and atmospheric conditions are favourable, a single sensor (i.e. FLIR) can make a confident detection of a suspected target. If the confidence level is not high, then the information from the GPR and MMD are added. If there is some doubt as to the nature of the target, then the TNA will establish the level of nitrogen in the target (nitrogen being a basic element of standard explosives).

6. **Control Vehicle Stations (CVS)**. The CVS are mounted in a separate third vehicle. The stations are designed to fit in a M113A2 or engineer LAV although presently mounted in a MLVW vehicle shelter. The CV requires a 10 KW generator to power the system. Each CVS has three displays and associated hardware: one for the driver-operator of the PV, one for the driver-operator of the RDV, and the other for the sensor fusion operator of the RDV. The system has a maximum tele-operation range of over two km (line of sight (LOS)) based on the video links. Functions can be switched between stations. The RDV driver-operator can see the scene from any of the driving cameras or the FLIR. He can assist the data fusion operator with designating suspect signatures on the ground.

ORGANIZATION

7. The organization required to operate the PV and RDV is based on a section plus or a troop minus tasking (based on an ILDS team, a conventional munitions disposal (CMD) team, and a road repair team). If the ILDS is used only for route proving, then a smaller task organization will be possible. Dependant on the local threat situation, a security force may be required. If the ILDS does not deploy with its own prime mover, then there will be a large transport requirement.

8. A typical mission organization could consist of the following:

a. an ILDS section (0-1-7);

b. CMD clearance team;

c. road repair team (task tailored);

d. force protection (as required);

e. medical support;

f. maintenance support (light mobile repair team and fire control systems technician capable); and

g. a flail team could also be part of this organization.

LIMITS OF EMPLOYMENT

9. The PV is vulnerable to shallow buried pressure fused anti-tank mines. Where theatre intelligence has identified this threat, and the road/ground conditions permit, employing full-width mine rollers (FWMR), or flails, in front of the PV could mitigate the risk to the PV. The purpose of the RDV then is for confirmation of the flail/roller's performance.

10. The system's RDV is designed to detect buried mines. Mines other than pressure fused ones can pose a threat to the RDV, including tilt rod, tripwire initiated, magnetically influenced, off route and surface mines and munitions, which must therefore be cleared by the use of the system's PV, or by other mine clearance assets.

11. The ILDS is designed for an optimal performance height above roads, tracks and fairly flat fields. Performance of the system on severely rutted roads, or on roads with extensive potholes, reduces the effectiveness of the SMCD blade; rollers may have to be employed. The system is not designed to work through tall vegetation. Steep temperature gradient changes can improve the FLIR's chances of identifying thermal disturbances. However, year round operation of the system may not be possible due to meteorological conditions such as deep snow, since the SMCD is not designed to effectively remove snow. The ILDS, as a system, has been designed to operate in temperature ranges between -20 °C and +40 °C.

12. When deploying more than one PV and/or RDV it is recommended that they not operate simultaneously any closer then 10 km apart due to radio frequency limitations.

PLANNING DETAILS

13. **Speed and Distances**. The Engineer Commander assigns a clearance task and during the battle procedure process, the ILDS section commander prepares a plan with appropriate report lines, lay-bys, passing areas, and staging areas as required. Assuming a travel rate of 1-3 kph for the RDV, and an operator shift of up to 30 minutes, then 500-1000 m long road segments is a good planning figure and provides good control. With the limitation of the SMCD against anti-personnel mines, the distance between the CV should not exceed 1000 m for recovery purposes. Communications (comms) are lost as soon as LOS is lost; therefore, natural and man-made obstacles are a prime planning consideration.

14. Based on the fact that mine targets are expected to be buried and blast is vented upwards, the safety/damage distance between the PV and CV has been taken as 500 m (personnel under armour). Safety distances when personnel are exposed (CMD team) need to be increased to reflect the mine threat and associated blast and fragmentation. To reduce the danger to soldiers conducting clearance operations within 500 m of the PV, or RDV, it is recommended that these vehicles remain stationary until personnel are outside the safety distance.

15. **Terrain Management**. One of the most important aspects of terrain management for the ILDS section commander is the management of the movement of up to ten vehicles along a 3 m lane, possibly tens of kiloms long, in a potentially mined environment. Terrain management includes:

a. providing a secure cleared assembly area at the task start line, ideally large enough for all task vehicles;

b. selecting and/or creating periodic pull off points (lay bys) along the cleared lane to allow for emergency, medical evacuation or vehicle recovery tasks;

c. selecting and/or creating a large lay by point for mid-day GPR calibration and replenishment of the PV and RDV paint tanks; and

d. selecting and/or clearing cleared turn around points for return to base camp at the end of the day's task.

16. **Reconnaissance Requirements**. In most theatres of operation, available terrain and map information has been rudimentary. Terrain and route management are important aspects of the successful completion of many of the ILDS missions. The principle factor affecting the rate of advance is the degree of the mine threat. The rate of advance is also affected by the physical characteristics of the route, including the materials used for construction, the amount of embedded metal, and the degree of moisture. These factors help identify the optimal mode of ILDS operation. Where possible, it is strongly recommended that the ILDS section commander over fly the assigned route to allow for detailed task planning.

DRILLS

17. **Route Clearance**. Route Clearance is only conducted in a permissive environment. A schematic of the route clearance team layout is at figure 5E-2.

a. **Order of March/Spacing**. The ILDS team can face two possible scenarios: either proving a previously cleared route, or conducting a new route clearance. In both cases, the PV should lead to mitigate any threat against the RDV. The PV lays a centre line mark along its sweep path, from which the RDV operator aligns the vehicle. The distance between the ILDS components is dictated by the following:

(1) The safety distance from blast and fragmentation in the case of a mine-strike on the PV. The distance maintained depends on the threat and the line-of-sight conditions, but general guidance suggests 750 m between the PV and the CV. The separation of the PV and RDV varies from 0-250 m.

(2) Initial testing has shown that the ground disturbance caused by the SMCD on the IR image is minimal or can even enhance its clarity. This is during good solar conditions. As the conditions for IR detection become less favorable, the time/distance separation between the PV and the RDV may need to be extended to about 20 minutes.

(3) For planning purposes, the maximum distance from the CVS to the PV and RDV, based on LOS, is 2 km.

b. **Detection, Marking**. There are two methods in which the ILDS vehicles can be used:

(1) **Caterpillar**. The PV proceeding first, to the limit of LOS, at a speed not to exceed 3 kph. The PV operator can relay any suspect disturbance in the road surface or shoulder to the RDV operator using the GPS location data available from the driving console. With the use of the pan and tilt camera, it is possible for the PV operator to search for other potential threats. The PV then halts, and the RDV proceeds down the lane, marking suspected targets. As the RDV proceeds down the path it either marks on the fly, or stops and interrogates targets with the TNA. The RDV halts when it closes up to the PV.

(2) **Parallel**. The system is run concurrently, i.e. both the PV and RDV are in motion simultaneously. This can be done if the system is being used along a low risk route, and there are no, or limited, false alarms. While the "caterpillar" method can be used with two operators, this method requires three operators to man all the stations. The PV speed is selected to just exceed that for the RDV, but not to exceed 3 kph. All other operating conditions remain the same.

c. **Disposal**. Regardless of the detection methodology, the CMD team moves forward and deals with the individual detections based on authorized and/or directed methods. The disposal procedure takes into account the circular error probability (CEP) for each type of detection and the accuracy of the GPS reference coordinate. Once any detected mines/UXO have been dealt with, the road is repaired (if required), the CV proceeds forward, and the entire process is repeated.

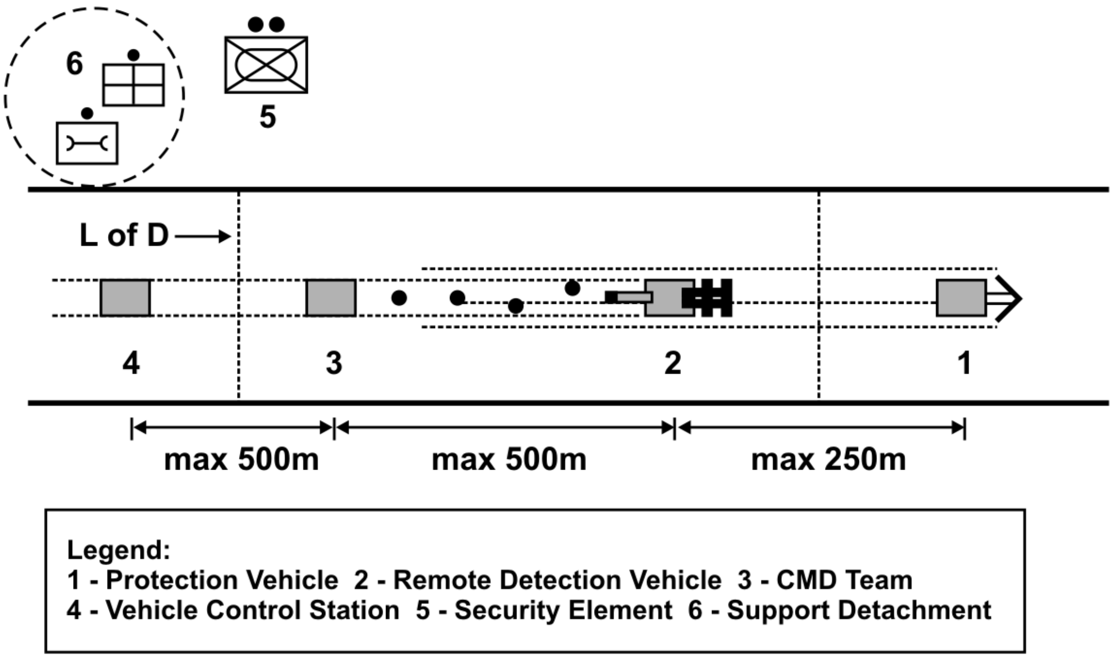


Figure 5E-2: Route Detection Layout

18. **Area Clearance**. ILDS area clearance is only conducted in a permissive environment. The term "area" implies a large-scale clearance; however, it may apply to claiming a smaller parcel for operational purposes. For control purposes, large areas need to be divided into a series of grid boxes. The grid box, in turn, will be cleared by a series of parallel lanes. First, a baseline lane is established. The ILDS (PV and RDV) is then moved up one side then down the other side. This is done repeatedly moving progressively inward. A schematic of the area clearance team layout is at figure 5E-3.

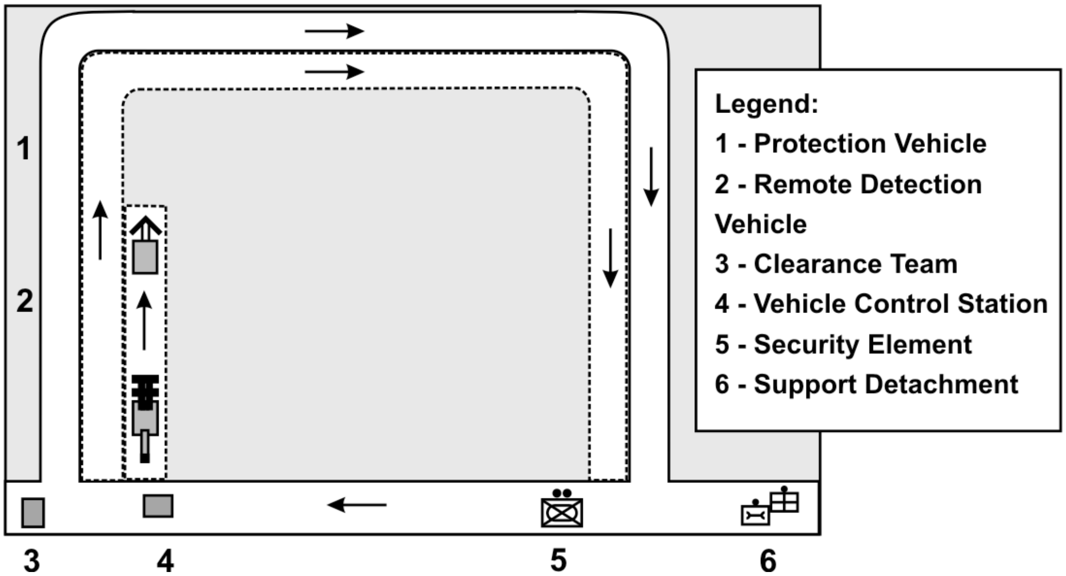


Figure 5E-3: Area Clearance

a. **Staging and Setting Out**. It is recommended to mechanically clear the forward edge of the intended clearance area and conduct a sweep with the RDV before launching the area clearance. This cleared lane serves as the baseline lane for the setting out of the area grid. If a flail is available the clearance of the baseline lane proceeds in accordance with the standard drill of a flail moving ahead of the PV. This approach is slow but is the most effective. In the case that a flail is not available, then the PV (or other vehicle) and roller is used. This approach is faster than the flail combination. Protection of the RDV from mine detonation effects remains an issue to consider in establishing the grid layout and distances.

b. **Detection, Marking and Disposal**. The clearance process remains the same as for route clearance although each lane needs to be recorded from a reference point/bench mark in order to control/verify the clearance of the intended grid box. The digital GPS reference accuracy (10 m) does not permit accurate designation of targets. Reliance on a combination of ground reference and odometer reading for each lane can address this problem. In practice, the start and end points are marked on the ground by a test mark.

19. **Miscellaneous Drills**:

a. **Lay-By Drill**. There is a continuous requirement to have room to permit the vehicles in the ILDS convoy to pull off the cleared safe lane. Unless existing cleared areas can be used (paved driveways, parking lots, occupied town/village terrain), the ILDS section commander has to allow for the creation of cleared vehicle lay-by areas. These can be created either at the side, or along the centre, of the road being cleared. The PV may be used to clear the lay-by, with the RDV confirming the absence of mines and UXO. The drill for the creation of a lay-by is as follows:

(1) The PV backs down the lane for an appropriate length (mid-day drill 20 m, regular lay-by not less then 10 m for RDV).

(2) The PV plows one or more lanes parallel to the primary lane. The point of the SMCD plow is always on the cleared side of the spoil pile/berm of the preceding strip, thereby continuously pushing any ordnance away from the cleared zone.

(3) The PV returns to the start of the uncleared portion on the primary lane ready to continue the mission.

(4) The RDV sweeps the main route up to the PV, then backs up and moves into the expanded lane.

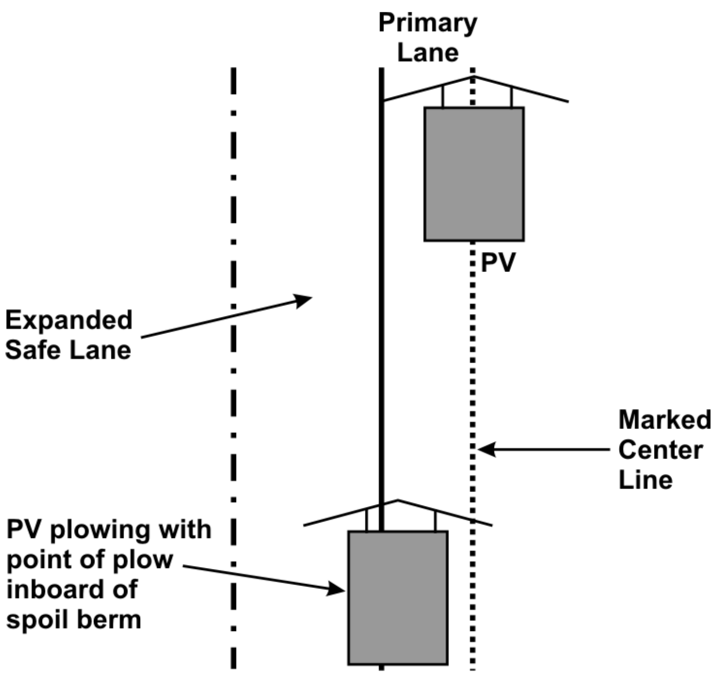


Figure 5E-4: Lay-By Drill

b. **Mid Day Drill**. The GPR must be re-calibrated after every four hours of actual operation. Assuming a normal early morning task start, the GPR may be calibrated during the mid day/lunch break, depending on the actual operating time and/or whether the ground conditions have changed. The paint tanks on the PV and RDV should be topped up at this time as well. It is recommended that the paint for this replenishment be stored in the crew compartment of the PV, to save time and effort in bringing the paint forward. In order to access the GPR and the PV and RDV paint tanks, the operator must walk along the side of the RDV, putting the operators too close to the edge of the cleared lane, and to the TNA. To create more security space, a lay-by area must be created. This could be on the side of the road, if space and the side profile of the road permits, or towards the centre of the road if the side is not useable. A minimum of 2–3 m extra width is required. Once the PV has cleared the requisite safety space and returned to the primary lane start point, the RDV closes up to the PV. The TNA head is manoeuvred off to the outside of the cleared lane, to maximize the safety distance for personnel conducting the paint replenishment and the GPR calibration.

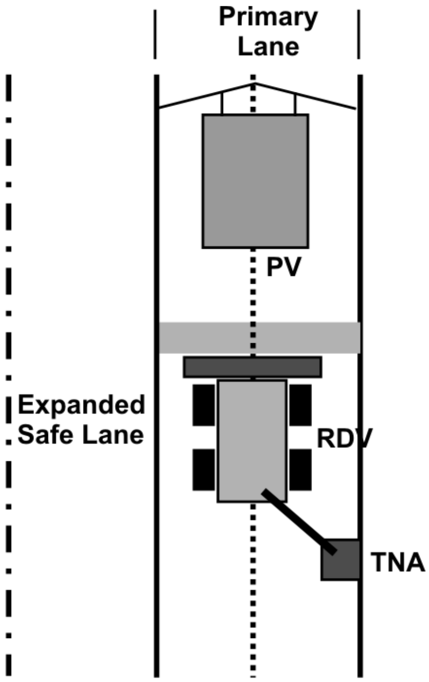


Figure 5E-5: Mid-Day Drill—RDV and TNA Positioning

c. **Action on Mine Strike**. Reporting of a mine strike will follow theatre SOPs but should be different than a "normal" strike call to prevent unnecessary tactical response initiation. The actions will be dependent on the vehicle being hit, the type of strike, location of the strike on the vehicle, the resultant damage, injuries sustained, the location on the route and the recovery assets. The driving cameras on the PV and RDV provide the means to remotely assess a situation. For instance, the RDV cameras could investigate a PV mine-strike. The RDV could mark a path to the PV to assist recovery. The reverse also applies, where the PV, with its rear camera, could investigate the RDV strike. In this case, the path will have been marked up to the RDV. Actual recovery will follow standard or improvised methods as directed by the ILDS Sect Comd, once all detected mines have been cleared. The RDV has limited front and rear anchor points for towing.

d. **Mine Strike/Accident Involving the TNA**. In the event of an accident or mine strike involving the RDV, the Radiation Safety Officer needs to be on site before the source is moved to assess the damage to the source and control the nuclear emergency or radiological occurrence.

e. **Action on Obstacles**. Road obstacles such as deep ruts, sharp bends, railway crossings, tunnels, overpasses and power lines, may impede the conduct of the clearance. Map, ground and aerial recce should pinpoint these obstacles. The RDV configuration (articulation) allows for negotiating road bends while maintaining fairly reliable sensor tracking. Sharp bends may cause some mis-tracking. The operator has to recognize this situation and adjust his line. The MMD on the RDV can be raised in order to negotiate small steps or minor road obstacles. Power lines may affect the radio link between the vehicles and the CVS. Tunnels and overpasses may also impede the radio link. The PV and the RDV are designed to stop when the radio link is interrupted. In this case, the situation should be handled like a mine-strike recovery, until radio link is restored. Obstacles such as logs and deep ruts in an area clearance should be assumed as being mined or booby-trapped. These obstacles should be fenced and avoided unless absolutely necessary. Clearance of these obstacles should be done with mechanical means such as flail, rollers, AEV boom or other. In using the RDV for proving, the operator must remember the system is meant for hard standing tracks and roads.

SAFETY

20. Each engineer unit that holds/uses the ILDS is required to have two senior NCMs/officers qualified to advanced radiation safety officer level available at all times that the unit is responsible for an ILDS. Other safety points are noted through the text.

ANNEX F
MINE PROTECTED VEHICLES

GENERAL

1. Mine protected vehicles are designed to withstand anti-vehicle blast mine explosion under any wheel (14 kg) or centrally below the vehicle (7.5 kg).

CONCEPT OF EMPLOYMENT

2. These vehicles are used primarily in a reconnaissance role to support mobility operations in both permissive and non-permissive environments in areas that the risk probability demands a vehicle of this nature, and for use by quick reaction force (QRF) and casualty evacuation.

LIMITS OF EMPLOYMENT

3. The vehicles are wheeled thus they are not capable of mobility in all types of terrain and climatic conditions. They are lightly armed against small arms fire, and thus their use in the face of enemy direct fire weapons is not encouraged.

PLANNING DETAILS

4. Information requirements to be sought by commanders prior to the use of these vehicles is similar to the needs of any other operation where personnel and vehicles are, or could be, entering a mined area.

SAFETY

5. The MPV is a vehicle and thus all road safety rules apply.

ANNEX G
NON STANDARD CLEARANCE METHODS

INTRODUCTION

1. The demands of clearance operations have resulted in innovative specialized equipment design as well as the manufacturing of modifications or specialized attachments to existing vehicle types. Techniques and procedures have also been introduced to deal with the challenges. This annex introduces some of the innovations and experiences of civilian and other military clearance efforts.

SECTION 1
FRONT-END LOADERS

CONCEPT OF EMPLOYMENT

2. Front-end loaders are built in numerous forms by a multitude of companies worldwide. A feature common to most of them is that they are robust and can be put to work to perform a variety of tasks. They are simple to operate and maintain. For the more common types, locating a dealer, finding spare parts, and managing the logistics for international operations, is relatively simple.

3. Clearance with front-end loaders has accounted for the clearance of thousands of square ms of suspect land in mine-affected countries. Commercial machines have a successful track record of use in the field, at least equal to any purpose-designed system. The use of front-end loaders is a contender for selection within the mechanical 'tool-kit' of any clearance organization. Some of the roles identified for front-end loaders successfully used in clearance operations include the use of mine rollers (mounted on a loader) and armoured buckets.

4. Successful use has been made of armoured front-end loaders with armoured buckets in direct mine clearance. Once a mined area is established by reliable information or by detonations caused by a mine roller, an armoured front-end loader starts operating in the area. The vehicle begins from an established baseline lane. The driver contacts the ground with the bottom front blade of the bucket, and drives forward. Using the manual controls, the bucket is angled to skim off the desired depth of soil. Once the bucket has become half full with potentially contaminated soil (in order to avoid spillage) the loader reverses down its own track to the baseline lane and then down the safe route, previously established, between the clearance area and soil inspection area.

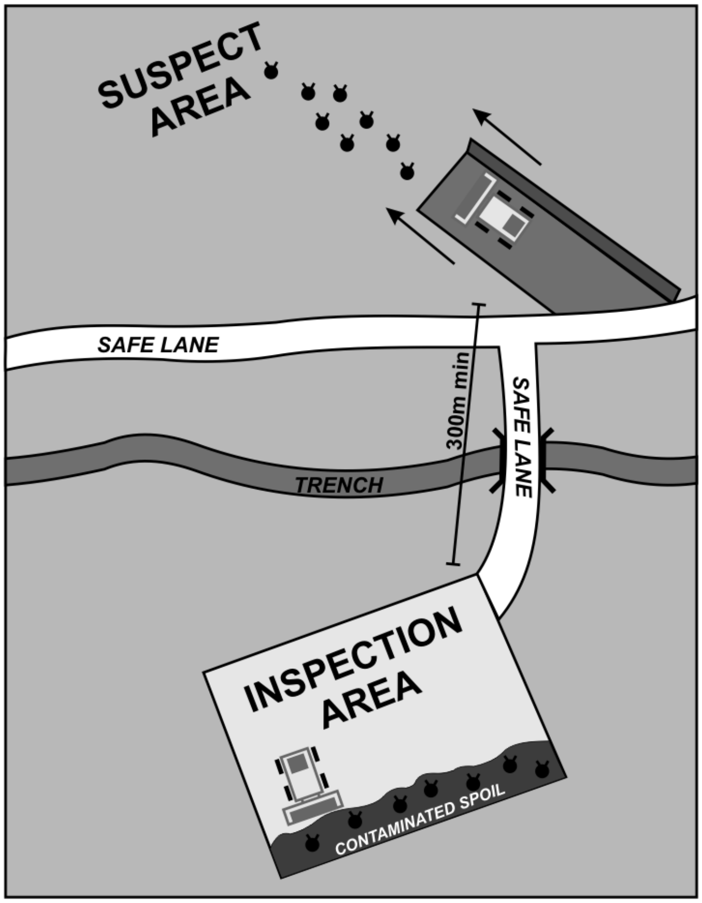


Figure 5G-1: Suggested positioning of inspection area in relation to clearance area for armoured bucket mine clearance.

5. To avoid time wastage, the soil inspection area should be as close to the clearance area as possible while at the same time observing safety distances. The machine dumps its bucket load of skimmed, contaminated soil at one end of the inspection area and then drives back to the clearance area to continue with excavation. In this way, it continues to shuttle loads of soil from the clearance area to the inspection area.

6. The inspection area needs to be large enough for at least one armoured front-end loader or tractor to manoeuvre freely. The surface must be hard. Concrete areas such as car parks and the like are ideal, but a section of field can also be used. Prior to the start of clearance, front-end loaders can prepare an inspection area by removing the topsoil of the selected location.

7. In many soil types (although not all) the ground layer beneath the topsoil can be made almost as hard as concrete by using a mine roller on the exposed surface. Such ground has been found to be suitable for subsequent inspection of contaminated soil. A second armoured front-loader or an armoured tractor works concurrently with the excavating vehicle, but in the inspection area. Its job is to rake the contaminated soil into a thin layer for manual inspection for mines or unexploded explosive ordinance (UXO). The raked soil should not exceed 8-10 cm in depth for this technique to be effective. It is probable that a mine contained within the raked soil will be visible. Placing the bottom of the armoured bucket on top of the spoil and exerting

“enough” downward pressure as the vehicle moves back can achieve the raking action. The teeth on the bottom plate of the bucket impart windrows down the length of the soil layer, lines that can subsequently be used as reference marks to control manual examination.

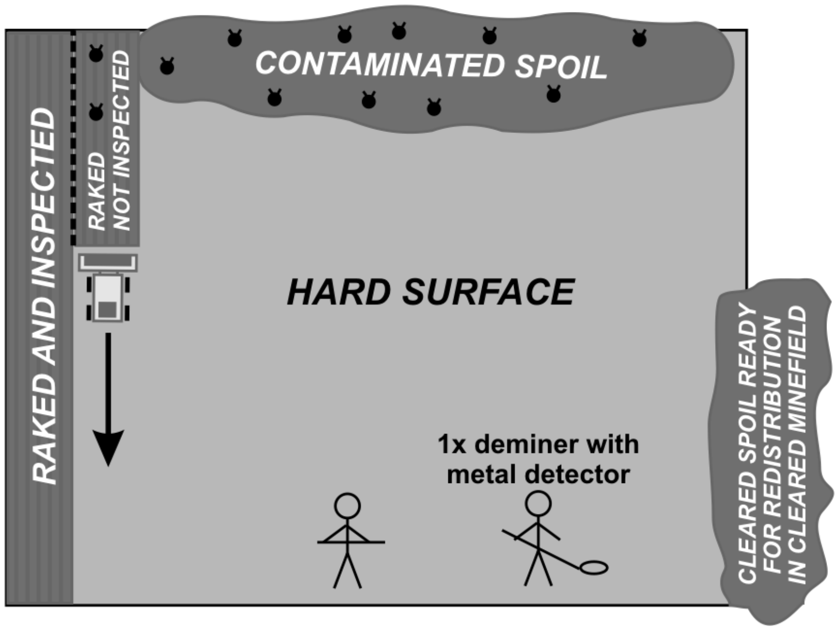


Figure 5G-2: Inspection area

8. Other systems for raking the spoil can be devised, such as a trailer or sledge with an under-hanging rake consisting of staggered pattern tines to distribute the earth evenly. Clearance staff must then inspect the soil. In past operations, the inspection team consisted of one de-miner as team leader, and one de-miner with a metal detector. As contaminated soil is being raked, personnel should be under cover or at least 300 m away. They return once the machine has raked one row of one-bucket width.

9. Experience has shown that AP mines usually survive the violence of excavation, transportation to the inspection area, dumping into a pile and the raking back by an armoured front-end loader/tractor. Once the soil has been inspected, it should be placed into an uncontaminated pile to await eventual redistribution in the excavated clearance area after it is cleared.

10. A further adaptation to the armoured buckets is the addition of a gill at the front, designed to let spoil and potential AP mines through, but to stop any AT mines from impacting at the back of the bucket and detonating. This has proved successful in operation and is a particularly positive development for work in areas where knowledge of likely mine types is unreliable.

Figure 5G-3: Front-loader bucket with gill

LIMITS OF EMPLOYMENT

11. For mine clearance, front-end loaders must be armoured in order to guarantee the safety of the operator. Wheels and tires can be guarded in the event of contact with anti-personnel mines by the application of protective, heavy-duty chain mesh, or the use of solid rubber or foam-filled tires. Mine protected front-end loaders have previously been used in AP minefields only, due to the damage that would be sustained in the event of an AT mine detonation during excavation. However, recently developed loaders have been fitted with specially devised buckets specifically for work within AT and mixed AT and AP minefields.

PLANNING DETAILS

12. The decision to use this equipment and where to begin "area reduction" drills must be made very carefully after conducting a complete risk analysis.

SAFETY

13. Nil.

SECTION 2
TRACTORS

CONCEPT OF EMPLOYMENT

14. Standard agricultural tractors can be employed in mine action in much the same way as front-end loaders outlined above. For clearance operations, the driver's cab must be armoured. In general, tractors are more limited than front-end loaders as they are lighter and not as powerful. Ideally, they can be employed in roles where the use of a more powerful front-end loader would be less economical.

15. As an example, during excavation clearance, a tractor would be best employed in the inspection area raking the contaminated spoil in order to free a front-end loader to operate in the clearance area. Tractors have however proven to be an excellent asset in the roles of vegetation cutting or obstacle removal.

16. Vegetation cutting heads and trimmers are produced by a large number of manufacturers worldwide. Cutters are usually sold with a hydraulic arm and can be fitted to many tractor types as long as the linkages are compatible. Standard operating procedures (SOPs) for bush cutting have been developed by numerous de-mining organizations and are not covered here.

Figure 5G-4: Vegetation cutter on armoured tractor

17. Vegetation cutting as assistance to manual clearance teams has been proven beyond doubt to increase the efficiency of manual mine clearance, but this depends largely on how and where a bush cutter is deployed. The designation of vegetation density can be deceptive. A field full of long grass but devoid of bushes and small trees will usually take longer for manual clearance than an area of shrubbery, even though the latter appears to be more dense.

18. Armoured tractors have been used to remove obstacles and debris (for example, concertina wire, metal junk and burnt-out cars), from mine sites that would otherwise slow clearance operations, either manual or mechanical. Once clearance has reached a point where the debris can be gained, a tractor moves into the location and drags it out from a position on the edge of the cleared area. This task is usually conducted by a backhoe on a hydraulic arm. Once the obstacle is removed, clearance continues.

LIMITS OF EMPLOYMENT

19. This equipment is for use in a permissive environment and in conjunction with other mechanical and manual clearance systems.

PLANNING DETAILS

20. The decision to use this equipment and where to begin “area reduction” drills must be made very carefully after conducting a complete risk analysis.

SAFETY

21. Nil.

ANNEX H
EXPLOSIVES DETECTION DOGS

GENERAL

1. A properly trained explosives detection dog (EDD) and handler are capable of detecting mines (metallic or non-metallic), booby traps, and trip wires, as well as other items that may be of an explosive nature or associated with mines. The value of a dog lies in its vastly superior sense of smell, sharpness of hearing, and ability to detect even the smallest movements. By interpreting the animal's reaction when it employs these physical capabilities, friendly forces are provided with a useful agent against the enemy, belligerents, or terrorists.

2. Army dogs are trained for specific roles such as guard, search, or tracker. To obtain the maximum efficiency from the animal, the dog shall be used only in the role for which it has been trained. Thus, although in certain situations any dog might be produced to act as a deterrent, a guard dog will not search for explosives or mines, nor will a search or tracker dog normally attack a man. A dog is compact, mobile, and easily transported, and can work in a variety of conditions, including in confined spaces and difficult terrain. It will increase the speed of many operations and can enhance the effectiveness of searches and patrols. A dog is normally unaffected by CS gas, air fresheners, or other aerosols.

CONCEPT OF EMPLOYMENT

3. A dog search team comprises a dog and handler, both of who can be thought of as an extension of each other's senses. It is the handler who provides the eyesight and brainpower, while the dog provides the highly developed sense of smell. This annex deals with mine search teams only.

4. The dog, which has taken up to two years to train, is already competent in its specialist role when it is taken over by its trainee handler. Thus, at the end of the handler’s training they enter operational service as a well-integrated partnership.

5. All things in this world have a scent. The dog perceives a scent picture. This picture is made up of the smell of an object (explosive in the case of a mine or its case material), the substances associated with the object (such as explosive binders or packing grease), and equally important, the smell from the disturbed environment associated with the object (such as earth covering a buried mine, earth and vegetation crushed in the process of laying the mine). The scent picture shall be disturbed as little as possible. Therefore, movement should be limited in and about a dog’s area of operations until it has finished its task.

6. Depending on their training, EDDs may wear harnesses when working. This equipment serves two purposes. First, it is associative in that the dog knows it is expected to work when the harness is placed around it and, secondly, it is functional in that the handler can grip it or a line attached to it. Dogs can be used for searching for years. For the purpose of mine detection or other clearance operations, two classifications of EDDs are considered:

a. **Mine Dog**. The mine dog is specifically trained for the detection of land mines, booby traps, and trip wires. The dog is normally trained to “sit” a source, and depending on the wind direction the dog can be given appropriate commands to safely place the dog between the mine and handler. The mine dog is trained to work open areas, roads, trails, etc. and it will experience difficulty if attempts are made to employ the dog in confined spaces such as a building or a vehicle. The mine dog shall not be cross-trained for any other task such as guard, or aggression duties.

b. **Bomb Dog**. The training given to a bomb dog is similar to that of a mine dog, as are the dog's reactions; however, a bomb dog is trained to search confined areas such as buildings and vehicles. The bomb dog may also be trained to detect trip wires. This would be a prudent measure, as most building searches conducted by engineers are normally suspected of being booby-trapped.

7. **Principal Tasks**. Principal tasks for EDDs are:

a. Searching for mines or explosives and ancillary equipment in:

(1) Buildings—occupied, unoccupied or derelict;

(2) Open areas—fields, islands, woods, hedgerows and embankments; and

(3) Vehicles—cars, trucks, trains, ships, boats and aircraft.

b. Route checks and clearance—roads and railways.

c. Providing negative information by checking buildings after workmen have left (to counter terrorists or "proxy mining/bombing"), clearing areas of operations such as vehicle check points and helicopter landing zones, and helping to confirm suspected hoaxes.

LIMITS OF EMPLOYMENT

8. **General**. To obtain the maximum value from the service of EDDs, it is essential to have a sound understanding of the tactical situation and conditions under which dogs work best. Dogs, like humans, are subject to external influences that have a direct bearing on their behaviour. It follows, therefore, that the performance of any dog, no matter how highly trained, is not constant and it cannot be expected to work efficiently under every type of condition. This is often not fully appreciated and instances have occurred where adverse criticism has been levelled against a dog simply because the person responsible for its employment was ignorant of its limitations. The dog must be considered as a specialised ancillary tool and shall only be used after a careful appreciation of the tactical picture, climatic conditions, and terrain have been made and found favourable.

9. **Limitations on use of EDDs**. None of the factors listed below needs to preclude the use of a dog completely. Its efficiency may be reduced, but it is better than nothing. With intelligent handling and use, many of these disadvantages can be minimized:

a. A dog can be distracted by other dogs (specifically male dogs by bitches), other animals, people, and food.

b. It can tire, sicken, be injured, reflect the mood of its handler, and have inexplicable off days.

c. It can be affected by extremes of weather.

d. Dogs may be of little use in detecting arms and explosives hidden on the person, where the dogs have learned to associate these as normally carried by humans, such as their handlers and other soldiers.

e. Dogs, like humans, have a short attention span. Extended searches shall be avoided unless replacement in situ is not possible, or where an extended rest for the dog cannot be afforded.

f. A EDD uses olfactory sensors to detect. These sensors are fine membranes that are kept moist by the dog's body. When the dog is actively engaged in a sniffing pattern, these membranes will dry out and the senses are diminished. Resting the dog often and allowing the animal to drink can remedy this problem.

g. Training for EDDs is based on reward/ rest breaks after each item found or search portion completed. This system must be strictly adhered to or the dog will quickly lose its motivation to work.

h. Area searches using dogs are conducted in an established grid pattern of marked out search boxes. This pattern is established using traditional search methods (mine detectors and prodders) before the dogs can begin their task.

i. Dogs have a reduced ability to detect objects more than 4 m above ground/floor level.

j. There is the danger of setting off anti-disturbance devices/booby traps inadvertently when employing dogs.

PLANNING DETAILS

10. **Tactical considerations**. Normally, the dog must have access to areas to be searched before other searchers move into it, except in buildings or areas where improvised explosive devices are suspected. In these instances, a check for devices by searchers other than the dog handler must be made before the dog moves in.

11. **Briefings**. A good briefing is the key to an efficiently run operation. On many occasions the EDD handler will find himself working in unfamiliar surroundings, with unfamiliar people. It is imperative that under these conditions the handler has enough information to make the best possible use of the dog. Without this information, the handler cannot be expected to work the dog at optimum efficiency; lack of confidence in the dog and strained relations with the user unit can be the only end result. The following points are listed to assist units in briefing dog handlers fully before a search operation:

a. The handler must know the number of areas it is intended to work the dog in, their size, and the type of ground.

b. Always indicate if the area has been checked for booby traps.

c. Indicate when, if at all, the area was last searched, and what the outcome was.

d. Provide a cover man and allow the handler to brief him personally.

e. Tell the handler how much time is allowed for this operation.

f. Indicate whether the operation is the result of new information/intelligence or routine.

g. Brief the handler on the local situation, and where and how troops are deployed in the area, such as observation posts (OPs) and cordons.

h. Make certain the handler understands what action is to be taken in the event of contact with enemy, belligerents, or terrorists, and in the case of a find.

i. Tell the handler what may be found—explosives, UXO and mines.

j. Warn the handler if the troops have no previous experience with EDDs. This is important from the point of view of unnecessary distractions to the dog when it is operating.

k. Make certain the handler fully understands your intended action in the event of a find (i.e. mine presence indicated by the dog).

l. When, or if, other EDD teams will be available, or are operating in the area.

m. Where veterinary services are in the event of an accident.

SAFETY

12. All specialist dog handlers shall be equipped with protective helmets (with ballistic face shields) and body armour (preferably covering crotch, abdomen, chest and neck) to provide protection from blast and some fragmentation effects. However, the protective equipment must permit the handler to be highly mobile and it must not cause degradation, through excessive heat or discomfort, to the handler's performance. It is mandatory to wear them during operations

CHAPTER 6
MINE STRIKE RESPONSE

GENERAL

1. Even with all of the appropriate safeguards in place there is still the potential for UXO related accidents. For the purposes of this manual all UXO incidents, whether mine, IED, or other UXO related, will be referred to as a “mine strike.”

2. Mine strike response must be included in both individual and combined arms pre-deployment training. Mine strike rehearsals should continue to be a regular part of the routine of the deployed force to ensure drills and response time are not victims of complacency.

3. Initially, it may not be clear if the strike was a result of a “missed” mine or a deliberate attack and possible ambush. Intelligence and situational awareness will indicate if the latter is in the realm of the possible. The response and reaction are different and therefore it is up to the personnel involved to make the right decisions.

4. A mine strike response may be initiated under the following circumstances:

a. the initiation of a mine or other UXO Incident Response Request (METHANE Report); or

b. any time a vehicle or personnel find themselves off an authorized route/area, especially in the case where mine indicators have been detected (normally sent by a Situation Report (SITREP)).

CONCEPT

5. **General**. There are two goals to successful mine strike response: the timely treatment and evacuation of casualties and extraction of others, and the prevention of any additional strikes. In order to accomplish these goals, emergency response forces must be designated, equipped, trained and ready to react to incidents whenever and wherever they may occur and moreover to do so under non permissive circumstances. As a general rule, if the situation permits, all personnel involved in a mine strike or in a similar situation should stay exactly where they are and/or in their vehicles until emergency response assets arrive to extract them. Minimizing unnecessary movement therefore prevents additional strikes. The response assets will further prevent additional strikes through countermine operations and the isolation of the mine strike area. This isolation requires the establishment of inner and outer cordons and may require the establishment of bypasses. The detailed tasks and responsibilities of the breadth of emergency response assets are listed below.

6. **Phases**. The two phases to a mine strike response are:

a. **Phase 1**. Stabilize the situation—rescue casualties/personnel.

b. **Phase 2**. Incident investigation and the recovery of vehicles and equipment.

7. **Threat to Life**. Ideally, all situations requiring casualty extraction from UXO contaminated areas will occur with engineer support. However, given the size of most theatres, poor road conditions, the possible condition of casualties (and the time to transport them to medical facilities), and the tactical situation the response time of engineers may be longer than desirable. Therefore, all personnel must be prepared to carry out the self-extraction and casualty extraction drills described in Annex A. Self-extraction drills should only be used in emergencies when it is clearly a better option than remaining in place. The potential threat to life must be considered when determining the immediate actions to be taken. The senior leader on the ground must be prepared to make these decisions.

ORGANIZATION

8. **Quick Reaction Force**. A quick reaction force (QRF) is normally established at the appropriate level to deal with a wide range of potential situations that may arise in a theatre of operations. Based on the situation, the controlling headquarters deploys either all or part of the QRF to deal with the initial response to an incident. The QRF must have appropriate, dedicated transport to deal with likely distances and threats. The following resources and elements should be included in the QRF in order to be capable of a mine strike response:

a. command;

b. engineer response section (ERS);

c. protection party (infantry section or other element);

d. ambulance detachment(s);

e. military police (MP) detachment; and

f. interpreters.

9. **Other Incident Response Capabilities**. Additional resources may be designated to deal with immediate and/or follow-on aspects of an incident that are beyond the capabilities and/or resources of the QRF. These may include:

a. advance surgical team (AST);

b. EOD team;

c. specialized forensics;

d. MP (investigation);

e. vehicle recovery teams;

f. electronic warfare (EW);

g. aviation;

h. legal;

i. public affairs; and

j. padre.

RESPONSIBILITIES

10. **Controlling Headquarters**. The responsibilities of the headquarters controlling the QRF are to:

a. Confirm that emergency conditions exist, and their nature.

b. Deploy the QRF by appropriate means (e.g. aviation) and any additional assets that may be required.

c. Restrict use of the route or area until the cause of the strike is known and subsequent actions are taken to ensure safe future use.

d. Inform personnel who are involved in the mine strike of all pertinent response details (in part, so that they may determine when/if it is appropriate to begin self-extraction drills in order to provide first aid to casualties and/or get themselves out of the danger area. This is based on consideration of the mine threat, tactical situation, condition of casualties, and the estimated reaction time of the QRF).

e. Coordinate details such as determining if any roads must be closed in order to limit interference with the mine strike response, and inform the appropriate HQs.

f. Reconstitute the QRF and/or take other appropriate measures (freeze all non-essential movement in theatre).

g. Send detailed reports to the higher headquarters if appropriate.

h. Confirm the destinations of any patients/casualties.

i. Rotate or reinforce QRF, ERS and other teams and personnel accordingly. Time on task site may be long particularly during phase 2—post incident recovery/investigation.

j. Close the incident area and ensure that the site is preserved until all post incident investigation is complete. An NDHQ/DCDS investigation team may be dispatched if required.

k. Coordinate execution of the recovery phase.

11. **QRF Command**. The QRF Commander will:

a. Establish a rendezvous (RV) if all elements are not able to depart from the same location or at the same time.

b. Take command of the mine strike response. All assets responding to the mine strike fall under the QRF Commander's control upon arrival on site.

c. Establish the incident control point (on the edge of the outer cordon) and minimize all personnel and vehicle traffic forward of that point.

d. Establish, secure and command the outer cordon (minimum 300m), Helicopter Landing Site (HLS) (40m x 60m), incident control point, vehicle RV and provide traffic control.

e. Send reports to headquarters. Particular emphasis must be placed on the condition of the casualties, HLS position, local tactical and traffic situation, and additional resources required.

12. **ERS**. The ERS(s) will:

a. Take control of all personnel and activities within the inner cordon of the response.

b. Establish, control and command the inner cordon with the ERS vehicle at least 100 m (positive safety the exact distances should be assessed and set on site) from the mine strike and minimize all personnel traffic forward of that point. Co-locate medical support with the ERS vehicle.

c. Ensure that the minimum numbers of personnel are exposed to explosive risks.

d. Recover casualties from the mine strike area to the Medics in outer cordon or escort Medics into the inner cordon and the casualty if deemed necessary by the QRF Commander.

e. Provide reports and returns.

f. Mark the suspected mine/hazardous area.

g. Be prepared to provide assistance to forensic investigation and post blast survey.

h. Provide clearance support to vehicle or equipment investigation and recovery assets.

i. Must be prepared to be lifted by vehicle or helicopter.

13. **Protection Party**. The protection party provides ongoing security of the site from the outset and until the investigation and recovery is complete. The protection party must have at least two vehicles so that they can act as cut off points at either end of a route at the outer cordon.

14. **Ambulance Detachment**. Medics are to remain outside the inner cordon unless it is deemed by the QRF Commander that they can or should move forward. Medics, if moving forward, will do so under escort by the engineers. Ambulance detachments will:

a. if possible, talk to the personnel trapped in the minefield, assess their medical condition, prioritize the casualties and inform the QRF Commander of the condition of each casualty, the appropriate extraction method (i.e. spine board) for each casualty and how soon the casualties must be extracted;

b. plan the evacuation of the casualties; and

c. be prepared to respond to additional casualties.

15. **MP Detachment**. MP are positioned outside the outer cordon. The MP Detachment will:

a. advise the QRF Commander of locations for traffic control points and bypasses to reduce the traffic at the outer cordon;

b. provide traffic control to re-route any people and traffic away from the outer cordon;

c. conduct liaison with local law enforcement agencies if applicable;

d. the MP will play a major role in phase 2. Be prepared to secure the site during the investigation and recovery stage of the operation; and

e. be prepared to conduct an MP Investigation.

ERS DRILLS

16. If the situation is not urgent, the ERS will use manual area clearance drills to clear and mark a 1 m lane to personnel. A possible difference from normal drills, left to the discretion of the on-site commander, is that all encountered mines, booby traps and other UXOs, and trip wires will be marked and bypassed instead of being neutralized, disarmed or destroyed. It is important to note that these measures result in some increased risk to the engineers conducting the clearance

17. If there are serious casualties, or if the tactical situation is degrading then time becomes a critical factor. In such cases the ERS can *breach* a lane more quickly by reducing its width to 0.75 m. Under certain circumstances other expediencies might be warranted. For instance, while it is by no means guaranteed, the tracks left by a vehicle may be a relatively safe means by which to quickly gain access to casualties (terrain and mine type dependant).

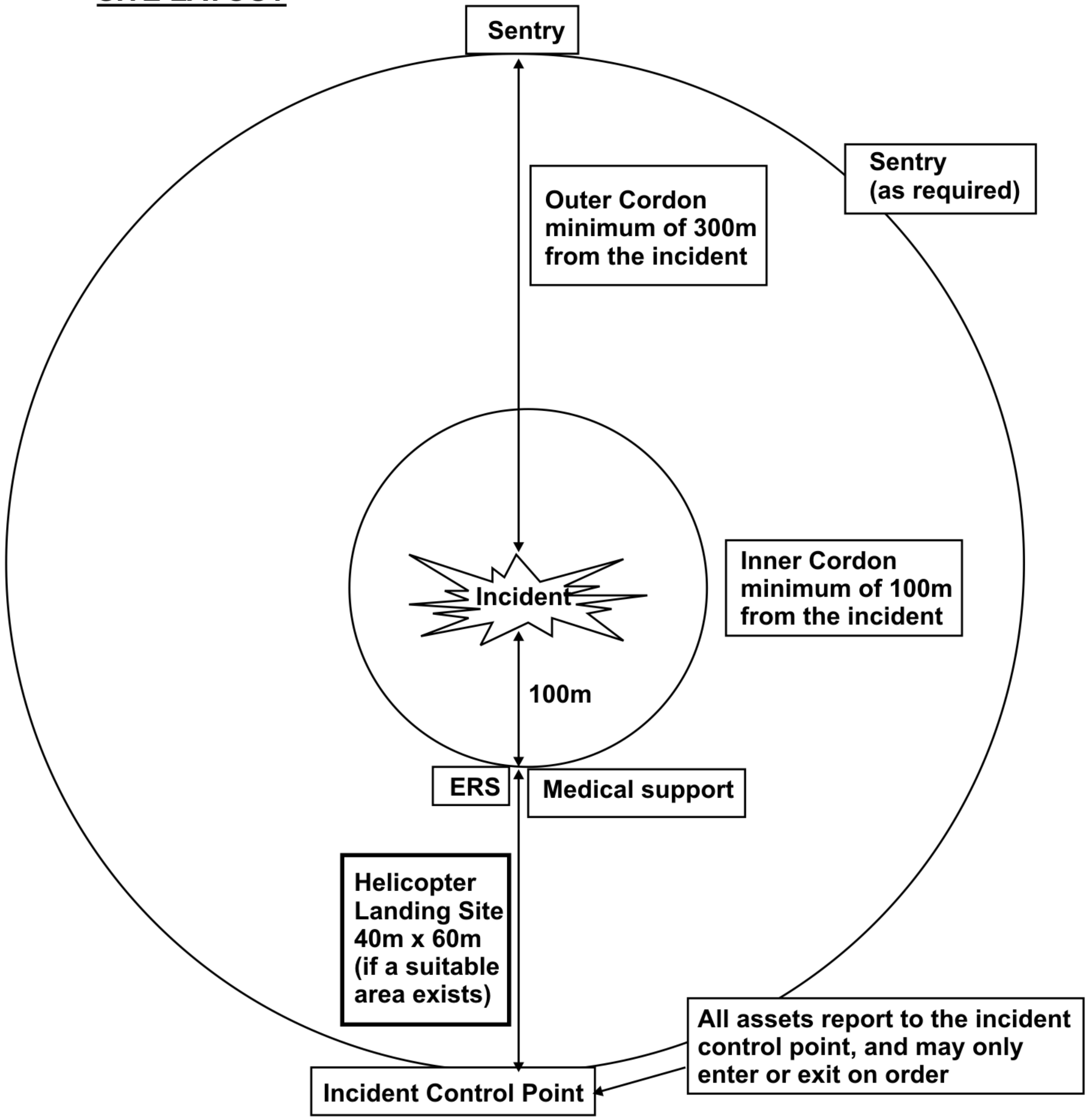
NOTE

Vehicle tracks are not to be considered clear of mines and trip wires. Their use without appropriate clearance drills implies the acceptance of risk. However, this risk may be warranted under certain circumstances.

CONCLUSION

18. Rapid, well-coordinated and efficient responses to mine strike incidents may mean the difference between life and death. All personnel must be prepared to take immediate action in order to save lives. To prepare personnel for this situation it is essential that mine and other UXO awareness and self extraction and casualty extraction training is received before deployment, on arrival in theatre and periodically. On-site personnel must be prepared to provide HQs, at all levels, with the critical information necessary to direct an appropriate response. Reaction to mine strikes is a coordinated combined arms effort that requires all personnel to be well versed in their potential duties and responsibilities.

SITE LAYOUT


Sentry
Sentry
(as required)
Outer Cordon
minimum of 300m
from the incident
Incident
Inner Cordon
minimum of 100m
from the incident
100m
ERS
Medical support
Helicopter
Landing Site
40m x 60m
(if a suitable
area exists)
All assets report to the incident
control point, and may only
enter or exit on order
Incident Control Point

ANNEX A
EMERGENCY EXTRACTION PROCEDURES AND DRILLS

GENERAL

1. All personnel who are deploying on expeditionary operations must be familiar with the drills described herein, and be prepared to carry them out when directed or required. These drills are only for emergencies and will not be used for any tasks other than self-extraction or casualty extraction. Not all circumstances or conditions can be related in this doctrine, therefore a common sense application of the principles provided is the key to success.

AIM

2. The aim of this Annex is to detail the self-extraction and casualty extraction procedures and drills that should be followed in the event of an emergency. The details herein must be reinforced during training.

WHEN TO EMPLOY EMERGENCY EXTRACTION PROCEDURES AND DRILLS

3. These procedures and drills are to be employed when:

   a. a vehicle or person has initiated a mine or other UXO strike (normally sent by CONTACT report followed by METHANE Report);

   b. anytime a vehicle or personnel find themselves off an authorized route/area, especially in the case where mine indicators have been detected (normally sent by SITREP); or

   c. a situation involving a possible ambush, preceded by a deliberate mine placement or an IED will require quick analysis of the situation and subsequent counter ambush drills (normally sent by CONTACT Report).

PROCEDURE

4. The procedure to be employed under the conditions stated above is defined by the acronym **SAID** (**S**TOP, **A**SSESS, **I**NFORM, **D**RILLS).

5. The procedure is to be conducted as follows:

   a. **STOP**. Cease **all** individual and vehicle movement. Warn personnel in the immediate area by yelling “STOP, MINES”, or passing this information on the radio or by hand signals if in convoy. Fragmentation mines, in particular, can kill or wound those around you - the cessation of all movement is both an individual and a collective responsibility. The one exception to this step is that stopping may not be appropriate in an obviously hostile tactical environment such as an ambush. A strike is reported immediately by means of a CONTACT Report to warn higher HQ of the need of incident response support.

b. **ASSESS**. Quickly determine the overall situation.

(1) **Tactical Situation**. Assess the tactical situation. Does an imminent threat exist which outweighs the apparent UXO threat? or conversely is **time** available in which to continue to assess the situation in a more complete manner?

(2) **Casualties**. Do casualties exist and what is their medical status? Are they likely to survive with or without assistance? How long will they survive? Can you safely reach them in that **time**? (Note: a casualty and the situation do not improve if you become a casualty. If you initiate a mine you may further injure or kill the victim, yourself and others, overwhelm the medical resources that are available or become unavailable to assist other rescue attempts - as a minimum you are most useful to the casualty if you remain alive). Are they continuing to pose a danger to themselves or others by uncontrolled movements? Who are the casualties and what are your responsibilities and authorities?

(3) **Mines and other UXO Threat/Hazards**. In many cases, individuals are not experts in the realm of identifying UXO, therefore report what is observable and if possible define the nature of the UXO threat. Are you dealing with mines? Anti-personnel or Anti-vehicle, tripwires, an improvised explosive device or previously unexploded munitions? Understanding the nature of the UXO threat is of considerable importance in determining the risk associated with follow-on courses of action.

(4) **Resources**. What resources are available? Is there a QRF available to deal with UXO strikes? How much **time** will it take to arrive? Where and what levels of medical coverage is available? Who is in your group and what resources (training, medical kits, trip wire feelers, mine prodders etc) are available?

c. **INFORM**. At the first opportunity and regularly thereafter, based on established procedures, update the initial CONTACT Report and provide further information by means of a SITREP or the METHANE Report- when there are casualties and immediate support is required: report your intentions. Include as much detail (i.e. the UXO description using common identifiers (shape, size, color, etc), number of casualties and their condition) as possible to help in coordinating the necessary resources. It is critical that others are informed, if you are going to commence self-extraction or casualty evacuation drills.

d. **DRILLS**. Once you have ascertained that a dangerous UXO situation exists you must react accordingly:

(1) **Remain in Place and Await Help**. Ideally, all personnel don protective equipment (if not already worn), remain in place and await assistance. Limited application of self-extraction clearance drills may be required to allow for personnel to sit if waiting periods are likely to be considerable

(2) **Provide Warning**. Using whatever means available (marking, voice, hand signals, radio etc) prevent further personnel or vehicles from entering the hazard area. Where possible move personnel and vehicles that are not in danger - to a position of further safety should an UXO initiation occur.

(3) **Conduct Self-Extraction or Casualty Evacuation Drills**. If emergency conditions exist, the self-extraction and casualty extraction drills are employed.

SELF-EXTRACTION AND CASUALTY EXTRACTION DRILLS

6. **Emergency Self-Extraction Drills**. The steps to be followed are as follows:

a. **Select the best route to a safe area**. Identify a safe area and assess the best route to that area. The assessment should combine elements such as: the ease of clearance (i.e. a brush filled area is more difficult to clear than an open area); the likelihood of a threat (i.e. an obvious choke point on a footpath is a prime location for a munition); the distance to the safe area; recent activity (i.e. on certain types of soil a fresh tire or animal track may be obvious and thus of use); and the number of personnel involved (extraction lanes can be linked).

b. **Prepare yourself for self-extraction**. Without placing anything on the ground, secure any articles of equipment or clothing that might interfere with your actions or inadvertently initiate a mine. Pay particular attention to straps or hanging articles that can either swing out or catch on items. Prepare your clearance resources and don any protective clothing that you may have (ballistic goggles, helmet, flak vest). Be careful when gathering resources such as trip wire feelers so that you do not expose yourself to additional hazards in the process.

c. **Execute the personal self-extraction drills of LOOK—FEEL—PROD**. Look for any loose or hidden tripwires. Use a trip wire feeler (e.g. a collapsible pointer or a long twig) to detect tripwires that are not visible. Look for any visible mines or mine fuses. Feel the earth lightly with your fingers for shapes irregular in nature. Prod gently at a 30-degree angle (from the horizontal). Aim to achieve a 10 cm penetration at a 2 cm spacing with a sharp object (bayonet, knife or stick) in the following manner:

(1) Clear an area in which you can safely rotate and/or kneel and in which you can temporarily store equipment.

(2) Clear a 1 m wide path in the intended direction of travel until it is possible to adopt the prone position (the prone position lowers your silhouette and minimizes exposure to fragments in the event an UXO detonates).

(3) Adopt the prone position and continue clearing and marking (use foot powder, sticks or any other available material) a 1 m wide lane. Clearly mark both sides of the lane. Keep your legs crossed to prevent movement outside the cleared lane.

(4) If feeling or prodding yields a possible mine then mark the location and by-pass by backing up 1 m and going around the suspected area–keeping a 1 m distance. In the case of trip wires mark and go over or under the hazard. Mark all known or suspected hazards. Marking of safe and hazard areas is key for those following you, in support of pending rescue attempts, and for yourself if for unanticipated reasons (i.e. an emerging tactical threat) you must reverse your direction. Never try to disarm a mine, booby-trap or cut a trip wire.

(5) Continue until you reach a known safe area. Be careful if you stand at any time during this process: trip wires may be located at various heights.

7. **Emergency Casualty Extraction Drills**. This requires the employment of the same drills as for emergency dismounted self-extraction drills with the following exceptions:

a. Dealing with the casualty is key, not only for the purposes of reassuring the casualty, but also in preventing the casualty from taking actions (i.e. moving) which are a threat to themselves, others, and their would-be rescuers.

b. Planning the route must now include how to reach the casualty and consider how the casualty may eventually be extracted. This may include the eventual requirement for the creation of larger safe areas under some circumstances. This may require orchestrating a group effort to get to the casualty and opening a lane.

c. When a casualty is reached, a 1 m space must be cleared around the casualty prior to rendering first aid (less what actions can be done without additional risk). Before moving, lifting, or rolling the casualty, check underneath the individual with your hand for any possible mines then, when moving the casualty, roll the casualty toward you ensuring he is between you and anything that may have been under him.

d. Render first aid, then, if necessary and using the most appropriate means, extract the casualty to further medical assistance. Ensure you have cleared for trip wires to standing height before any personnel walking through the cleared lane. Minimize the number of personnel exposed to hazards.

8. **Emergency Extraction Drills from a Vehicle**. This requires the same drills for emergency self-extraction. The vehicle is abandoned and only the personnel extracted. Care

will be taken to ensure exiting the vehicle is done without exposure to hazards (i.e. do not fully lower the ramp on an armoured vehicle).

9. **Emergency Drills**. When the tactical situation restricts time, to the point where it is impossible to follow the drills as stated above, the following are a list of options, that **are of significantly increased risk in employment**, but may be useful:

a. **Mounted**. Attempt to back out on the tracks on which you entered the hazard area or if distances are excessive clear a turning area and drive out on the existing tracks. Provide guidance to the driver, where possible, when backing up.

b. **Dismounted**.

(1) Clear only your intended footfall rather than a 1 m lane;

(2) Attempt to follow vehicle tracks or footprints where obvious; and

(3) Attempt to move from apparent safe area to apparent safe area (e.g. large rocks or visible bedrock).

CHAPTER 7
DEMOLITION SAFETY DISTANCES

1. Safety distances between personnel during clearance operations are as prescribed by each of the clearance methods. They can be modified with the wearing and use of protective equipment.

2. *Positive safety distances* are to be used for the destruction of explosive ordnance; however, there may be a tactical necessity to decrease the safety distances. If this is the case, several steps must be taken:

a. Authority must be requested and obtained from the appropriate level[33] able to grant such authority.

b. Safety distances will only be decreased by as much as is required and all necessary safety precautions must be taken to mitigate risk (such as taking cover from blast, debris and fragments).

c. The bare minimum safety distances are known as "operational safety distances,"(see below) but personnel still require appropriate protection from fragments and debris. These distances are used by exception.

d. All personnel including civilians will be removed from within any decreased safety distance. Decreased safety distances apply to personnel performing the task and all others must be moved outside the prescribed positive safety distance. If moving personnel and civilians beyond the positive safety distance is not feasible, then risk to these individuals must be mitigated (e.g. all civilians remain indoors away from windows and protected from the blast effects).

e. Mitigating measures such as protective works should not be overlooked when explosive ordinance must be destroyed in situ; particularly when personnel cannot effectively be moved beyond the positive safety distance, and there is a high risk of collateral damage (e.g. infrastructure).

3. Pickets and traffic control must be established at all critical locations and warning of a blast must be passed across the radio network.

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[33] "Appropriate level" must be defined prior to mission deployment by J staff.

OPERATIONAL SAFETY DISTANCES

WARNING: OPERATIONAL DEMOLITIONS USE ONLY (DO NOT EXTRAPOLATE)

Serial	Weight of Explosive	Injury from Blast (Note 1, 3 and 4)				Damage to Property (Note 1, 3 and 4)			
		Distance at which men are safe, provided they have adequate protection (i.e., inside a trench or AFV) from fragments and debris	Distance up to which men suffer acute aural discomfort and possibly some ear damage	Distance up to which there is likelihood of ear injury and possibility of more serious injury	Distance up to which men may sustain serious but probably not fatal injury and there is danger of fatalities by blast pressure or sudden displacement	Average distance up to which houses are badly damaged and require demolition	Average distance up to which houses are rendered un-habitable. Extensive repairs necessary	Average distance up to which minor house damage occurs	Average distance up to which 50% of glass is broken (Note 2)
	(kg)	(m)	(m)	(m)	(m)	(m)	(m)	(m)	(m)
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
1	05	20	15	10	05	05	05	10	25
2	10	25	15	10	05	10	10	15	35
3	20	30	20	10	10	10	10	20	45
4	30	35	20	15	10	10	15	25	55
5	40	40	25	15	10	15	15	30	60
6	50	45	25	15	10	15	20	35	65
7	60	45	25	15	10	15	20	40	90
8	70	50	30	15	10	15	20	40	100
9	80	50	30	20	10	15	25	45	110
10	90	50	30	20	10	20	25	50	115
11	100	55	30	20	15	20	25	50	125
12	150	60	35	20	15	20	35	65	140
13	200	70	40	25	15	25	35	75	185
14	300	75	45	25	20	30	45	95	235
15	400	85	50	30	20	35	55	115	280
16	500	85	55	30	20	35	60	130	320
17	600	95	55	30	25	40	65	145	360
18	700	100	60	30	25	45	70	160	395
19	800	105	60	35	25	45	75	170	425
20	900	110	65	35	25	50	80	185	460
21	1,000	110	65	35	30	50	85	195	485
22	1,500	130	75	40	30	60	105	250	620
23	2,000	140	80	45	35	70	125	300	740
24	2,500	150	85	50	40	75	140	340	845
25	5,000	190	110	60	50	105	200	350	860

NOTES

1. Distances have been rounded off to the next highest 5 ms.
2. 10% of glass is broken at twice these distances, and usual limit of glass breakage is three times these distances.
3. These distances are for blast effect only. Protection must be sought from flying debris.
4. Figures are for service plastic explosives.

WARNING: OPERATIONAL DEMOLITIONS USE ONLY (DO NOT EXTRAPOLATE)

MINIMUM SAFETY DISTANCES FOR DISPOSAL OF DUD LAND ELEMENT AMMUNITION

Taken From: C-09-008-002/FP-000 "Destruction of Dud and Misfire Ammunition on CF Ranges and Training Areas"

NATURE	DISTANCE IN METRES
66 mm HEAT	250
84 mm HEAT, RAP	270
106 mm HEAT and HEP	1000
40 mm HE	165
60 mm HE	300
35 mm HEI and AHEAD	500
81 mm HE	550
81 mm WP and Illum	250
105 mm How, HE and HESH	900
155 mm HE	1100
76 mm HE and HESH	900
105 mm Tank, HESH	1000
Grenade M67	300
Guided Missile TOW 2 and 2A	750
Guided Missile TOW 2B	600
Guided Missile Javelin	500
Guided Missile ADATS	350 (Frag Danger)
Guided Missile ERYX	250

NOTES

1. If appropriate shelter is available, above safety distances do not apply.
2. Guided missiles shall only be destroyed by qualified EOD specialists.
3. Safety distances for the disposal of misfired ammunition shall be the same as those for dud ammunition.

GUIDANCE

4. Explosives can propel lethal fragments of a dud to great distances and at high velocities. How far explosive-propelled fragments travel in the air depends primarily on the charge-to-case ratio and physical properties of the cased material, the nature and quantity of the explosive, and the attitude of the dud. The missile hazard from steel cutting charges may extend a greater

distance under normal conditions than that from cratering, quarrying, or surface charges of base explosives. It must also be stressed that high elevation, desert conditions and above average winds will adversely affect safety distances and must be a considered prior to commencing destruction operations.

5. With regard to the above paragraph it can be appreciated that safety distances involved in the destruction of dud and misfired ammunition vary according to the nature of the ammunition involved.

6. Safety distances for the destruction of dud and misfired land element ammunition are detailed in B-GL-381-001/TS -OO1 - Training Safety and are described as “positive safety distances” on the template for each type of land element ammunition used in the Canadian Forces.

GLOSSARY

NOTE

Herein are the accepted definitions of relevant terms used in support of mobility support—countermine—route and area clearance. These terms were current at the time of publication. Readers are to refer to the appropriate references if there is doubt with currency.

AAP 6—NATO Glossary of Terms and Definitions

AAP 19(D)—*NATOP Combat Engineer Glossary*

AAP 41—*NATO Glossary of EOD Terms and Definitions*

1. **Actuate**. To operate a firing mechanism by an influence or a series of influences. (AAP-19 (D)

2. **Airfield (Aerodrome) EOD**. A set of specialist EOD techniques developed for rapid clearance of aircraft operating areas to enable air operations to recommence as soon as possible following enemy attack. (A-AE-025-0/FP-1)

3. **Amended Protocol II—Conventional Weapons Convention**. Amended Protocol II to the Convention on Prohibitions or Restrictions on the Use of Certain Conventional Weapons which May be Deemed to be Excessively Injurious or to have Indiscriminate Effects, prohibits the use of all undetectable anti-personnel mines and regulates the use of wider categories of mines, booby-traps and other devices.

NOTE: For the purposes of the IMAS, Article 5 lays down requirements for the marking and monitoring of mined areas. The technical Annex provides guidelines on, *inter-alias*, the recording of information and international signs for minefields and mined areas. (A-AE-025-0/FP-1)

4. **Ammunition**. See munition

5. **Anti-disturbance device**. An internal or external device on a mine arranged to actuate the mine in case of outside disturbance. See also anti-countermining device; antihandling device. (AAP-19 (D)

6. **Anti-handling device**. A device intended to protect a mine and which is part of, linked to, attached to or placed under the mine and which activates the mine when an attempt is made to tamper with or otherwise intentionally disturb the mine. (AAP-6)

7. **Anti-helicopter mine**. A mine designed to produce a destructive effect on low-flying helicopters. (AAP-19 (D)

8. **Anti-personnel mine**: In land mine warfare, a mine designed to be exploded by the presence, proximity or contact of a person and that will incapacitate, wound or kill one or more persons.

NOTE: Mines designed to be detonated by the presence, proximity or contact of a vehicle, not to a person, and that are equipped with antihandling devices, are not considered anti-personnel land mines as a result of being so equipped. *See also mine* (AAP-19(D)

9. **Anti-tank mine**. A mine designed to immobilize or destroy a tank. (AAP-6)**Area clearance**. In land operations, the detection and if found, the identification, marking and neutralization, destruction or removal of mines or other explosive ordnance, improvised explosive devices and booby traps in a defined area to allow a military operation to continue with reduced risk. Related terms: explosive ordnance; improvised explosive device; proofing. (AAP-6)

NOTE: Area clearance is normally conducted by military units.

11. **Area reduction**. The process through which the initial area indicated as contaminated (during a general survey) is reduced to a smaller area. (AAP-41)

NOTE: Area reduction may involve some limited clearance, such as the opening of access routes and the destruction of mines and unexploded explosive ordnance which represent an immediate and unacceptable risk, but it will mainly be as a consequence of collecting more reliable information on the extent of the hazardous area. Usually it will be appropriate to mark the remaining hazardous area(s) with permanent or temporary marking systems. (AAP-41).

12. **attle area clearance**. The clearance of land over which battles have been fought. Also called battlefield area clearance. (AAP-41)

13. **Battlefield area clearance**. See battle area clearance. (AAP-41)

14. **Battlefield Monitions Disposal (BMD)**. Not formally recognized. See Conventional Munitions Disposal.

15. **Blow in situ**. See destroy in situ. (AAP-41)

16. **Booby trap**. A device designed, constructed or adapted to kill or injure, which functions when a person disturbs or approaches an apparently harmless object or performs an apparently safe act. Related term: proofing. (AAP-6)

17. **Booster**:

    a. An auxiliary or initial propulsion system which travels with a missile or aircraft and which may or may not separate from the parent craft when its impulse has been delivered. A booster system may contain, or consist of, one or more units. (AAP-6)

b. A high-explosive element sufficiently sensitive so as to be actuated by small explosive elements in a fuze or primer and powerful enough to cause detonation of the main explosive filling. Related term: charge. (AAP-6)

18. **Breaching**. A breach is a synchronized combined arms operation, in direct support of a manoeuvre commander, conducted to create a lane through an obstacle under non-permissive tactical conditions. A passage is formed through an obstacle to advance forces to the far side. A breach may be hasty or deliberate, and in the case of a composite obstacle several engineer capabilities may be required.

19. **Charge**:

a. The amount of propellant required for a fixed, semi-fixed, or separate loading projectile, round or shell. It may also refer to the quantity of explosive filling contained in a bomb, mine or the like. Related terms: cratering charge; cutting charge; inert filling; shaped charge. (AAP-6).

b. In combat engineering, a quantity of explosive, prepared for demolition purposes. Related terms: booster 2; primed charge; priming charge. (AAP-6)

20. **Clearance**. Clearance describes the detection and removal of mines and other UXO threats in a defined area or along a route to allow a military operation to continue with reduced risk. Clearance operations are conducted in a tactically permissive environment, are normally not time restricted, and are inherently deliberate thus permitting the employment of a full range of countermine systems. Clearance operations support a tactical commander but normally clearing is just an engineer task (with administrative support).

21. **Cleared Area (cleared land)**. An area that has been physically and systematically processed by a demining organization to ensure the removal and/or destruction of all mine and UXO hazards to a specified depth. (AAP-41)

NOTE: IMAS 09.10 specifies the quality system (i.e. the organization, procedures and responsibilities) necessary to determine that land has been cleared by the demining organization in accordance with its contractual obligations.

NOTE: Cleared areas may include land cleared during the **technical survey** process, including **boundary lanes** and **cleared lanes**. Areas cleared for worksite administrative purposes, such as car parks, storage locations, and first aid posts need not be officially documented as cleared, unless national procedures so require.

22. **Cleared land (See cleared area)**. (AAP-41)

23. **Cluster**. Group of bombs released together. A cluster usually consists of fragmentation or incendiary bombs. (AAP-6)

24. **Cluster bomb unit**. An expendable aircraft store composed of a dispenser and sub-munitions. See also dispenser. (AAP-6)

25. **Command-detonated munition**. A munition that is deliberately and remotely detonated by the person in control of that munition. (AAP-6)

26. **Controls**. Actions taken to mitigate risks normally by reducing their probability or severity. (B-GJ-005-502/FP-000)

27. **Conventional Munitions Disposal**. CMD involves the detection, identification, field evaluation, rendering safe and disposal of munitions. In general, this includes a complete device charged with explosives, propellants, pyrotechnics, initiating composition, or Chemical, Biological, Radiological or Nuclear (CBRN) material for use in military operations, including demolitions. Additionally, in Canada, the term includes the disposal of Canadian and foreign munitions and all explosives and detonators, whether from military or civilian sources. CMD does not include the disposal of Improvised Explosive Devices (IEDs). (B-GJ-005-316/FP-000)

28. **Countermine operation**. In land mine warfare, an operation to reduce or eliminate the effects of mines or minefields. (AAP-6)

29. **Cratering charge**. A charge placed at an adequate depth to produce a crater. See also charge. (AAP-6)

30. **Cutting charge**. A charge which produces a cutting effect in line with its plane of symmetry. See also charge. (AAP-6)

31. **Deflagration**. A chemical reaction proceeding at subsonic velocity along the surface of, and/or through an explosive, producing hot gases at high pressures. A deflagration under confinement increases the pressure, the rate of reaction and the temperature which may cause transition into a detonation. See also detonation. (Ammunition Vocabulary). (AAP-41)

32. **Deliberate breaching**. The creation of a lane through a minefield or a clear route through a barrier or fortification, which is systematically planned and carried out. Related terms: Minefield Breaching and Hasty Breaching. (AAP-6)

33. **Demine**. An employed person, including a public servant, qualified and employed to undertake demining activities or work on a demining worksite. (AAP-41)

34. **Demining**. The removal of all unexploded mines, explosive ordnance, improvised explosive devices and booby traps from a defined area to make the area safe for civilians. Related terms: countermine operation; improvised explosive device; mine clearance; mine. (AAP-6)

NOTE: Demining is not normally conducted by military units.

35. **Demining Organisation**. Refers to any organisation (government, NGO, military or commercial entity) responsible for implementing demining projects or tasks. The demining organisation may be a prime contractor, consultant or agent. (AAP-41)

36. **Demining organization accreditation**. The procedure by which a demining organisation is formally recognised as competent and able to plan and manage mine action activities safely, effectively and efficiently. (AAP-41).

NOTE: For most mine action programmes, the national mine action authority will be the body which provides accreditation. International organisations such as the United Nations or regional bodies may also introduce accreditation schemes.

37. **Demolition**. The destruction of structures, facilities or materiel by use of fire, water, explosives, mechanical, or other means. See also uncharged demolition target. (AAP-6)

38. **Destroy in situ**. To destroy an item of ordnance by explosives without moving the item from where it was found, normally by placing an explosive charge alongside. Also called blow in situ. See also destruction in situ. (AAP-41)

39. **Detection**. The discovery by any means of the presence of a person, object or phenomenon of potential military significance. Related terms: identification; identification, friend or foe (IFF); recognition. (AAP-6)

40. **Detection**. In the context of demining, the term refers to the discovery by any means of the presence of mines or unexploded ordnance. (AAP-41)

41. **Detonation**. A violent and complete chemical reaction proceeding at supersonic velocity within an explosive, generating gases at extremely high pressure and temperature. The sudden and enormous pressure of hot gases violently disrupts the surroundings, and a shock wave is propagated at supersonic velocity. (Ammunition Vocabulary) (AAP-41)

42. **Detonating cord**. A waterproof flexible fabric tube containing a high explosive designed to transmit the detonation wave. (AAP-6)

43. **Detonator**. A device containing a sensitive explosive intended to produce a detonation wave. (AAP-6)

44. **Disposal site**. An area authorised for the destruction of ammunition and explosives by detonation and burning. (AAP-41)

45. **Electronic Countermeasures**. That division of electronic warfare involving actions taken to prevent or reduce an enemy's effective use of the electromagnetic spectrum through the use of electromagnetic energy. There are three subdivisions of electronic countermeasures: electronic jamming, electronic deception and electronic neutralisation. (AAP-6)

46. **Exploder**. A device designed to generate an electric current in a firing circuit after deliberate action by the user in order to initiate an explosive charge or charges. (AAP-6)

47. **Explosive**. A substance or mixture of substances which, under external influences, is capable of rapidly releasing energy in the form of gases and heat. (AAP-6)

48. **Explosive Materials**. Components or ancillary items used by demining organisations which contain some explosives, or behave in an explosive manner, such as detonators, fuses and primers. (AAP-41)

49. **Explosive Ordnance (EO)**. All munitions containing explosives, nuclear fission or fusion materials and biological and chemical agents. This includes bombs and warheads; guided and ballistic missiles; artillery, mortar, rocket and small arms ammunition; all mines, torpedoes and depth charges, demolition charges; pyrotechnics; clusters and dispensers; cartridge and propellant actuated devices; electro-explosive devices; clandestine and improvised explosive devices; and all similar or related items or components explosive in nature. (AAP-6)

50. **Explosive ordnance clearance**. Tasks (actions) to reduce or eliminate the explosive ordnance (EO) hazards from a defined area. (AAP-41)

51. **Explosive Ordnance Disposal (EOD)**. The detection, identification, on-site evaluation, rendering safe, recovery and final disposal of unexploded explosive ordnance. It may also include explosive ordnance which has become hazardous by damage or deterioration (AAP-6).

52. **Explosive Ordnance Disposal Procedures**. Those particular courses or modes of action taken by explosive ordnance disposal personnel for access to, diagnosis, rendering safe, recovery and final disposal of explosive ordnance or any hazardous material associated with an explosive ordnance disposal incident. EOD procedures may include the following: (AAP-6)

a. **Access Procedures**. Those actions taken to locate exactly and to gain access to unexploded explosive ordnance.

b. **Diagnostic procedures**. Those actions taken to identify and evaluate unexploded explosive ordnance

c. **Recovery procedures**. Those actions taken to recover unexploded explosive ordnance.

d. **Render-safe procedures**. The portion of the explosive ordnance disposal procedures involving the application of special explosive ordnance disposal methods and tools to provide for the interruption of functions or separation of essential components of unexploded explosive ordnance to prevent an unacceptable detonation.

e. **Final disposal procedures**. The final disposal of explosive ordnance which may include demolition or burning in place, removal to a disposal area or other appropriate means.

53. **Explosive Ordnance Reconnaissance (EOR)**. Reconnaissance involving the investigation, detection, location, marking, initial identification and reporting of suspected unexploded explosive ordnance, by explosive ordnance reconnaissance agents, in order to determine further action. (AAP-6).

54. **Explosive train**. A succession of initiating and igniting elements arranged to cause a charge to function. (AAP-6)

55. **Firing**. Actuation of the firing system. See also firing system. (AAP-6)

56. **Firing circuit**. In land operations, an electrical circuit and/or pyrotechnic loop designed to detonate connected charges from a firing point. (AAP-6)

57. **Firing mechanism**. See firing circuit. (AAP-6)

58. **Firing point**. That point in the firing circuit where the device employed to initiate the detonation of the charges is located. (AAP-6)

59. **Firing system**. System designed to actuate an explosive or electro-explosive or other train in order to cause the explosion of a charge. See also firing. (AAP-6)

60. **Fuze**. A device which initiates an explosive train. Related terms: base fuze; boresafe fuze; impact action fuze; proximity fuze; self-destroying fuze; shuttered fuze; time fuze. (AAP-6).

NOTE: Fuzes come in a variety of types including mechanical, chemical, friction and electrical.

61. **Hasty breaching**. The rapid creation of a route through a minefield, barrier or fortification by any expedient method. Related terms: Minefield Breaching and Deliberate Breaching. (AAP-6)

62. **Hazard**. Potential source of harm [ISO Guide 51:1999(E)] (AAP-41)

63. **Hazard area**. An area which is not in productive use due to the presumed or actual presence of mines, unexploded explosive ordnance or other explosive devices. Also called hazardous area; contaminated area. (AAP-41)

64. **Hazard marker**. Object, other than mine signs, used to identify the limits of a mine and unexploded explosive ordnance hazard area. This marker shall conform to the specification established by the national mine action authority. (AAP-41)

65. **Hazard marking system**. A combination of measures designed to provide the public with warning and protection from mine and unexploded explosive ordnance hazards. The system may include the use of signs or markers, or the erection of physical barriers. (AAP-41)

66. **Hollow charge**. A shaped charge producing a deep cylindrical hole of relatively small diameter in the direction of its axis of rotation (AAP-6)

67. **Humanitarian demining**. Activities which lead to the removal of mine and unexploded explosive ordnance hazards, including technical survey, mapping, clearance, marking, post-clearance documentation and the handover of cleared land. It may be carried out by different types of organizations, such as non-governmental organizations, commercial companies, national mine action teams or military units. (AAP-41)

NOTE: In IMAS standards and guides, mine and unexploded explosive ordnance clearance is considered to be just one part of the humanitarian demining process.

NOTE: In IMAS standards and guides, humanitarian demining is considered to be one component of mine action.

68. **Ignite**. A device designed to produce a flame or a flash which is used to initiate an explosive train. (AAP-6)

69. **Improvised Explosive Device (IED)**. A devise placed or fabricated in an improvised manner incorporating destructive, lethal, noxious, pyrotechnic or incendiary chemicals and designed to destroy, incapacitate, harass or distract. It may incorporate military stores, but is normally devised from non-military components. (AAP-6)

70. **Information Management System for Mine Action (IMSMA)**. The United Nation's preferred information system for the management of critical data in United Nations-supported field programmes and at the United Nations headquarters in New York. (AAP-41)

NOTE: IMSMA consists, essentially, of two modules: The Field Module (FM) and Global Module (GM). The FM provides for data collection, information analysis and project management. It is used by the staffs of mine action centres at national and regional level, and by the implementors of mine action projects—such as demining organisations. The GM refines and collates data from IMSMA FMs (and other field-based information systems) and provides the UN and others with accurate, aggregated information for the strategic management of mine action.

71. **Initiation**. The action of a device used as the first element of an explosive train which, upon receipt of the proper impulse, causes the detonation or burning of an explosive item. (AAP-6)

NOTE: The revised mine action standards have been developed to be compatible with ISO standards and guides. Adopting the ISO format and language provides some significant advantages including consistency of layout, use of internationally recognised terminology, and a greater acceptance by international, national and regional organisations who are accustomed to the ISO series of standards and guides.

72. **Joint Explosive Ordnance Disposal Cell (JEODC)**. The cell which, on deployed operations, provides advice and support to J3 (and J2) staff concerning EOD in a joint environment. (A-AE-025-0/FP-1)

73. **Land Service Ammunition**. Munitions typically used in the conduct of operations on land. (A-AE-025-0/FP-1)

74. **Magazine**. In the context of humanitarian demining, any building, structure or container approved for the storage of explosive materials. (AAP-41)

75. **Marking**. Implementation of a measure or combination of measures to identify the position of a hazard or the boundary of a hazardous area. This may include the use of signs, paint marks, or the erection of physical barriers. (AAP-41)

76. **Marking system**. An agreed convention for the marking of hazards or hazardous areas. (AAP-41)

77. **Mine**:

a. In land mine warfare, an explosive munition designed to be placed under, on or near the ground or other surface area and to be actuated by the presence, proximity or contact of a person, land vehicle, aircraft or boat, including landing craft. Related terms: acoustic circuit; acoustic mine; antitank mine; horizontal action mine; practice mine; pressure mine; scatterable mine. (AAP–6)

b. In naval mine warfare, an explosive device laid in the water with the intention of damaging or sinking ships or of deterring shipping from entering an area. The term does not include devices attached to the bottom of ships or to harbour installations by personnel operating underwater, nor does it include devices which explode immediately on expiration of a predetermined time after laying. (AAP-6)

78. **Mine Action**. Activities which aim to reduce the social, economic and environmental impact of landmines and Unexploded Explosive Ordnance.

NOTE: Mine action is not just about demining, it is also about people and societies, and how they are affected by landmine contamination. The objective of mine action is to reduce the risk from landmines to a level where people can live safely; in which economic, social and health development can occur free from the constraints imposed by landmine contamination, and in which the victims' needs are able be addressed. Mine action comprises five complementary groups of activities. (AAP-41)

a. Mine and Unexploded Explosive Ordnance awareness and risk reduction education.

b. Humanitarian demining, i.e. mine and Unexploded Explosive Ordnance survey, mapping, marking and (if necessary) clearance.

c. Victim assistance, including rehabilitation and reintegration.

d. Stockpile destruction.

e. Advocacy against the use of anti-personnel mines.

NOTE: A number of other enabling activities are required to support these five components of mine action, including: assessment and planning, the mobilisation and prioritisation of resources, information management, human skills development and management training, quality management and the application of effective, appropriate and safe equipment. (AAP-41)

79. **Mine action centre**. An organisation that carries out mine awareness training, conducts reconnaissance of mined areas, collection and centralisation of mine data and coordinates local (mine action) plans with the activities of external agencies, of (mine action) non-governmental organizations and of local deminers. [UN Terminology Bulletin No. 349] (AAP-41)

NOTE: For national mine action programmes, the MAC usually acts as the operational office of the national mine action authority.

80. **Mine Ban Treaty**. Treaty which provides for a complete ban on the use, stockpiling, production and transfer of anti-personnel mines and their destruction. (AAP-41)

NOTE: For the purposes of IMAS documents, Article 5 of the Mine Ban Treaty (MBT) (Ottawa Convention) lays down requirements for the destruction of APMs in mined areas. Article 6 details transparency measures required under the Treaty including on the location of mined or suspected mined areas and measures taken to warn the local population.

81. **Mine clearance**. In countermine operations, action to restore the freedom of movement within a mined area or along a mined route. Also called minefield clearance. (AAP-19(D) and AAP-41)

82. **Mine detection**. Activities to discover the presence of and to locate individual mines. This may include the identification of their type and status. (AAP-19(D)

83. **Mine disposal**. The process of either rendering safe, neutralizing, recovering, removing or destroying mines. See explosive ordnance disposal. (AAP-19(D)

84. **Mine sign**. A sign which, when placed as part of a marking system, is designed to provide warning to the public of the presence of mines. (AAP-41)

85. **Mine warfare**. The strategic and tactical use of mines and their counter-measures. Also called land mine warfare. (AAP-6)

86. **Mined area**. An area which is dangerous because of the presence or suspected presence of mines. (AAP-6)

87. **Minefield**:

a. In land mine warfare, a defined area in which mines have been emplaced. Related terms: mixed minefield; nuisance minefield; phoney minefield; protective minefield; tactical minefield. (AAP-19(D) and AAP-6)

b. In naval warfare, an area of water containing mines laid with or without a pattern. (AAP-6).

88. **Minefield record**. A complete written record of all pertinent information concerning a minefield, submitted on a standard form by the officer in charge of the laying operations. (AAP-6)

89. **Misfire**. Failure to fire or explode properly. Failure of a primer of the propelling charge of a round or projectile to function wholly or in part. (AAP-6)

90. **Munition**. A complete device charged with explosives, propellants, pyrotechnics, initiating composition, or nuclear, biological or chemical material for use in military operations, including demolitions. Certain suitably modified munitions can be used for training, ceremonial or non-operational purposes. Synonym: Ammunition (AAP-6).

91. **Ottawa Convention (Mine Ban Treaty)**. Provides for a complete ban on the use, stockpiling, production and transfer of antipersonnel mines and on their destruction. For the purposes of IMAS documents, Article 5 of the Mine Ban Treaty lays down requirements for the destruction of antipersonnel mines in mined areas. Article 6 details transparency measures required under the Treaty including on the location of mined or suspected mined areas and measures taken to warn the local population. (A-AE-025-0/FP-1)

ED NOTE: The term “minefield” includes phoney minefields.

92. **Plastic explosive**. Explosive which is malleable at normal temperatures. (AAP-6)

93. **Primed charge**. A charge ready in all aspects for ignition. See also charge. (AAP-6)

94. **Priming charge**. An initial charge which transmits the detonation wave to the whole of the charge. See also charge. (AAP-6)

95. **Probability**. The likelihood that an event will occur. (B-GJ-005-502/FP-000)

96. **Proofing**. In land operations, the process following breaching, route or area clearance to further reduce the risk from mines or other explosive ordnance, improvised explosive devices and booby traps in a defined area. Related terms: area clearance; booby trap; countermine operation; explosive ordnance; improvised explosive device; mine clearance. (AAP-6)

97. **Proven**. Not defined but usually taken to be synonymous to *Proofing*

98. **Pyrotechnics**. A mixture of chemicals which when ignited is capable of reacting exothermically to produce light, heat, smoke, sound or gas, and may also be used to introduce a delay into an explosive train because of its known burning time. The term excludes propellants and explosives. (AAP-6)

99. **Pyrotechnic delay**. A pyrotechnic device added to a firing system which transmits the ignition flame after a predetermined delay. (AAP-6)

100. **Remote control**. In barrier operations, the ability of a user to actuate a charge or change the state of a mine, from a distance. For a mine, remote control is divided into: (AAP-19D).

   a. **Remote Control Level 1**. Ability to react to a received remote control stimulus to change from standby state to armed.

b. **Remote Control Level 2**. As Level 1, and the added ability to react to a received remote control stimulus to return from armed to standby state.

c. **Remote Interrogation Capability**. The ability of a mine to respond to a remote interrogation on its state, either armed or standby. This capability may be superimposed on either Level 1 or Level 2, and may be indicated by the suffix (I).

101. **Remotely delivered mine / mine posée à distance**. A mine delivered to the target area by air assets, or by indirect fire from a distance of more than 500 ms. Note: the exact position of the mines may not be known. *Related term: scatterable mine.* (AAP-6)

102. **Render Safe Procedure**. The application of special EOD methods and tools to provide for the interruption of functions or separation of essential components to prevent an unacceptable detonation. (AAP - 41)

103. **Risk / risque**. Chance of injury or loss expressed in terms of probability and severity. (B-GJ-005-502/FP-000)

104. **Risk Decision**. The decision to accept or not accept the risk(s) associated with an action; made by the commander or individual responsible for performing that action. (B-GJ-005-502/FP-000)

105. **Route clearance / dépollution le long d'itinéraire**. In land operations, the detection and if found, the identification, marking and neutralization, destruction or removal of mines or other explosive ordnance, improvised explosive devices and booby traps threatening a defined route to allow a military operation to continue with reduced risk.

NOTE: Route clearance is normally conducted by military units. (AAP-6)

106. **Safe**. The absence of risk. Normally the term tolerable risk is more appropriate and accurate. (AAP-41)

107. **Safety and arming mechanism**. A dual function device which prevents the unintended actuation of a main charge or propulsion unit prior to arming but allows activation thereafter upon receipt of the appropriate stimuli. (AAP-6)

ED NOTE: Most mines have built in safety devices to prevent unintentional functioning of the fuze. Depending on the type of mine the safety device is usually of the safety fork and arming dial type, or a safety pin or clip. Additional safety may be provided by the removal of components such as the fuze or detonator.

108. **Safety fuze**. Pyrotechnics contained in a flexible and weatherproof sheath burning at a constant rate, used to tansmit a flame to the detonator, with a predetermined delay. (AAP-6)

109. **Self-destruction**. An automatic detonation of the explosive in a mine after a preselected period of time. (AAP-19(D)

110. **Self-neutralization**. The rendering of a mine inoperable, but not necessarily safe to handle, by means of an automatically functioning mechanism incorporated into the mine. This process may be reversible. (AAP-6)

111. **Self-deactivation**. In mine warfare, automatically rendering a mine inoperable by the exhaustion of any component that is essential to the operation of the mechanism. This action makes the mine safe to handle.

NOTE: This process may be reversible with the physical replacement of the exhausted component, such as a battery. (CEWG 2003) (AAP-19(D)

112. **Severity**. The expected consequence of an event in terms of degree of injury, property damage, or other mission-impinging factors (loss of combat power, adverse publicity, etc.) that could occur. (B-GJ-005-502/FP-000)

113. **Shaped charge**. A charge shaped so as to concentrate its explosive force in a particular direction. See also charge. (AAP-6)

114. **Sheet explosive**. Plastic explosive provided in a sheet form. (AAP-6)

115. **Submunition**. Any munition that, to perform its task, separates from a parent munition. (AAP-6)

116. **Survey marker**. A durable and long lasting marker used to assist in the management of marked and cleared land demining operations. (AAP-41)

117. **Sympathetic detonation**. Detonation of a charge by exploding another charge adjacent to it. (AAP-6)

118. **Threat**. Any real or potential condition that can cause injury, illness or death of personnel or damage to, or loss of, equipment, property or lead to mission degradation. (B-GJ-005-502/FP-000)

119. **Unexploded explosive ordnance (UXO)**. Explosive ordnance which has been primed, fused, armed or otherwise prepared for action, and which has been fired, dropped, launched, projected or placed in such a manner as to constitute a hazard to operations, installations, personnel or material and remains unexploded either by malfunction or design or for any other cause. Related term: demining. (AAP-6)

120. **Weapon of mass destruction**. A weapon that is capable of a high order of destruction and of being used in such a manner as to destroy people, infrastructure or other resources on a large scale. (AAP-6)

ABBREVIATIONS

ADR	Airfield Damage Repair
AF EOD	Airfield EOD
BG	Battle Group
AMT	Advanced Manual Techniques
AO	Area of Operations
AP II	Amended Protocol II (see Glossary)
AP	Anti-Personnel
AmmoTech	Ammunition Technician
BCMD	Biological and Chemical Munitions Disposal
BDA	Battle Damage Assessment
BG	Battle Group
C^2	Command and Control
CBRN	Chemical, Biological, Radiological and Nuclear
CCW	Convention on Conventional Weapons
CJEODDC	Combined Joint EOD Cell
CJTF	Canadian Joint Task Force
CM	Conventional Munitions
CMD	Conventional Munitions Disposal
CP	Clearance Party
CS	Clearance Section
CS Comd	Clearance Section Commander
CT	Clearance Team
DCDS	Deputy Chief of the Defence Staff
DFAIT	Department of Foreign Affairs and International Trade
DGT	Designated Ground Trace
DWME	Disposal of Weapons of Mass Effect
ECM	Electronic Countermeasures
EED	Explosives Detection Dog
EO	Explosive Ordnance
EOC	Explosive Ordnance Clearance

EOD	Explosive Ordnance Disposal
EOR	Explosive Ordnance Reconnaissance
ERS	Engineer Response Section
GST	Geomatics Support Team
HMA	Humanitarian Mine Action
HN	Host Nation
HRS	High Risk Search
IED	Improvised Explosive Device
IEDD	Improvised Explosive Device Disposal
ILDS	Improved Landmine Detection System
IMSMA	Information Management System for Mine Action
ISTAR	Intelligence, Surveillance, Target Acquisition and Reconnaissance
JEOD	Joint EOD
LAV	Light Armoured Vehicle
LOC	Line of Communication
LOS	Line of Sight
MAT	Mine and UXO Awareness Training
MCM	Mine Counter Measures
MIE	Mine Information and Exploitation
MNEODCC	Multinational EOD Coordination Cell
MPV	Mine Protected Vehicle
MRE	Mine and UXO Risk Education
NATO	North Atlantic Treaty Organization
NDMIC	National Defence Mine Countermeasures Information Centre
NGO	Non-Government Organisation
OGD	Other Government Departments
OPCOM	Operational Command
OPCON	Operational Control
QRF	Quick Reaction Force
RDD	Radiological Dispersal Devices
ROE	Rules of Engagement

RP	Road Party
RSP	Render Safe Procedure
SAID	Stop, Assess, Inform, Drills
SIBCRA	Sampling and Identification of Biological, Chemical and Radiological Agents
SME	Subject Matter Experts
SOP	Standard Operating Procedure
SP	Side Party
SpP	Support Party
STANAG	Standard NATO Agreement
TACON	Tactical Control
TF	Task Force
TFC	Task Force Commander
TFHQ	Task Force Headquarters
TTPs	Tactics, Techniques and Procedures
UN	United Nations
UNMACC	UN Mines Action Coordinating Committee
UXO	Unexploded Explosive Ordnance