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TACTICAL DOCTRINE FOR ENGINEERING

Edition B, Version 1

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NORTH ATLANTIC TREATY ORGANIZATION

ALLIED TACTICAL PUBLICATION

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NORTH ATLANTIC TREATY ORGANIZATION (NATO)

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NATO LETTER OF PROMULGATION

10 July 2023

1. The enclosed Allied Tactical Publication ATP-3.12.1, Edition B, Version 1, TACTICAL DOCTRINE FOR ENGINEERING, which has been approved by the nations in the MILITARY COMMITTEE LAND STANDARDIZATION BOARD, is promulgated herewith. The agreement of nations to use this publication is recorded in STANAG 2394.

2. ATP-3.12.1, Edition B, Version 1, is effective upon receipt and supersedes ATP-3.12.1 , Edition A, Version 1, which shall be destroyed in accordance with the local procedure for the destruction of documents.

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4. This publication shall be handled in accordance with C-M(2002)60.

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Lieutenant General, GRC (A)
Director, NATO Standardization Office

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RECORD OF RESERVATIONS

CHAPTER	RECORD OF RESERVATION BY NATIONS

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RECORD OF SPECIFIC RESERVATIONS

[nation]	[detail of reservation]
BEL	According to BEL legislation, BEL military personnel are not allowed to use, store, deploy any type of anti-personnel mines. BEL troops will not take over obstacles reinforced by anti-personnel mines.
CZE	a) In the Czech Armed Forces the Geospatial engineering support (mentioned in para 7.1. subsection c., para 7.3. subsection 2.b.(8), para 7.4.), Environmental Protection (mentioned in para 6.3. and para 7.5. subsection 7.d.), Power Generation (mentioned in para 6.2.3.), Fire Protection (mentioned in para 6.2.4.), Explosive Safety and Munitions Risk Management (mentioned in para 5.7. subsection 2.) are not engineer support tasks. The Czech Armed Forces will not implement these paragraphs. b) The Czech Armed Forces will not implement para 3.3. subsection 5.a., para 3.8., para 6.2.6., para 6.5., para 8.5.5. Corps of engineers do not have the capabilities, organisation and equipment to fulfil these tasks. c) The Czech Armed Forces will defer implementation of para 3.7., para 5.2. subsection 3.e., para 5.9., para 6.2.1.,para 6.2.2., para 6.2.5. subsection 2., para 8.4. subsection 7.a.(1), para 8.6 subsection 4.d.(1) until equipment is procured and required capability is achieved to fulfill these tasks.
ESP	1. Paragraphs 1.2.1 and 6.3 : « Environmental Protection is not a Spanish Engineer units´ responsibility. This task will be carried out by appropriate structures ». 2. Paragraph 1.2.1 : « Spanish Engineer units are only responsible for the management of Deployed Force Infraestructure ». 3. Paragraph 3.8.2 : « Spain will carry out the planning, command and control of amphibious operations in accordance with ATP-08 Vol.I ». 4. Paragraph 5.7.2 : « Spanish Engineer units are not responsible for handling, transport and storage of explosives and ammunition in a logistical support context ». 5. Paragraph 5.8 : « Spain reserves the right to have the « Military Search » neither under the coordination of Engineers nor carried out exclusively by Engineers ». 6. Paragraph 5.9 : « Water supply is a task included in general Engineer support, within the framework of the contribution of Engineers to logistical support ». 7. Paragraph 6.2.5.2 : « Engineer support to air bases and facilities in Spanish territory is the responsibility of eachService ». 8.Paragraph 7.4 : « Geospatial Engineering is not a Spanish Engineer units´responsibility. This task will be carried out by appropiate structures ».

ITA	- Italy, in accordance with National law, will not use any device which may be classified as antipersonnel mine according to the following definition “An antipersonnel mine is defined as a device which may be placed above, under, inside or next to any surface and adjusted or adapted with specific measures in order to explode, cause an explosion or realise incapacitating substances as the result of the presence, the proximity or contact by a person”. Moreover, considering military activities in a multinational scenario, cooperation of the Italian Armed Forces also with no signatory Nations of the Ottawa Convention is permitted, with the provision that activities conducted by Italian servicemen be compatible to the Ottawa regulations. Italy, in accordance with National regulation, considers: • Environmental protection (1.2 para 1): an all Commanders’ responsibility, led by the Logistic Branch. The support of Military Engineers encompasses all the necessary technical activities, assessed by the logistic and by the EP advisors, aimed to prevent or mitigate adverse environmental impacts of military operations; • Fire protection (6.2.4): an all Commander’s responsibility. The support of Military Engineers includes all the necessary technical activities to implement fire prevention and suppression systems within infrastructures; • Geospatial Engineering (7.4): as an inherent task for the Italian Military Geographic Institute. The Military Engineers provide support with the collection of engineer-of-interest information related to the terrain executed by engineer reconnaissance units.
LVA	LVA MILENG is not responsible and not planning to develop Geomatics, Support to CBRN, Environmental protection, Water supply and Fire Protection tasks. For those tasks are responsible other entities and units (J-2, CBRN COY, State Centre for Defence Military Sites and Procurement)
SVK	Although, SVK engineer units provide support to whole spectrum of the Engineering Roles, there are several restrictions as follows: • The Slovak republic as a landlocked country - reserves the right not to deliver engineering support to Amphibious operations and thus not build neither Maritime nor Naval Engineering Support Capabilities. • SVK Engineers perform only limited support to Environmental Protection, Fire Protection, Power Generation, Geospatial Engineering, Improvement and Maintenance of Railways and Railways related infrastructure.

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Preface

Scope

1. Allied Tactical Publication (ATP)-3.12.1(B), *Tactical Doctrine for Engineering*, describes how engineering activities are planned and conducted during operations.

2. This edition of ATP 3.12.1 is a significant change to previous editions in that it reflects the Military Committee (MC) Policy on Military Engineering MC0560/2 and AJP-3.12(C) *Allied Joint Doctrine for Military Engineering,* which describe MILENG as a function which supports shaping of the physical operating environment and consists of a number of areas of expertise, of which engineering is the predominant area of expertise.

Purpose

3. This publication describes the roles and activities within the engineering area of expertise and the context in which they occur.

Application

4. ATP-3.12.1(B) is intended primarily for NATO commanders and staff at the tactical level. It also provides guidance for all levels of command and is instructive for coalition and NATO partners.

Structure

5. This publication consists of eight chapters. Chapter 1 describes the fundamentals of engineering, including the relationship with MILENG and the context of the operating environment. Chapter 2 details engineering command and control and planning. Chapters 3 to 7 describe the engineering activities grouped by the roles of mobility, counter-mobility, survivability and general engineer support. Chapter 8 describes the impact of several specific environments on engineering planning and activities.

Linkages

6. ATP-3.12.1 is subordinate to AJP-3.12 and has been harmonized with the AJP-3.2 Series of publications for Land doctrine. A full list of related documents is at Annex B.

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CHAPTER 1 INTRODUCTION AND THE CURRENT OPERATING ENVIRONMENT

1.1. INTRODUCTION

1. **Physical environment**. Throughout history, terrain, both natural and manmade, has played an essential part in warfare. Knowledge of its characteristics and the ability to take advantage of them has been a key aspect of successful operations. The ability to shape the physical environment to one's advantage, or to an adversary's disadvantage can significantly contribute to military success.

2. Military Engineering (MILENG) comprehensively addresses NATO's capability to affect the physical environment. MILENG includes specialized knowledge including advising, expertise in organization, execution, supervision and integration of MILENG capabilities supporting the peaceful resolution of disputes or undertaking actions in crisis management operations

1.2. MILENG AND ENGINEERING

1. **Military Engineering**. NATO defines MILENG as "a function in support of operations to shape the physical operating environment (POE)". It achieves desired objectives by enabling or preventing mobility; developing, maintaining and improving infrastructure and supporting the survivability and sustainability of forces. MILENG incorporates five areas of expertise: engineering, explosives ordnance disposal (EOD), environmental protection (EP), military search and management of infrastructure, including contracted civil engineering. MILENG also makes a significant contribution to countering improvised explosive devices (C-IED), protecting the force and providing life support.

2. **Engineering**. Engineering is the largest of the areas of expertise and is the focus of this publication. The other areas of expertise will be discussed in this publication only when required to ensure a full understanding of the subject matter. The primary doctrine related to the other MILENG areas of expertise can be found in the AJP and ATP-3.12 series, AJP-3.18 *Allied Joint Doctrine for Explosive Ordnance Disposal Support to Operations* and the Allied Joint Environmental Protection Publications (AJEPPs).

3. Engineering provides commanders technical expertise and means for shaping the physical operating environment in a manner that best meets operational and campaign objectives. In the context of MILENG, engineering capabilities are further subcategorized into combat support engineering (predominantly dedicated support to the manoeuvre forces), and general support engineering (wider assistance to the whole force, the host nation (HN), and other non-military actors when agreed upon and decided by the commander).

4. **Engineering roles**. Engineer activities are categorized under four roles:

   a. **Mobility support**. Mobility support will enable movement or manoeuvre of own forces. It will provide freedom of movement (FOM) in the area of responsibility (AOR).

b. **Counter-mobility support**. Counter-mobility support will assist in stopping or hindering an adversary's movement or manoeuvre. It will hamper FOM in the AOR.

c. **Survivability support**. Survivability support will facilitate life support and contributes to force protection (FP). It includes aspects of physically protecting personnel, weapons, and materiel from the effects of weapons, detection systems, and from environmental conditions.

d. **General engineer support**. General engineer support provides technical and construction expertise to sustain our own forces

5. Figure 1-1 is a graphical representation of the engineering activities that will be described in detail in Chapters 3 through 7. Many engineering activities do not fit neatly under a single role but can be interpreted as contributing to more than one. For the purposes of this publication, activities that span two or three roles are listed under the role that has been assessed as the most prominent. Activities that span all four roles have been grouped under the heading "Activities Spanning All Roles" and are described in Chapter 7. Activities that include the phrase "Support to" are activities where engineers play a vital part but do not have primary responsibility for the completion of the activity.

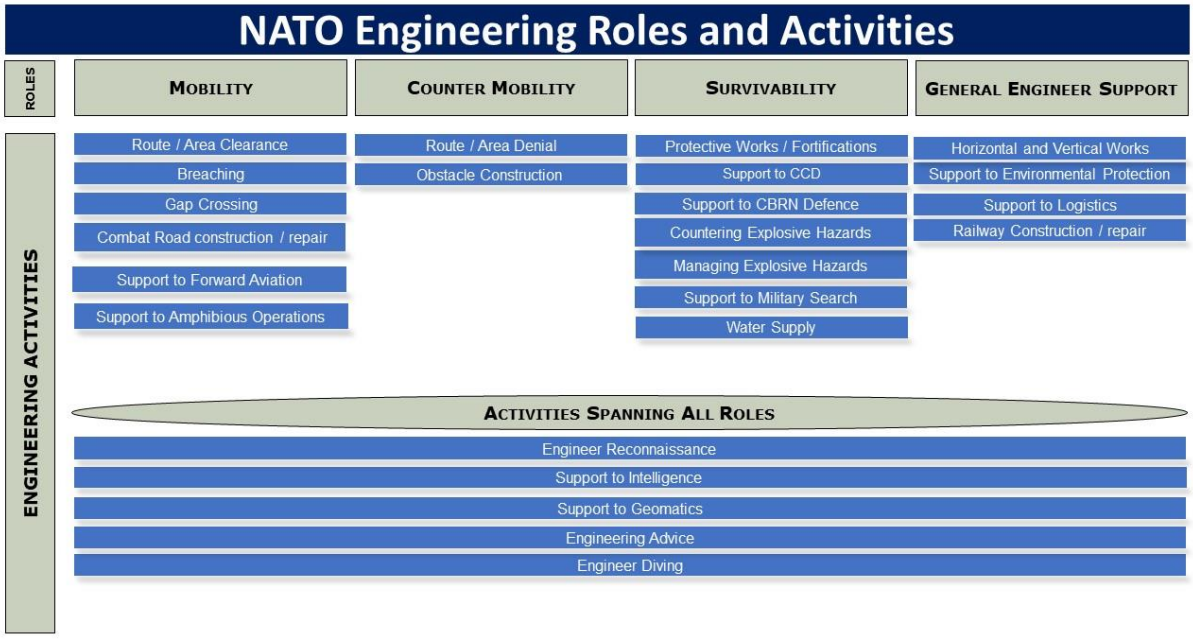


Figure1-1: NATO Engineering Roles and Activities

6. Engineering provides support to all forces and commanders but does so within the land operating environment. An understanding of that environment is therefore crucial.

1.3. THE LAND OPERATING ENVIRONMENT

1. Land forces are required to operate in dynamic, complex, and increasingly urbanized environments. To be successful they must contend with a range of geography, terrain, climatic conditions and the availability (or lack) of infrastructure in their area of operations.

2. The land operating environment extends beyond the mere physical boundaries of a defined area. It includes a broad range of aspects including the sea, land, air, space and cyber domain, the range of actors, facilities, weather, terrain, the information environment, the electromagnetic spectrum (EMS) and chemical, biological, radiological and nuclear (CBRN) threats and hazards. It can be visualised and assessed through political, military, economic, social, informational and infrastructural aspects (PMESII).

3. Unlike the air or maritime environments, the land environment is distinguished by the fact that it is where people predominantly live. Land operations must deal with the complexity of an environment characterized by the presence of people and their culture, religions, societies, governments, economic centres and infrastructure.

4. Weather and terrain affect every military operation and therefore military activities, tasks and actions. Terrain in the land environment is varied and complex, with open grassland, cultivated land, forests, mountains, deserts, jungles, rivers, swamps, urban and littoral areas. Each creates constraints and opportunities, placing different demands on the people and equipment that operate within them and the choice of forces to be used for each task. Some of these specific environments are described in detail in Chapter 8.

1.3.1. The Doctrinal Hierarchy of Land Tactical Operations

1. Land tactical operations and the activities that forces undertake within them may be viewed as a hierarchy, ranging from the operational level to the level of tactical tasks. All these may be visualised in relation to the spectrum of conflict and are planned and conducted as a continuous process to achieve the objectives and the end state, and ideally moving the overall situation to the lower end of the spectrum of conflict.[1]

2. The threat, the strategic direction and objectives and the end state issued to military forces will determine the overall operational level theme. Along the spectrum of conflict, the operational level acknowledges four different operations themes [2] according the level of force to be applied for mission accomplishment:

a. Warfighting;

b. Security;

c. Peace support;

d. Peacetime military engagement.

[1] AJP-01 Allied Joint Doctrine Ed E V1, Chapter 2, section 3, paras 2.22 to 2.32 describe the Spectrum of Conflict.
[2] Reference AJP-3.2 Allied Joint Doctrine for Land Operations

3. Within those operations themes military forces conduct operations. An operation is defined as: a sequence of coordinated actions with a defined purpose (NATO-Term). The general purpose of land operations, as any other operation, is to affect the behaviour of actors. A given end state and defined objectives ensure that this is done in a directed way.

4. Land tactical operations[3] can be divided into three categories, based on their purpose and objective:

a. Offensive operations with the purpose to impose one's own will upon the adversary.

b. Defensive operations with the purpose to deny the adversary his objectives.

c. Stability operations with the purpose to restore and maintain a level of security and stability within a civil populace, and to eventually set the conditions for this security and stability to be maintained by civil authorities.

5. Each operations theme will be executed through a combination of these three land tactical operations, but the balance across the categories will reflect the strategic direction, the nature of the operations theme, its guiding principles and the level of force. For example, a situation of warfighting will include a predominance of offensive and defensive operations, whereas a counter-insurgency (COIN) operation under the security theme should involve a greater percentage of stability operations.

6. Within operations land forces accomplish their mission by conducting "tactical activities". Tactical activities are the specific application of doctrine to solve specific tactical problems. They are often used to assign missions to subordinates. Tactical activities[4] are subdivided into four categories:

a. Offensive activities: tactical activities in which forces seek out the adversary in order to attack them and degrade, destroy, neutralise or otherwise affect its capabilities. They may also focus on seizing or securing terrain such as vital ground or infrastructure;

b. Defensive activities: tactical activities that oppose adversary offensive tactical activities, and deny their aim or objective.

c. Stability activities: tactical activities focused primarily on maintaining or re-establishing a safe and secure environment.

d. Enabling activities: tactical activities that link, support, or create the conditions for offensive, defensive and stability activities.

7. A detailed list of tactical activities is provided in ATP-3.2.1.1 *Conduct of Land Tactical Activities*.

[3] Reference ATP-3.2.1 Conduct of Land Tactical Operations
[4] Reference ATP-3.2.1.1 Conduct of Land Tactical Activities

8. Engineer activities can support all tactical activities, in all types of land operations and in all operations themes. They are usually a subset of the larger land tactical activity although they may occur separately in time and space.

1.3.2. Threats

1. **Introduction**. Land operations may be conducted against a variety of threats which can be described as regular, asymmetric, irregular or hybrid threats. Each threat has its own characteristics. However, as belligerent opponents may employ all the military and non-military ways and means available to them to seek success, the threats and their characteristics may not be distinct. This may lead to incorrect perceptions of the threat.

2. **Regular threats**. Regular threats are generally associated with definable, recognisable military forces, that are employed by a state authority and use conventional capabilities. Their operational and tactical objectives tend to focus on controlling terrain and population centres and are directly connected to the strategic aims of a state authority. Regular threats are normally countered through symmetrical engagements, requiring a major effort from the joint force.

3. **Irregular threats**. Irregular threats are generally associated with non-aligned forces, groups or individuals that resort to violence as a means of achieving objectives for their group. They are frequently ideologically or criminally motivated, to effect or prevent change as a challenge to governance. This classification includes insurgents, serious and organised criminal elements, illegal militias and similar groups. Irregular forces have varying tactical capabilities and act to gain immediate higher level or strategic effect. They generally do not engage in positional warfare as conventional forces do, but use their asymmetric characteristics as an advantage, such a blending in with civil populations or using improvised explosive devices (IEDs). Countering irregular threats requires an understanding of the variety of actors and a comprehensive approach using all diplomatic, informational, military and economical means available.

4. **Asymmetric threats**[5]. Asymmetric threats are generally associated with adversaries seeking ways to negate military advantage by using unconventional warfare. The threat that such adversaries can pose both to Alliance forces and civil societies is termed ‘asymmetric’ because it is not possible for the Alliance to counter it in an equal way or by equal methods. This asymmetric threat is mainly defined by the nature of the adversary, the nature of the adversary’s ideas and objectives, and the method that the adversary may employ to counter an Alliance advantage.

5. **Hybrid threats**. Hybrid threats are a type of threat that combines conventional, irregular and asymmetric threats in time and space. Conflict could involve a range of transnational, state, proxies, group and individual participants operating globally and locally. Some conflicts may involve concurrent inter-communal violence, terrorism, cyberspace attacks, insurgency, pervasive criminality and widespread disorder.

[5] NATO-Term: A threat emanating from the potential use of dissimilar means or methods to circumvent or negate an opponent's strengths while exploiting his weaknesses to obtain a disproportionate result.

6. Engineering forces are vulnerable to all of these threats and engineering activities can assist in countering these types of threats. Engineering organizations also adapt their training to meet the diversity of threats and climes.

1.3.3. Comprehensive Approach

1. Central to land operations is analysis and understanding of the root causes of instability and therefore the range of military units, government and non-governmental organizations (NGOs) which may contribute to its resolution. NATO's comprehensive approach refers to a coordinated approach to operations by the international community, in which the actions of a range of military and non-military actors are coordinated. Its aim and its principles are described in detail in AJP-3.2 *Allied Joint Doctrine for Land Operations*. The approach affects land operations in particular, because most activities of non-military actors occur in the land commanders' areas of operation.

2. Many operations will seek to achieve objectives related to the long-term security, stability and good governance of the host nation and its civilian populace. While the land forces may be given various tasks to help achieve such objectives, efforts in this area are best conducted and lead by civilian organisations, such as the HN, NGOs or international organisations (IOs). Thus, when working to achieve the same or similar objectives, land forces will be expected to work, to varying degrees, with these agencies. This may range from simply providing a secure environment for other agencies, to direct cooperation in the achievement of goals related to infrastructure and governance.

3. The completion of engineering activities will often involve interaction with state and non-state actors. Therefore, it is crucial that engineers have a good understanding of the capabilities of these actors and how best to interact with them in an effective and efficient manner.

1.4. OTHER OPERATING ENVIRONMENTS

1. Engineering support to air and maritime forces takes place on land or in inland waterways (lakes, ponds, rivers) and the specific activities are often the same as activities conducted in support of land forces but under different circumstances. For example, the repair of a runway involves the same engineering skills and equipment as the repair of a highway, although the specific details of the two surfaces may differ. Hardening infrastructure on an airfield or at a port requires the same engineering skills as hardening a building used as a land force logistics hub.

2. While the majority of the activities described in this publication are described from a land force centric viewpoint, they are applicable to supporting any force when appropriate.

CHAPTER 2 ENGINEER C2 AND PLANNING

2.1. COMMAND AND CONTROL[6]

1. **Mission Command**. Mission command is the conduct of military operations through decentralized execution based on mission-type orders for effective mission accomplishment[7]. Mission Command is the preferred NATO command philosophy due to its inherent responsiveness versus changing operational situation.

2. Mission command has the following principles, which are described in detail in AJP-3.2:

   a. A commander gives orders in a manner that ensures that subordinates understand the commander's intentions (intent), their own missions and the context of those missions.

   b. Subordinates are told what they should achieve and the reason why it is required (the immediate effect and the purpose).

   c. Subordinates are allocated sufficient resources to carry out their missions.

   d. A commander uses the minimum level of control possible so as not to unnecessarily constrain subordinates' freedom of action. Mission command relies on the subordinates' ability and willingness to use their initiative.

   e. Commanders rely on subordinates' initiative and coordination to act within the commander's intent and concept of operations.

3. Due to its inherent scarcity, engineering capabilities are optimally organized, in terms of Command and Control (C2), applying the mission command principles. Engineers commanders, following the mission command philosophy ensure the necessary responsiveness and concentration of capacities in order to effectively support the manoeuvre.

4. **Engineer Command and Control**. Effective Control of engineers relies on ensuring a certain degree of coordinating authority over all the engineer capabilities, including the ones not under direct command, in order to maintain responsiveness and effectively prioritize the engineer effort in accordance with the commander's intent. The most effective engineer C2 relies on the concept of: "Centralized Control, Decentralized Execution". NATO Command and Control relationships are explained in detail in ATP-3.2.2 *Command and Control of Allied Forces*. Figure 2- 1 is a summary of these relationships.

5. In accordance with ATP-3.2.2 – *Command and Control of Allied Forces*, as expressed in Fig 2-1 Note 5, tactical engineer elements, not organic to manoeuvre units, must normally

[6] The authority, responsibilities, and activities of military commanders in the direction and coordination of military forces and in the implementation of orders related to the execution of operations (ATP-3.2.2 *COMMAND AND CONTROL OF ALLIED LAND FORCES*)
[7] ATP-3.2.2

remain OPCON to an engineer senior commander throughout the mission and detached TACOM or TACON to the supported unit.

Authority	FULLCOM	OPCOM	OPCON (2)	TACOM	TACON (7)
Task organize the assigned element (1)	X	X			
Assign missions to the assigned element (3)	X	X	X (4)		
Assign tasks to the assigned element for the purpose of which it has been assigned.	X	X	X	X (5)	
May further delegate command authority (6)	OPCOM OPCON TACOM TACON	OPCOM OPCON TACOM TACON	OPCON TACOM TACON	TACOM TACON	TACON
Coordinate movement, local defence, and force protection.	X	X	X	X	X
Planning and coordination	X	X	X	X	X
Administrative and logistic responsibility	X				

FULLCOM full command OPCON operational control TACON tactical control
OPCOM operational command TACOM tactical command

Notes:
(1) The gaining commander may task organise the assigned unit and thus assign separate missions to it and its component parts. This is limited to FULLCOM and OPCOM. A commander assigned forces under FULLCOM or OPCOM may employ those forces for any purpose.
(2) For forces allocated under OPCON the gaining commander may not break up the organisational integrity of the force for separate employment. Under OPCON forces assigned may only be employed within certain constraints such as function, time or location imposed by the higher authority. For example, the forces may only be assigned for a single phase of a particular operation. This may be done for national purposes in the case of a multinational context, where it is in a participating nation's interest to constrain in some fashion the employment of the contributed force. In other cases, the assigning commander may require the force for other purposes later in the operation.
(3) A mission is defined as: A clear, concise statement of the task of the command and its purpose.
(4) Under OPCON the gaining commander may assign a mission to the assigned element that is distinct from, but related to, the gaining commander's overall mission. OPCON is normally applied to assigned manoeuvre elements such as infantry and armour forces.
(5) Under TACOM the gaining commander may only allocate to the assigned force a specific task consistent for the accomplishment of the mission and purpose assigned by the higher commander, that is, within the parameters of the current mission given by the higher authority. TACOM is used where the superior commander recognizes the need for additional resources for a task but requires the resources intact for a later role. Under TACOM the assigned force is allocated for specific tasks and is allocated normally for a limited period of time. This prevents the gaining commander from employing the assigned force in a role or manner not intended by the higher commander. When the task is complete or the specific timeframe expires, the TACOM relationship with the gaining force ends. TACOM is usually applied to specific situations and to combat support elements that have unique capabilities. Example of forces and situations in which TACOM would likely be used is: an engineer sub-unit assigned to an infantry unit to assist in building field fortifications for a specific period of time.
(6) With the exception of FULLCOM, a gaining commander may further delegate the same or a lesser command authority over the allocated force to a subordinate commander, but within the same constraints initially given.

(7) TACON is generally used to indicate those units that will be located within another unit or formation's assigned geographical boundaries, and by so assigning, the gaining unit becomes responsible for coordination aspects within the shared area of operations. The gaining commander has authority to coordinate local defence, force protection and terrain allocation

Figure 2-1: NATO C2 Relationships

6. Sometimes, technical requirements will impact the Commander's plan and engineer advisors have to ensure these impacts are properly understood and factored into the plan.

7. **Engineer Command and Control Principles**. Effective command and control will be a key enabler towards the provision of coherent and optimized engineer support at all levels. Tactical C2 of engineers presents many of the same features and responds to the same principles stated in AJP-3.12 (C). The following principles should be applied:

a. Unity of command is the operation of all forces under a single responsible commander who has the authority to direct and employ those forces in pursuit of a common purpose. The senior NATO engineer advises the commander on the employment of engineer capabilities.

b. Centralized planning and coordination coupled with de-centralized execution.

c. Timely warning, reconnaissance and deployment by engineers is key to success.

d. Use of the Supporting/Supported Command Concept (via engineer advisors) to employ key engineer assets to where they are most required, if necessary, cross component. Use of HN engineers, international organizations, etc…, may also be relevant.

e. Centralized coordination authority not only to ensure unity of engineer effort but also to ensure that common engineer support standards are met.

f. Reach-back. A reach-back function is a pre-planned access from deployed engineer elements to technical authority and expertise either in the theatre rear area, higher HQ or national structure.

8. **Engineer Support to a NATO Corps**. MILENG support will be required to enable land-based 3-star-level HQ operations. Whereas divisions have organic (and likely national) engineers, a corps does not. A Corps Rear Area could have various configurations and may not be in the physical rear area. The Corps MILENG organization typically works in this area. The MILENG activities likely in this battlespace are identified in AJP 3.12 and in chapter 3 to 7 of this publication and will be primarily related to supporting the survivability and sustainability of the Corps. Nevertheless, the Corps engineer units could also be required to support Divisional engineers forward of the Corps Rear Area. The HQ of the Corps engineer formation is expected to be created by, and aligned to, the Framework Nation of the NATO Warfighting Corps at readiness. In contrast, as the units of the Corps engineers are likely to be task organized for each deployment, Force Generation will be multinational. Training, communications, equipment, and infrastructure will be found organically in the units which are Force Generated to support the HQ of the Corps engineers.

2.1.1. Communication and Liaison

1. **Engineer Communication**. A clearly defined channel of communication, to communicate accurate and timely information, is essential to enable an engineer commander to advise their tactical commander and to command and coordinate engineer activities. Reports and returns are to be submitted in accordance with STANAG 2430.

2. In order to enable the engineer commander to exercise effective C2 on their widely dispersed troops, properly advise the tactical commander and review priorities, they must be able to:

   a. Receive early reconnaissance reports and information on tasks.

   b. Issue orders quickly and clearly on tasks, priorities, grouping, resource allocation and movement.

   c. Have good situational awareness of ongoing missions in order to monitor the locations of resources available and the progress of tasks.

   d. Be able to communicate with all Engr commanders within a Theatre

   e. Have access to the appropriate technical advice as required (often reach-back to Allied and/or national-level specialized capabilities and Host Nation Support (HNS)).

3. Communications are therefore vital to engineers, both within units and to the supported formations. All available means to maintain links must be utilized including liaison officers where appropriate.

4. **Procedures**.

   a. **Lateral Communications**. Lateral communications are particularly important for engineer activities that cross unit boundaries.

   b. **Communications between superior and subordinate engineer commanders**. The coordinating authority is enabled by maintaining effective communication among all the engineers within the area of operations and ensuring the direct link with the parent HQ in order to receive proper guidance and priorities. Engineer commanders must as early as possible establish technical liaison with both parent and subordinate engineers.

5. **Liaison**. If an engineer unit does not have a permanent representative at the headquarters of any formation it is supporting, an effective liaison must be ensured. It is important that an engineer is represented at all planning meetings, reconnaissance or orders groups. If engineers of more than one nation are involved in a specific operation it is essential that engineer liaison between nations is established.

6. Principles and procedures for establishing liaison are described in ATP-3.2.2, as well as in STANAG 2101. Liaison requirements should be included in all orders. There are three requirements of importance to engineers:

a. Reciprocal liaison when an engineer unit is placed under operational control (OPCON) of a headquarters of a different nationality.

b. Liaison with the host nation authority at the appropriate level through G4/HNS Staff Officer.

c. Specific liaison must be established between adjacent formations in order to ensure the detailed coordination of engineer activities that cross formation boundaries.

7. Engineering activities will often impact civil affairs. Engineers are regularly required to maintain situational awareness concerning the technical and engineering capabilities and capacities of civilian actors within the area of responsibility.

2.2. ENGINEER PLANNING

1. **Planning Process**. Planning should follow the normal method of an estimate, but certain aspects peculiar to engineers need emphasis. These are:

a. **Engineer Information Collection**. The engineer commander must base decisions on the best possible information available and request reconnaissance be conducted to fill information gaps. Different sources will be utilized to gather information and this information must be properly selected and prioritized, in the light of engineer needs (**see chapter 7**).

b. **Formulation of the Plan**. The engineer commander may discuss aspects of their plan with subordinates before issuing orders. This is particularly important when operating with allied or regrouped engineer forces.

c. **Priorities**. There will always be a demand for more engineer resources than are available. The engineer commander must advise the tactical commander and set the engineer priorities in coherence with the tactical commander's intent.

d. **Allocation of Resources**. Based on these priorities, given the coordination authority over all the engineer capabilities, the engineer commander allocates resources on the authority of the tactical commander. They will allocate specialists, materials and time to these tasks in accordance with the priorities for work and their subordinate units' capabilities. Additional engineer resources may be available with the assistance of the engineer commander or advisor at the higher level of command.

2. **The Engineer Estimate**. A comprehensive engineer estimate is the foundation of effective, efficient and decisive engineer support to tactical operations. Ideally, the estimate is conducted at the highest levels of the Engineer structure in theatre, providing subordinate Engr

Commanders with guidelines within which to conduct their own. However, the estimate is generally more of a tactical planning tool. The findings of the engineer estimate will lead to the formulation of the Engineer Annex EE to OPLANS and Orders.

3. **Engineer estimate integration**. As commanders generally do not get involved in detailed supporting arms planning, engineer advisors conduct their own estimate of the situation, following the commander's planning guidance. The sequence below demonstrates the continuous iterative and re-iterative process that should be used as a guide:

a. **Commander's Mission Analysis**. Upon reception of the tasks from the higher commander or upon a change to the initial situation, the commander will initiate his Mission Analysis. At higher levels, they will do so with staff while at lower tactical levels they may do so during their reconnaissance with arms advisors. At the end of this process, the commander will have issued their planning guidance, either in writing or verbally.

b. **Engineer Advisor's Mission Analysis**. Engineers (advisors or commanders) conduct their own mission analysis concurrently with the commander's. This analysis will focus specifically on engineer tasks, defining the engineer mission statement and identifying key issues to be addressed with the commander or staff. All technical limitations or aspects of the engineer mission analysis which can affect the commander's plan will be addressed at the proper level.

c. **Preliminary Staff Checks**. As the estimate and engineer planning continues, initial staff checks are conducted in order to confirm the operation's feasibility from an engineer's perspective. As key information is discovered, engineers will keep the commander or staff informed and will also prepare the engineer input to the Information Brief covering engineer-related capabilities, limitations and risks requiring decision from the Commander.

d. **Engineer Advisor's Analysis of Relevant Factors**. With the commander's planning guidance and their mission analysis, the engineer advisor directs their staff or subordinate commanders to conduct an analysis of key factors. While the most prevalent factor is often ground, the analysis should also cover adversary, friendly forces, resources available as well as time and space.

e. **Final Staff Check**. This stage corresponds with the courses of action comparison inside the planning process. Engineer advisors will develop an engineer concept of support for each tentative COA. When considering tasks specific to each course of action (COA), specialized resources and time assessment will be identified as well as regroupings of engineer assets and inherent command relationships proposals.

4. **Considerations**. While conducting the estimate, the engineer advisor will analyse key factors relevant to specific aspects of the theatre or expected mission/tasks. Note that many of the information requirements for the engineer estimate are the result of the Intelligence Preparation of the Operational Environment (IPOE). When conducting the estimate, engineers are not generating new knowledge but interpreting known information into deductions that will form the basis of a plan. The factors below are discussed as considerations for developing the estimate:

a. Situation

(1) **Adversary**. Overall intentions and doctrinal engineer support to the adversary course of action.

(2) **Friendly**. Commander's intent and all available engineering assets.

b. **Physical Operating Environment (POE)**. This is a general assessment of the terrain where operations will take place using terrain analysis information from the IPOE[8].

5. The use of unmanned aerial vehicles (UAV) and unmanned ground vehicles (UGV) will have a huge impact on current and future engineer planning. The use of UAVs will increase the common operational picture and provide a better situational understanding. UGVs can contribute in all activities and roles by reconnaissance or remote action. The use of UGVs by NATO forces will allow Allies to reduce the human casualties for activities at high risk (breaching, gap crossing, route and area clearance). The use of UGVs can also help reduce the number of personnel required and shift priorities.

6. The use of UGVs and UAVs by adversary forces might augment their willingness and ability to detect or breach our obstacles at a much lower human cost. This might have an impact on the way Allies construct obstacles in the future

7. **Employment of Engineers**. The employment of engineers is an integral part of the tactical commander's plan at all levels. Engineers must be included in the operational planning process from the outset to ensure that scarce assets are optimized in support of the joint force. The role of the engineer advisor will be central in this regard.

8. Elements of the plan for the employment of engineers will interact with many other aspects of the operational plan. It is essential that the engineer commander/advisor ensures that all such aspects are fully coordinated with other arms/branches.

2.2.1. Barrier Planning[9]

1. **Introduction**[10]. The integration of obstacles with direct and indirect fire support and the manoeuvre plan is known as barrier planning. Barrier planning occurs at the strategic, operational and tactical levels and involves close coordination with the host nation(s) involved.

[8] IPOE is detailed in ATP-108 Intelligence Support to Land Operations. Additionally, Engineers may also conduct their own assessment of the terrain using different methods. One example is the mnemonic FLOCARK; F-features, L-lanes, O-objectives, C-canalizing ground, A-approaches, R- rate of approaches and K-key terrain

[9] Some nations use the term Obstacle Planning.

[10] NATOTerm: **Obstacle**: A natural or artificial object that creates a physical impediment to, or hazard for, the movement of vehicles and/or personnel. **Barrier**: One or more obstacles that may have an impact on a manoeuvring force and may be used to create an operational effect.

2. The overall barrier planning process and the linkages between the strategic, operational and tactical level are shown in Figure 2-2. The eight steps shown as numbers in circles in the figure are described below:

Step 1. Once a crisis is emerging, or in the framework of a Graduated Response Plan (GRP), the North Atlantic Council (NAC) addresses the NAC Initiating Directive (NID) to the Strategic level who then starts to develop the strategic campaign plan and the strategic planning directive (SPD).

Step 2. At the same time, the strategic level requests the National Barrier Guidance (NBG) from the potentially affected Nation(s) via the National Military Representatives (NMR). The NBG should encompass:

a. National operational and tactical POCs contact details. It is important that these POCs have the authorization to speak on behalf of their Nation;

b. Critical National Infrastructure (CNI) list; and

c. Barrier limitations (constraints and restraints).

Step 3. Once the operational level (JTF) has received the SPD and the NBG, the JOPG integrates this information into the J-OPLAN describing the barrier operational effects (OEs) that should be achieved and the general location in which they will be achieved which will be designated as Obstacle Areas (OAs).

Step 4. The J-OPLAN is transferred to the tactical level (LCC) with the NBG in order to turn the barrier OEs into barrier tactical effects (TEs).

Step 5. The barrier plan is further developed:

a. the LCC level defines additional Barrier Restricted Areas (BRAs) and OAs with the effects to be achieved;

b. then the Corps / Divisional level defines Obstacle Zones (OZs) within the OAs;

c. then the Brigade level defines Obstacle Belts (OBs) within OZs;

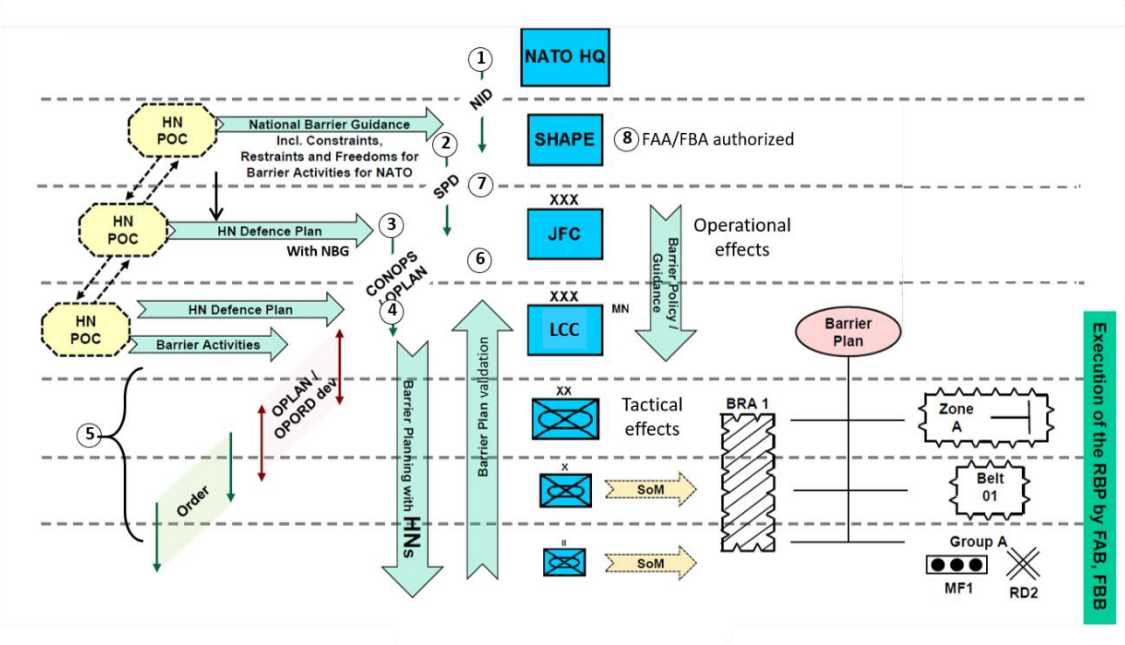
d. and finally, the Battalion level defines the Obstacle Groups within the OBs.

Step 6. The operational level receives the proposed tactical level barrier plan, confirms that it is in accordance with the operational guidance, and then seeks national consent via national POC.

Step 7. Once national consent is received, the operational level reports to the strategic level that agreement has been reached and that the barrier plan is now executable within all known constraints and restraints.

Step 8. The strategic level can declare the Crisis Response Measures[11] (CRMs) FAA and/or FBA authorizing the preparation of barrier activities and/or denial operations according to the approved barrier plan.

3. All of the steps described above have to be closely coordinated with the relevant national POC(s).



RBP = Regional Barrier Plan

Figure 2 – 2: Barrier planning process

2.2.2. Tactical Level Barrier Planning

1. **Introduction**. The barrier plan is a key component in the design of the battlefield for defensive and offensive operations. It is developed in accordance with the commander's intent. Barrier planning is the commander's responsibility. Engineer commanders and staff play a key role in advising their commander to ensure the integration of the engineer effort within the overall tactical plan. This is a key component in shaping the operating environment for both offensive and defensive operations.

2. Barrier planning ensures that counter-mobility efforts support the commander's intent and manoeuvre plan. The products of barrier planning include as a minimum barrier overlay showing the planned obstacles and obstacle control measures. It could also include a reserved obstacle list or a priority list for completion.

[11] Crisis response measures (CRMs) are detailed pre-planned actions available for immediate implementation at the appropriate level. MILENG related CRMs include: FAA and FBA which authorize the preparation of barrier activities or denial operations respectively, according to the approved barrier plan. FAB and FBB authorize the completion of barriers or denial operations respectively. CRMs are not abbreviations.

3. If individual obstacles are designated the following should be included:

a. Method of employment

b. Responsibility for individual obstacles

c. Demolition Orders as necessary

4. **Obstacle Control Measures**. Obstacle control measures serve to coordinate the placement of obstacles and synchronize them with the intended manoeuvre plan. They include both measures that enable establishment of obstacles and measures that restrict the placement of obstacles. Restrictions may be temporary.

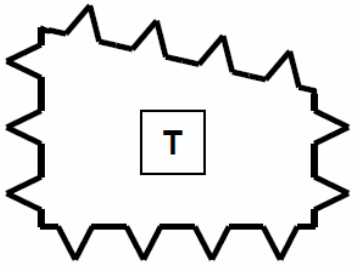
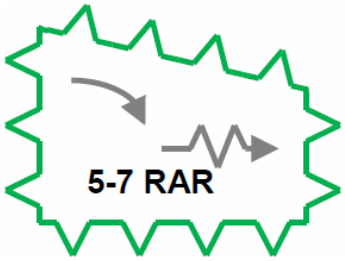
Obstacle Control Measure	Organization	Specific Obstacle Effect	Size of Enemy Avenue of Approach
Zone	Division/Corps	Normally, but Optional	Division/Brigade
Belt	Brigade	Mandatory	Brigade/Battalion
Group	Battalion	Mandatory	Battalion/Company
Restrictions	All	N/A	N/A

Figure 2-3: Obstacle Control Measures

5. **Obstacle Control Measure Graphics**. As part of orders, the obstacle control measures (zones, belts, and groups) will be designated graphically:

a. **Obstacle Zones/Belts**. Zones and belts are normally assigned to achieve a specific effect. The size and location of the effect symbol does not indicate the relative location of the obstacles.

b. **Obstacle Groups**. Groups are always assigned a specific effect. Positioning of the effect symbol is important because it does indicate the estimated location of obstacles with respect to terrain, friendly forces positioning, and where the target is to be engaged.

Description	Symbol	Example
Obstacle zone – Area containing one or more obstacle belts to create a specific effect, thus serving as an obstacle control measure.		

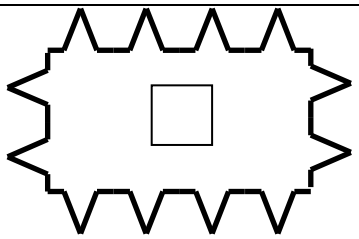
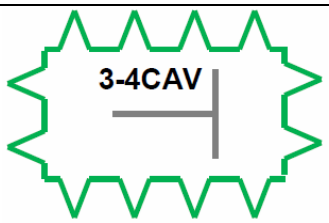
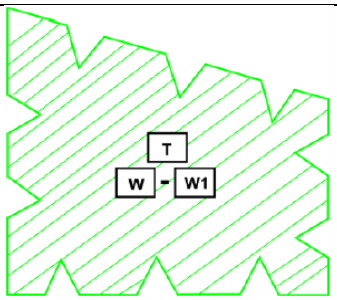
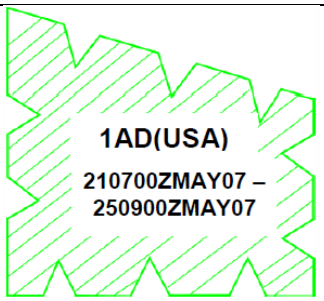
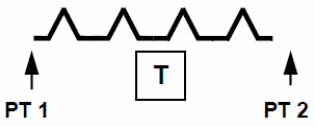
Obstacle belt –. A part of an obstacle zone that combines a number of obstacle groups, serving as an obstacle control measure to create a specific effect.		
Obstacle group – A number of individual obstacles combined to create a specific effect, thus serving as the lowest-level obstacle control measure.	The effect symbol is used and positioning on map shows estimated location of obstacles.	
Barrier restricted area – An area declared by an authorized commander where manoeuvre of friendly forces must not be hindered by barriers. Restrictions imposed may include a complete ban on the placement of obstacles in certain areas for specified periods.		
Obstacle line – A conceptual control measure used at battalion or brigade level to show placement intent without specifying a particular type of linear obstacle.		

Figure 2-4: Obstacle Control Measure Graphics

6. **Obstacle Intent**. Obstacle Intent is how the commander wants to use tactical obstacles to support the manoeuvre plan. Obstacle intent consists of the target, obstacle effect and the relative location.

7. **Target**. The target is the enemy that the commander wants to effect with tactical obstacles. The commander usually identifies the target in terms of the size and type of enemy, the echelon and the avenue of approach.

8. **Obstacle Effects**. Obstacle effects are used by the commander to indicate the desired effect of obstacles in a geographical area. The desired effect dictates the intensity and placement of obstacles in that area. These effects are to disrupt, turn, fix or block the adversary:

Effects	Symbol	Description
Disrupt		Disruption is designed to break up the enemy formation by differential delay across the adversary's formation. This can be done across the width or depth of the formation. It reduces the adversary's mobility, separates force elements and thereby his ability to mass forces and encourage the premature commitment of breaching assets, thus reducing his tempo. The obstacle(s) should allow part of the adversary to advance while other parts are delayed or stopped.
Turn		Turning aims to divert an adversary towards terrain of our own choosing. This could be Engagement Areas or alternative axis of advance. The obstacles should be strong enough to encourage the adversary to bypass the obstacles in the direction of the commander's choice.
Fix		Fix should slow an enemy within a specified area. It is used to allow a force time to detect, acquire and destroy enemy forces using air, aviation and direct and indirect fire. The initial obstacles facing the adversary should seem relatively easy to breach to make sure that the adversary continues in the intended direction. Subsequent obstacles should ensure that the adversary can be effectively engaged by relevant systems.
Block		Block should stop the adversaries advance in a specified area or axis of advance. The obstacles must be of sufficient complexity and depth to effectively stop the adversary. This ensures that the adversary's breaching capability is insufficient to breach the combination of obstacles.

Figure 2-5: Obstacle Effects

9. **Relative Location**. The effect symbols on the barrier plan at the obstacle group level are used to signify where the commander wants the obstacle effect to influence the target.

10. **Obstacle Control**. Obstacle control is the control that commanders exercise to ensure that obstacles support current operations, maximise subordinates' flexibility, and facilitate future operations. Commanders maintain obstacle control by:

a. focusing or withholding placement authority; and

b. restricting obstacle siting or design, and timings for obstacle placement.

11. **Obstacle Placement Authority**. Obstacle placement authority is the authority that a formation or unit commander has to emplace obstacles. Authority for the placement of protective obstacles rests with unit commanders and is normally delegated to sub-unit commanders. Reserved obstacles are only executed on the command of the authorised commander or based on specific criteria identified by the authorised commander. The authorised commander is normally a division or higher formation commander who has been granted authority to emplace the type of obstacle and has ordered the obstacle placement.

12. **Obstacle Restrictions**. Commander at all levels may use obstacle restrictions to provide additional obstacle control. The following are possible obstacle restrictions:

a. **Siting Restrictions**. Commanders may designate areas, routes or specific locations to be free of obstacles. "Barrier Restricted Areas" such as countermove axes, may be labelled as such on the barrier plan overlay or may be specified in the operation order.

b. **Design Restrictions**. Commanders may restrict the design of obstacles (e.g. surface laid mines only, no scatterable mines, no anti-handling devices, no bridge demolitions or inundation).

c. **Timing Restrictions**. Commanders may restrict timings associated with obstacle placement and effectiveness.

13. It is the commander who is responsible for counter-mobility in his or her area of responsibility. In principle they are authorised to use all legal obstacles, but in practice, restrictions are normally enforced from higher headquarters. The following describes the roles and responsibilities for the different levels.

14. The operational level should set the framework for the tactical levels in regard to what types of obstacles are allowed and when. This also includes coordination with national authorities in the area of operations as well as coordination with troop contributing nations.

a. **Rules of Engagement**. The strategic level releases delegated rules of engagement to lower levels.

b. **National authorities in the area of operations**. Restrictions on certain type of obstacles or the requirement for specific authorization for demolitions of specific types of infrastructure may be in place. The operational level should ensure these matters are dealt with and that the tactical level is informed about any matters that need national approval as well as how to get it.

c. **National caveats**. There will likely be national caveats for individual countries. These will include both establishment of obstacles and the transfer of obstacles between nations. The operational level should ensure that tactical commanders are informed about any restrictions.

15. If the tactical level does not receive the needed authorizations or if the framework is unclear it should actively engage the operational level for clarification.

16. Corps and division normally assign Obstacle Zones and restrictive measures to subordinate commands. They may also assign individual obstacles that are critical to the manoeuvre plan.

17. The brigade normally assigns Obstacle Belts, restrictive measures and individual obstacles as needed.

18. **Obstacle Numbering**. The aim of obstacle numbering is to assist in identifying and tracking obstacles that have been planned, constructed, or discovered. To achieve greater interoperability, NATO has agreed to number obstacles using the numbering system detailed in STANAG 2237.

19. **Barrier Resourcing**. The engineer advisor at each level requires a method of estimating obstacle resource requirements to make the necessary allocations to subordinate units. The two techniques for estimating obstacle resources are:

a. requirement-based resourcing; and

b. capability-based resourcing.

20. **Requirement-based Resourcing**. The requirement-based resourcing method allocates subordinate formations with mines, explosives, defence stores and manpower based on anticipated requirements. The engineer advisor does a preliminary staff check to determine the type and a number of obstacles that will be used to achieve the commander's intent. The use of standard obstacle designs can be used to calculate mines, defence stores and heavy equipment for specific avenues of approach or zone.

21. **Capability-based Resourcing**. Capability-based barrier resourcing considers an engineer unit's obstacle construction capability, in terms of engineer resources, in relation to the time available for the task. This is a particularly useful method of barrier resourcing when time is short, for areas of lower threat hence lower overall effort or when mines, explosives and defence stores are limited. Capability-based resourcing can also be used as a staff check to ensure that, given the manpower and equipment available, there is sufficient time to transport and deliver the obstacle materials, and emplace the obstacles resourced using requirement-based resourcing method.

22. **Early Allocation**. Due to the time and resources required to coordinate and conduct delivery and dumping, corps and divisions must allocate barrier planning resources to obstacle zones very early in the planning process. Even brigades and often units will be required to allocate resources based on initial reconnaissance and before a detailed reconnaissance can be completed. For this reason, it is essential that appropriate resource reserves be established at all levels to mitigate allocation shortfalls once detailed reconnaissance is completed.

23. **Transfer of Barriers**. Close coordination is essential when transferring barriers. Engineer liaison, early in the planning between the incoming and outgoing force is essential to ensuring a seamless transition. Within multinational operations, it is essential to understand the limitations other countries have and what types of obstacles they can accept. For example, some nations do not accept any obstacle that includes anti-personnel mines. The transfer of barriers containing modern networked munitions may also involve the transfer of classified

crypto information. Early liaison will reduce friction and ensure that potential issues such as national caveats are identified and dealt with early. Details are provided in STANAG 2989 Transfer of Barriers**.**

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CHAPTER 3 MOBILITY

3.1. INTRODUCTION

1. Mobility is defined as a quality or capability of military forces which permits them to move from place to place while retaining the ability to fulfil their mission. Military forces require the ability to move rapidly and freely in the area of operations in order to fulfil their primary mission. Mobility is necessary to deploy rapidly, achieve concentration of forces and to engage or disengage from the adversary.

2. Mobility needs should therefore be considered for movements both rear to front as well as laterally across the battlefield. Superior mobility may compensate for numerical inferiority and is affected by terrain, weather, adversarial activity and interaction with the local population. A lack of mobility for a force will increase its vulnerability to the effects of an adversary's weapon systems.

3. Adversarial counter-mobility efforts are likely to focus on stopping or slowing NATO forces so as to fix them in some form of target area or they may simply attempt to prevent our freedom of manoeuvre.

3.2. MOBILITY IN TACTICAL OPERATIONS

1. Whether conducting offensive, defensive or stability operations, mobility is a primary concern. Guaranteed mobility allows the commander freedom of action within the operational area.

2. All arms units will attempt to maintain mobility by use of their integral resources and efforts. When obstacles are encountered, the preferred methods for overcoming them are normally:

a. **Bypass of obstacle(s)**. Avoiding the obstacle is the preferred method for maintaining momentum and preserving valuable resources for use later in the operation. Consideration must always be given as to whether or not bypassing an obstacle meets the enemy's intent to shape friendly force maneuver. The marking, reporting and recording of bypassed obstacles for follow-on forces must be a priority as this provides advanced warning of potential issues for them as well;

b. **Hasty action**. Use of organic resources with little or no additional orders being given. The orders, when required, could be hasty radio orders or action on contact drills depending upon the situation and availability of own assets to deal with the situation. This will normally involve integral assets being used to breach or reduce obstacle(s); and

c. **Deliberate action**. Extra planning and preparation in the form of deploying specialist resources following a reorganization and coordination of efforts. This will normally involve specialist assets being brought in to breach or reduce obstacle(s).

3. Hasty and deliberate actions are not to be considered as absolutes. Depending upon the situation, some actions may include characteristics from either of the three types above. As with many things, it will be situation dependent and will rely upon orders and restrictions that have been passed down.

4. The bypassing of obstacles should not be confused with the Commander's bypass criteria of enemy elements. When dealing with bypass of enemy units, it must be carefully considered, as the exact strength and composition of enemy units can be difficult to determine and could have lasting effects on an operation.

5. Mobility support is not only an issue for front line units, as many units require mobility in various directions in order to support the lead elements as well as the main body as it moves forward and/or to support the front-line units.

6. Maintaining mobility and the tempo of operations, whether in the face of the adversary or not, will depend on the following:

a. An early assessment of the likelihood of obstacles to be encountered.

b. Deployment of the force in an appropriate manner, in order to overcome likely obstacles speedily as they are encountered;

c. Early detection and reconnaissance of obstacles; and

d. Effective Tactics, Techniques and Procedures (TTPs).

7. **Engineers**. Supporting the mobility of friendly forces is a key engineer responsibility. A significant percentage of engineer vehicles and equipment are designed specifically, but not exclusively, to support the maintenance of friendly force mobility. Some engineer units or sub-units are organized and equipped specifically for mobility activities.

8. In supporting the mobility of all arms units / formations, the main engineer activities are:

a. Route and Area Clearance;

b. Breaching;

c. Gap crossing;

d. Combat Road construction and repair;

e. Support to forward aviation; and

f. Support to Amphibious Operations.

3.3. ROUTE AND AREA CLEARANCE

1. Route and area clearance are the manoeuvre commander's responsibility within their area of operations. Engineering facilitates the coordination, synchronization, and execution of

clearance tasks. Engineers support the commander through technical advice and capabilities to the mobility plan. Route and area clearance are engineer activities executed in support of other tactical activities to achieve and maintain freedom of movement and manoeuvre.

2. Unlike breaching, route and area clearance are not executed when in direct contact with the adversary. However, planning must consider the threat of possible adversary surveillance and / or attack.

3. Route Clearance[12] is defined as: the detection and if found, the confirmation, the identification, marking and neutralization, destruction or removal of explosive ordnance (EO) and non-explosive obstacles threatening a defined route to allow a military operation to continue with reduced risk.

4. Area clearance[13] is primarily a survivability activity, but is included in this chapter due to similarities and doctrinal relationship to route clearance. It is defined as: The systematic detection, identification, marking and neutralization, destruction or removal of obstacles in a defined area to enable a military operation with reduced risk.

5. Some situations where area clearance could be required, in support of operations, include;

a. Airfield clearance.

b. Equipment retrieval.

c. Runway construction or repair.

d. Logistics facility construction.

e. Air and seaport recovery.

f. Forward air refuelling point (FARP) construction.

g. Support and relief activities.

6. Route and area clearance can be executed dismounted, mounted or a combination of the two. Both methods have their advantages, disadvantages, and risks that need to be considered by the commander with advice from the engineer advisor.

a. Dismounted Clearance is conducted by dismounted personnel and may be supported by mounted elements. Dismounted clearance may be required due to terrain restrictions, equipment availability, training, commander's guidance, threat, or national guidance. The advantages of dismounted clearance are a greater awareness over complex terrain and increased individual sensory involvement, which result from visual and physical detection. Some disadvantages include increased time to execute and reduced force protection.

[12] NATO-Term record 11621
[13] NATO-Term record 11620

b. Mounted Clearance may be supported by dismounted elements, but the primary technical means of military search and detection employ mounted systems. The advantage of mounted clearance is increased coverage, force protection, capacity, and potentially, more capable detection equipment. A disadvantage of mounted clearance is terrain limitations.

7. Route and Area Clearance are described in ATP-3.12.1.3 *Route and Area Clearance*. Intermediate and advanced search teams may contribute to the detection of obstacles as described in ATP-3.12.2 *Allied Tactical Doctrine for Military Search*

3.4. BREACHING

1. Breaching implies the creation of one or multiple lanes through an obstacle with the potential presence of the enemy. Obstacle breaching will invariably be part of a combined arms operation. In many instances, the obstacle may include several types of obstacles forming a complex obstacle system to be breached. Complex obstacles, as their name suggests, can pose a considerable challenge to friendly force manoeuvre. The engineer contribution to breaching is the creation and marking of a lane or breach.

2. As a minimum, the unit executing the breach requires to know the depth and complexity of the obstacle being breached as well as any known weapon systems covering the area. At least two breaches should be attempted in order to increase the chances of success and provide flexibility should one lane fail, or if one requires maintenance over time.

3. Breaching may be conducted as a hasty or deliberate action, by manual, mechanical, explosive, or using a combination of means. Once lanes are established they are marked and reported in accordance with Land Mine Laying, Marking, Recording and Reporting Procedures (STANAG 2036) and Countermine Operations in Land Warfare (STANAG 2485). The difference between a hasty and deliberate breach hinges on the reaction time and the ability to conduct a breach with or without reorganisation:

a. **Hasty Breaching[14].** An attacking force will attempt to breach from the march using breaching resources within the force when the nature of the obstacle and the adversary's strength allows for it. Very little reorganization is required and SOPs may be developed for breaching to commence with little or no additional orders being given across the combined arms force.

b. **Deliberate Breaching[15].** If a hasty breach cannot be conducted because the obstacle is too complex to be breached using the resources on hand or if the adversary's force is substantial enough to require additional combat forces and indirect fires, deliberate breaching will be attempted. The resultant loss of momentum has to be accepted, as more time is required for reconnaissance, planning and the build-up of necessary resources. The force normally consists of infantry, armour, engineers, indirect fire support and close air support (CAS).

[14] NATO-Term record 17801: The creation of a safe lane through an obstacle or barrier by any expedient method using organic resources.
[15] NATO-Term record 15270: The planned creation of a safe lane through an obstacle or barrier.

4. Engineer support to breaching will likely to include the following:

   a. Detailed reconnaissance of the obstacle to determine locations and obstacle types. Modern reconnaissance and surveillance techniques such as UAVs or UGVs, as well as information obtained from maps, terrain analysis and other sources enable a commander to determine the likely location of obstacles. The use of all arms reconnaissance, supplemented by engineer specialists provides timely obstacle information that enables proper deployment of breaching capabilities. It may not always be possible or necessary to determine the exact composition of an obstacle. As a minimum, the width and depth of the obstacle, including details of enemy weapons covering the obstacle are needed.

   b. Engineer advice to commanders. The advice will likely include the location of the best places to conduct the breach from an engineer point of view, what capabilities will be needed as well as how much time will be required to breach the obstacle.

   c. Provision of engineer equipment and personnel to assist in the conduct of the breach.

   d. Proofing, marking, reporting and maintenance of lanes. Once lanes are established they are marked and reported in accordance with STANAGs 2036 and 2485.

5. The level of preparation and equipment provided will invariably be higher during deliberate breaches compared to hasty breaches, but the same categories of support will be needed.

3.5. GAP CROSSING

1. Gap crossing is the activity of creating a crossing over a gap, which restricts movement and requires special equipment to overcome it, in order to project combat power across the gap. Gaps can be wet or dry and be naturally occurring or created by the adversary.

2. Gap crossing can be hasty or deliberate.

   a. **Hasty gap crossing.** An attacking force will attempt to cross a gap from the march using gap crossing resources within the force when the nature of the gap and the adversary's strength allows for it. Very little reorganisation of the assault echelon is required and SOPs may be developed for the gap crossing to commence with little or no additional orders being given across the combined arms force.

   b. **Deliberate gap crossing.** If hasty gap crossing cannot be conducted using the resources on hand or if the adversary's force is substantial enough to require additional combat forces and indirect fires, deliberate gap crossing will be attempted. The resultant loss of momentum has to be accepted, as more time is required for reconnaissance, planning and the build-up of necessary resources. Engineer support to the deliberate gap crossing is extensive. Deliberate water crossing procedures are contained in STANAG 2395 – *Deliberate Water Crossing Procedures.*

3. **Covert Gap Crossing**. Crossing a significant gap without being detected by an adversary and therefore subject to direct or indirect opposition, is most unlikely. However, crossing a large gap undetected could provide a significant tactical advantage and should not be overlooked if the opportunity arises. The principles and procedures remain largely the same but stealth and camouflage, concealment and deception become more important factors.

4. Engineer support to gap crossing will likely to include the following:

   a. Detailed reconnaissance of the gap to determine possible crossing locations and adversary obstacles used to reinforce the gap. Modern reconnaissance and surveillance techniques, including UAVs and UGVs, as well as information obtained from maps, terrain analysis and other sources enable a commander to determine the likely location of obstacles. The use of all arms reconnaissance, supplemented by engineer specialists provides timely information that enable proper deployment of gap crossing capabilities.

   b. Engineer advice to commanders. The advice will likely include the most suitable locations to establish crossing points from an engineer point of view, what capabilities will be needed as well as how much time will be required to establish crossings. It should be noted that the ideal technical crossing points are also likely to be the most heavily defended

   c. Provision of engineer equipment and personnel to establish crossings.

   d. Clearance of obstacles as required on routes to and in areas required for the establishment of the crossing(s).

   d. Proofing, marking, reporting and maintenance of routes leading to the crossings. Once lanes are established they are marked and reported in accordance with STANAGs 2036 and 2485.

   e. Improvement of the crossing site(s) by general engineer capabilities.

5. The level of preparation and equipment provided will invariably be higher during deliberate gap crossings compared to hasty crossings, but the same categories of support will be needed.

6. Normally the unit in command of the gap crossing should attempt to create two crossings for every one required. This creates flexibility and increases the chance of success.

7. **Gap Crossing Equipment**. Different types of gap crossing equipment are used for different size gaps.

   a. Smaller gaps can be crossed using assault gap crossing equipment such as:

      (1) vehicle-launched bridges;

      (2) vehicles capable of fording;

(3) fascines;

(4) assault boats; and

(5) infantry / foot bridges.

b. Larger gaps require the use of equipment such as:

(1) general support bridges; and

(2) rafts and ferries

8. In all cases, once a crossing point has been established it must be classified for weight crossing capacity and marked in accordance with STANAG 2021.

3.6. COMBAT ROAD CONSTRUCTION AND REPAIR

1. A Combat Road is a route that has been cleared of obstacles to increase trafficability and to meet military purposes. Combat Road construction and repair occurs in forward areas in close proximity to the enemy. It may occur while under fire.

2. Combat Roads are usually constructed for a specific task and to meet the immediate minimum military requirement for the manoeuvre force. This can involve improvement of existing routes or the construction of new ones.

3. Combat Roads are not intended to last for long periods of time without significant maintenance. Combat Roads may be allowed to deteriorate and can be abandoned once the immediate requirement is fulfilled. Alternatively, depending on the circumstances, combat roads may be upgraded by follow on forces and serve as the basis for more permanent road construction.

4. Marking of routes must be in accordance with NATO STANAG 2021.

3.7. SUPPORT TO FORWARD AVIATION

1. Support to forward aviation involves engineering support at forward sites where aircraft operate outside of established air bases with their full range of support services.

2. This task includes but is not limited to:

a. the clearance of obstacles;

b. construction of helicopter landing sites (HLS);

c. construction of forward arming and refuelling points (FARPs);

d. construction and maintenance of landing strips, including the adapting of roads and other hard surfaces for use by aircraft;

e. improvement of drop zones;

f. construction of field fortifications for aircraft: and

g. close coordination with manoeuvre force for site security

3. Support to forward aviation often involves the use of expedient techniques.

4. This task most often involves support to rotary wing aircraft (helicopters), but can also support certain fixed wing aircraft and UAV.

3.8. SUPPORT TO AMPHIBIOUS OPERATIONS

1. Amphibious operations[16] against undefended or defended coastlines present particular problems for engineer support to the landing force. They should be considered in terms of the initial landings and then subsequent operations; engineer support is essential in both phases. The ability to create a rapid build-up of forces ashore accounts for the organisational and technical differences between amphibious and land warfare. Amphibious operations are focused on mobility, characterised by extensive reconnaissance and massed engineer effort to assist in breakout operations.

2. The command structure for an amphibious operation includes active collaboration between the senior commanders of the navy element and the landing force. Command of the amphibious force is consolidated at the senior navy commander level during embarkation, movement to the amphibious objective area, and until the headquarters of the landing force is established ashore. Detailed planning by the navy and landing force staff occurs prior to embarkation. The landing plan and supporting plans may be modified (as necessary) during movement to the amphibious objective area. Plan modifications can require key assets (such as breaching systems) to be replaced in preloaded landing craft or repositioned between amphibious warships (e.g. – “cross decking”). See ATP-08 Vol I and Vol II for information on command relationships germane to amphibious operations.

3. **Key Engineer activities**. The range of engineer activities in an amphibious operation includes:

a. **During Initial Landings**. Combat engineer effort to clear beach obstacles, defences and mines and to construct or improve beach exits and dump areas. The most important engineer focus is to enable rapid mobility across the beach for the force.

b. **During Subsequent Operations**. The full range of engineer activities are likely to occur. There could be requirements for support to rotary wing (RW) or fixed wing (FW) aircraft, the provision of tactical fuel handling equipment (TFHE) facilities or water supply. Engineers are essential in facilitating the break-out

[16] NATO-term record 3517: A military operation launched from the sea by a naval and landing force embarked in ships or craft, with the principal purpose of projecting the land force ashore tactically into an environment ranging from permissive to hostile.

from the beach. The construction of expedient port facilities or repair of existing installations to support over-the-shore operations may also be required.

4. All units should land with the maximum equipment and resources and be prepared to survive on it for an indefinite period of time. Emphasis must be placed on improvisation and the full use of local resources after landing.

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CHAPTER 4 COUNTER-MOBILITY

4.1. INTRODUCTION

1. Counter-mobility (C-MOB) support will prevent movement or manoeuvre to the adversary. It will also hamper FOM in the AOR.

2. Counter-mobility aims to hinder an adversary's manoeuvre through the reinforcement of natural obstacles and the establishment of man-made obstacles. Counter-mobility supports the commander's plan by shaping the POE with the intent to turn, block, fix or disrupt the adversary's forces.

3. Obstacles can be emplaced manually, mechanically or by remote means including indirect fire as well as fixed and rotary wing aircrafts. For obstacles to be effective they need to be covered by observation in conjunction with direct and indirect fire.

4.2. COUNTER-MOBILITY IN TACTICAL OPERATIONS

1. Counter-mobility is an element of all types of tactical operations, but the application and focus will differ according to the commander's intent and the desired effects. Counter-mobility is achieved through the use of obstacles, which can be used to impede both vehicles, ranging from light vehicles to tanks, and dismounted adversaries. They include natural and man-made obstacles.

2. **Offensive activities.** During the offense, counter-mobility efforts can be used to:

   a. Protect flanks – The use of rapid counter-mobility means (scatterable mine systems or other rapid counter-mobility measures) as situational obstacles along an advance can help protect exposed flanks.

   b. Consolidate on an objective – The placement of obstacles to enable friendly forces to consolidate and prepare a hasty defence in preparation for an adversary counter-attack.

   c. Deny an adversary withdrawal routes and areas – The placement of obstacles (scatterable mine systems or other rapid counter-mobility capabilities) to deny the adversary the ability to withdraw or mass in preparation for a counter-attack.

3. **Defensive activities.** In the defence, the tactical commander's plan includes the covering force, main defence, and rear area. The skilful use of natural and man-made obstacles is often essential to success of a defence. An effective barrier plan can decisively enhance the commander's overall tactical plan, by denying the enemy the freedom of manoeuvre he requires in order to gain and maintain the initiative. Sound obstacle plans usually require:

   a. Obstacle control measures coordinated at all levels, but recognised by subordinate commanders;

b. Obstacles that complement and do not dictate the overall tactical plan. Their specific aim (to fix, disrupt, turn or block the enemy) must be clearly stated;

c. Wherever possible obstacles must be covered by direct fire. When this is not achievable, they must at least be covered by observers able to call for indirect fire.

4. Barrier plans should incorporate existing natural obstacles, for example, rivers, lakes, mountains, forests and other canalizing ground, that will force the enemy to conduct a deliberate obstacle crossing. It should then include the deployment of man-made obstacles to obstruct enemy manoeuvre and protect battle positions, improving their inherent strength.

5. As a general rule, defensive positions should always be protected by obstacles which can be covered by friendly fires (both direct and indirect). The power of obstacles may be significantly enhanced by anti-armour fires in particular, which may destroy the most dangerous threats (tanks and armoured units) as they cross the narrow crossing sites.

6. In the delay, the aim will be to adversely affect enemy mobility and operational tempo with obstacles emplaced in depth. It also causes them to employ and expose valuable breaching resources early, as well as canalize their tactical formation. In this way, obstacles afford friendly forces several advantages:

a. They gain time,

b. Preserve friendly forces, and

c. Support more effective engagement of enemy targets with direct and indirect fire.

4. **Other activities.** In stabilizing and enabling activities counter-mobility can serve to increase the force protection of own and friendly forces, but also to separate warring factions.

5. **Engineers**. Engineering support to counter-mobility is vital. Obstacles are often established by engineers, but also by other means including indirect fire as well as fixed and rotary wing aircrafts. Engineers also advice Commanders regarding the use of obstacles for counter-mobility. Engineer staffs coordinate counter-mobility activities on behalf of the tactical commander.

6. The main engineering counter-mobility activities are:

a. Route and Area Denial; and

b. Obstacle Construction

4.3. ROUTE AND AREA DENIAL

1. NATO has a requirement to deny adversary personnel and vehicles access to routes and areas. The terms route denial and area denial are used to describe these tasks.

a. **Route Denial**: employment of systems to support local security, and prevent adversary obstacle placement and their use of linear avenues of approach (border, tunnel, route).

b. **Area Denial**: employment of systems to support the scheme of manoeuvre by shaping or hampering the movement of the adversary and enhance the effectiveness of direct and indirect fires (area, point).

4.4. OBSTACLE CONSTRUCTION

1. Counter-mobility is achieved through the use of obstacles. An obstacle[17] is defined as: A natural or artificial object that creates a physical impediment to, or hazard for, the movement of vehicles and/or personnel. Obstacles usually require the dedication of resources to overcome.

2. **Types of Obstacles**. There are several ways in which obstacles can be categorized into types. Figure 4-1 illustrates the most common types of obstacles based on their nature:

a. **Natural obstacles**. These are natural terrain features such as rivers, mountains and forests.

b. **Man-made obstacles**. These are obstacles that are not natural and are either explosive or nonexplosive in nature.

(1) Nonexplosive

(a) Cultural – These are obstacles of particular significance whose reduction or destruction is either restricted, prohibited or would cause problems greater than the impediment or hazard for movement created by their existence.

(b) Constructed – These include existing man-made features such as buildings as well as obstacles such as wire fences and ditches.

(c) Demolition – Demolition[18] is defined as: The destruction of structures, facilities or materiel by use of fire, water, explosives, mechanical, or other means. As an obstacle type, demolition refers to any obstacle created by the use of explosives. (ie destroyed bridge, road crater etc)

[17] NATO-Term record 25659
[18] NATO-Term record 15410

(2) Explosive

(a) IED.

(b) UXO.

(c) Mines.

(d) Other explosive hazards.

(e) Networked munitions.

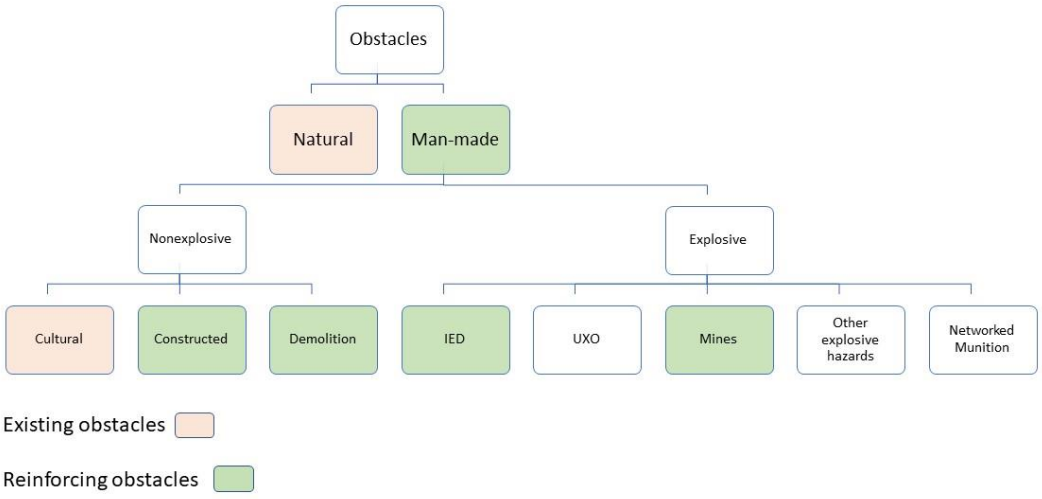


Figure 4-1: Types of Obstacles

3**.** Obstacles can also be categorised as existing or reinforcing as shown by the colour codes in Figure 4-1. Reinforcing obstacles are those obstacles specifically constructed, emplaced or created through military effort and designed to strengthen existing terrain. Reinforcing obstacles can be further categorised based on the intended obstacle effect as shown in Figure 4-2 and explained below:

a. **Tactical**. Tactical obstacles contribute to the commander's plan by reducing the enemy's ability to manoeuvre and increasing the effects of friendly fire. They can be broken down as follows:

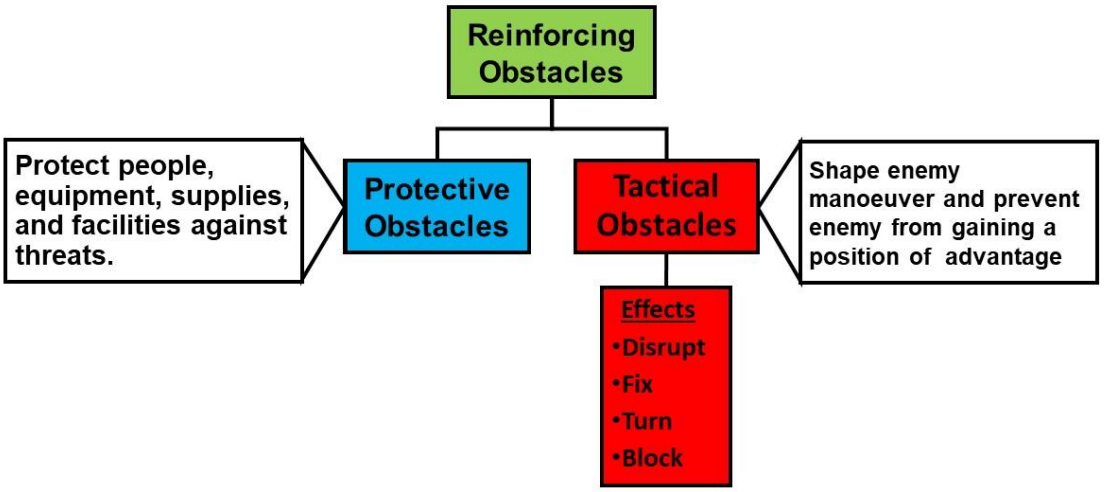
(1) **Directed Obstacles**. An obstacle ordered by a higher commander as a specified task for a subordinate unit. The target can usually be executed immediately provided that prior authority has been granted. Most tactical obstacles are directed obstacles, and most directed obstacles are

planned at manoeuvre unit level. The placement of these obstacles is primarily an engineering responsibility.

(2) **Reserved Obstacles**. Obstacles[19] for which the authorised commander restricts execution authority. The authorised commander usually specifies the units responsible for constructing, guarding and executing the obstacle. Reserved obstacles are normally used to close reserved routes and lanes. A specific type of reserved obstacle is a reserved demolition target. This is a target for demolition, the destruction of which must be controlled at a specific level of command because it is a vital part of the tactical or operational plan, or because of the importance of the structure itself. The placement of these obstacles is primarily an engineering responsibility.

(3) **Situational Obstacles**. A tactical obstacle for which the resources are held in reserve. Execution is triggered by friendly and/or enemy actions and is normally assigned as a "be prepared" task. An example would be the placement of scatterable mines on an exposed flank that is being threatened by the enemy. The placement of these obstacles can be an engineering responsibility but is often tasked to others such as artillery or air assets.

b. **Protective**. Protective Obstacles are designed primarily to improve survivability through force protection. The placement of these obstacles is usually a unit responsibility but engineers may be tasked to assist.



Obstacle Effect: The intended impact of the obstacles and fires with respect to the safeguarding friendly assets (protective obstacles) or the intended impact of the obstacles and fires on the enemy (tactical obstacles).

Figure 4-2: Reinforcing Obstacles

[19] See STANAG 2017 *Orders for the Demolition Guard Commander and Firing Party*

4. **Demolitions**. Engineers may use explosives as a tool to create obstacles by demolishing manmade structures such as bridges, roads or buildings in order to canalize or impede enemy forces. These types of activities must be carefully considered due to the long-lasting effects of destroying infrastructure. Typically, the ROE will provide guidance in regard to the use of demolitions against infrastructure. Explosives can also be used in conjunction with natural features to create effective obstacles.

5. **Planning Factors**. The main planning factors for obstacle design are the adversary, the terrain and own capabilities.

a. **The Adversary.** The type, placement and necessary depth of obstacles is heavily influenced by the overall mobility of the adversary's force as well as the specific breaching and bridging assets.

b. **The Terrain.** The terrain must be analysed to assess both the adversary's opportunities as well as the key features present in the AoO that are beneficial to own forces. The properties of the terrain may vary depending on the season or changing weather conditions.

c. **Own Capability**. Own capability includes both the units, the equipment and the time available.

CHAPTER 5 SURVIVABILITY

5.1. INTRODUCTION

1. Survivability includes all aspects of physically protecting personnel, weapons, and materiel from the effects of enemy weapons and detection systems. It may also include camouflage, concealment and deception measures.

2. Survivability advice and activities are the main contributions of the engineers to the joint function of Force Protection[20].

5.2. SURVIVABILITY IN TACTICAL OPERATIONS

1. All arms/branches are responsible for their own immediate survivability requirements. Engineers will augment and enhance unit survivability measures within the limits of available resources and the priorities of the commander. Engineers will provide the specialist advice in assessing the vulnerabilities of infrastructure against the probable threats. Engineer effort will be concentrated on tasks requiring specialist skills or equipment. Survivability measures begin with the engineer assessment of vulnerabilities and the use of all available concealment and cover, followed by digging and constructing fighting and protective positions.

2. During operations, the design, resourcing and construction of appropriate force protection facilities including camps and other facilities, is a MILENG responsibility and is often under the engineering area of expertise. This key activity will demand a range of specialist skills and equipment to protect the force and enable it to conduct operations effectively.

3. The main engineering survivability activities are:

   a. protective works and fortifications;

   b. support to camouflage, concealment and deception (CCD);

   c. support to CBRN defence;

[20] Force protection FP is a joint function to minimize the vulnerability of personnel, facilities, equipment, materiel, operations and activities from threats and hazards to preserve freedom of action and operational effectiveness thereby contributing to mission success. As described in AJP-3.12 and AJP-3.14, MILENG Support to FP is one of the fundamental elements of FP. One of the main aspects of MILENG Support to FP are the tasks described in this publication under Protective Works and Fortifications. AJP-3.14 uses the term Protective Infrastructure when discussing these tasks. AJP-3.12 uses the phrase “maintaining, and improving infrastructure including hardening of facilities.”. Some nations use the term Force Protection Engineering to describe these and other related tasks.
Regardless of the phrase or term used, Engineers are responsible for the assessing, planning, designing, coordination, construction and maintenance of appropriate infrastructure, hardening facilities, perimeter security systems, bases’ surveillance system, determining stand-off distances and field fortifications. Engineers are involved in every stage of the staff processes that evaluate the threat, assess the risk and decide upon appropriate measures.

d. countering explosive hazards;

c. managing explosive hazards;

d. support to military search; and

e. water supply.

5.3. PROTECTIVE WORKS / FORTIFICATIONS

1. **Protective works.** Engineers provide advice and construct protective works. Engineers may augment existing structures or facilities with enhancements or protective materials to increase the level of protection. Protective emplacements are used primarily for personnel, infrastructure, unit locations and logistic concentrations. Commanders may require hardening of key command and control facilities.

2. **Fortifications**. The preparation of fortifications is an all arms responsibility. Engineers provide SME advice on vulnerabilities and construction techniques to mitigate vulnerabilities. When time is limited or the nature of the terrain requires special techniques, such as the use of earthmoving equipment or explosives, engineers provide support in accordance with the commander's priorities

3. **Infrastructure protection.** Infrastructure relevant to NATO operations should be protected. This may include Host Nation infrastructure. The types of protection will depend upon the terrain and threat assessment. The engineer advisor provides the commander the most suitable measures to minimize the risk.

4. The physical protective measures employed by a force must also be considered in regard to the impact they may have on the overall operation. The loss of a military capability, critical national infrastructure, mission vital infrastructure or key infrastructure as described in AJP-3.12 may often have more significance to the overall mission in this context, than if measured purely in terms of physical value to the force.

5.4. SUPPORT TO CAMOUFLAGE, CONCEALMENT AND DECEPTION

1. Camouflage, concealment and deception (CCD) is a command responsibility executed by all arms. This includes the engineering expertise in planning, designing, construction and maintenance of concealment and deception measures. These measures may include the construction of fighting positions, the installation of dummy equipment and the placement of phoney minefields to support formation and unit deception plans.

2. **Camouflage and Concealment**. In general, all units are responsible for their own concealment and local camouflage. Major positions, facilities, and operational sites, may, however, require multi spectral camouflage measures. The electro-magnetic spectrum must also be considered. Efforts must be made to mitigate the distinctive signatures that engineer work can create. Apart from the use of camouflage nets and natural camouflage material, multi spectral camouflage measures may require the employment of engineer equipment and means.

3. **Deception.** It is an engineer responsibility to provide advice about engineer capabilities that could be used in supporting deception. Engineer support to deception is primarily provided through the construction of decoys. Decoys as part of a deception plan are very effective tools. Decoys are generally expendable, and they can be elaborate or simple, pre-constructed or made from field-expedient materials.

4. Proper decoy employment serves a number of tactical purposes, including:

   a. Increasing the survivability of key unit equipment and personnel.

   b. Deceiving the enemy about the strength, disposition, and intentions of friendly forces.

   c. Drawing enemy fire, which reveals its positions.

   d. Encouraging the enemy to expend munitions on relatively low-value targets (decoys).

5. Decoys include construction of dummy positions, phoney obstacles, including minefields, and the simulated employment of construction equipment. Damaged or captured materiel can also be used to create deception. Dummy positions and decoys must be carefully planned and coordinated within the framework of the tactical plan and genuine positions.

5.5. SUPPORT TO CBRN DEFENCE

1. Engineering supports CBRN Defence by way of horizontal and vertical construction tasks in addition to the provision of water and equipment used in decontamination. Engineers must implement the general rules for defence against the CBRN threat which are common to all arms/branches.

2. National engineers may have specific CBRN responsibilities allocated to them; these vary between nations and are not considered further in this publication. Regardless of special CBRN responsibilities allocated to engineers nationally, they are very likely to be involved in the following tasks because of their generic capabilities and organisation:

   a. Assistance with Survivability. With construction capabilities, engineers are suited and equipped for advising and assisting other arms/branches in the provision of field fortifications and other shelters against CBRN attack including improvised collective protection (COLPRO) against chemical attack; these measures are termed “Survive to Operate”.

   b. Opening of routes through or around areas affected by CBRN strikes. As part of their normal task of route opening and maintenance, engineers are likely to be tasked to clear routes blocked by the effects of CBRN strikes, or to open routes to by-pass contaminated areas.

c. Decontamination. Engineers may be called upon to construct traffic circuits and facilities in a decontamination station. In some armies, they may operate the point or provide water for it. Area decontamination may also be an engineer task.

d. Release Other Than Attack (ROTA) and Toxic Industrial Hazards (TIH). In built up or urban areas, there is considerable potential for engineers to have to deal with the effects of ROTA and TIH. Industrial areas, power stations and even hospitals offer a range of options for potential enemies to exploit.

5.6. COUNTERING EXPLOSIVE HAZARDS

1. Countering explosive hazards includes the detection, identification, marking, reporting, recording and disposition of all explosive hazards. The most common explosive hazards involve explosive ordnance, which in principle are an EOD responsibility. However, on the battlefield, time is often limited and EOD personnel are not always available in sufficient quantities to respond to all incidents. Depending on the situation, threat and troop contributing nations, engineers can be called upon to conduct some explosive ordnance disposal tasks, primarily “blow in place” of known UXO types, often coordinated with the Explosive Ordnance Disposal (Coordination) Cell.

5.7. MANAGING EXPLOSIVE HAZARDS

1. Explosive hazard management includes identifying, assessing and controlling the risk arising from explosive hazards and providing advice or making decisions that balance the risk with mission success. Explosive hazard management is a MILENG responsibility and requires the centralised collection of information pertaining to explosive hazards. This task overlaps the MILENG areas of expertise of engineering and EOD. Depending on the situation, threat and nations providing troops, either area of expertise could be assigned lead responsibility.

2. **Explosives Safety and Munitions Risk Management**. In addition to explosive hazards, engineers might have responsibilities regarding the safe handling, storage and transportation of ammunition and explosives. This could involve the transportation of large quantities of explosives for use on tasks or the construction of a temporary deployable magazine (TDM) for ammunition storage. Where compliance with Allied Ammunition Storage and Transport Publications AASTP-1 and/or AASTP-5 cannot be met, the Explosives Safety and Munitions Risk Management (ESMRM) risk assessment / risk management process described in Allied Logistics Publication (ALP)- 16 *Explosives Safety and Munitions Risk Management (ESMRM) in NATO Planning, Training, and Operations* shall be followed.

5.8. SUPPORT TO MILITARY SEARCH

1. Military Search is the management and application of systematic procedures and appropriate equipment to locate specified targets in support of military operations. Specified targets may include people, information and material resources employed by an adversary.

2. Military Search is subcategorised as Advanced Search and Intermediate Search, which require formal training and specific equipment, and Basic Search. In NATO, Military Search is a separate area of expertise under the MILENG function but in many nations Advanced Search and Intermediate Search are engineering tasks.

3. Military Search is described in detail in ATP-3.12.2 *Allied Tactical Doctrine for Military Search.*

5.9. WATER SUPPLY

1. One of the most important requirements for a fighting force is an adequate water supply. The need for water will be in two major areas: water required by field units and water required by administrative bases and static units. Water supply to field units and formations will normally be provided by integral resources. Raw water sources will be used if domestic reservoirs are not available. Liaison with the appropriate staff branch is necessary in obtaining the use of domestic water resources from the host nation. The criteria for the emergency supply of water are set out in STANAG 2885.

2. Water must be sourced, treated, stored, distributed, issued and disposed. Water quality standards must be appropriate for a range of uses including drinking, cooking, washing, laundering, medical, firefighting and water-borne sewerage systems. Water services include purification, bulk storage with distribution being achieved through bulk deliveries, packaging and/or pipelines. Key references for water quality standards are STANAG 2136, *Requirements for Water Potability during Field Operations* and in Emergency Situations and STANAG 2629 *Water Production, Storage and Distribution* or national standards if they are more restrictive.

3. The division of responsibilities for water supply is as follows:

   a. **G3/G4 Staff**. Authorising scales and establishing policy on general location of water points and distribution methods.

   b. **Engineers**. Development of sources, collection, treatment, storage and the operation of water points. Drilling wells when required.

   c. **Medical**. Testing and recommending methods of purification.

   d. **Logistics**. Storage, distribution and transport.

   e. **Consumer Units**. Collecting water at the water point, distributing to sub-units.

4. The following information must be considered in planning water supply operations:

   a. Quantity of water required.

   b. Quality required for uses such as consumption, washing, machinery cooling systems or decontamination.

   c. Source characteristics, such as locations, yield, nature, quality.

d. Existing facilities for treatment, storage, pumping and distribution.

e. Protection.

5. When bottled water is used, acquisition, storage and distribution are Logistics responsibilities.

CHAPTER 6 GENERAL ENGINEER SUPPORT

6.1. INTRODUCTION

1. General engineer support encompasses activities that require extensive preparation and provide indirect support to manoeuvre forces. It also includes those activities associated with sustaining the joint force throughout the operation. General engineer support may involve a greater degree of cross-component support and the engineer activities will usually be more enduring, relying more on purpose-designed and built solutions. It is likely to fulfil a longer-term, operational requirement. These activities are:

a. Horizontal and Vertical Works.

b. Support to Environmental Protection (EP).

c. Support to Logistics.

d. Railway construction / repair.

6.2. HORIZONTAL AND VERTICAL WORKS

The term Horizontal and Vertical works includes: the construction, repair and maintenance of land line of communications (LOC); Tier 1 and Tier 2 Deployed Force Infrastructure[21]; power generation; fire protection; and engineering support to air force and maritime infrastructure.

6.2.1. Land Lines of Communication

1. In addition to the responsibility for combat road construction as described in Chapter 3, engineers are responsible for the construction, maintenance and repair of land lines of communications. This involves road construction, maintenance and improvement intended to support the mobility of the entire force throughout the whole area of operations. This will involve improvement of existing routes or the construction of new ones.

2. This includes supply routes (main, alternate, contingency and emergency) and other routes designed and constructed to meet higher standards than those discussed in Chapter 3. Such tasks can require a substantial amount of time to complete and may involve the use of HN resources.

3. Such routes are intended to support a wide range of military and civilian traffic, and support activities such as sustainment, and Reception Staging and Onward Movement (RSOM). This includes the construction of lines of communication bridges when required.

4. These routes must be cleared of obstacles, classified and marked in accordance with NATO STANAG 2021.

[21] ATP 3.12.1.4 Deployed Force Infrastructure

5. Combat roads constructed for tactical movement can be further upgraded into more robust land lines of communications.

6.2.2. Deployed Force Infrastructure

1. Deployed Force Infrastructure (DFI) comprises buildings, facilities and installations required to support military forces when deployed. ATP-3.12.1.4 *Deployed Force Infrastructure* categorizes infrastructure as Tier 1 to 4 as follows:

a. Tier 1 support is what the initial personnel deploying on operations can carry on their person or in their support vehicles. These personnel will operate under field conditions. Tier 1 will span a period of several weeks or months. Some documents also refer to this as integral standard.

b. Tier 2 provides basic support for the initial phase of an operation. It provides only austere working and living space. It will span the period of between one and two months up to two years. Some documents also use the term initial standard when referring to Tier 2.

c. Tier 3 infrastructure provides semi-permanent accommodation for the sustainment phase of an operation. It will span the period of over six months to more than 10 years. Some documents also use the term temporary standard when referring to Tier 3.

d. Tier 4 facilities are permanent infrastructure and installations. Some documents also refer to this as permanent standard.

2. Infrastructure specialists and civilian contractors will generally become more involved and assume more responsibility the longer an operation endures. In the earliest phases of an operation, construction of roads, and other surfaces as well as accommodations, utilities and associated services will be an engineering responsibility. This can include the use of expeditionary support packages or prepared stocks of materials.

3. ATP-3.12.1.4 *Deployed Force Infrastructure* is intended as guidance for the planning of national, coalition or multinational operations and recognizes the existence of various national standards. It includes recommended scales and standards for accommodation and essential services for expeditionary forces. DFI scales and standards are intended to mitigate the effects of climate and environment in order to preserve the health, welfare and overall operational effectiveness of an expeditionary force. It does not cover the technical specifications for standard infrastructure or designs. However, it facilitates the transfer of DFI between nations by identifying basic common standards to be used when designing and constructing camps.

6.2.3. Power Generation

1. Power requirements differ for every mission and the optimum power production solution differs depending on the location, climatic conditions, local resources, size, function, force structure, concept of operation and the phases of the operation. Planners must ensure that appropriate requirements for energy efficiency are met during the infrastructure planning phase.

2. Commanders are responsible for the use of resources under their command but engineers play a key role by advising on operational energy concerns. Engineers are responsible to provide efficient and secure power generation for DFI. In order to be effective, they should follow the three key principles of modularity, interoperability and sustainability. These principles are described in detail in ATP-3.12.1.4 *Deployed Force Infrastructure*.

3. To successfully implement these principles, it is necessary for engineers to adopt a holistic approach to power generation. This includes the use of a mixture of fossil fuel-based generators, renewable energy sources, energy storage and HN power, as well as the use of passive and active measures in the infrastructure design to ensure maximum energy efficiency whenever possible.

6.2.4. Fire Protection

Fire protection includes the design and construction of fire prevention and suppression systems within infrastructure. It includes the development, implementation and monitoring of fire safety programs, which includes the evaluation of the fire protection plans. Fire protection services on operations can be obtained through national contributions, contracted solutions or HN. Fire protection is a component of Force Protection (FP) planning for operations and should be considered when establishing any and all deployed force infrastructure.

6.2.5. Engineering Support to Air Force Infrastructure

1. Engineering support to Air Force Infrastructure can be described under two main categories:

a. Engineering support to domestic airbases; and

b. Engineering support to deployed airbases.

2. **Engineering support to domestic airbases**. Every military airfield requires an engineer staff or engineer unit responsible to oversee or conduct a series of tasks on a daily basis. These are significant engineering tasks required to ensure the airfield can continue to operate safely and at full capacity. These tasks include, but are not limited to:

a. daily maintenance and construction of the airfield operating surfaces, such as runways, taxiways, aprons, HLSs, and supporting surfaces,

b. snow and ice removal,

c. painting and marking of surfaces and obstacles,

d. flight safety related tasks (foreign object damage prevention, wildlife control related tasks, etc.),

e. sweeping and dust removal,

f. maintenance of airfield lighting,

g. fortification, camouflage, concealment and deception,

h. support to Explosive Ordnance Disposal (EOD) tasks, and

i. use of aircraft arresting systems, etc.

3. These airfields also require an Airfield Damage Repair (ADR) capability, or at least access to such a capability and the knowledge to properly utilise it. STANAG 2929, AATMP-03, Edition A, Version 1, *Airfield Damage Repair (ADR) Capabilty*, provides a method for determining the required ADR capability for any airfield. It specifically focuses on Repair of Airfield Operating Surfaces (RAOS).

4. **Engineering support to deployed airbases**. The tasks are very similar to support to a domestic NATO airbase but there are significant priority differences. There is also a NATO required capability, identified in the Bi-SC CAPABILITY CODES AND CAPABILITY STATEMENTS entitled “DAAM – Deployable Airbase Activation Module”.

5. The required engineering tasks are comparable to a domestic airbase but ADR usually receives greater emphasis at a deployed airbase. Deployed airbases often originate from the initial use of abandoned, bare airfields or HN airfields with limited infrastructure or services, which do not meet the minimum military requirements. Engineering tasks include:

a. engineering reconnaissance of the airfield and surrounding area. This must include pavement classification measurement and evaluation,

b. maintenance and repair of existing airfields, landing strips and other facilities (including airfield damage repair equipment (concrete plates or mats) as well),

c. construction of landing strips, including the adapting of roads and other hard surfaces for use by aircraft,

d. construction of helicopter landing sites (HLS), FARPs and other austere facilities,

e. hardening command posts and key facilities,

f. blast protection for aircraft and key infrastructure,

g. clearance of obstacles,

h. improvement of drop zones, and

i. support to EOD– augmenting ADR capability, recovery operations on fixed installations or misfired ammo on different air vehicles.

6.2.6. Engineering Support to Maritime Infrastructure

1. When planning for and conducting allied operations adjacent to or around NATO's area of responsibility, maritime platforms and supporting assets require assured support from maritime facilities. If the facilities offered do not meet NATO's standards, the success of the mission and the forces assigned to accomplish it, may be put at risk. Robust and resilient

facilities provide the benefit of greater assurance of support to NATO maritime forces and therefore greater operational flexibility and reach, particularly in escalating crises.

2. In this context, the Forward Logistic Sites (FLS) are quite important during a maritime operation since they provide logistic support to the allied maritime force. ALP-4.1, *Multinational Maritime Force Logistics*, describes the engineering support required for maritime operations, with a focus on the FLS. Key points are summarized in the following paragraphs.

3. During the selection of a proposed FLS location, consideration should be given to site-peculiar engineering requirements. This consideration should include evaluation of existing infrastructure (seaport, airfield, warehouse, transportation, fuel, accommodation and utilities, including power, water, and sewage / waste handling) and ship services (salvage, towing, repair, tugs, cargo handling, harbourmaster).

4. Once the mission of the proposed FLS is known, the next step is the development of an engineering support plan, if required. The plan should identify minimum essential facilities and civil engineering capabilities needed to support the commitment of allied military forces.

5. Deployed forces now face many tasks for which they are not equipped, such as assisting with rebuilding war damaged national infrastructure. Infrastructure shortfalls impeding FLS establishment or operations can be mitigated by the use of HN engineering support (skilled laborers, equipment and materials) if available. A thorough understanding of current HN capabilities is essential, particularly when operations are conducted outside member nations.

6. Contracting is a significant tool that may be employed to gain access to additional resources and services. However, it should not be used to replace military capability, especially if the military capability is available.

7. Although establishment and operation of FLS are beneficial for sustained maritime operations, the deactivation of FLS and redeployment of forces operating them can create significant new engineering tasks and operational dilemmas. This can include curtailment of FLS functions and services, dismantling facilities, site restoration, disposal of wastes and support for the redeployment of personnel, materials and equipment. To mitigate these factors, a prioritized schedule to complete engineering tasks must be developed. It should consider; public works, site restoration, construction contracting, and the retrograde of engineering support. In this situation, allied maritime forces may require general engineering support in two different locations at the same time.

8. **Maritime Facilities in Allied Host Nations**. The Bi-SC 85-8 Criteria and Standards for Maritime Facilities document is the main source for evaluation of maritime facilities in Allied HNs. The document shapes identification, assessment, determination of member countries' maritime facilities for usage by NATO vessels. In order to support NATO maritime operations and Graduated Response Plans, allied nations are enhancing their maritime facilities' capabilities through both nationally funded infrastructure projects and NATO Security Investment Program (NSIP) funded projects.

9. Typical maritime facility improvement projects can include; dredging, berthing places (piers, wharfs, mooring etc.), POL facilities, ammunition facilities, supporting infrastructure

related tasks, major repair facilities, sea port of debarkation (SPOD) related tasks, infrastructure needs of degaussing ranges and ship/submarine sensor and weapon check ranges. A series of maintenance activities of aforementioned facilities may be conducted by the engineering units of the allied naval bases in accordance with HN responsibilities. In case of a maritime operation including an allied HN facility, the engineer support plan should cover or refer to the related NATO documents for the coordination procedures for the infrastructure requirements.

10. **Maritime Facilities in Other Host Nations**. The engineering support in non-NATO HN to allied maritime operations should be included during the development of an Operation Plan (OPLAN) and a supporting Alliance Operations and Missions (AOM) Requirements and Resources Plan (ARRP).

11. As previously stated, depending on the capabilities needed, the infrastructure projects supporting an allied maritime operation can be accomplished using engineers, HN capabilities or through civilian contractors. During operations, allied maritime forces may need to use HN naval bases or commercial infrastructure which does not meet the minimum military requirements of the allied force. Engineering tasks that may be performed to address infrastructure deficiencies can include activities such as:

a. engineering reconnaissance of host nation naval bases and surrounding area,

b. maintenance and repair of existing berthing places and all other waterfront facilities,

c. construction of berthing places and other facilities,

d. supporting infrastructure related tasks,

e. maintenance and construction tasks of Major Repair Facilities.

12. The Bi-SC 85-8 Criteria and Standards for Maritime Facilities document can still be utilized as the main reference for the maritime infrastructure requirements, though the operational conditions in theatre and technical regulations of the HN may necessitate some alterations from the criteria/standards outlined in Bi-SC 85-5. Under these circumstances, engineer reconnaissance of HN infrastructure is valuable because the information obtained can aid in developing or modifying the engineer support plan accordingly.

13. During allied maritime operations it may become necessary to use civilian contractors to improve or repair maritime infrastructure. Typically, these engineering projects are considered to be urgent by definition. As a result, these projects receive funding from the NSIP, via the Crisis Urgent Requirement (CUR) procedure. ACO Manual 015-001, dated 16 Jun 16, describes the detailed procedures employed by the SCs in developing and approving Alliance Operations and Missions project proposals.

6.3. SUPPORT TO ENVIRONMENTAL PROTECTION

1. Environmental Protection (EP) is defined as: “The prevention or mitigation of adverse environmental impacts”. Essentially, EP is the protection of the environment from the actions

of NATO forces. Protecting our forces from natural environment is part of FP and not EP. The main NATO references for EP are identified in Chapter 1.

2. As explained in Chapter 1, EP is its own area of expertise within the MILENG function. However, certain tasks related to EP are generally an engineering responsibility, particularly in the early phases of an operation. Such tasks often involve the employment of heavy equipment assets. The tasks include but are not limited to:

a. construction of certain protective / preventive measures. (i.e. berms and ditches to prevent or mitigate the impact of spills of fuels and other contaminates),

b. contribution to emergency response teams / plans,

c. remediation (This includes the identification and clean-up of solid, liquid, and hazardous wastes and the remediation where applicable of other environmental impacts resulting from NATO-led military activities).

6.4. SUPPORT TO LOGISTICS

1. Engineering Support to Logistics covers the construction, repair, and maintenance of those infrastructure facilities required to receive, accommodate, sustain and onward deployed military forces. This can also include construction, repair and maintenance of lines of communication. Detailed planning and thorough reconnaissance, involving all functional specialists, are essential to identify resources and shortfalls for the construction, maintenance and operation of facilities. Priority is given to facilities to install ports of debarkation (POD), Staging Areas, Assembly Areas and their connecting routes.

2. Support to logistics can be a significant engineering activity in operations. Infrastructure is critical for logistic purposes. Once the concept of support for an operation has been developed engineering support requirements for logistics can be derived and compared with existing infrastructure in order to identify shortfalls and the engineering support required to meet the requirements.

6.5. RAILWAY CONSTRUCTION AND REPAIR

1. Railways are a land line of communication but are identified as a separate task due to its specialized nature.

2. Specialist engineer units can support the construction, improvement and maintenance of railways and railway related infrastructure (including bridges, rails and loading/unloading points) in order to ensure mobility and effectively support the logistic and sustainment into theatre. Specialized capabilities are needed for the recce and execution of those activities. Like many other activities, this work can be carried out by contractors under engineer supervision.

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CHAPTER 7 ACTIVITIES SPANNING ALL ROLES

7.1. INTRODUCTION

Most engineering activities can be categorized primarily under one of the four roles as described in the previous chapters. However, there are a number of engineering activities that do not fit neatly under one role but rather apply equally to all of the Engineering roles and are therefore described in this chapter. These activities are:

a. Engineer Reconnaissance,

b. Engineer Support to Intelligence,

c. Geospatial Engineering / Geomatics,

d. Engineering Advice, and

e. Engineer Diving.

7.2. ENGINEER RECONNAISSANCE

1. The primary role of engineer reconnaissance is to provide combined arms and engineer commanders with timely and accurate engineer information on the natural and manmade environment, and on adversary engineer activity and intentions.

2. Its secondary role is to play an integral part in collecting information about resources including stores and equipment. Engineers differ from other arms/branches in that many tasks require stores and equipment that are not permanently held with units. The successful and prompt completion of engineer work depends upon personnel, stores and equipment being available in the right configuration, place and time. Engineer reconnaissance is therefore a key engineer enabling activity in providing the necessary information about HN resources.

3. Technology such as UAVs, UGVs and unmanned underwater vehicles allow a wide range of information to be gathered remotely but does not remove the need for a manned engineer reconnaissance capability to provide guaranteed “eyes on” to the commander in all weather and environments. Engineer Reconnaissance is often a scares resource and must be employed in accordance with the Commanders’ priorities.

4. It is important that the engineer commander accompanies the tactical commander on any significant reconnaissance in order to ensure that engineer aspects are considered at an early stage. The composition of the reconnaissance party required for engineer activities will depend on the nature of the task. The need for local protection should not be overlooked.

5. Principles of Engineer Reconnaissance. As stated, engineer activities are resource-intensive and engineer tasks can impose a drag on operational tempo if their sequencing is not planned early. Engineer reconnaissance is therefore essential to ensure that engineer

effort is focused where it can best achieve the desired effect and to allow focused concurrent activity.

a. Principles. The following principles apply to the provision of effective engineer reconnaissance:

(1) Engineer reconnaissance should be command-driven, normally through the Commander's Critical Information Requirements (CCIRs), Priority Information Requirements (PIRs) and Requests for Information (RFI).

(2) Engineer reconnaissance should be centrally coordinated at each level of command in order to maintain tempo. Thus, it may need to be task organized in order to provide the required level and type of detail on time.

(3) Engineer reconnaissance units generally deploy as part of combined arms reconnaissance.

(4) Engineer reconnaissance units should have the same vehicle signature (though not necessarily exactly the same vehicle) and the same basic combat sensor suite (though engineer additions may be required) as combined arms reconnaissance units.

(5) Engineer reconnaissance requires specialist training.

(6) Access to the products of engineer reconnaissance should be available at every level of command, while adhering to information security regulations and respecting the principle of "need to know".

b) Tasks. The tasks that engineer reconnaissance units are likely to carry out in all types of operations and at all levels include:

(1) Confirmation of terrain analysis in support of the IPOE process.

(2) Route reconnaissance to either confirm terrain information or to gather new information.

(3) Obtaining cross-country movement and trafficability information.

(4) Reconnaissance of natural, adversary and friendly obstacles in support of manoeuvre.

(5) Identification of the location, strength, grouping, movement and procedures of adversary engineers.

(6) Identification of local infrastructure, facilities, utilities, resources and transportation.

(7) Identification of explosive hazards.

(8) Obtaining battle damage information.

(9) Technical reconnaissance for specialised engineer work.

7.3. ENGINEER SUPPORT TO INTELLIGENCE

1. To contribute to military decision making, intelligence staffs must produce intelligence based on a wide range of factors. Intelligence staffs need to reach out for expertise to support their analysis.

2. Engineers can contribute to every phase of the intelligence cycle:

a. **Direction**: Engineers provide expertise in setting (identification and prioritization) the intelligence requirements priorities in accordance with the Commander's direction.

b. **Collection**: Engineer staff and units contribute to the collection phase providing information from various sources (mainly by reconnaissance), focusing on:

(1) adversary engineer capabilities,

(2) terrain,

(3) weather,

(4) infrastructure,

(5) utilities,

(6) engineer resources,

(7) civilian engineer capabilities, and

(8) geographic information.

c. **Processing**: Engineer staff will contribute to different steps of information processing when required but the necessary expertise is applied primarily in analysing and interpreting engineer related information.

d. **Dissemination**: Engineer related intelligence will feed the following processes:

(1) **Force Generation**. Engineer Intelligence informs the force generation process by allowing the engineer commander to advise on and plan the optimal engineer force structures for a particular operation.

(2) **IPOE**. Identifying terrain impact (terrain and movement overlay) on the operations and the infrastructure impact on manoeuvre.

(3) **Situational Understanding**. Engineer intelligence adds to the overall situational understanding with particular emphasis on terrain and the capability of adversary engineers. Modern technology (i.e. UAVs and UGVs) offers considerable benefits in ensuring engineer situational understanding. Information is rapidly and accurately reflected in a complete all arms/branches or joint picture.

(4) **Joint Targeting Process**. Engineer Intelligence can contribute to the joint targeting process by input to the selection of targets, aiming points, and Battle Damage Assessment (BDA). Destroying infrastructure targets may limit the military options for an adversary in the short term, but may create significant limitations for NATO in the longer term. Consequently, engineer intelligence may assist significantly in any Effects Based Approach (EBA) for example by denying rather than destroying targets. Engineer intelligence may also help to identify alternative targets that create similar effects without the consequent damage and other limitations such as cost.

(5) **Force Protection**. Engineer intelligence can add considerably to force protection planning and implementation by examining how the adversary could exploit the terrain and what actions our own forces could take to reduce or mitigate potential adversary action.

7.4. GEOSPATIAL ENGINEERING

1. **General**. Geospatial support is essential to the conduct of modern military operations. Every weapon system, combat unit, aircraft and ship require some form of geospatial support to deploy, navigate, manoeuvre and fight. Geospatial support includes a responsibility for updating, revising and maintaining geospatial databases, including paper maps, providing limited production capabilities, distributing geographic data including mapping and softcopy data, and other geospatial products conducting terrain analyses, providing terrain analysis teams to formations and conducting field surveys. Cooperation with the G2 staff, engineer and reconnaissance units is necessary to both obtain and confirm data. Liaison with the appropriate staff concerning the provision of geospatial information from a host nation is also essential.

2. **Database Management**. Geospatial elements provide field support to users of map background displays both in hard and soft copies. It is necessary to ensure that geospatial information is readily available, up-to-date and distributed throughout the theatre. There is a requirement for close liaison with EOD- and engineer Intelligence staff as the management of mines, UXO and general engineer intelligence related databases may also be done by the geospatial staff.

3. **Production**. Geospatial elements have a limited capability for the provision of graphic support to staff and production of geomatics products, including mapping. However high speed, high volume reproduction capabilities may not be available in the field, in which case they must be provided by national base-plant resources.

4. **Geographic Information Dissemination**. Geospatial elements are tasked to establish formation map supply points tied into higher formation, theatre or national networks. Responsibilities include shipping, receiving, inventory control and sourcing of geomatics data in both hard and soft copy. It does not include delivery to field units which remains a service support function.

5. **Terrain Analysis**. Terrain analysis studies are undertaken to address specific concerns of the commander about the terrain and how it will affect the implementation of the plan. Terrain analysis consists of applying classic workflows and initiative to produce terrain analysis products using terrain databases in conjunction with other sources. It does not include information collection. The terrain analysis information provided is used by G2/G3/G4/MILENG and other formation staffs in planning operations.

6. **Field Survey**. Geospatial elements provide theatre level survey support to various weapon systems. They can conduct terrestrial surveys and collect spatial data for production of mission specific mapping either from the ground or from imagery. Other tasks can include obstacle locating and advice on navigation.

7. **Geographic Imagery Provision**. Although the majority of imagery is supplied from and for G2, Geospatial staffs also have access to imagery that can be used for production of image maps and graphics for the G3 element. This requires close liaison with G2 to ensure the correct prioritisation/classification, as the imagery sources will often be the same.

8. **Command and Control**. For all operations at Div level and above it is necessary to appoint a Chief Geographic Officer to man the senior formation HQ. They are responsible for coordinating the geographic requirements for the operation. Tasks include production of a map distribution matrix, guidance on datum and coordinate information for the theatre, guidance on any border issues, prioritisation of geospatial support and advice to the formation commander on geospatial issues. Command and control of geospatial staff can reside with G2, G3 or MILENG Branches as the nation/formation sees fit, the key point being that liaison between all staff chains is essential to ensure geospatial support is delivered most effectively.

7.5. ENGINEERING ADVICE

1. One of the key responsibilities of engineer commanders at all levels is the provision of timely and accurate engineer advice. Advise is provided primarily to the tactical commander but can also be provided to the staff and commanders of subordinate units.

2. Engineer advice to the commander covers all aspects of engineering and depending on the specific force structure and situation, the engineer advisor and staff may also be responsible to provide advice on other areas such as EOD, CBRN, and infrastructure.

3. Engineer advice includes:

   a. Integration of engineer plans into combined arms/branches operations plans. Barrier Planning is potentially the most important example of this as explained in Chapter 2.

b. Planning of engineer employment within the formation.

c. Coordination of all engineer work within formation boundaries, including HN

4. **Technical Advisor**. In addition to his responsibilities to the tactical commander, due to engineer technical specificity, every engineer commander is linked to an engineer "technical network". It is not a chain of command, but is a functional chain of engineer coordination and technical expertise. It exists to ensure the most economical employment of engineers and engineer resources.

5. Elements of the plan for the employment of engineers will interact with many other aspects of the operational plan. It is essential that the engineer commander ensures that all such aspects are fully coordinated with other arms/branches.

6. The engineer commander as advisor can provide technical advice to the tactical commander and his staff about:

a. Integration of engineer plans into combined arms/branches operations plans.

b. Planning of engineer employment within the formation.

c. Coordination of all engineer work within formation boundaries.

7. Furthermore, at tactical level, the engineer advisor can provide support in all the MILENG areas including:

a. Management of infrastructure

b. EOD

c. Military search and

d. Environmental protection

7.6. ENGINEER DIVING

1. Engineer diving is an extension of engineering that provides support to mobility, counter-mobility, survivability and general engineering in and around the water. This can include harbours, inland waterways, littoral zones, and other like aquatic areas. The term brown water is frequently used to describe the areas where engineer divers usually operate in order to differentiate it from the blue water where navy divers operate. Supporting assets range from a small team to multiple larger teams with a diverse range of capabilities. Because of the unique operating environment and limited resources, early integration of divers into the planning processes is critical to success.

2. Engineer dive capabilities are tailored to the mission requirements, allowing the use of various diving apparatuses and marine equipment; e.g. surface-supplied diving (SSD), self-contained breathing apparatus (SCUBA), and remotely operated vehicles (ROV). Engineer

dive tasks include the full range of engineering activities, conducted underwater. A few examples are:

a. reconnaissance in support of gap crossing,

b. placement of obstacles underwater,

c. inspection and repair of underwater infrastructure such as piers,

d. standby safety for activities on or near water, and

e. suburban network reconnaissance.

3. Engineer dive elements support nearly all specialized underwater missions on the battlefield. Divers are organised to maximise availability of resources required for underwater tasks within specified environment considerations. Engineer divers are generally assigned to the theatre commander, but are likely attached to supported units anywhere in the battlefield. All engineer dive detachments have varying degrees of equipment and capabilities and traditionally are composed of squad to platoon size elements.

4. All engineer diving must be conducted in accordance the applicable national diving safety regulations.

5. Engineer dive elements can support Navy divers as well as other government and nongovernment agencies requiring diving assistance in the conduct of non-engineer specific tasks such as search and recovery efforts.

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CHAPTER 8 SPECIFIC ENVIRONMENTS

8.1. INTRODUCTION

1. **General**. Weather and terrain affect every military operation and therefore military activities, tasks and actions. Each creates constraints and opportunities, placing different demands on the people and equipment that operate within them and the choice of forces to be used for each task. Terrain can block or enable communication, provide cover from detection or attack, and obstruct or enable movement. Therefore, the size and characteristics of terrain and specific environments in which forces are deployed have a significant influence on the planning of land operations and the employment options of available forces.

2. In general, it is important for engineer commanders to:

   a. understand the effect of the POE on their own operations and those of the adversary;

   b. use the assigned area of operations efficiently;

   c. consider the time required for preparing and conducting operations in relation to the terrain;

   d. consider the space required for the employment of their forces; and

   e. identify the appropriate areas for specific activities.

3. Characteristics of several specific land environments result in significant limitations on and employment considerations for land forces. This chapter describes the seven most commonly encountered and significant environments by giving an overview of their main characteristics, planning considerations and key engineer activities in each specific environment. The seven specific land environments in this chapter are:

   a. Urban Environments;

   b. Wooded and Forest Environments;

   c. Cold Weather Environments;

   d. Desert Environments;

   e. Mountainous Environments;

   f. Jungle Environments; and

   g. Riverine Environments.

8.2. OPERATIONS IN URBAN ENVIRONMENTS

1. **Description**. A greater percentage of the world's increasing population will live in urban areas and as a result, the land area physically covered by towns and cities will continue to increase. The urban environment (UE) is a complex interconnected system of systems expressed through a three-dimensional physical system, an information system and a human system comprising a population of significant size and varied configuration. UEs have high-density populations and man-made structures built to support them. UEs include towns, cities and their surrounding suburbs.

2. The UE is characterized by a physically functional system of transportation, communications, education, cultural, health, public safety, and utility infrastructures forming a complex matrix of flows, with linkages and nodes that enable the critical flow of water, fuel, electricity, money, people, goods, and waste to sustain the city's function. The physical system includes both the natural geographic features (whether it is flat or hilly, the associated drainage and its proximity to the coast) and the man-made infrastructure built to support the urban population on and below the surface. It includes subterranean (e.g. underground), surface, super-surface (e.g. rooftop), and hollow-space environments. The multi-dimensional blend of horizontal, vertical, interior, and exterior forms superimposed on the natural landscape makes the total size of the surfaces and spaces of an urban area many times that of a similarly sized piece of natural terrain.

3. **Planning considerations**. The main considerations of conducting operations within an UE are as follows:

a. Contiguous and non-contiguous areas of operations.

b. The challenge of avoiding fratricide, collateral damage or civilian casualties.

c. Rapid transition between offensive, defensive, stability and enabling tactical activities.

d. Multi-dimensional battle space.

e. High troop demand due to the close and dense environment.

f. High CSS demand.

g. Varied and complicated options for observation, concealment and camouflage.

h. Limited mounted manoeuvre space.

i. Fire support and collateral damage.

j. The presence of the local population.

k. The presence of critical national infrastructure, mission vital infrastructure and key infrastructure[22].

[22] See AJP-3.12 *Allied Joint Doctrine for Military Engineering*

4. **Key Engineer activities**.

a. Mobility.

(1) Clearance of obstacles including mines, booby traps and rubble where necessary. Armoured engineer equipment with earthmoving blades and buckets to push debris, winches and booms to move obstacles, and demolition guns are invaluable, but their manoeuvrability may be limited.

(2) Gap crossing. Covered and concealed routes may be constructed for both personnel and combat vehicles. Military explosives can be used to create access holes into buildings, while equipment can be used to dig where access to sewers becomes a necessity.

(3) Maintain counterattack, communications, and resupply routes.

(4) Enhance movement between buildings, catwalks, bridges, and so on.

(5) Use of hand-emplaced demolitions to destroy fortifications and strong points that cannot be removed with the unit's organic assets.

b. Counter-mobility.

(1) Construction of obstacles to protect flanks and rear areas. Obstacles are planned and installed in depth, starting well forward of the urban area, to allow penetration only on routes selected by the defender. Use of local materials, where possible, makes obstacle construction easier and reduces logistics requirements. Streets should be barricaded in front of defensive positions at the effective range of anti-tank weapons

(2) Rubbling of buildings.

c. Survivability.

(1) Make the urban area safe for defence by controlling specific hazards like electrical systems, gas storage facilities, fuel depots and (if required) neutralizing, Toxic Industrial Hazards (TIH) of varying types. They also construct firebreaks in high-risk areas. Engineers reinforce structures against direct and indirect fire, as well as producing construction materials by dismantling structures that are not required. They can provide tools, equipment and expertise to help the defenders prepare.

(2) Provide technical advice to commanders, to include use of existing facilities. Engineers also assist in the selection of the most survivable structures for defensive positions.

(3) Assist in the preparation of defensive strongpoints.

d. General Engineer Support.

(1) Conduct a technical reconnaissance to determine the location and type of enemy obstacles and minefields, and to make breaching recommendations. The multi-dimensional nature of the battlefield makes this more challenging.

(2) Restoration of utilities during subsequent consolidation.

e. Engineers may also provide a military search capability, both intermediate and advanced, as described in ATP-3.12.2.

8.3. OPERATIONS IN WOODED AND FOREST ENVIRONMENTS

1. **Description**. The collective term of wooded areas refers to an area that consists mostly or completely of woods and forests and of which the obstacle value is such that dispersed mounted operations are barely possible, if at all. Operating in wooded areas is extremely demanding and has many similarities to operations in urban areas though less multi-dimensional. The emphasis is on close combat, conducted on a de-centralized basis by units of company and platoon size, who are required to be able to operate independently in separate sectors. The through-roads and paths often form the key terrain where the battles are initially fought.

2. Wooded areas can be classified in accordance with several factors such as: tree density, tree height, tree diameter, land use, legal standing and ecological function. Woods at different latitudes and elevations form distinctly different ecozones: boreal forests near the poles, tropical forests near the equator and temperate forests at mid-latitudes. Both elevation and precipitation affect the composition of wooded areas.

3. Fighting in wooded areas is characterized by small-unit engagements at relatively close range, with a reliance on combat support units, such as combat engineers to provide movement support.

4. **Planning considerations**. Due to its characteristics and nature, wooded areas are difficult to control and protect. Natural obstacles, the limited presence of roads and variable condition of those roads contribute to reduce the rate of movement of forces. In addition, several other considerations are related to:

a. Types of Forces. Operations in wooded areas are most suited to light or medium forces capable of moving and operating for long periods with limited fire and logistic support.

b. Limited Observation.

c. Concealment and camouflage. The concealment from vegetation means that surprise can easily be achieved.

d. Limited Range of Fire support. In defensive operations, tanks and long and medium-range anti-tank weapons are used on flanks or positioned on the front

edges of woods to use their range and lethality. The (mechanised) infantry establishes its positions deep in the forest so that they cannot be observed nor attacked directly by armoured units.

e. Command and Control. Engineers may need to be deployed in small, widely dispersed, dismounted detachments. Command, control and communications will therefore be more difficult. Commanders at each level will require greater freedom of action.

f. Reduced Tempo.

g. Manoeuvre. Forested areas are generally unsuitable for reserved routes, though routes will need to be kept open for rapid re-deployments and counter attack.

h. Obstacles. Forests are not necessarily impenetrable to armoured vehicles. Some areas will need to be reinforced with anti-tank mines and other obstacles.

5. **Key Engineer activities**

a. Mobility.

(1) Road Network. Route maintenance, route improvement and obstacle clearance will assume particular importance. Many routes through forests are unsuitable for heavy tracked and wheeled vehicles; therefore, considerable effort may be required to improve them. Road network maintenance will require the use of plant, surfacing material and, possibly, trackway.

(2) Terrain Clearing. Other possible tasks for engineers include the clearing of terrain for Helicopter landing sites, drop zones, Artillery firing positions and generally improving fields of fire and observation.

(3) The initial emphasis in counter-mine operations is likely to be on the close support of combat units, primarily to prevent casualties. Counter-mine teams will generally work dismounted using manual clearance methods. Later, area clearance tasks for key routes, landing sites and artillery positions, may assume a higher priority and will be conducted by mechanical and/or manual means.

(4) The removal of obstacles may be achieved by armoured vehicles equipped with cranes, dozer blades and winches or by personnel using tools such as chain saws.

b. Counter- mobility.

(1) Obstacles. There is plenty of raw material (tree trunks) available for the creation of effective obstacles in wooded areas. Abatis type obstacles may be widely employed. Anti-tank obstacles can easily be created in wooded areas using surface laid mines, road cratering charges and

abatis. The use of anti-personnel obstacles will significantly delay the enemy's progress.

(2) Mines. Wooded areas facilitate the use and camouflage of mines.

c. Survivability.

(1) Other arms/branches may require the assistance of engineers in the clearance of fields of fire and construction of field fortifications. Manoeuvring and operating engineer equipment amongst the trees is likely to be difficult. Forests will frequently be used as hide areas and engineer support to camouflage, concealment and deception may be required.

8.4. OPERATIONS IN COLD WEATHER ENVIRONMENTS

1. **Description**. Cold regions can be defined as any region where cold temperatures, unique terrain, and snowfall have a significant effect on military operations for one month or more of each year. Weather conditions can have a large impact on operations, particularly when extreme weather events disrupt both military and civilian functions. Cold weather operations are conducted when the temperature (including wind chill) is 8° C and below. Executing tactical activities in those cold weather conditions requires special techniques, training and equipment. Snow, ice, frost and fog are likely to occur in such conditions. Wind intensifies the effect of cold on personnel and equipment. There is no single formula for mission success in Cold Weather Environment, as every valley, mountain, lake, river, forest and urban area will present new challenges that will require new solutions. However, close host nation liaison, in-depth mission analysis, effective task organization and proper allocation of engineers can help adapt to these special challenges. Cold regions are broken down into sub-regions: the arctic, subarctic, and temperate sub-regions.

2. There are different types of cold conditions:

a. Wet cold. Wet cold conditions occur when the average temperature is above -10°C (+14 F), and variations in day and night temperatures cause alternate freezing and thawing. Wet snow or rain, causing the ground to become slushy and muddy, often accompany these conditions.

b. Dry cold. Dry cold conditions occur when average temperatures are below -10°C (+14 F). The ground is usually frozen and the snow dry. These low temperatures, plus wind chill (the combined effects of wind and temperature), increase the need for protection of the entire body.

3. A wet cold condition is more dangerous to troops and equipment than the colder, dry cold environments as the ground becomes slushy and muddy and clothing and equipment becomes perpetually wet. Water conducts heat 25 times faster than air, meaning that wet cold environments can result in higher environmental casualty rates (both personnel and equipment) if the forces are not properly equipped, trained, and led. Under wet cold conditions, the ground alternates between freezing and thawing, which can adversely affect vehicle movement.

4. When conditions become extreme and the temperature falls below –32° C (-25 F), the problem of survival becomes of greater significance; everything tends to become subordinated to the quest for warmth and comfort. Therefore, cold conditions can have a radical effect on the conduct of land operations.

5. There is little difference between the tactical procedures utilized in a cold environment and those employed in other climates. However, the speed and tempo with which the activities are conducted can decrease significantly to account for the extremes of the environment. The outcome of most of the cold weather combat is decided more by environmental factors than by the opposing forces. Effective analysis of the weather conditions peculiar to cold regions may increase opportunities for surprise.

6. **Planning considerations**. Engineer planning must take account of likely weather conditions and possible changes. The impact of weather changes on engineer activities will be considerable. For example: As consequence of main characteristics of cold weather, the main limitations to operations are:

a. Movement. Severe frost can improve the condition of terrain that was previously difficult or impossible to negotiate. The obstacle value of waterways or marshy areas can be reduced or eliminated completely if low temperatures persist. Reconnaissance of potential routes in winter time may be vital to avoid damage and injuries of own forces.

b. Snowfall. Heavy snowfall may have significant effects on land operations, including:

(1) Movements over previously passable terrain can become impossible.

(2) Roads may need to be cleared before they are used. Planning for snow and ice clearance (SNIC) and the allocation of appropriate resources can be critical.

(3) Aerodromes, HLS, need to be cleared and de-iced continuously to support air operations.

(4) The camouflage requirements in snowy conditions are different due to the change in contrast in the electromagnetic spectrum between our equipment and the surrounding terrain.

(5) The effect of artillery and mortar fire is considerably reduced by the smothering effect of snow. Conversely, the impact of indirect fire and aviation munitions onto hard-packed snow and ice can propel ice fragments in addition to munition case fragments.

(6) Heavy snowfall in combination with canalized terrain and narrow road systems, may affect and limit locations available for staging/assembly areas, equipment parks, resupply, field hospitals and artillery firing positions. Snow removal can become a vital task.

c. Melting. After a long period of freezing weather, a thaw can result in localised flowing and saturation making some areas impassable.

d. Logistic demand. Fuel consumption rates increase as equipment must be kept warm to prevent its failure. The use of specialized fuels or additives designed for cold temperatures may be required.

e. Light. Semi-arctic areas have long periods of daylight in the summer and short to none in the winter.

f. Equipment availability. Keeping weapon systems, vehicles and other equipment combat ready requires special measures, equipment and facilities. Metals and plastics become harder as the temperature drops and the risk for it to become brittle and be damaged increases. The drain on vehicle batteries can increase significantly due to cold temperatures. Special equipment such as vehicle chains or studded tires may be required.

g. Personnel demand. The living conditions are particularly tough for personnel and impose heavy demands on their physical stamina. Measures need to be taken against frostbite, hypothermia and dehydration. Specialist clothing, equipment, food and medical support are needed to maintain fighting power.

h. Protection. Making trenches and building or digging cover is problematic if the ground is frozen, snow-covered, or water-logged. Defences may also be very vulnerable to aerial observation.

i. Deep falls of snow may render minefields ineffective while thaw conditions will increase the number and size of water obstacles.

j. In extreme cold every engineer task requires more time to execute and allowance for this must be made in planning.

k. Individual preparation for an operation requires great attention to details, such as clothing and equipment, and individual basic skills are key to success. Personnel operating in these conditions require additional time for rest.

l. Planning must take account of the absolute requirement for shelter and water supply.

7. **Key Engineer activities**. It is likely that in cold weather conditions, greater emphasis will be placed on mobility and survivability:

a. Mobility. Mobility will be impeded by snow, ice-covered terrain, weather and long hours of darkness.

(1) Increased engineer effort will be necessary for the construction, improvement and maintenance of forward airstrips, helicopter landing sites and roads, especially LOC, which are likely to be high priority targets.

(2) Roads and tracks may quickly become impassable to wheeled and tracked vehicles in heavy snowfalls. Snow clearance and route maintenance equipment must always be available.

(3) Waterways, such as rivers and lakes, can become avenues of approach during wintertime. Water route reconnaissance must be conducted by specially trained personnel and can be very time consuming.

(4) LOC will often follow river valleys and cross many bridges which may become impossible to bypass if destroyed. There may be a major requirement for new bridges, over-bridging, rafting and/or ferrying. Improvisation is possible using ice and snow. Equipment bridging can be used but the following should be borne in mind:

(a) It must be used with care as light alloy and cast metal can become brittle at low temperatures.

(b) Construction times are increased (normally doubled).

(c) An adequate reserve of spare parts is required.

(5) Gap crossing. Areas identified as dry gaps during the initial engineer reconnaissance may become wet gaps overnight due to rain or melting snow.

(6) Obstacle Clearance. Clearing or reducing obstacles in this environment may be extremely difficult and time consuming. Any requirement to reduce obstacles placed by friendly forces to support future activities should be identified early.

b. Counter-mobility. Counter-mobility activities are likely to concentrate on the limited routes available. Route denial, demolitions and off-route mines will be particularly important.

(1) Emplacing Obstacles: Manmade obstacles used within restrictive terrain and covered by fire are extremely effective in mountainous areas, but their construction is very costly in terms of time, materiel, transportation assets, and labour. Additional time must be allocated for the construction of obstacles in cold weather. When developing obstacle plans, engineers must consider the effects of changes in weather. Sudden temperatures changes may cause areas to freeze or melt rapidly, radically altering their viability as avenues of approach.

(2) Minefields may be used but the following must be considered in their planning and laying:

(a) The effect of cold on materials. For example, water seeping into and around the pressure-firing devices may freeze and prevents detonation.

(b) The reduced work rates in arctic and cold weather conditions.

(c) The variable performance of equipment and systems in deep snow conditions. For example, burying mines in a frost layer of more than 20-30 centimetres may be prohibitive, causing mines to be placed on top of the ground. Snow or ice can also prevent sufficient pressure from being put on the mine to cause detonation

(d) The need for subsequent adjustment to be made after fresh falls of snow or sudden thaws. For example, flash floods and excessive runoff can dislodge mines from their original location although they may remain armed.

(3) Enhancing Natural Obstacles: Natural obstacles can be used to great advantage in cold weather environments. Icy slopes and fallen trees can disrupt and channel troop movements. Slopes with heavy snow can be rigged with explosives to catch enemy forces in the avalanche runout zone. Barbed wire and concertina wire can be effective in snow. Ice on frozen lakes or rivers can be destroyed to tactical advantage.

c. Survivability. In extreme cold weather, survival can become the sole mission. Shelter is essential to survival. The preservation of our own shelters and the destruction of the enemy's become important ends in themselves, which can influence the outcome of the battle. Measures to increase chances of survival from enemy action and from the hostile environment will include:

(1) The construction of field defences, snow and ice fortifications with overhead protection using either improvised or equipment shelters and snow/ice-concrete. Digging into the ground provides better protection than using snow fortifications, but this is not always possible due to the hardness of the ground or the depth of the snow.

(2) The provision of advice and assistance with counter-surveillance plans and works.

d. General Engineer Support. Increased resources should be allocated for water supply and the construction of facilities for shelter with heating and lighting. Melting snow or ice as a source of water is impractical on large scales.

8.5. OPERATIONS IN DESERT ENVIRONMENTS

1. **Description**. A desert is an area with annual rainfall of less than 250 mm and can include areas with both high and low temperatures. Vegetation is sparse, and the daily temperature fluctuations can be extreme, ranging from below freezing to 55°C (130° F) in one 24-hour period. Topography and soil types vary greatly between deserts. Long periods of drought can be interrupted by sudden rain and flash floods.

2. There are four types of desert terrain:

a. Mountain. It is characterized by scattered ranges or areas of barren hills or mountains, separated by dry, flat basins.

b. Rocky plateau. It is extensive flat area with quantities of solid or broken rock at or near the surface

c. Sandy or dune terrain. It is extensive flat area covered with sand or gravel, the product of ancient deposits or modern wind erosion.

d. Cold deserts. Some high areas may have extremely low temperatures but be classified as deserts due to their low rainfall. The Gobi Desert is an example of a cold, high desert, with extremely low rainfall yet with temperatures that can fall to -40°C in winter. The principles of operating in cold weather environments apply to these deserts.

3. Operations in desert regions are mainly defined by features of their terrain: the lack of population, infrastructure and local supplies; extensive fields of observation and fire; scarcity of ground water, sparse vegetation and, significant temperature ranges and arid conditions. Temperatures have a major effect on the performance of personnel and equipment.

4. **Planning considerations**. The key factors in planning desert operations are:

a. Types of forces. Beside the adversary, the type of desert region will determine the composition of the force. Heavy and medium forces are essential for more open deserts, whereas, light forces are more suitable to employment in closer, mountainous desert regions. Armoured, air assault and motorized forces be advantageously employed to exploit the vast distances characteristic of some desert warfare.

b. Observation. Extensive fields of observation and fire require a permanent all-round protection, mobility and long-range reconnaissance. Featureless desert terrain makes day and night navigation challenging and high levels of visibility over long distances can cause distances to be underestimated.

c. Command and Control. Depending on the force composition, units can operate very disperse or in independent groups. Engineers support can be ensured with small units including various capabilities. Mission command will guide the engineer commanders of those units.

d. Sustainment. Ground water is often so deep that only small amounts can be obtained by digging wells meaning water resupply will be a key planning factor. Intensive rainfall occurs sporadically in desert regions. Because of the lack of vegetation, the ground is unable to soak up the enormous amount of water, which results in local flooding. The wind can be extremely strong and cause sandstorms, impairing visibility. The environment can cause considerable damage and wear to equipment.

e. Mobility. The surface conditions away from the few roads require equipment with some degree of off-road capability. In addition, the extreme weather conditions, the lack of water, the terrain, sparse population and limited road networks hamper mobility, survivability and resupply of forces.

f. Cover and concealment are generally scarce in some types of the desert. Flat sandy deserts provide little if any natural cover or concealment, especially from aerial attack or reconnaissance. Ground concealment and protection from fire can be found behind dunes or in wadis. Forces must use artificial aids for camouflage: such as camouflage and multi-spectral netting.

g. Obstacles. In some desert areas, natural obstacles such as wadis or other terrain features can be found. Often, however, it will be necessary to use man-made obstacles in order to shape enemy manoeuvre.

h. Scarcity of resources. Desert has scarcity of resources. Engineers must plan accordingly and execute early reconnaissance in order to provide the proper support and maintain tempo. Stockpiles and early delivery of materials and equipment are vital in for ensuring the engineer support.

5. **Key Engineer activities**. Important tasks for engineers in desert operations include:

a. Mobility. The vastness of the desert makes mobility a prime concern. Cross-country mobility may be poor in soft-sand, rocky areas, and salt flats. Greater engineer reconnaissance effort will be needed to identify routes, existing obstacles and minefield locations. Engineer tasks may include:

(1) Assistance to manoeuvre by reducing slopes, smoothing rock steps and route maintenance.

(2) The provision of dry-gap crossings including those required to traverse oil pipelines.

(3) Increasing weight-bearing capacity by soil stabilisation to provide good roads or sites for aircraft landing strips.

(4) Dust suppression.

(5) Obscuration of enemy lines of sight during breaching operations.

b. Counter-Mobility. In order to be of any tactical value in the desert, a minefield must usually cover a relatively large area, so mechanical means are best suited. Since there are often too many avenues of approach to be covered with mines, it is usually best to employ tactical minefields to cover any gaps between units, especially at night. Target-oriented obstacles may often be the best choice to reduce the enemy's mobility. Terrain dependent obstacles may be extensive and must be used in conjunction with each other and with any natural obstacles. Sand is effective in covering mines, but also creates potential problems such as exposing the mines, causing them to malfunction and degrading their performance due to excessive accumulation of overburden. Shifting sand can

also cause mines to drift. Anti-tank ditches require extensive preparation time. Caution must be exercised to prevent the ditch from identifying a defensive front or flank and to deny their use as protection for enemy infantry.

c. Survivability. Deserts provide little cover and concealment from ground- based observers and even less from aircraft. Because of the lack of concealment camouflage must be used. Hull and turret defilade positions for tactical vehicles may be important. Dispersion and frequent moves are other survivability techniques. Preparation of fortifications in the desert is difficult. Sandy soil requires revetments, while rocky plains or plateaus may be impossible to dig in; to counter this problem, emplacements are built up with rocks and depressions are used. Hardening of logistics facilities, command and control nodes, and up-grades or construction of forward landing strips and main supply routes are important in desert operations. A safety inspection of construction works is likely to be required daily, after heavy rain and after receiving direct or indirect fire.

d. General Engineer Support. Other engineer tasks that may be applicable in these conditions include engineer recce, terrain analysis, provision of water, provision of sites for the stocking of supplies such as water and fuel and the erection of sun shelters for equipment and personnel. Due to the vastness of desert environments, air support is a key enabler and engineers play a major role in enabling air assets by providing landing zones or airstrips.

8.6. OPERATIONS IN MOUNTAINOUS ENVIRONMENTS

1. **Description**. Mountainous environments are those with high, steep-sided slopes and valleys, which cover a large area. Towns and other built-up areas are concentrated in the valleys. Some mountain chains are in dry desert regions with temperatures ranging from extreme heat in the summer to extreme cold in the winter. In tropical regions, small to medium mountains are covered in lush jungles with deep ravines that flood during the rainy season. Temperatures in these areas typically remain warm and humid all year. Different mountain chains have different types of climates, but in general, their height means that the weather conditions are extremely changeable.

2. Mountains may rise abruptly from the plains to form a giant barrier or ascend gradually as a series of parallel ridges extending unbroken for great distances. Mountains may have isolated peaks, rounded crests, eroded ridges, and high plains and be intersected by valleys, gorges, and deep ravines. High rocky crags with glaciated peaks and year-round snow cover exist in mountain ranges at most latitudes. Rugged terrain is common among all types of mountain. Mountainous environments frequently require the employment of small units and corresponding engineer support provided by small unit with a mix of capabilities.

3. **Planning considerations**.

a. Types of forces. Mountainous areas require specialist training and equipment and a period of acclimatisation. Light forces are best suited to operations in mountainous regions due to their mobility and ability to secure the high ground and flanks. Heavy armoured units can only be used to their full advantage in

the valleys or passes. Aviation can be used effectively for movement, JISR, fire support, and sustainment.

b. Manoeuvre. The road infrastructure generally follows the pattern of watercourses restricting movement corridors. At higher altitudes, the road network is extremely limited and movement off-road is only possible for dismounted or airborne light forces.

c. Observation. The enormous differences in altitude provide long fields of view, but at the same time create large areas of dead ground, which cannot be observed.

d. Concealment. On the lower slopes, vegetation often consists of woods and bushes, which provide concealment. There is virtually no cover from view above the tree line.

e. Sustainment. The limited road infrastructure imposes restrictions on the combat service support for tactical formations. Operating on foot in mountainous terrain is extremely physically demanding on personnel and equipment due to the gradient, thin air, enormous differences in altitude and climate. Air (both rotary and fixed wing) can be used to resupply units effectively.

f. Command and control. Differences in attitude can affect the range of communications equipment. Command and control of engineers may become more difficult because of the terrain and possible extremes of climate.

4. **Key Engineer activities**.

a. Mobility. Mobility support is likely to be the major task; particularly the construction, improvement and maintenance of routes. Engineer reconnaissance must be positioned well forward during any advance. Plant and equipment must be readily available to the lead engineer elements. Main supply routes may be vulnerable particularly where they run through defiles. The provision of drainage and bridging is likely to be required because of the large number of mountain streams and their susceptibility to flash flooding. New bridges may be required to cross streams, replace weak bridges and cross gorges. Construction of new routes is likely to involve major engineering work especially excavation and fill. Because of the shortage of routes and restricted access, the following mobility tasks will also assume particular significance:

(1). Obstacle clearance.

(2). Construction of passing and parking areas.

(3). Snow clearance.

(4). Helicopter landing sites.

(5). Tasks related to resupply by air.

(6) Maintenance and, where possible, improvement of routes to allow friendly forces movement.

b. Counter-mobility. As routes are restricted the effect of obstacles will be greatly enhanced. Blocking of roads and passes, including by triggering landslides or snow slides, destruction of tunnels and minelaying are particularly effective in rugged terrain. Care must be taken not to restrict the movement of own forces. Due to the limited manoeuvre possibilities in this type of terrain, all obstacles must be more closely coordinated with higher echelons than in normal operations. The creation of obstacles along a restricted number of routes will be particularly useful in delaying operations as part of the defence. Mountainous terrain can be used very effectively for ambushes

c. Survivability. Digging in may be difficult even when using explosive means. It is likely that defensive positions will largely be based on raised fortifications and sangers-. The construction of such defences remains an all arms/branches responsibility but engineer may be called upon to provide more advice and enhanced capability when required. Irregular mountain terrain provides many opportunities for cover and concealment. Light engineer equipment transported by helicopters or ropeways can provide valuable assistance in the protection of manoeuvre units. There may also be the need to construct support bases for artillery and air defence weapons.

d. Other Tasks. Other tasks may include:

(1). Construction and operation of aerial ropeways.

(2). Construction of logistic facilities.

(3). Anti-helicopter measures.

(4). Support to remote signals sites.

(5). Geographic and survey support.

(6) The destruction of strong points and fortifications.

8.7. OPERATIONS IN JUNGLE ENVIRONMENTS

1. **Description**. Jungles vary from tropical rainforests and secondary growth forests to swamps and tropical savannas. The dominating features of jungle areas are thick vegetation, constantly high temperatures, heavy rainfall, and high levels of humidity. Weather is subject to rapid and violent change. These features combine to restrict movement, fields of fire, communication, battlefield surveillance and target acquisition.

2. The intensity of jungle warfighting is different from operations in more temperate and open environments. Combat in the jungle is characterized by long periods of shaping actions and finding the enemy; and short periods of violent, and sometimes unexpected, combat. Jungle battles are more often ambushes, raids, and meeting engagements. Battles are not

fought for high ground as frequently hills in the jungle are often too thickly vegetated to permit observation and fire, and therefore do not always qualify as key terrain. In the jungle, roads, rivers and streams, fording sites, and landing zones are more likely to be key terrain features.

3. **Planning considerations**.

a. Types of forces. Jungle combat is primarily a fight between light forces, while medium and heavy forces operate along roads or natural avenues of movement, where decisive battles generally occur. Further, the environment of extreme heat, virulent diseases, and frequently dangerous flora and fauna requires that units are carefully trained, equipped, and acclimated before deployment.

b. Observation and Concealment. The dense vegetation and general lack of infrastructure, along with reduced visibility and engagement ranges, make it extremely difficult to locate and engage enemy forces. Conversely, these same features make it very easy to conceal oneself.

c. Manoeuvre. Maximum use of helicopters. Without the use of special equipment, it will be difficult, if not impossible to see anything at ground level from the air. Rotary Wing (RW) assets are the predominant method of transporting troops between open areas.

d. Command and Control. Thick foliage and rugged terrain reduce the range of radio communications and distort sounds affecting C2.

e. Fire Support. These factors also tend to militate against the use of heavy and medium forces and reduce the effectiveness of adjustment of indirect fire support and employment of aircraft designed to provide intelligence and close air support to ground combat units.

f. Joint operations. When the AOO lies in a coastal or island area, naval support can be essential. Air support can be decisive. Air operations are also highly important due to the difficulties of ground movement. Reconnaissance, manoeuvre, fire support, and CSS can all be greatly assisted by air operations.

g. Sustainment. In addition, due to several problems with corrosion, there is an increasing demand on spare parts and maintenance. Movement of supplies can be difficult and vulnerable to enemy attack as canalised by restricted routes. Environmental health planning and force health protection are vital to sustaining the force. The intensity of offensive jungle operations can result in higher casualty rates.

4. **Key Engineer activities**.

a. Mobility.

(1) The construction and maintenance of roads and tracks are the initial means of improving mobility. Heavy rainfall, the clearance of vegetation, drainage and the movement of plant and stores all combine to make this

a long and painstaking task. Once constructed, routes will need regular maintenance.

(2) Landing sites and drop zones will also need to be constructed to enhance the ability to move troops and stores by air transport and helicopters more swiftly within theatre. However, with training and advice, other troops should be able to take on some of these tasks.

(3) Crossing obstacles such as large rivers, may well need engineer advice, specialist watermanship support and, possibly, some plant and machinery, but once suitable material for the construction of boats, rafts and small bridges has been provided other troops will often be able to complete the task. Bridging of obstacles to allow vehicle passage normally requires specialist equipment and should remain an engineer task.

(4) Minefields in the jungle are likely to be of the nuisance or protective variety and will remain an engineer task for clearance. Engineers may also be required to breach enemy defensive positions and to clear booby-traps.

b. Counter-mobility. The main counter-mobility tasks for engineers will be:

(1) construction of obstacles, including the execution of demolitions, to blocking roads or tracks.

(2) Counter-mobility tasks may also assist in the development of a deception plan, provided this is coordinated at the highest appropriate level.

c. Survivability. Engineers may be required to construct defensive positions, field fortifications, including artillery gun positions, and protective locations for combat supplies. Clearing Terrain in order to improve fields of observation and fire is also a frequent task.

d. General Engineer Support. Engineers will have a large variety of other tasks and commitments which will demand their advice and attention. In the early stages of a deployment these are more likely to be concerned with the establishment of a secure base. In jungle operations particular emphasis may be on:

(1) Water. The supply, purification and treatment of water in conjunction with the medical authorities.

(2) Survey. The provision of mapping and other survey tasks as appropriate

8.8. OPERATIONS IN RIVERINE ENVIRONMENTS

1. **Description**. The riverine environment is an inland, coastal or delta area comprising both land and water, often with limited or non-existent land lines of communications. The area

is likely to have extensive water surface and/or inland waterways (including lakes) that provide natural routes for transportation and communications. It is three-dimensional, with surface, subsurface and air environments. Waterways serve as primary lines of communication and frequently constitute key terrain. To control this key terrain, forces operating in a riverine environment must seek to control all three environments; however, managing risk remains a critical task in this complex environment and battlespace. While many nations have riverine forces that are part of a naval force, some nations' army or marine forces execute these operations. Riverine operations may, therefore, be executed by some nations' naval, army, marine, amphibious or special operations forces.

2. Operations in this environment are described as riverine operations. They are detailed in ATP-08 Volume III *Riverine Operations* and can be conducted in two ways:

a. as an extension of an amphibious operation (from the sea to the inland waterways through the mouth of the river);

b. as a specific land operation when the operations are conducted in a part of land characterized by the presence of rivers, lakes, lagoons or swamps, canals (natural or artificial), part of littoral area and bays.

3. **Planning considerations**.

a. Types of forces. The riverine environment requires unique capabilities and tactics. The primary advantage of a riverine force is its ability to concentrate a mix of forces effectively for operations in the riverine area, including the ability to attack selected targets in depth.

b. Manoeuvre. Riverine operations exploit the advantages of the waterways for movement, capitalizing on mobility to find, fix, and destroy hostile forces and exploit. Surface mobility is achieved primarily by riverine craft maintaining control of water lines of communication (LOC) and providing combat support and combat service support.

c. Riverine LOC are visible to aerial observation and may be subject to continuous or intermittent harassment to deny or limit movement along the routes. Bridges and roads may be destroyed or blocked to stop or restrict military traffic and become congested with civilian traffic. Movements on the waterways and on the limited road network are particularly vulnerable to ambushes.

d. Tactical surprise and operational deception should be used to compensate for natural channelling. Friendly ground forces may be transported by wheeled, mechanized, airmobile, airborne, or waterborne vehicles.

e. Riverine fire support forces equipped with long-range/indirect fire-capable weapons should be able to contribute to long-range indirect fires when appropriate, as well as close/long-range direct fire support.

f. Sustainment. A balance must be struck between making the riverine force self-sufficient for as long as possible, and keeping the riverine force as small, agile,

and defendable commensurate to the mission. Waterways may be used as LOC for resupply, considering their protection from ambush.

g. Joint. By their nature, riverine operations are joint operations requiring the coordinated and integrated efforts of participating forces to achieve a common objective.

4. **Key Engineer activities**.

a. Mobility

(1) Operation of boats

(2) Obstacle clearance

b. Counter-mobility

(1) Obstacle placement on possible boat landing sites

c. Engineer Diving

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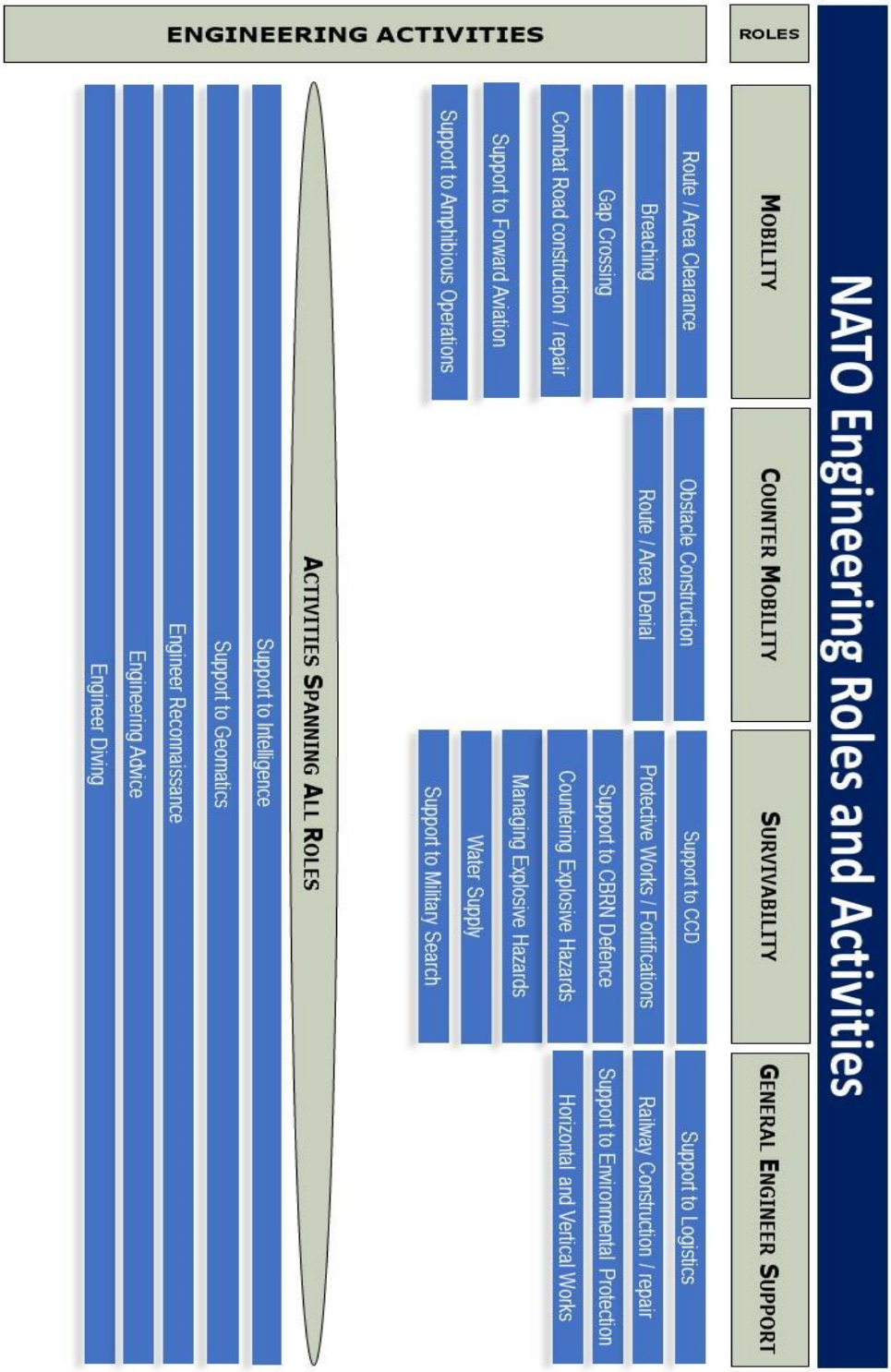
ANNEX A NATO ENGINEERING ROLES AND ACTIVITIES



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ANNEX B RELATED DOCUMENTS

Policy

MC 0469/1 *NATO Military Principles and Policies for Environmental Protection*
MC 0560/2 *MC Policy for Military Engineering*
MC 0626 *MC Policy on Power Generation for Deployed Force Infrastructure* (DFI)

Joint Doctrine

AJP-01 *Allied Joint Doctrine* (STANAG 2437)
AJP-2 *Allied Joint Doctrine for Intelligence, Counter-Intelligence and Security* (STANAG 2190)
AJP-3 *Allied Joint Doctrine for the Conduct of Operations* (STANAG 2490)
AJP-3.2 *Allied Joint Doctrine for Land Operations* (STANAG 2288)
AJP-3.8 *Allied Joint Doctrine for Comprehensive Chemical, Biological, Radiological, and Nuclear Defence* (STANAG 2451)
AJP-3.12 *Allied Joint Doctrine for Military Engineering* (STANAG 2238)
AJP-3.14 *Allied Joint Doctrine for Force Protection* (STANAG 2528)
AJP-3.15 *Allied Joint Doctrine for Countering Improvised Explosive Devises* (STANAG 2295)
AJP-3.17 *Allied Joint Doctrine for Geospatial Support* (STANAG 2599)
AJP-3.18 *Allied Joint Doctrine for Explosive Ordnance Disposal Support to Operations (STANAG 2628)*
AJP-3.19 *Allied Joint Doctrine for Civil-Military Cooperation* (STANAG 2509)
AJP-4 *Allied Joint Doctrine for Logistics* (STANAG 2182)
AJP-4.5 *Allied Joint Doctrine for Host Nation Support* (STANAG 2234)
AJP-4.6 *Allied Joint Doctrine for the Joint Logistic Support Group* (STANAG 2230)

MILENG Doctrine

ATP-3.12.2 *Allied Tactical Doctrine for Military Search* (STANAG 2283)
ATP-3.12.1.2 *Allied Engineer Publication for Military Search Training Requirements* (SRD to STANAG 2283)
ATP-3.12.1.3 *Allied Tactical Doctrine for Route and Area Clearance* (STANAG 2625)
ATP-3.12.1.4 *Deployed Force Infrastructure* (STANAG 2632)
STANAG 2017 *Orders to the Demolition Guard Commander and Demolition Firing Party Commander (Non-nuclear)*
STANAG 2036 - *Land Mine Laying, Marking, Recording and Reporting Procedures*
STANAG 2280 – *Test Procedures and Classification of the effects of Weapons on Structures*
STANAG 2989 - *Transfer of Barriers*
STANAG 2485 – *Countermine Operations in Land Warfare*
STANAG 2885 - *Emergency Supply of Water in War*
STANAG 2430 – *Land Forces Combat Engineer Messages, Reports and Returns* (R2) (AEngrP-2)
STANAG 2021 – *Military Load Classification of Bridges, Ferries, Rafts and Vehicles*
STANREC 2642 – *Testing and Interoperability of Area Access Control Obstacle Systems*
AEP-28 – *Standard agreement on electrical power supply in the field: Technical aspects for interoperability*

STANAG 4133 - *Electrical Power Supplies: Standard Types and Rotating Generating Sets*
STANREC 4587 – *Hand-held and Robotic Detector Testing*
STANREC 4843 – *Standardized Recommendations for Considerations for the Testing of Military Search Equipment*

Land Doctrine

ATP-3.2.1 – *Conduct of Land Tactical Operations* (STANAG 2605)
ATP-3.2.1.1 – *Conduct of Land Tactical Activities* (STANAG 2606)
ATP-3.2.2 – *Command and Control of Allied Forces* (STANG 2199)
ALP-4.2– *Land Forces Logistic Doctrine* (STANAG 2406)
STANAG 2395 – *Deliberate Water Crossing Procedures*

Environmental Protection

AJEEP-2 – *Environmental Protection Best Practices and Standards for Military Camps in NATO-Led Military Activities* - (STANAG 2582)
AJEEP-3 – *Environmental Management System in NATO Operations* (STANAG 2583)
AJEEP-4 – *Joint NATO Doctrine for Environmental Protection during NATO-led Military Activities* (STANAG 7141)
AJEPP-6 *NATO Camp Environmental File During NATO-Led Operations* (STANAG 6500)
AJEEP-7 - *Best EP Protection Practices for Sustainability of Military Training Areas.* (STANAG 2594)

EOD

ATP-3.18-1 *Allied Tactical Publication for Explosive Ordnance Disposal* (STANAG 2282)
STANAG 2143 - Explosive Ordnance Disposal and Minimum Standards of Proficiency
STANAG 2221 – Explosive Ordnance Disposal Reports and Messages (AEODP-06)
STANAG 2282 – Interservice EOD Operations on Multinational Deployments (ATP-72)

Other

ATP-08 vol 1 – *Doctrine for Amphibious Operations* (STANAG 1149)
ADivP-1- *Allied Guide to Diving Operations* (STANAG 1372)
AASTP-1 *NATO guidelines for the storage of military ammunition and explosives* (STANAG 4440)
AASTP-5 *NATO guidelines for the storage, maintenance and transport of ammunition on deployed missions or operations* (STANAG 4657)
AATMP-03 *Airfield Damage Repair (ADR) Capability* (STANAG 2929)
ALP-16 *Explosives Safety and Munitions Risk Management (ESMRM) in NATO Planning, Training, and Operations* (STANAG 2617)
ATP-104 *Water Production, Storage and Distribution* (STANAG 2629)
AMedP-4.9 *Requirements for Water Potability During Field Operations and in Emergency Situations* (STANAG 2136)

ACO Directives

ACO Directive 084-001 Military Engineering
ACO Directive 084-002 Infrastructure Assessment
Bi-SC 85-5 *NATO Approved Criteria and Standards for Airfields Directive*

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ANNEX C LEXICON

Part 1 – Acronyms and abbreviations

ADR	airfield damage repair
AJP	Allied joint publication
AOM	Alliance Operations and Missions
AOO	area of operations
AOR	area of responsibility
ARRP	Alliance Requirements and Resources Plan
ATP	Allied tactical publication
BDA	battle damage assessment
BRA	barrier restricted area
C2	command and control
CAS	close air support
CBRN	chemical, biological, radiological, nuclear
CCD	camouflage, concealment and deception
CCIR	commander's critical information requirement
C-IED	countering improvised explosive devices
C-MOB	counter mobility
CNI	critical national infrastructure
COA	course of action
COIN	counter-insurgency
COLPRO	collective protection
CRM	crisis response measure
CUR	crisis urgent requirement
DFI	deployed force infrastructure
EBA	effects-based approach
EOD	explosive ordnance disposal
EMS	electromagnetic spectrum
EP	environmental protection
ESMRM	explosive safety and munitions risk management
FARP	forward arming and refuelling point
FLS	forward logistics site
FW	fixed wing
FOM	freedom of movement
FP	force protection
FULLCOM	full command
GRP	graduated response plan
HLS	helicopter landing site
HN	host nation
HNS	host nation support
IED	improvised explosive device
IO	international organization
IPOE	intelligence preparation of the operational environment
JOPG	Joint Operations Planning Group
JTF	joint task force

LCC	land component command
LOC	line of communications
MILENG	military engineering
NAC	North Atlantic Council
NATO	North Atlantic Treaty Organization
NBG	National Barrier Guidance
NGO	non-governmental organization
NID	NAC initiating directive
NMR	national military representative
NSIP	NATO Security Investment Programme
POC	point of contact
OA	obstacle area
OPCOM	operational command
OPCON	operational control
OPLAN	operational plan
OB	obstacle belt
OZ	obstacle zone
PIR	priority information requirement
PMESII	political, military, economic, social, informational and infrastructural
POD	port of debarkation
POE	physical operating environment
RAOS	repair of airfield operating surfaces
RFI	request for information
ROE	rules of engagement
ROTA	release other than by attack
RSOM	reception, staging and onward movement
RW	rotary wing
SNIC	snow and ice clearance
SOP	standard operating procedure
SPD	strategic planning directive
SPOD	seaport of debarkation
TACOM	tactical command
TACON	tactical control
TDM	temporary deployable magazine
TE	tactical effect
TIH	toxic industrial hazard
TFHE	tactical fuel handling equipment
TTP	tactics, techniques and procedures
UAV	unmanned aerial vehicle
UGV	unmanned ground vehicle
UXO	unexploded explosive ordnance

Part 2 – Terms and definitions

amphibious operation
A military operation launched from the sea by a naval and landing force embarked in ships or craft, with the principal purpose of projecting the landing force ashore tactically into an environment ranging from permissive to hostile.
(NATO-Term record 3517)

area clearance
The systematic detection, identification, marking and neutralization, destruction or removal of obstacles in a defined area to enable a military operation with reduced risk.
(NATO-Term record 11620)

asymmetric threat
A threat emanating from the potential use of dissimilar means or methods to circumvent or negate an opponent's strengths while exploiting his weaknesses to obtain a disproportionate result.
(NATO-Term record 6844)

barrier
One or more obstacles that may have an impact on a manoeuvring force and may be used to create an operational effect.
(NATO-Term 1158)

barrier restricted area
An area declared by an authorized commander where manoeuvre of friendly forces must not be hindered by barriers. Restrictions imposed may include a complete ban on the emplacement of obstacles in certain areas for specified periods.
(NATO-Term record 8128)

command and control
The authority, responsibilities and activities of military commanders in the direction and coordination of military forces as well as the implementation of orders related to the execution of operations.
(NATO-Term record 25675)

deliberate breaching
The planned creation of a safe lane through an obstacle or barrier.
(NATO-Term record 15270)

demolition
The intentional destruction of structures, facilities or materiel by the controlled use of fire, water, explosives, mechanical or other means.
(NATO-Term record15410)

environmental protection
The prevention or mitigation of adverse environmental impacts.
(NATO-Term record 25573)

explosive ordnance disposal
The detection, accessing, uncovering, identification, mitigation, rendering safe, recovery, exploitation and final disposal of explosive ordnance, regardless of condition.
(NATO-Term record 15423)

force protection
All measures and means to minimize the vulnerability of personnel, facilities, equipment and operations to any threat and in all situations, to preserve freedom of action and the operational effectiveness of the force.
(NATO-Term record 7618)

forward logistic site
An ashore site that provides logistic support to the multinational maritime force, ensuring that all passengers, mail and materiel are processed and transferred as expeditiously as possible via multiple means of transport.
(NATO-Term record 23389)

hasty breaching
The creation of a safe lane through an obstacle or barrier by any expedient method using organic resources.
(NATO-Term record17801)

hybrid threat
A type of threat that combines conventional, irregular and asymmetric activities in time and space.
(NATO-Term record 37938)

military engineering
A function in support of operations to shape the physical operating environment.
(NATO-Term record 10403)

military search
The management and application of systematic procedures and appropriate equipment to locate specified targets in support of military operations.
(NATO-Term record 26005)

obstacle
A natural or artificial object that creates a physical impediment to, or hazard for, the movement of vehicles and/or personnel.
(NATO-Term record 25659)

obstacle belt
A part of an obstacle zone that combines a number of obstacle groups, serving as an obstacle control measure to create a specific effect.
(NATO-Term record 27928)

obstacle group
A number of individual obstacles combined to create a specific effect, thus serving as the lowest-level obstacle control measure.
(NATO-Term record 27932)

obstacle zone
An area containing one or more obstacle belts to create a specific effect, thus serving as an obstacle control measure.
(NATO-Term record 27936)

obstacle control measure
Specific measure that simplifies the granting of obstacle-emplacing authority while providing obstacle control.
(NATO-Term record 27930)

operation
A sequence of coordinated actions with a defined purpose.
(NATO-Term record 3510)

reserved obstacle
A planned obstacle that is deemed critical to the counter-mobility plan and for which the authority to execute is retained by a designated commander.
(NATO-Term record 28000)

route clearance
The detection and, if found, the confirmation, identification, marking and neutralization, destruction or removal of explosive ordnance and non-explosive obstacles threatening a defined route to allow a military operation to continue with reduced risk.
(NATO-Term record11621)

ATP-3.12.1(B)(1)