This publication supersedes Land Warfare Doctrine 3-6-1, Employment of Engineers, 2002.
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Contents
PREFACE

Aim

1. The aim of the publication is to describe the capabilities of engineers in order to provide an understanding of their contribution to the comprehensive range of military activities within a 'whole-of-government' approach to national security.

Level

2. This publication is written for new members of the Army. It provides corps non-specialists with an understanding of the capabilities of the organisation and its raise, train and sustain role. This publication is a useful reference for government and non-government agencies working with the Army.

3. This publication provides application level doctrine. This is the capstone publication for engineers as part of the Land Warfare Doctrine Operation Series. This publication describes the employment of engineers. This publication complements Land Warfare Doctrine 3-0, Operations (Developing Doctrine), 2008 and Land Warfare Doctrine 3-0-3, Land Tactics (Developing Doctrine), 2009. Further doctrine is contained in the engineer-specific publications.

Scope

4. This publication provides:
   
   a. a description of the operating environment for the employment of engineers;

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### Contents

| b. | an explanation of the role, concepts of employment, command and control and sustainability issues associated with engineers; |
| c. | a description of engineer organisations, capabilities and limitations; |
| d. | a description of the missions and the types of tasks undertaken by engineers, including synchronising activities within the combined arms team; |
| e. | an explanation of the planning, tasking, coordination processes and control measures for engineer capabilities; |
| f. | a description of engineers in offensive, defensive, stability and enabling activities within a whole-of-government approach; |
| g. | an explanation of the unique combat service support structures and systems that support engineers and their impact within the mission space; and |
| h. | an explanation of the employment of engineers in specific environments. |

### Associated Publications

5. This publication should be read in conjunction with the following publications:

| b. | *Allied Technical Publication 52(B), Land Force Combat Engineer Doctrine (Ratification Draft)*, 2006; |
Contents

e. *Land Warfare Doctrine 2-0, Intelligence*, 2008;
f. *Land Warfare Doctrine 3-0, Operations (Developing Doctrine)*, 2008;
g. *Land Warfare Doctrine 3-0-3, Land Tactics (Developing Doctrine)*, 2009;
h. *Land Warfare Doctrine 3-6-9, Geospatial Support*, 2006; and

On-line Doctrine

6. This and other doctrine publications are available via the Army Doctrine Electronic Library website located at: [http://adel.defence.gov.au](http://adel.defence.gov.au). Paper copies may be out of date. The Army Doctrine Electronic Library is the authoritative source for current doctrine. Users are to ensure currency of all doctrine publications against the Army Doctrine Electronic Library.

Photographs

7. All photographs in this publication were taken by Australian Defence Force personnel during military operations or training activities and remain the property of the Australian Defence Force.

Gender

8. This publication has been prepared with gender-neutral language.
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**abatis**
An obstacle constructed by the felling and interlacing of trees across a route.

Related term: obstacle

**block**
1. To deny access to a given area, or to prevent an advance in a particular direction.
2. The integration of fire planning and obstacles to stop an attacker on a specific avenue of approach or to prevent an enemy from exiting an engagement area.

**breach**
To break through or secure a passage through an enemy defence, obstacle, minefield or fortification.

**capability**
The ability of a trained and equipped individual or organised force to effectively achieve an assigned mission, task or function.
complex obstacle
An obstacle for which a force has to employ more than one type of asset to reduce.

complex terrain
The environment shaped by physical, human and informational factors that interact in a mutually-reinforcing fashion. It is terrain that limits the utility of technological intelligence, surveillance and reconnaissance and reduces opportunities for long range engagement with a consequent increased emphasis on close combat.

counter-mobility
The denial of the enemy’s freedom to physical manoeuvre.

counter-mobility support
An element of the mobility and survivability battlespace operating system that includes action taken to deny the enemy freedom to physically manoeuvre thereby allowing the commander to select the time and place to engage the enemy.

deception
Those measures designed to mislead the enemy by manipulation, distortion, or falsification of evidence to induce them to react in a manner prejudicial to their interests.

decontamination
The process of making any person, object or area safe by absorbing, destroying, neutralising, making harmless or removing, chemical or biological agents, or by removing radioactive material clinging to or around it.

decoy
An imitation of a person, object or phenomenon, which is intended to deceive hostile surveillance or detection systems or mislead the adversary.
defence stores
Non-explosive stores for the construction of field defences. Note: Most defence stores are recoverable and include; wire, pickets, sandbags, timber, corrugated iron, revetment materials and expedient protective wall systems.

demolition
The destruction of structures, facilities or materiel by use of fire, water, explosives, mechanical or other means.

disrupt
To neutralise or destroy parts of a force in a manner that prevents is acting as a coordinated whole.

dummy
See: decoy

effect
Effect is the adverse physical, physiological, psychological or functional impact on the enemy as a result or consequence of own military or non-military actions.

emergency response
The actions taken to respond to threats and incidents involving hazardous materials or situations, including fire, with the intent of minimising the risk to life and damage to property and the environment. Incidents may be deliberate attacks or accidents.

engineer intelligence
The product resulting from the processing of information concerning enemy engineer operations and resources, environmental conditions, military geographic information and terrain required by a commander in the planning of combat operations.

explosive ordnance
All munitions containing explosives, nuclear fission or fusion materials and biological and chemical agents. This includes bombs and warheads; guided and ballistic missiles; artillery,
mortar, rocket and small arms ammunition; all mines, torpedoes and depth charges, demolition charges; pyrotechnics; clusters and dispensers; cartridge and propellant actuated devices; electro-explosive devices; clandestine and improvised explosive devices; and all similar or related items or components explosive in nature.

**explosive ordnance disposal**
The detection, identification, on-site evaluation, rendering safe, recovery and final disposal of unexploded explosives ordnance. It may also include explosives ordnance which has become hazardous by damage or deterioration.

**facilities**
Real property, including all buildings, land and permanent improvements such as access roads, rail links, fencing, piers, etc required for operation and support of an equipment.

**fix**
A tactical task in which actions are taken to prevent the enemy from moving any part of its forces from a specific location, and/or for a specific period of time, by holding or surrounding them to prevent their withdrawal for use elsewhere.

**gap**
An area within a minefield or obstacle belt, free of live mines or obstacles, whose width and direction will allow a friendly force to pass through in tactical formation.

**geodetic control**
A network of ground control points for which precise three-dimensional spatial coordinates are known on a specific datum.

**geospatial information**
Spatial data and other related information exploited to produce geospatial intelligence and other geospatial products such as maps and charts.
geospatial support
The acquisition and management of information about the physical dimension.

hazard
A condition with the potential to cause injury, illness, or death of personnel; damage to or loss of equipment or property; or mission degradation.

high risk search
The search of an area, vehicle or building suspected of containing devices which are intended to kill or maim.

Related term: low risk search

host nation
A nation which, by agreement:

1. receives forces and materiel of North Atlantic Treaty Organization or other nations operating on/from or transiting through its territory;

2. allows materiel and/or North Atlantic Treaty Organization organisations to be located on its territory; and/or

3. provides support for these purposes.

host nation support
Civil and military assistance rendered in peace, crisis or war by a host nation to North Atlantic Treaty Organization and/or other forces and North Atlantic Treaty Organization organisations which are located on, operating on/from, or in transit through the host nation’s territory.

improvised explosive device
A device placed or fabricated in an improvised manner incorporating destructive, lethal, noxious, pyrotechnic or incendiary chemicals and designed to destroy, incapacitate, harass or distract. It may incorporate military stores, but is normally devised from non-military components.
infrastructure
A term generally applicable for all fixed and permanent installations, fabrications, or facilities for the support and control of military forces.

interoperability
The ability of systems, units or forces to provide the services to, and accept services from other systems, units or forces and to use the services so exchanged to enable them to operate effectively together.

low risk search
Low risk search is a physical search for items in a low risk environment. The low risk is a result of the nature of the items, the complexity of the environment in which the search is being conducted or the potential for enemy interference. Items entailing low risk include personnel, standard ammunition and explosives. Low risk search may be conducted by all-corps personnel with the appropriate training. Low risk search does not include the neutralisation or disposal of located items, and other specialists, such as explosive ordnance disposal technicians, or ammunition technicians, may be required.

Related term: high risk search

mine
In land mine warfare, an explosive munition designed to be placed under, on or near the ground or other surface area and to be actuated by the presence, proximity or contact of a person, land vehicle, aircraft or boat, including landing craft.

minefield
In land mine warfare, a defined area in which mines have been emplaced.

mobility
A quality or capability of military forces which permits them to move from place to place while retaining the ability to fulfil their primary mission.
mobility support
An element of mobility and survivability battlespace operating system support that includes action taken to enhance the mobility of the force thereby allowing the commander the freedom to physically manoeuvre.

neutralisation
In mine warfare, a mine is said to be neutralised when it has been rendered, by external means, incapable of firing on passage of a target, although it may remain dangerous to handle.

obstacle
Any obstruction designed or employed to disrupt, fix, turn, or block the movement of an opposing force, and to impose additional losses in personnel, time, and equipment on the opposing force. Obstacles can be natural, man-made, or a combination of both.

obstacle breaching
A synchronised combined arms operation, conducted in contact with an enemy force, to project combat power to the far side of an obstacle. Physical ground movement through the obstacle is through lanes that have been created by the reduction of the obstacle.

Related terms: obstacle, obstacle crossing

obstacle crossing
A tactical operation to move to the far side of an obstacle. Obstacle crossing is not necessarily a combined arms operation – although it may be conducted in coordination with other forces – and not necessarily conducted in contact.

Related terms: obstacle, obstacle breaching

potable water
Water that is deemed to be of sufficient quality that it is fit for human consumption.
In obstacle crossing or breaching operations, the process by which the obstacle is neutralised or physically removed. Reduction is normally performed by combat engineers as part of the combined arms team. Reduction is achieved using a variety of specialist equipment and techniques.

**reserved demolition**
A demolition which must be controlled at a specific level of command because it plays a vital part in the tactical or operational plan, or because of the importance of the target itself, or because the demolition may be executed in the face of the enemy.

**route**
The prescribed course to be travelled from a specific point of origin to a specific destination.

**search**
Search is the management and application of systematic procedures and appropriate detection equipment to locate specified targets.

**services**
Those elements of infrastructure that provide a service to people or facilities including water supply, electricity supply, lighting, heating, air conditioning, refrigeration, hazard reduction and waste disposal measures.

**shape**
Engage in actions that enhance the friendly force’s position, delay the enemy’s response, or lead the enemy into an inadequate or inappropriate response in order to set the conditions for decisive action.

**support**
The action of a force, or portion thereof, which aids, protects, complements or sustains any other force.
survivability
Concept which includes all aspects of protecting personnel, weapons, and supplies while simultaneously deceiving the enemy. Survivability tactics include building a good defence; employing frequent movement; using concealment, deception, and camouflage; and constructing fighting and protective positions for both individuals and equipment.

sustainability
The ability of a force to maintain the necessary level of combat power for the duration required to achieve its objectives.

target
The object of a particular action, for example a geographic area, a complex, an installation, a force, equipment, an individual, a group or a system, planned for capture, exploitation, neutralisation or destruction by military forces.

technical control
The provision of specialist and technical advice by designated authorities for the management and operation of forces. Notes:

1. For forces assigned to operations, technical control is exercised by capability managers, through the Commander Joint Operations and where applicable through Joint Task Force commanders.

2. For non-operational activities, technical control is exercised by designated authorities appointed by capability managers.

3. Technical control advice may not be modified but may be rejected in part or in total by a commander in consideration of operational factors.

terrain
A tract of land, especially as considered with reference to its natural and man-made features.
terrain analysis
The collection, analysis, evaluation and interpretation of geographic information on the natural and man-made features of the terrain, combined with other relevant factors, to predict the effect of the terrain on military operations.

terrain visualisation
The depiction of terrain, most particularly its topography and relief, through visual images.

turn
To force a hostile element, group or organisation to change direction.

unexploded explosive ordnance
Explosive ordnance which has been primed, fused, armed or otherwise prepared for action, and which has been fired, dropped, launched, projected or placed in such a manner as to constitute a hazard to operations, installations, personnel or material and remains unexploded either by a malfunction of design or for any other cause.

utilities
See: services

water point
A site adjacent to a water source such as a river, lake, dam or well, where potable water is produced and stored.
ABBREVIATIONS

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<td>AOR</td>
<td>area of responsibility</td>
</tr>
<tr>
<td>CIMIC</td>
<td>civil–military cooperation</td>
</tr>
<tr>
<td>EOD</td>
<td>explosive ordnance disposal</td>
</tr>
<tr>
<td>ESR</td>
<td>Engineer Support Regiment</td>
</tr>
<tr>
<td>HNS</td>
<td>host nation support</td>
</tr>
<tr>
<td>JTF</td>
<td>joint task force</td>
</tr>
<tr>
<td>KPP</td>
<td>key point protection</td>
</tr>
<tr>
<td>LOE</td>
<td>line of effort</td>
</tr>
<tr>
<td>LRSS</td>
<td>Littoral and Riverine Survey Squadron</td>
</tr>
<tr>
<td>TCP</td>
<td>traffic control post</td>
</tr>
<tr>
<td>VAP</td>
<td>vital asset protection</td>
</tr>
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<td>VCP</td>
<td>vehicle checkpoint</td>
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2. The following abbreviations are used in the figures and tables of this publication.

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tr>
<td>COIN</td>
<td>counterinsurgency</td>
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CHAPTER 1

THE FUNDAMENTALS

SECTION 1-1. INTRODUCTION

1.1 RAE provide a broad range of flexible and adaptable engineering support to the Australian Army and the ADF. The RAE Corps motto ‘Ubique’ is a Latin word which literally means ‘everywhere’. The old engineer maxim ‘just try going to war without us’ provides an accurate insight into the essential nature of engineers in the battlespace, as they provide a significant contribution to almost every facet of warfighting. Figure 1–1 depicts engineers during a patrol in Afghanistan.

![Figure 1–1: Engineers on Patrol in Afghanistan](image)

1.2 This publication discusses the employment of RAE across the comprehensive range of military activities. It outlines RAE capability, organisation, planning and participation in offensive,
defensive, stability and enabling activities and their employment in specific environments. Figure 1–2 illustrates an engineer visiting a victim of a land mine during an engineer de-mining task as part of a larger stability activity.

Figure 1–2: Australian De-miner Visiting a Mine Victim

1.3 This chapter describes the fundamentals of RAE including the role, characteristics, capabilities, principles of employment, limitations and their contribution to land warfare.

SECTION 1-2. ROLE

1.4 The role of the RAE is to provide geospatial, combat and force support engineering capabilities to enable joint manoeuvre and survivability.
1.5 Engineers are a finite resource, and warfighting requires military engineers to undertake a very broad range of tasks. At one end of the scale, engineers may be required to breach a minefield during an advance in contact. At the other end of the scale, they might be rebuilding a school to assist the local population to return to prosperity after a conflict. To achieve their diverse range of tasks, engineers need to be enterprising (see Figure 1–3) and well-equipped, and require the following interdependent characteristics:

Figure 1–3: Engineers Constructing a Field Machine

a. Flexibility. Above all other characteristics, engineers must be mentally, physically and technically flexible.
Noting the time required to reconfigure, regroup and relocate personnel and equipment; engineer groupings are modular in structure to enable rapid transition between missions with the personnel and equipment available. This purpose underpins the engineer requirement for a high level of multiskilling and the ability to be effective soldiers.

b. **Mobility.** Engineers must be able to achieve mobility commensurate with the FE they are tasked to support regardless of whether it is a mechanised combat team or infantry on foot. Engineers also maintain their equipment, such as the medium bulldozer illustrated in Figure 1–4, and stores on vehicles to enable them to transition rapidly between missions in different locations.

![Medium Bulldozer](image)

*Figure 1–4: Medium Bulldozer*

c. **Skill.** In order to be able to undertake a diverse range of tasks with limited human resources, engineers must be multiskilled. All engineers are soldiers first, sappers second and specialists third. Figure 1–5 depicts an engineer carpenter and Figure 1–6 shows an engineer Army work diver on task. Officers are trained in all types
of engineer support. Multiple diverse skills facilitate flexibility, rapid mobility and the ability to transition quickly between missions by reducing the time required to relocate larger numbers of personnel and equipment.

Figure 1–5: Carpenter
SECTION 1-4. TASKS

1.6 Engineer tasks are prioritised because there are always more tasks than can be accomplished by the available engineers. The important consideration is which tasks should be accorded the highest priority. All engineer tasks fall into the five interdependent engineer functions. These functions are illustrated in Figure 1–7.
1.7 Engineers are tasked to provide the following support:

a. Mobility Support. Mobility support is action taken to enhance the mobility of the force, thereby allowing the commander the freedom to physically manoeuvre.

b. Countermobility Support. Countermobility support includes action taken to deny the enemy freedom to physically manoeuvre, thereby allowing the commander to select the time and place to engage the enemy.

c. Survivability Support. Survivability support is action taken to reduce the effects of hazards created by the enemy, by friendly forces or by nature.

d. Sustainability Support. Sustainability support is action taken to enable a force to maintain the necessary level of fighting power for the duration required to achieve its objectives.
1.8 Engineer capabilities are grouped by function. The specific capabilities and capacity for those capabilities is dependent on the role and function. Capabilities may be brigaded or dispersed, dependent on the circumstances and requirement.

Mobility Support

1.9 Engineer capabilities to provide mobility support include:
   a. bridging,
   b. gap crossing,
   c. obstacle breaching,
   d. road construction,
   e. airfield construction, and
   f. port construction.

Countermobility Support

1.10 Engineer capabilities to provide countermobility support include:
   a. constructing obstacles on land and offshore,
   b. bridge demolition, and
   c. route demolition.

Survivability Support

1.11 Engineer capabilities to provide survivability support include:
   a. CBRN and explosive;
   b. fire and emergency response;
c. physical force protection (hardening and fortification);
d. explosive ordnance disposal (EOD); and
e. high-risk search.

Sustainability Support

1.12 Engineer capabilities to provide sustainability support include:
   a. provision of water;
   b. provision of electricity;
   c. provision of sanitation;
   d. provision of public hygiene facilities;
   e. provision and maintenance of infrastructure (living, working, transport and logistics); and
   f. Army work diving tasks.

Geospatial Support

1.13 Engineer capabilities to provide geospatial support include:
   a. cartography;
   b. geospatial information, including data overlays and probabilistic overlays;
   c. land and hydrographic (littoral and riverine) surveying;
   d. the theatre grid system;
   e. map management; and
   f. multimedia technicians.

SECTION 1-6. PRINCIPLES OF EMPLOYMENT

1.14 Effective employment of engineer support can significantly enhance a commander’s chance of success in the battlespace and can be a deciding factor in tactical actions. Like all military capabilities, engineers should be employed in accordance with the principles of war and the tenets of manoeuvre.
The responsibility for identifying the correct mix of engineer capability and applying it in the battlespace rests with the manoeuvre commander. It is determined during the planning process based on advice from the senior engineer. The principles of employing engineers complement the principles of war and the tenets of manoeuvre and assist a commander integrate engineer support into the manoeuvre plan.

**Centralised Control with Decentralised Execution**

The effective execution of engineer support tasks requires careful deployment and control of engineer troops, equipment and stores. The most efficient results are achieved using centralised control at the highest appropriate level, with responsibility for tactical execution decentralised and delegated to the lowest practical level.

Centralised control with decentralised execution supports the mission command philosophy. The centralised command provides the intent and the resources, while the decentralised execution conducts the mission within the intent and limitations provided.

**Early Warning and Reconnaissance**

Engineer tasks generally require the relocation and/or assembly of vehicles, equipment, explosives, construction materials and personnel. Moving plant, bridging equipment and construction materials may take considerable time and require the provision and coordination of external lift capability. Early warning and reconnaissance and anticipation and foresight are, therefore, crucial factors in efficient and effective application of engineer support within the battlespace. Commanders and staffs should ensure the following:

a. that engineers are given maximum possible warning of future activities and likely support tasks,

b. that engineers are involved in the planning process as early as possible, and

c. that engineers are afforded the opportunity to undertake engineer reconnaissance.
Priority of Work

1.19 Engineers seldom have the capacity to undertake and complete all of the engineer support tasks. The engineer commander must maintain close liaison with the manoeuvre commander and staff to advise on what is achievable, when and by whom, and assist the commander to set priorities for engineer effort. Once the priorities are set, reconnaissance and preparatory relocation of equipment and stores can begin. Changing priority should be avoided if possible as it consumes considerable time and resources. Engineers should not be kept in dedicated reserve, but it is important to identify engineer capacity on lower priority tasks that can be redirected at short notice to undertake essential and unforeseen tasks as a situational reserve.

Concentration of Effort

1.20 Greater efficiency is obtained by concentrating engineer effort on high-priority support tasks rather than dispersing resources over a larger number of tasks.

Continuity of Effort

1.21 Once work begins on an engineer support task, the same engineer unit should complete the task. Unnecessary redeployment of engineer resources must be avoided. Any break in the continuity of engineer work causes delay and usually requires extra effort to complete the task.

Economy of Effort

1.22 Engineers are trained and equipped to carry out technical tasks. It is uneconomical to employ them on tasks that can be carried out by other units. Similarly, it is also uneconomical to apply more engineer effort than is necessary to complete tasks in the required time or to use engineer effort on the unskilled aspects of engineer tasks.
Protection

1.23 Engineers cannot work efficiently and provide for their own protection simultaneously. Providing protection for engineers significantly increases efficiency.

SECTION 1-7. LIMITATIONS

1.24 Engineer FEs have limitations similar to other arms and services. Providing for these limitations requires commanders to balance the priority of work with the available time. The most significant engineer limitations are vulnerability while working, reduced efficiency at night, reliance on materiel and maintenance and rest time.

Vulnerability

1.25 Engineer tasks require skilled application of effort; therefore, engineers have limited capacity to protect themselves while working. With the exception of those tasks that can be completed in a protected vehicle, engineer support tasks are normally carried out by dismounted troops at critical locations outside defended areas. These support tasks usually require the use of specialised equipment that is characterised by high visibility (silhouettes) and noise signature, which draws enemy attention and fire. All engineers carry personal weapons and man crew-served weapons, but they cannot work and fight simultaneously. Other elements may be required to provide protection for engineer work parties to permit uninterrupted work (see Figure 1–8).
Night Work

1.26 Engineers are trained to complete their tasks in all light levels. However, tasks carried out in darkness require much more time to complete than similar tasks carried out in daylight, even when night vision devices are used. Therefore, commanders must consider the increased time required and the fatigue caused by working in low light levels against the benefits of using light in non-tactical situations.

Reliance on Geospatial Data, Equipment, Construction Materials and Stores

1.27 Engineers differ from other FEs in that most of their work requires geospatial data, equipment, construction materials and stores not permanently held within units. Engineer work will only progress smoothly if the necessary geospatial data, equipment, construction materials and stores are available when required. The delivery of data, equipment, stores and materials must be planned and coordinated so that they are available in the right order at the right place at the right time. Planning must include staff coordination to ensure that the...
appropriate priority is placed on the procurement, movement and use of these items.

1.28 If multiple pieces of a type of equipment are held in an operational area, the equipment may be decentralised and held in units. If there is a very limited number of a piece of equipment (such as bridging) it must be controlled centrally and held in a location that will permit its rapid employment. If the equipment is held too far to the rear, delays in its use will occur. If it is held too far forward, the operational situation may not permit its relocation when it is needed. Similarly, if control is vested in too high an authority, delay in release is probable; if it is controlled at too low a level, it may not be allocated to the appropriate priority task.

Maintenance and Rest Time

1.29 Engineer work is physically demanding on the sappers and their equipment. During the planning of an engineer task, consideration must be given to the scheduling of regular rest and administration periods for the sappers and maintenance periods for equipment and vehicles.

SECTION 1-8. CONTRIBUTION TO LAND WARFARE

Operating Environment

1.30 Campaign Themes. The spectrum of military conflict ranges from stable peace through unstable peace and irregular war to general war. Within the spectrum of conflict, land forces (including engineers) operate in a conceptual framework that consists of campaign themes and military activities. The campaign themes are Peacetime Military Engagement, Peace Support, Counterinsurgency and Major Combat. The theme for a campaign is determined based on the predominant theme in a particular campaign or operation. For example, the campaign theme for Australia’s commitment to the Regional Assistance to the Solomon Islands (commonly known as RAMSI) is Peace Support.
1.31 **Comprehensive Range of Military Activities.** The comprehensive range of military activities includes offensive, defensive, stability and enabling activities. The campaign themes and range of military activities are illustrated in Figure 1–9. Figure 1–9 also provides an indication of the balance or level of effort required during each type of activity. For example, stability activities (Peace Support theme) have a greater requirement for interagency cooperation than offensive and defensive activities (Major Combat theme). At any time the emphasis of a particular activity may change according to the threat circumstances. However, it should be noted that a combat team attack during Peace Support may be no less violent than one during Major Combat, but there will be far more combat team attacks during Major Combat, hence the balance of effort on offensive and defensive activities is greater.

![Figure 1–9: Campaign Themes and the Range of Military Activities](image)

1.32 **Interagency Cooperation.** All ADF operations are joint or joint interagency and are conducted either unilaterally or, more often, as part of a combined, coalition or multinational force. ADF operations are also conducted within a whole-of-government framework using a comprehensive approach. This means that the ADF is not the only element of Australia’s national power striving to achieve the national
strategic endstate. Other government departments are likely to be working alongside the ADF. This national effort requires significant coordination and is represented in Figure 1–9 as interagency cooperation. The spectrum of conflict, operating environment, campaign themes and range of military activities are explained in LWD 3-0, Operations (Developing Doctrine), 2008.

Characteristics of Land Warfare

1.33 The characteristics of the land warfare operating environment are evolving lethality, density of battle, exploitation of complex terrain, operational uncertainty and information dominance. These characteristics combine to produce a range of challenges where soldiers fight in a multi-dimensional battlespace against forces seeking to develop and exploit an asymmetric advantage and, thereby influence the perceptions of the population through information manipulation. The characteristics of land warfare are described in LWD 1, The Fundamentals of Land Warfare, 2008.

1.34 Battles may be won through decisive engagement, the application of fighting power and the destruction or attrition of enemy forces. However, the conflict itself is rarely resolved in combat. The conflict is won or lost in the perception battle, the hearts and minds of the population and the world’s media (who cannot be successfully suppressed).

1.35 In conflict, even if a coalition involving Australia achieves the strategic endstate and success is declared, it is incumbent upon the coalition to restore essential services and infrastructure if they wish to win the perception battle. The restoration and reconstruction may take many years and require a significant commitment from the nations involved in the coalition and the UN.

Conduct of Land Warfare

1.36 Australian Participation. Australia’s current circumstances indicate that any Australian involvement in conflict will probably be as part of a coalition, most likely a UN-sanctioned coalition. Depending on the size and location of the force, Australia may
be the lead nation or may be a contributing nation. Regardless
of the conflict, Australia will apply and be held accountable for
applying high moral and ethical standards before, during and
after the activity.

1.37 Adaptive Action. Adaptive action is an iterative process of
stimulating a response from the threat force, learning from
those responses and changing the behaviour accordingly.
Adaptive action incorporates outputs from deliberate planning
as the start point for subsequent interaction with the operating
environment. Engineers operate within and alongside multiple
FEs within the battlespace and contribute across the full range
of military activities. This affords engineers continuous
interaction with enemy forces, adversaries, neutrals and
friendly forces, which in turn provides a continuous opportunity
to observe, learn from and adapt to the changes within the
operating environment.

1.38 Mission Command. Mission command is a methodology
whereby the commander states their requirement and provides
the resources, and the subordinate determines how to achieve
that requirement within any specified limitations. Mission
command underpins the engineer employment principle of
centralised control with decentralised execution. Engineer
commanders act within the commander's intent to prosecute
their mission or conduct their task and adapt to the changing
circumstances. They may change their methods based on
events or changing circumstances and they do so
understanding their superior commander's intent and the
implications for the mission.

Lines of Effort

1.39 Conceptually, land forces operate across five interdependent
and mutually reinforcing lines of effort (LOEs). All land force
activities contribute to one or more of these LOEs. However,
gineers provide a significant contribution to all LOEs, as
follows:

a. Joint Land Combat. In the joint land combat LOE,
gineers interpret, shape and fight battles
predominantly by providing mobility, countermobility, survivability and geospatial support to enable the land force to manoeuvre in contact through complex terrain.

b. *Population Protection.* In the population protection LOEs, engineers contribute to protection and security through their construction of secure facilities; conducting high-risk search; improvised explosive device disposal; EOD; CBRN and toxic industrial waste disposal and management; and protection of key assets.

c. *Public Information.* In the public information LOEs, engineer integration into the community through the provision of population protection, support and indigenous capacity-building provides and distributes information. Multimedia media technicians assist in communications and the dissemination of key themes and messages through non-verbal images.

d. *Population Support.* In the population support LOEs, engineers restore essential services such as water, power, sanitation and roads, thereby rapidly improving habitability.

e. *Indigenous Capacity Building.* In the indigenous capacity-building LOEs, engineers integrate with the local community on nation-building tasks. They can provide employment and training to nationals through their restoration and reconstruction tasks for a wide range of skills, such as providing water and sanitation, and construction and trade skills for roads, bridges and buildings.
CHAPTER 2

ORGANISATION

SECTION 2-1. INTRODUCTION

2.1 The Army engineer capability is organised to interpret and shape the environment to enable joint manoeuvre. It comprises CERs to provide close support to the Brigades; Engineer Support Regiments (ESRs) to provide a more general support to deployed forces; CE Works to design the more complex construction projects; construction regiments to undertake construction work for deployed forces and the IRR to respond to specific emergency situations.

2.2 Engineer groupings are capability-based and are regrouped dependent on their mission and tasks. The groupings have remained extant for many years and have proven suitable. However, the higher operational tempo of recent years indicates that a transition to a more modular approach may assist the rapid regrouping to task-organised FEs.

2.3 This chapter describes how RAE is organised to provide engineer support to Army in a joint setting.

SECTION 2-2. COMMAND AND CONTROL

Centralised Control with Decentralised Execution

2.4 Command is the process of impressing the will of the commander on subordinates, encompassing the full authority to deploy organic forces to fulfil a mission or task. Control over these forces is the process employed by the commander to organise, direct and coordinate the actions of those forces.

2.5 Centralised Control. As there are multiple priorities for engineer effort in all phases of conflict and on all LOEs, assignment of engineer priorities and control of engineer effort is managed centrally. Central coordination facilitates
anticipation of engineer tasking, pre-positioning of equipment and stores and maximises the effectiveness and efficiency of engineer effort. It also provides visibility of key engineer assets and resources and allows them to be employed to achieve the best outcome.

2.6 Decentralised Execution. Decentralised execution of engineer tasks operates in a mission command environment. The engineer commander is allocated the task and resources and advised of any limitations. The commander has the freedom of action to complete the task and as a result of the benefits of higher central control (anticipation and foresight) has the confidence that their priorities will remain extant until that task is complete. They also have the confidence that the equipment, personnel and resources will be available at the right time and place in accordance with the critical path.

2.7 Technical Control. Technical control is the specialised or professional guidance and direction exercised by an authority in technical matters. In an operational setting, technical control constitutes the advice of a technical engineer nature to maintain technical standards or comply with legislation and ensure the most effective employment of engineers. In the case of some of the more complex engineer tasks (eg. vertical construction), the specific technical capability required may not be resident in the deployed engineer force. Under these circumstances, the force may reach back to the national support base to have the building plans and specifications drawn or approved. It is important to understand that in certain operational circumstances, the design and construction of structures is constrained by the need to comply with the relevant legislation applicable to the task.

Degrees of Authority

2.8 The type and level of engineer support required varies according to the physical nature of the environment, the type of operation and the stage of the campaign. For example, an AO with a low level of infrastructure and high rainfall will require a high level of engineer support, particularly in the early stages of a campaign.
2.9 RAE is organised to do the following:

a. provide close and habitual engineer support to organisations who have a reasonably constant demand for support, such as the relationship between a CER and the brigade; and

b. provide a particular type of engineer support to organisations with specific requirements, such as multimedia support to information actions, EOD and high-risk search to a special operations task group, or emergency response to aviation units.

2.10 Thus, brigades have CERs under their command to provide mobility, countermobility and survivability support, while a range of other specialist engineer units are commanded in barracks at higher levels and provide geospatial, specialist survivability and sustainability support. These specialist engineer units are valuable shaping and weighting assets and are force-assigned according to the requirements of a particular operation or campaign.

2.11 The senior engineer in an organisation, such as the CO of a CER or ESR, adopts the title of brigade or force engineer. For example, the CO of 3 CER is also the 3 Bde Engr. Although a brigade or force engineer may also be a commander, this title recognises their responsibility to provide engineer advice to the commander of the supported organisation and to exercise technical control of all engineer elements in that organisation.

2.12 For deployed operations, specialist engineer units are assigned to the deploying force. The appointed force engineer commands these assigned engineer units (or elements thereof) and is therefore responsible for optimising their employment. In doing so, the force engineer may either control the tasking of these elements directly or place them under the temporary control of deployed engineer FEs. In this fashion, the capabilities and capacities of engineer FEs can be tailored to suit the operation.

2.13 In exceptional circumstances, a force engineer may seek the regrouping of deployed engineer FEs to move under their
control. This may occur, for example, when there is a critical shortage of engineers and a centralised approach is necessary.

Levels of Advice

2.14 Engineer commanders provide their supported manoeuvre commanders with advice on the employment of engineers and on technical engineer matters. Engineer advice and liaison provides commanders with a realistic view of what is achievable, when, and at what cost. This is particularly relevant during stability activities. The appropriate levels of engineer advice to supported organisations are as follows:

a. engineer lieutenant/captain to a combat team;

b. engineer major to a battlegroup;

c. engineer lieutenant colonel to a brigade commander; and

d. engineer post-unit command lieutenant colonel or colonel to a force commander.

2.15 The relationship between a manoeuvre commander and their engineer advisor is crucial to the effective and efficient employment of engineer capability. Although much depends on personalities, the principles apply equally to a lieutenant colonel advising a joint task force (JTF) commander as they do to a corporal advising a combat team commander. Engineer advisors should do the following:

a. be present during all stages of planning so that they understand the situation and the plan and can advise the supported commander accordingly,

b. study their supported commander’s methods in order to anticipate their engineer requirements,

c. be an expert on enemy engineer capabilities and be able to advise about their impact on the supported commander’s plan,
d. advise their supported commander against any plans that are not sound from an engineer viewpoint,

e. be realistic in their estimates for the provision of engineer support, and

f. be aware of the engineer assets and priority of effort at least one level higher.

Command on Operations

2.16 Engineer Command. Engineers are an integral part of the combined arms team. Although discrete engineer FEs should always be commanded by an engineer commander, engineers are frequently allocated under the command of a battlegroup or combat team commander. Under these circumstances, the senior engineer generally becomes the engineer advisor to the battlegroup or combat team commander. Dependent on the structure and mission of a battlegroup or combat team, an engineer may be best suited as the commander. This is particularly relevant where engineer support is the key enabler to the success of the mission.

2.17 Technical Control. Regardless of the operational C2 arrangements, technical control (see paragraph 2.7) is vested in the force engineer. Exercising technical control impacts upon the design of a project and may require reachback to obtain support from Australia.

2.18 Directed Engineer Tasks. When supported elements have been assigned engineers, then directed engineer tasks will be assigned to the supported unit. This arrangement ensures that the supporting element engineer commander is not compromised by potentially receiving conflicting direction from the supported commander and the engineer commander.

2.19 Coordination and Liaison. Coordination and liaison, within and outside the force, must be considered and responsibilities to perform these functions assigned accordingly. Engineers supporting adjacent units and elements will liaise with each other and coordinate their actions. This may be on matters as important as tying together an obstacle plan across a
boundary, to advice on the potential problem areas in a section of road. This liaison and coordination is often the trigger for the surging of engineer effort forward and the establishment of engineer work lines.

SECTION 2-3. STAFF

2.20 Most senior engineer commanders have staff. Engineer staff provide advice to their engineer commander as well as to the staff of their supported manoeuvre commander.

2.21 Engineer staff at HQ JOC advise on strategic, operational and tactical level engineering and engineer planning and facilitate engineer intelligence and close and general engineer support to deployed FEs.

2.22 RAE has a dedicated engineer staff in LHQ known as HQ Land Command Engineers. The Commander Land Command Engineers, in addition to their staff and technical control responsibilities, also commands a range of specialist engineer units. Command at this level is warranted by the relative scarcity of these specialist units. The Commander Land Command Engineers does not command the CER in the brigades.

2.23 RAE does not currently have dedicated engineer staff in either HQ 1 Div or at the Brigade HQ. In these two instances, the commander of the senior engineer unit, under command of those HQ, assumes the role of the force or brigade engineer. In the brigades, this function is performed by the COs of the CERs. For HQ 1 Div, this function is performed the CO of 6 ESR and staff are drawn mainly from 6 ESR and HQ Land Command Engineers.

2.24 In addition to their command responsibilities, force and brigade engineers have staff and technical control responsibilities over all engineer units assigned to them or their supported HQ.

2.25 The unit staff that support these engineer commanders also provide staff to the supported HQ. These unit staff may be augmented by staff from any assigned specialist engineer units.
to ensure that they possess the requisite expertise in relevant specialist fields.

2.26 Construction Officer. In the construction units (construction regiments and 6 ESR), the S3 is titled the Construction Officer. The S3 Cell includes the Construction Officer, Works Officer and a number of trade advisors. In addition to the normal operations functions, the S3 Cell undertakes project design and management tasks.

SECTION 2-4. FORCE ELEMENT OPTIONS

2.27 Deployed engineer FEs are task-organised to meet the predicted requirements of the mission. Engineer troops and squadrons are ‘plug and play’ and a deployed engineer FE generally contains a mix of capabilities within each squadron. This ‘plug and play’ methodology is evolving over time to a more modular engineer force to facilitate rapid regrouping and multiskilling.

2.28 Engineer FEs generally deploy a HQ element and sub-units (engineer squadrons) dependent on the expected tasking. Individual troops may be included or excluded in accordance with the forecasted requirement for specific capabilities.

2.29 As a general rule, formed engineer units will not deploy as a unit FE unless the scale of the task requires an entire engineer unit.

2.30 At the smaller end of the capability scale, an engineer FE may just consist of a small Army engineer element, which may be managing and coordinating a civilian construction agency.

SECTION 2-5. TYPES OF SUPPORT

2.31 Engineer support for most activities is based on the following, noting that capabilities may be added or subtracted as required:

a. combat engineer troop to a combat team;
b. combat engineer squadron to a battlegroup;

c. engineer group to a JTF; and

d. a CER to a brigade during raise, train and sustain functions.

2.32 This support must be reviewed and, if necessary, adjusted for each specific operation or campaign. This support is the basis from which organisational structures have been developed and along which habitual support affiliations should be established during training.

2.33 The type of engineer capability must also be reviewed dependent on the LOEs that engineer FEs are working on. For example, combat engineers are essential in offensive and defensive activities, and although they are very useful in the restore phase of a stability activity, a construction regiment or parts thereof may prove more useful in restoring essential services.

Habitual Engineer Support Affiliations

2.34 Where possible, habitual support affiliations should be developed between engineer units and the elements that they are likely to support. Such affiliations promote the development of understanding and trust that underpins Army's mission command philosophy. Important habitual support affiliations include those between combat engineer squadrons and supported manoeuvre units and brigade geospatial support sections and their supported brigades.

2.35 Royal Australian Navy. The RAN clearance diving teams and deployable geospatial support teams have capabilities that may contribute to the provision of mobility support during amphibious activities or maintaining port. The clearance diving team's tasks include:

a. conducting beach reconnaissance and survey;

b. demolition of underwater obstacles, including clearance of sea mines;

c. clearance of explosive ordnance;
d. conducting high-risk search of ship hulls and underwater facilities; and

e. conducting underwater salvage.

2.36 **Royal Australian Air Force.** The RAAF airfield engineers have capabilities that contribute to the provision of sustainability support. The role of airfield engineering elements is to establish and maintain infrastructure and engineering services on air bases (including repair and maintenance of the airfield itself). RAAF airfield engineers also include EOD technicians and firefighting units. Airfield engineering elements usually form part of an Expeditionary Combat Support Squadron. The force engineer is responsible for ensuring that the efforts of the Army engineers and RAAF airfield engineers are coordinated.

2.37 **Force Engineer Responsibilities.** When RAN clearance diving teams or RAAF airfield engineers are part of the joint force, the Force Engineer is responsible for the following:

a. coordinating their effort;

b. allocating engineer equipment, construction materials and stores in conjunction with the CSS staff; and

c. exercising technical control over their work.

SECTION 2-6. UNITS

2.38 Engineer units have been designed and organised to provide the support required at brigade and force level and to maintain specialist skills within barracks. Close support to a brigade is provided by a CER. The role and structure of a typical CER is described in Annex A.

2.39 The specialist engineer units include:

a. the ESR,

b. the IRR,

c. the CE Works, and
Contents

2-10

d. the Construction Regiment.

2.40 The roles and structures of these specialist engineer units are also contained in Annex A.

Annex:
A. Engineer Units
ANNEX A TO CHAPTER 2

ENGINEER UNITS

Combat Engineer Regiment

1. **Role.** The role of the CER is to provide mobility, countermobility, survivability and limited sustainability support to a brigade.

2. **Organisation.** The CER consists of two field engineer squadrons. Ideally, a CER will have as many field engineer squadrons as manoeuvre units in the brigade that it supports. The CO acts as the brigade engineer. A field engineer squadron will habitually support a manoeuvre unit. The field engineer squadron has a commensurate degree of mobility and protection to the supported manoeuvre unit. The support squadron contains assets that augment the field engineer squadrons for specific tasks. The CO of the CER weighs a brigade main effort with an allocation of field engineer squadrons and support squadron effort/assets. The CSS squadron provides limited logistics, medical and repair capability to the unit. The organisation of the CER is shown in Figure 2–1.

![Figure 2–1: Combat Engineer Regiment](image-url)
3. **Combat Engineer Regiment Units.** The current Army organisation includes these CERs:
   a. 1 CER (ARA) – 1 Bde;
   b. 2 CER (ARA) – 7 Bde;
   c. 3 CER (ARA) – 3 Bde;
   d. 4 CER (ARes) – 4 Bde;
   e. 5 CER (ARes) – 5 Bde; and
   f. 8 CER (ARes) – 8 Bde.

**Engineer Support Regiment**

4. **Role.** The role of the ESR is to provide geospatial support and undertake construction tasks in support of deployed forces.

5. **Organisation.** The ESR consists of two construction squadrons: a topographic survey squadron and an explosives hazards centre. The ESR provides tailored force groupings in support of an operation or campaign. The CO of 6 ESR acts as the HQ 1 Div Engineer and on deployment, with the Deployable Joint Force HQ, may act as the force engineer. The organisational structure of the ESR is illustrated in Figure 2–2.
Incident Response Regiment

6. **Role.** The role of the IRR is to provide specialist response to incidents involving CBRN and/or explosive hazards and other hazardous material, and situations including fire.

7. **Organisation.** The IRR organisational structure is illustrated in Figure 2–3. Its core capabilities are CBRN and explosives, mobility and emergency response. The regiment also has signals and logistic support troops. The regiment can deploy tailored force groupings of up to squadron size with a regimental HQ for C2. The current Army organisation includes one IRR.

![Figure 2–3: Incident Response Regiment](image)

Chief Engineer Works

8. **Role.** The role of the CE Works is to plan, design, coordinate and control infrastructure projects.

9. **Organisation.** A CE Works, illustrated in Figure 2–4, consists of a HQ, four works teams and a CSS troop. The HQ contains a command group as well as sections responsible for the unit’s operations and administration. The works teams can be deployed independently in order to design and project manage construction tasks that can be undertaken by construction units.
or civilian contractors. The current Army organisation includes the 19 CE Works.

Figure 2–4: Chief Engineer Works

Construction Regiment

10. **Role.** The role of the construction regiment is to undertake construction tasks in support of deployed forces.

11. **Organisation.** A construction regiment, illustrated in Figure 2–5, consists of two construction squadrons, a CSS squadron and a works team. 21 Const Regt also has a Littoral and Riverine Survey Squadron (LRSS) and a civil–military cooperation (CIMIC) squadron. 22 Const Regt has quarrying and forestry capabilities. Other capabilities may be attached to a construction regiment as required. The Regimental HQ also has a limited ability to manage civilian contractors.

12. **Units.** The current Army organisation includes these construction regiments:
   
a. 21 Const Regt, and

b. 22 Const Regt.
Notes:
21 Const Regt only
- Littoral and Riverine Survey Sqn
- Civil Military Cooperation

22 Const Regt only
† Quarry Tp or Forestry Tp

Figure 2–5: Construction Regiment
CHAPTER 3

PLANNING

SECTION 3-1. INTRODUCTION

3.1 It is essential that engineers are involved in the planning process from the beginning. Indeed, planning often cannot commence without a minimum level of geospatial information or products. Engineers participate in the planning process by providing specialist input and advice to commanders and staff, and undertake their own planning using the MAP.

3.2 This chapter outlines the major planning considerations for engineer support, how engineers contribute to the planning process and describes aspects that should be considered.

SECTION 3-2. PLANNING

3.3 At the beginning of and throughout a planning cycle, engineers will undertake an estimate so that they can contribute effectively to the planning process. Initially, the estimate may have a number of information gaps and be dependent on the development of a scheme of manoeuvre. Assumptions may have to be made to allow planning to continue; these must all be reconciled before plans are finalised. Towards the end of a planning cycle, there should be sufficient information, no remaining fundamental assumptions and sufficient deductions to enable a plan for the provision of engineer support to be produced.

3.4 Engineer planning should derive the following:
   a. What are the shortfalls in the engineer information and intelligence requirements?
   b. What impact will terrain, climate and weather have on the conduct of operations, both friendly and enemy?
c. How will the enemy’s engineer support be best countered through disruption and dislocation?

d. What threats and environmental hazards are likely, and how can their impact be anticipated and reduced?

e. What engineer support CIMIC tasks have been directed by higher HQ?

f. What resources and time are available?

g. How can the engineer support requirement be satisfied with the assets and resources available, and what additional assets or resources need to be obtained?

h. What grouping, C2 and liaison arrangements are appropriate?

i. What priority of work is appropriate?

j. What allocation of resources is appropriate?

k. What directed tasks need to be assigned?

l. What aspects about the provision of engineer support need to be coordinated with other elements?

m. What support contingencies can be anticipated and planned for?

3.5 The engineer intelligence officer (or engineer, in the absence of a dedicated engineer intelligence officer), in the planning process, must also be prepared to provide specialist advice on enemy engineer capabilities to the intelligence staff who are developing the enemy COAs. This requirement demands a high degree of knowledge of the enemy engineer capabilities and should stimulate ideas on how they can be disrupted or dislocated by friendly force actions.

Engineer Information and Intelligence

3.6 Although engineers require the same general information and intelligence as every other part of the force, they also require specialist information and intelligence to enable them to perform their role. This information can be quite detailed, and
because of the long lead times associated with some engineer works, the lack of this information can have long-term repercussions on the mission or task; for example, detailed information on a construction site for the provision and delivery of construction materials, timber, steel, concrete, wire and corrugated iron. Ideally, engineer intelligence should be collected by engineers as illustrated in Figure 3–1.

Figure 3–1: Engineer Intelligence – Knowledgeable Reconnaissance

3.7 Engineer staff coordinate their needs and actions with other intelligence staff. Intelligence is described fully in LWD 2-0, Intelligence, 2008.

3.8 The geospatial information requirements are important because they are required early to allow a planning cycle to commence. Geospatial support is also an element that must be considered as part of the provision of engineer support throughout the operation.
3.9 Engineer information and intelligence requirements are many and varied. They typically include:

a. geospatial information (including terrain, climate, weather and infrastructure);

b. enemy engineer capabilities (including units, grouping, equipment, resources, doctrine, tactics and recent trends);

c. information on friendly and enemy man-made obstacles;

d. equipment and resource availability;

e. survey data on designated construction sites (see Figure 3–2);

f. availability of civilian contractors;

g. availability of host nation support (HNS); and

h. ROE as they apply to the employment of CBRN weapons, mines and booby traps, as well as the conduct of demolitions.

Figure 3–2: Engineer Survey
3.10 Engineer information and intelligence requirements can be satisfied in the following ways:

a. by directing reconnaissance to be undertaken by units under engineer command or control – this is appropriate for the acquisition of technical information or intelligence and will require coordination with manoeuvre elements who are responsible for the AO in which the reconnaissance needs to be conducted;

b. by seeking the information or intelligence through technical control chains – this is usually the best approach to obtain geospatial information from higher HQ or to satisfy information and intelligence requirements within a brigade setting; or

c. by having the information and intelligence requirements included in the supported unit’s information and intelligence requirements for:
   (1) inclusion in the intelligence collection plan, or
   (2) passage to higher HQ as a request for information.

3.11 In order to satisfy these information and intelligence requirements, it will often be necessary to conduct combined arms reconnaissance. Combined arms reconnaissance ensures that all the relevant tactical and technical considerations are understood and considered against possible manoeuvre COAs.

Impact of Terrain, Climate and Weather

3.12 The impact of terrain, weather, tides and climate on the conduct of friendly and enemy activities should not be underestimated. Engineers contribute to the intelligence preparation of the battlespace by providing geospatial support, including analysis of terrain, climate, tidal windows and weather and their impact on enemy engineer capabilities.
Enemy Engineer Support

3.13 The enemy should be considered intelligent, cunning and adaptable. Often, information or intelligence on the enemy engineers’ activity is a good indicator of the enemy scheme of manoeuvre. For this same reason, assessment of the visible enemy engineer effort should consider that it may be part of an enemy deception plan.

3.14 Friendly force engineers ‘fight’ the enemy engineers by identifying potential enemy high-value engineer targets and striving to ensure that their supported units have better geospatial knowledge, mobility, survivability and sustainability than the enemy. They also try to interfere with the enemy’s plans and create a relative mobility advantage by providing countermobility support.

3.15 Friendly engineers will often seek support from other friendly FEs to degrade the enemy’s engineer support capability. This could range from targeting high-value enemy engineer targets with offensive support assets, to specific manoeuvre missions against enemy engineer capabilities.

Responsibility for the Provision of Engineer Support

3.16 The finite engineer capacity cannot meet the demand for engineer services. Consequently, there are agreed divisions of responsibility for the provision of engineer support between the Services and between the Army engineers and units. The responsibilities between the Services are outlined in Annex A. The responsibilities between engineers and units are outlined in Annex B.

3.17 The promulgation of the divisions of responsibilities ensures the following:
   a. that engineer effort is allocated to the highest priority tasks,
   b. that units understand their responsibilities and are not requesting and waiting for engineer support that will not be allocated, and
c. that units understand their responsibilities and can ensure that their FEs are appropriately trained and prepared to fulfil their own engineer support responsibilities prior to deploying on operations.

**Engineer Support Requirement**

3.18 The force engineer is responsible for determining a force’s requirement for engineer support and, in consultation with other force HQ staff, determines the most appropriate method to satisfy that requirement.

3.19 The major factors that will impact on the level and type of engineer support required by a force or smaller element include the following:

a. terrain, climate and weather;

b. enemy engineer capabilities;

c. level and complexity of tactical and environmental hazards;

d. composition of the combined arms force;

e. nature of the FE’s mission, which will dictate the requirement for specialist engineer support, including civilian contractors and HNS;

f. time constraints, as engineer support may be on the critical path to establish other elements of the force in-theatre, requiring a surge of engineer support in the early stages of the activity;

g. level and condition of the existing infrastructure; and

h. ROE which dictate whether mines, booby traps and demolitions can be employed – restrictions on the use of mines, booby traps and demolitions will require additional manoeuvre and engineer FEs to achieve the same outcome.

3.20 Engineer support is likely to be achieved using a combination of military units, civilian contractors and HNS. Clearly, in the early stages of an operation or campaign, the scarcity of civilian
contractors and HNS may demand a greater number of military units. The use of civilian contractors and HNS will be primarily for the provision of sustainability support.

**Priority of Effort**

3.21 Engineer planning determines where engineer effort should be applied to best support the commander's intent. The total engineer effort is likely to be made up from a combination of military assets, civilian contractors and HNS. For example, in the CERs, a balance of effort between mobility support, countermobility support, survivability support and sustainability support will usually be derived. Such a balance will usually be translated into directed tasks in orders. Specialist engineer FEs should only be tasked with non-specialist engineer tasks when these tasks will not detract them from their ability to respond and conduct specialist engineer tasks in a timely manner.

**Allocation of Equipment, Construction Materials and Stores**

3.22 The provision of equipment, construction materials, stores and appropriate geospatial data often limits engineer effort. Geospatial data is sourced along engineer technical control lines and, because it is usually manipulated into products in-theatre, its availability and allocation is not as great a concern as equipment, construction materials and stores.

3.23 The allocation of equipment, construction materials and stores is usually commensurate with the priority of engineer effort. Engineer staff work with CSS staff to ensure that the requisite equipment, construction materials and stores are procured and are delivered to engineer units and task sites in a timely manner. Both engineer and CSS staff must ensure that their priorities are not corrupted. For example, on a recent operation, a water purification machine was removed from a transport aircraft and replaced with several pallets of bottled water. The water purifier was capable of producing 20 000 L of water per hour. Several pallets of bottled water would not be more than 3000 L.

3.24 Engineers differ from other arms in that most of their work requires equipment, construction materials and stores not
permanently held within units. Engineer work will only progress smoothly if the necessary equipment, construction materials and stores are available at the task location and time required. Appropriate CSS effort must be applied to coordinating the procurement and transport of these items to the work site to ensure that construction work is not halted unnecessarily. Wasted engineer effort always causes adverse consequences on the force.

3.25 The provision and control of equipment, construction materials and stores is a CSS responsibility. The nature of the activity, however, might place such demand on some equipment and stores that specialist engineer advice needs to be provided to the CSS staff on what is required, where, and how it should be controlled. Such advice may be required on the following:

a. the requirement for and procurement of construction stores (Class 4);
b. the requirement for and allocation of defence stores (Class 4);
c. the requirement for and allocation of certain munitions (particularly mines) and explosives (Class 5);
d. the requirement for and positioning of equipment bridging (Class 7);
e. the requirement for repair pools of specialist engineer equipment (Class 7);
f. the requirement to identify suitable replacement items if the specified items are not available; and
g. the requirement for other specialist engineer stores and consumables.

3.26 In some instances, the engineers may be delegated control of certain equipment and stores. Such delegation of control does not negate the requirement for the CSS system to store, distribute and maintain those equipment, construction materials and stores.
3.27 Engineers may also win water and construction materials locally. These may be passed to the CSS system for storage and distribution to other elements of the force.

3.28 The provision and management of equipment, construction materials and stores with civilian contractors and HNS will be specified on a case-by-case basis in contracts or Memoranda of Agreement.

3.29 **Stores Dumps.** It may be necessary to dump stores forward, at or near work sites, especially large quantities of mines and explosives. The decision to dump will depend on the earliest and latest times that the stores are required by the user unit, the actual time available and the availability of transport and materiel handling equipment. The tactical situation must be carefully considered in determining the locations and stock levels of stores dumps. Once established, stores dumps can telegraph intent and are vulnerable to interdiction. In some circumstances, stores dumps may warrant protection against ground and air threats. Stores dumps must be planned judiciously in conjunction with manoeuvre and CSS staff.

**Engineer Support to Civil–Military Cooperation**

3.30 The demand for engineer support by the force may be dwarfed by the demand for support from the civilians within a theatre. While the force is not obligated to provide support to non-military elements within a theatre, invariably a degree of support is necessary to ensure the operation’s success. Non-military elements in a theatre that may desire engineer support include the host nation government or legitimate authority, non-government organisations or private voluntary organisations.

3.31 Engineer support to non-military elements should be undertaken as a conscious decision at the potential expense of the level of engineer support to the force. Any support provided must always be coordinated as part of the CIMIC framework.
and conform to the information action plan. The following types of engineer support tasks to non-FEs may be provided:

a. providing technical engineer advice, including project management;
b. producing water;
c. clearing mines and explosive hazards;
d. establishing humanitarian demining and explosive hazard clearance programs, including the conduct of mine, unexploded explosive ordnance and hazard awareness training;
e. constructing refugee or displaced person handling centres or facilities;
f. repairing and/or maintaining civilian infrastructure;
g. assessing the structural integrity of buildings; and
h. dismantling obstacles and military structures.

Engineer Contingency Planning

3.32 There will invariably be more engineer support tasks required than assets and resources to achieve those tasks. The risk management considerations, as part of the planning process, will identify those tasks that will not be able to be undertaken in the near time frame unless additional assets or resources are able to be obtained. The process may also identify tasks that may not need to be undertaken unless certain conditions are met; these are usually as a result of enemy action or weather. The conduct of these tasks would be identified and contingency plans derived for their possible completion at short notice. Contingency plans may also be completed for engineer support tasks that are being undertaken but have a degree of risk associated with not being completed within the required time. All engineer contingency plans should have the relevant triggers identified for their implementation and include the conditions on which the plan is based.
3.33 Engineer assets or effort should not be kept in dedicated reserve for engineer contingency plans. Engineer commanders will always have identified tasks being undertaken that can be stopped at short notice so that effort may be applied against engineer contingency plans. The fact that all engineers have some combat engineer skills allows greater flexibility to undertake urgent mobility or countermobility support tasks, in particular with specialist engineer elements.

Engineer Plans

3.34 The engineer plan is developed to provide the optimum engineer support to the manoeuvre plan. Key aspects regarding the provision of engineer support should be included in the manoeuvre plan, either in the base document or as an annex to the plan. These include:

a. the engineer commander’s intent;
b. engineer unit groupings and specified tasks;
c. the priority of engineer work;
d. the obstacle plan, including the obstacle control measures, obstacle emplacement authority and authority to conduct demolitions;
e. the geospatial support plan, including the establishment of geodetic control, methods to distribute geospatial support products and data management arrangements;
f. the allocation of critical equipment such as bridging, construction materials and stores (including mines and explosives) – these may be included or duplicated in the CSS annex to the plan, which should also detail how equipment and stores will be delivered;
g. the engineer liaison requirements;
h. the engineer control measures; and
i. the engineer contingency plans either in place or in development.
3.35 Engineer units will also produce orders detailing how these plans and requirements are to be achieved. These are often prepared during parallel planning.

SECTION 3-3. INFORMATION ACTIONS

3.36 Influence Actions. Influence actions have the primary purpose of influencing the perceptions and, hence, the will, attitudes and, ultimately, the behaviour of target audiences, both enemy and civilian. Relevant tools include military public affairs, including public information and CIMIC. Any engineer effort applied to restoration and reconstruction of infrastructure damaged during conflict sends a powerful message to the local population and is potentially the most effective engineer contribution to influence actions. Completing minor but important projects quickly proves the effectiveness of the security force, thereby supporting the information actions to win hearts and minds. This generates local support for larger longer term projects, which, in the event of attack by insurgents, reduces insurgent credibility with the local population. Engineers may also contribute the following:

- engineer FEs to repair, maintain and develop infrastructure to support the population, such as water, sanitation and electricity to assist the perception battle;
- tradespeople to provide trade training for indigenous personnel to assist reconstruction;
- engineer projects to provide employment for disenfranchised youth, providing purpose and reducing frustration and destructive tendencies;
- emergency response to supplement and train local services; and
- multimedia technicians to provide support in the form of graphics and photography for non-verbal communications with the full range of stakeholders in the battlespace.

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LWD 3-6-1, Employment of Engineers, 2008
3.37 **Counter-command Actions.** Counter-command actions are aimed at deceiving, disabling or destroying enemy commanders and disrupting, degrading, destroying or denying the information systems and information they rely upon. Relevant tools include deception, electronic attack, computer network attack and physical attack. Engineer support to counter-command actions is normally in their capacity as part of a combined arms team undertaking combat action in the battlespace.

3.38 **Command and Information Protection.** Command and information protection actions are aimed at protecting commanders and the information systems and information on which they depend. Relevant tools include electronic protection, computer network defence and operations security. Engineers contribute to command and information protection through the provision of survivability support to information systems.

### SECTION 3-4. THREATS

**Common Threats**

3.39 **Hostile Force Interdiction.** Engineer FEs cannot undertake engineer tasks and provide for self-protection at the same time. If the manoeuvre plan relies on significant engineer effort and this is clear to the enemy, the engineer FE becomes a high-payoff target. Additionally, in the latter stages of a conflict, when undertaking restore tasks, engineers become a high-payoff target for hostile forces trying to derail development or generate support or fear among the population.

3.40 **Explosive Hazards.** Explosive hazards, including improvised explosive devices, provide a similar threat to engineers as they do to other FEs. However, engineer EOD FEs may be subject to extreme risks during the disposal process.

3.41 **Emergency Response.** Emergency response personnel are often subject to high levels of risk from the explosion, fire or accident they are responding to. Additionally, all first
responders (including medical response assets) become secondary targets.

3.42 Electronic Warfare. Engineer activities are at particular risk from electronic warfare because of the following:

a. Engineers are frequently deployed in small groups over a wide area and effective C2 is difficult without radio communications.

b. Engineer preparations frequently commence before a major activity and are indicators for the type of activity being planned or taking place, for example, route opening before the move of a reserve force or preparation of obstacles before a defensive operation.

Countering the Threats

3.43 Force Protection. During tasking, it is important that engineers maintain a high level of force protection measures. Wherever possible, this should include a dedicated FE, particularly when the task is time-sensitive and critical to the success or failure of the manoeuvre plan.

3.44 Communications Plan. The special requirements of engineers must be taken into account by the tactical commander in formulating the communications plan to counter the electronic warfare threat. Additionally, engineers must be practised in electronic warfare countermeasures to maintain the communications security. In principle, they will operate under radio silence when carrying out preparatory tasks or conducting obstacle crossings and use secure communications whenever possible.

SECTION 3-5. COORDINATION MEASURES

3.45 The coordination measures applicable to all friendly FEs apply equally to the provision of engineer support. Additionally, there is a requirement for tight coordination of engineering effort within the battlespace to generate effectiveness and efficiency
3.46 In order to provide the necessary degree of engineer effort to the supported FE, the force engineer may surge force level engineer effort across rear boundaries. Such action would be coordinated with the relevant JTF commander but would not necessarily result in a change of grouping, command or control status. For engineer units, such a delineation of responsibility is called an ‘engineer work line’, but it may be used on a task or time basis rather than a geographic basis. Engineer work lines are most commonly used to coordinate engineer work in maintaining routes. They are never used where engineers are providing close support in close combat.

3.47 Other specific engineer coordination measures relate to the central control of engineer effort and critical equipment and stores. These items are coordinated centrally and their use directed by the force engineer in accordance with the engineer priority of effort.

SECTION 3-6. COALITION OPERATIONAL CONSIDERATIONS

Interoperability

3.48 The ability of different military forces to operate effectively together directly affects the outcome of a coalition operation. Engineers must be able to work with their counterparts from other nations regardless of nationality, culture, equipment, skill levels or operating procedures. In particular, the issues associated with language barriers and the diversity of equipment need to be overcome to achieve the desired results. Pre-deployment training should take account of these requirements to ensure that personnel are as well prepared as possible to work with and, if necessary, to support other nations’ military forces.

3.49 Engineers should be aware that potential allies are equipped with a wide range of engineer equipment and materiel for which
there is little standardisation between nations. Engineer organisations at each level of command differ nationally, and while engineer missions and tasks are similar, procedures often vary, particularly when providing sustainability support.

3.50 Engineer commanders should understand the differences in national organisations, engineer tasks and procedures, especially if they are exercising technical control over coalition engineers. It is equally important that any adverse impact of these differences on the outcome of the engineer mission is minimised. To this end, ABCA Armies’ Standardisation Program QSTAGs and NATO STANAGs cover several important engineer activities. The QAP–292, *Coalition Engineer Handbook*, 2003; AJP 3.12, *Joint Engineering*, 2003 and *ATP 52(B), Land Force Combat Engineer Doctrine (Ratification Draft)*, 2006 are the primary points of reference for these agreements.

3.51 Engineer commanders must be aware of what is standard within a particular coalition and adhere to the agreed principles and procedures. Where standardisation has not been achieved, interoperability may still be feasible, either by adapting procedures and equipment for use with that of another nation or by training one nation’s engineers on the procedures and equipment of another. The ability to interchange engineer equipment and resources between nations may also increase their combined effectiveness.

3.52 It is very important to maintain liaison to ensure that differences in procedures are immediately identified and, if required, common standards established. The use of exchange liaison officers considerably enhances interoperability.

**Geospatial Data**

3.53 In coalition operations, the lead nation normally establishes the geospatial support plan for the force. Coalition operational consideration for geospatial data is discussed in Chapter 4.
Construction Stores

3.54 The plan for the provision of engineer construction stores should also be agreed upon early during the planning phase. While some requirements such as rock soil, timber and water can sometimes be won locally, the remaining stores are generally sourced and transported from outside the theatre of operations. The primary options for the provision of engineer stores are through the lead nation or along national lines. However, in practice, it is often a combination of both.

3.55 Notwithstanding which of the options are used, the correct construction stores must be available at the construction site at the correct time. For example, all the other construction stores for an aircraft hangar are useless if the cement is not available for the footings.

SECTION 3-7. INTERAGENCY CONSIDERATIONS

3.56 Engineer tasks span the full range of military activities across the spectrum of conflict. Consequently, engineer capability is in high demand. During offensive and defensive activities, allocating priority of engineer effort is relatively straightforward. However, during stability activities, considerable pressure may be applied by external agencies in an attempt to influence the engineer priority of effort to accord with their priority of effort.

3.57 During the planning, preparation and execution of engineer tasks, engineers interact with multiple ADF and non-ADF groups, including supporting ADF elements, government agencies, intelligence organisations, commercial organisations and non-government organisations. This interaction is generally premised in the provision of engineer support. The following major issues should be considered before, during and after that interaction:

a. **Liaison.** Engineer LOs and CIMIC representatives need to be aware of current and future engineer priorities so that, as far as operations security limitations allow, they
can discuss engineer support and priority of effort with external organisations.

b. *Engineer Intelligence.* Engineers and other staff must be cognisant of the continuous requirement for engineer intelligence. This information provides engineers better situational understanding and may influence the priority of engineer effort.

c. *Geospatial Data.* The provision of geospatial data to external organisations must be closely managed to ensure that information that may adversely impact on current and future operations or areas of interest is not released.

d. *Aim, Objectives and Endstate.* Each agency has its own specific aim, objectives and endstate. Wherever possible, personnel should be aware of the aims, objectives and endstates of other agencies and seek opportunities for mutual support without hindering their tasks. Where operations security permits, promulgation of engineer aims, objectives and endstates may facilitate cooperation and understanding between military FEs and other organisations.

Annexes:

A. Division of Responsibilities Between the Services

B. Division of Responsibilities Between the Corps and Engineers
Contents

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ANNEX A TO CHAPTER 3

DIVISION OF RESPONSIBILITIES BETWEEN THE SERVICES

1. The responsibilities between the Services may impact on the provision of engineer support on operations. This annex outlines the division of responsibilities between the Services but does not include all of Army’s responsibilities. Although the text refers to the individual Services, they are synonymous with the environmental components in a JTF.

Geospatial Support

2. **Army.** Army is responsible for the production of topographic geospatial information and services, including the management of topographic data and metadata.

3. **Royal Australian Air Force.** RAAF is responsible for the production of aeronautical geospatial information and services, including the management of aeronautical data and metadata.

4. **Royal Australian Navy.** RAN is responsible for the production of hydrographic geospatial information and services, including the management of hydrographic data and metadata. Army assets may be suitable to assist RAN in the reconnaissance and surveys in littoral environments. RAN is responsible for the provision of meteorological information.

5. **Defence Imagery and Geospatial Organisation.** The Defence Imagery and Geospatial Organisation is responsible for the acquisition of base terrestrial geospatial information over both onshore and offshore regions, and produces, manages and disseminates digital and hard copy geospatial data and products, in standard formats, that can be reproduced en masse for broad distribution.
Water Production

6. Army is responsible for the production of water for land-based RAN and RAAF elements, except in those areas or for those activities for which the RAN or RAAF accept responsibility.

Facilities

7. All Services are responsible for the provision of temporary living and working accommodation (including waste management services) and electrical power supply for up to the first 60 days of a deployment into a new AO.

8. JOC is responsible for the provision of other than temporary land-based living and working accommodation and facilities. However, 19 CE Works typically undertakes the project management. Provision may be achieved through construction, purchasing, leasing and/or hiring. Facilities can include ports and airfields for aircraft. The Services are responsible for advising on their facilities’ requirements.

9. RAAF is responsible for repairing and maintaining airfields from which they are operating.

Search

10. Army is responsible for conducting search on land, excluding areas for which the RAN or RAAF accept responsibility. RAAF areas of responsibility (AORs) may include airfields.

Explosive Ordnance Disposal

11. Army is responsible for land-based EOD including inland waterways but excluding areas for which the RAN or RAAF accept responsibility. RAAF AORs include airfields and RAAF aircraft crash sites.

Emergency Response

12. Army is responsible for land-based emergency response, excluding areas for which the RAN or RAAF accept responsibility. RAAF AORs include airfields and RAAF aircraft crash sites.
Chemical, Biological, Radiological and Nuclear Defence

13. Army is responsible for conducting CBRN reconnaissance and survey (including airborne reconnaissance and survey) on land, excluding areas for which the RAN or RAAF accept responsibility.

14. Army is responsible for the decontamination of personnel and equipment on land, excluding those personnel and equipment for which the RAN and RAAF accept responsibility.

Amphibious Activities and Logistics over the Shore

15. RAN and Army are jointly responsible for tactical beach reconnaissance and survey.

16. RAN is responsible for the demolition of underwater obstacles and clearance of mines in open water in conjunction with the Army. Army is responsible for the clearance or demolition of beach obstacles (including mines) in conjunction with RAN. The high water mark is typically used as a boundary for responsibility.

17. Army is responsible for the establishment and maintenance of routes over the beach.

Riverine Activities and Inland Waterways

18. Army is responsible for the reconnaissance and survey of inland waterways. RAN assets may be suitable to assist Army in the reconnaissance and survey of inland waterways.

19. Army is responsible for the demolition of obstacles in inland waterways.

20. Army is also responsible for EOD in inland waterways.
ANNEX B TO CHAPTER 3

DIVISION OF RESPONSIBILITIES BETWEEN THE CORPS AND ENGINEERS

1. The division of responsibilities between engineers and the other corps within Army may impact on the provision of engineer support. This annex outlines those divisions by specifying the corps responsibilities. The annex is not intended to specify every single facet of engineer activity; rather, it provides an overview from which commanders may draw inference.

2. This annex is not intended to duplicate the remainder of this publication by listing what support engineers can provide but to delineate responsibility in certain functional areas where ambiguity or uncertainty may exist. Engineer advice and support for these all corps responsibilities may be requested from engineer LOs or staff.

Physical Force Protection Measures

3. All corps are responsible for the following:
   a. constructing and maintaining expedient fighting positions or protective structures (including the demanding of defence stores); and
   b. constructing and maintaining physical security control measures (including the demanding of defence stores or construction materials).

Chemical, Biological, Radiological and Nuclear Defence

4. All corps are responsible for the following:
   a. actions to prevent CBRN hazards;
   b. conducting immediate decontamination of personnel, their personal equipment and unit equipment; and
   c. warning and reporting CBRN hazards at the point of contact or to the extent that they can be identified only.
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Fire Hazards

5. All corps are responsible for the following:
   a. actions to prevent fire hazards,
   b. conducting immediate combat of fire hazards, and
   c. reporting fire hazards.

Roads and Tracks

6. All corps are responsible for the following:
   a. reporting damage on main supply routes and secondary supply routes, and
   b. constructing and maintaining expedient tracks and culverts within unit perimeters.

7. MPs are responsible for enforcing traffic control measures on main supply routes and secondary supply routes.

Helicopter Landing Points

8. All corps are responsible for constructing and maintaining expedient helicopter landing points within unit perimeters.

Logistics over the Shore

9. The CSS system is responsible for the provision of amphibious beach teams to support logistics over the shore tasks.

Obstacles

10. All corps are responsible for the following:
    a. constructing, maintaining and recovering protective obstacles within unit perimeters in accordance with the relevant plans and orders; and
    b. reporting enemy obstacles to the extent that they can be identified.

Search

11. All corps are responsible for conducting low-risk search as required to enable the achievement of their mission or tasks.
Explosive Hazards

12. All corps are responsible for the following:
   a. reporting unexploded explosive hazards at the point of contact only,
   b. extracting unit personnel and equipment from unexploded explosive hazard contaminated areas,
   c. reporting and marking enemy explosive hazards such as minefields and booby traps at the point of contact or to the extent that they can be identified only, and
   d. extracting unit personnel and equipment from minefields.

13. Ammunition technical officers are responsible for the following:
   a. disposing of friendly unfired or unsafe munitions, and
   b. assisting RAE to clear unexploded ordnance disposal in rear areas.

Demolition of Unit Equipment and Stores

14. All corps are responsible for demolishing unit equipment and stores when necessary. This may be achieved with techniques employing explosives or other means.

Water Supply

15. The CSS system is responsible for the following:
   a. packaging and distribution of water, and
   b. conducting complete tests on the suitability of potable water.

Waste Materials

16. All corps are responsible for the following:
   a. maintaining hygiene within their organisations, including the local collection and storage of waste materials; and
   b. requesting advice and assistance to backload or otherwise dispose of waste materials in their AORs.
Accommodation and Electrical Power Supply

17. All corps are responsible for the provision of their basic temporary living and working accommodation and rudimentary, non-reticulated electrical power for up to the first 60 days of a deployment into a new AOR.
CHAPTER 4
GEOSPATIAL SUPPORT

SECTION 4-1. INTRODUCTION

4.1 Geospatial support is action taken to acquire, manage and analyse geospatial data and to provide geospatial products and services. The successful conduct of the comprehensive range of military activities necessarily relies on commanders at all levels having an appreciation of the terrain over which activities are to be conducted. Accurate geospatial information, coupled with meaningful analysis, is a key factor in assisting commanders to gain a better appreciation of the influence of terrain, weather and enemy movements and trends.

4.2 The better the appreciation of the environment, the greater the likelihood of achieving advantage over the enemy. This may be particularly important to an expeditionary force intending to operate against an enemy with 'local knowledge' of the terrain and weather. This chapter describes how engineers provide geospatial support. Additional information is contained in LWD 3-6-9, Geospatial Support, 2006.

SECTION 4-2. PROVISION OF GEOSPATIAL SUPPORT

Overview

4.3 The requirement for geospatial support is constant in all types of offensive, defensive and stability activities. The type of activity may require some variation in the types and quantities of geospatial products and services provided. Typical geospatial support tasks include:

a. providing geospatial support advice;

b. establishing geodetic control and the Theatre Geodetic Control Network;
4.4 Geospatial information can be considered a particular type of intelligence; hence, the processes involved in the provision of geospatial support are closely aligned to that of intelligence. Most intelligence also needs to be spatially referenced to be meaningful. Geospatial information is an important contributor to improving situational understanding as well as being an essential element to inform other engineer work.
Figure 4–1: Terrain Visualisation
4.5 The provision of geospatial support to Army is primarily achieved by two organisations. At the tactical and lower operational levels, 1 Top Svy Sqn provide geospatial support to the force and to brigades and other FEs that comprise the force. The LRSS (21 Const Regt) provides specialist highly detailed hydrographic and land surveys of ports, beaches, approaches, point of entry and logistics over the shore in the littoral environment. At the higher operational and strategic levels, the Defence Imagery and Geospatial Organisation provide geospatial support to the strategic and operational levels of command in the ADF and the ADO.

4.6 1 Top Svy Sqn’s role is to provide geospatial support concurrently to a force and to deployed JTFs or battlegroups. The composition of these geospatial support elements can be tailored to suit the demands of the operation. These elements are typically collocated with the JTF or battlegroup HQ but are
4.7 LRSSs primary role is to conduct land, inshore and riverine hydrographic surveys. LRSS is typically required to ground truth and densify data on navigable charts and conduct detailed surveys of approach routes, wharves, jetties, beaches and other points of entry in support of logistics over the shore. LRSS represents Army’s sole inshore and riverine hydrographic survey capability. LRSS is able to provide tailored augmentation teams to supplement 1 Top Svy Sqn and geospatial support elements in non-imagery-based tasks including the establishment of geodetic control, military geospatial information and engineering survey support. LRSS can augment RAN’s deployable geospatial support teams in support of specific tasks. LRSS is presently required to source all geospatial expertise from reserve members.

4.8 1 Top Svy Sqn specialises in the land environment. The RAN’s Australian Hydrographic Office and the RAAF’s Aeronautical Information Service specialise in their respective environments. Often, the air and maritime environments will reference their geospatial information to the land environment, particularly in the littoral.

4.9 HQ 1 Div receives geospatial support from 1 Top Svy Sqn and 6 ESR. The force geospatial support element will also require a degree of augmentation with appropriate hydrographic and/or aeronautical geospatial capability. This augmentation may range from a single LO to a production team. Geospatial support elements are detached from 1 Top Svy Sqn to various FEs or HQ to provide geospatial advice.

SECTION 4-3. APPLICATION OF SUPPORT

4.10 As geospatial information and terrain analysis are key components of the intelligence preparation of the battlespace, these geospatial support elements are often collocated with
HQ intelligence staffs. Their priority of effort is specified by the force engineer. The intelligence staff and the geospatial support element must coordinate their requests for information and data from higher HQ in order to avoid possible duplication, particularly as most imagery is now geospatially referenced.

4.11 In order to trigger the provision of geospatial support leading up to an activity, most brigade HQ have permanently established geospatial support advisors. The geospatial support advisors can provide a limited degree of geospatial support in barracks mostly by ‘reaching back’ to 1 Top Svy Sqn and the Defence Imagery and Geospatial Organisation for data sets.

4.12 At the start of a campaign or operation, 1 Top Svy Sqn is heavily reliant on the geospatial information data sets provided by Defence Imagery and Geospatial Organisation support. Conversely, once a force is deployed, 1 Top Svy Sqn is able to densify these data sets through ground truthing and tactical ground activities and then pass this information back to the Defence Imagery and Geospatial Organisation.

4.13 1 Top Svy Sqn will always maintain a base element in its barracks location. This element acts as a data set management and transfer point between Defence Imagery and Geospatial Organisation and any deployed geospatial support elements. This approach reduces the number of soldiers and amount of equipment required by a deployed geospatial support element. This approach is also dependent on a suitable communications information systems infrastructure.

4.14 In some instances, geospatial support elements are integral or may be assigned to units. Engineer units, in particular, require a detailed knowledge of the terrain in order to perform specific engineer tasks and have a geospatial support element integral to their organisation. Similarly, some SOF units also have integral geospatial support elements to support their specialist tasks.
Responsibilities

4.15 Force and brigade engineers are responsible for the following:

a. providing engineer advice of a geospatial support nature to the supported commander and their staff; and

b. commanding the geospatial support elements, including technical control – due to the highly specialised nature of skills required to provide geospatial support, force and brigade engineers may also need to seek technical advice from suitably qualified specialists at higher levels of the Army and Defence hierarchy.

4.16 The senior member of a geospatial support element is responsible for the following:

a. providing geospatial support advice to the supported engineer commander, the supported commander’s staffs and geospatial support users;

b. establishing habitual arrangements (including SOP) for the provision of geospatial support to the supported element;

c. commanding the members of the geospatial support element, including technical control;

d. acquiring, managing and analysing geospatial data;

e. advising the intelligence staff and supported engineer commander on the most suitable methods to collect geospatial data in theatre;

f. establishing geodetic control in a theatre or AO; and

g. recommending and providing geospatial products and services including:

(1) paper and digital terrain maps,

(2) terrain visualisation tools,

(3) terrain analysis and decision support products, and
(4) spatial and temporal visualisations of enemy activity.

SECTION 4-4. COALITION OPERATIONS

4.17 In coalition operations, the lead nation normally establishes the geospatial support plan for the force. A considerable amount of effort has been expended to ensure that the format of digital data sets and paper products is standardised between the ABCA armies. To a large degree, these formats and arrangements are also compatible with forces that are members of NATO.

4.18 The establishment of a common geospatial picture across the coalition is a primary consideration during the planning phase of any coalition operation. The type of information required to coordinate geospatial support across a coalition force includes:

a. the concept for geospatial support to the force, including coalition and national arrangements and intra-theatre and extra-theatre geospatial data flows;
b. guidance on the provision of the base line geospatial data set for the theatre;
c. advice on the establishment of geodetic control;
d. direction on the integration of geospatial support information systems, command support and intelligence support systems;
e. procedures for geospatial data collection, data management and data storage;
f. procedures for requesting geospatial support and the distribution of products, including updates; and
g. policy on the releasability of products.
CHAPTER 5

ENGINEERS IN OFFENSIVE ACTIVITIES

SECTION 5-1. INTRODUCTION

5.1 The purpose of offensive activities is to defeat the enemy by application of focused violence. Physical destruction of the enemy is, however, merely a means to success and usually not an endstate. The requirement is to defeat the enemy's centre of gravity. Ultimately, success in battle is achieved through offensive action, which includes advance, attack and pursuit.

5.2 To defeat friendly force offensive actions, the enemy will try to influence friendly force movement, destroy forces and restore their own freedom of action. To achieve this aim, the enemy will do the following:
   a. use obstacles, especially mines, to restrict and disrupt movement and to cause casualties;
   b. exploit weaknesses and attack perceived critical vulnerabilities; and
   c. maintain reserves to counterattack and exploit opportunities.

5.3 This chapter describes how engineers provide support to combined arms teams and other FEs during offensive activities through the five engineer functions. Further information on offensive activities is available in LWD 3-0-3, Land Tactics (Developing Doctrine), 2009.

SECTION 5-2. SUPPORT TO OFFENSIVE TACTICAL ACTIONS

5.4 In offensive activities, engineer support is required to maintain momentum and tempo. Engineer effort is predominantly applied to mobility support to overcome the impact of terrain.
and enemy action, and countermobility support to protect the flanks against counterattack and geospatial support because the terrain over which friendly forces advance, attack and pursue will, in all probability, be unfamiliar.

5.5 The achievement of engineer tasks in support of offensive activities depends on timely reconnaissance, appropriate groupings, centralised control and the timely provision of the equipment and stores. Guiding principles for the employment of engineers during offensive activities are as follows:

a. Engineers must be involved early in the planning process. This ensures that a comprehensive terrain analysis can be generated to support decision-making, that the ISR effort that can be informed and that specialist equipment, such as obstacle breaching and bridging equipment, can be prepared and pre-positioned.

b. Engineer reconnaissance parties must be located with forward elements and have effective communications so that their reports can be quickly actioned at the appropriate HQ.

c. In order to maintain tactical momentum, engineers should be grouped to lower levels than normal habitual support relationships and have the ability to rapidly regroup to counter unforeseen requirements. This may include grouping for a substantial planned task such as a river crossing. Wherever possible, the amount of planned regrouping should be minimised.

d. Engineers must be linked up with their supported manoeuvre elements in sufficient time to allow involvement in the planning process and the conduct of battle procedure, including rehearsals and preparation of specialist equipment.

e. Engineer tasks undertaken by lead elements should only be completed to the minimum standard required to maintain momentum of the supported force. This ensures that engineer effort is not diluted. Follow-on
engineer elements will be tasked to upgrade the standards as required.

f. Engineer assets and resources should not be tasked or earmarked as a dedicated engineer reserve but identified as a situational engineer reserve for unforeseen tasks. Unforeseen tasks may result from a gap in information, enemy action or the impact of weather.

SECTION 5-3. ADVANCE

Advance to Contact

5.6 Advance to contact is an offensive activity designed to gain or re-establish contact with the enemy. Although engineers provide support through all engineer functions during the advance to contact, mobility support is accorded the highest priority.

5.7 Mobility Support. Engineers provide mobility support to maintain the momentum of the advance. Support tasks may include:

a. reducing a complex obstacle (which may include a river) as part of obstacle breaching;

b. crossing and clearing obstacles;

c. assisting the mobility of manoeuvre elements advancing and attacking through complex terrain;

d. clearing routes;

e. constructing routes, including bridging, as illustrated in Figure 5–1 and Figure 5–2;
Figure 5–1: Equipment Bridge in Timor Leste
Figure 5–2: Non-equipment Bridge Using Locally Won Materials

f. maintaining routes as illustrated in Figure 5–3;
g. constructing, maintaining and operating rafts, as illustrated in Figure 5–4, when bridging is not practicable;

Figure 5–3: Route Maintenance

Figure 5–4: Raft in Operation
h. constructing, maintaining and repairing aviation forward arming and refuelling points (commonly known as FARPs);

i. constructing, maintaining and repairing aircraft landing strips, zones and points;

j. constructing drop zones for aerial resupply;

k. neutralisation of unfired enemy demolitions; and

l. clearing explosive ordnance from routes, areas and facilities that need to be moved over, through or occupied by friendly forces, as illustrated in Figure 5–5 and Figure 5–6.

Figure 5–5: Explosive Ordnance Disposal
5.8 Countermobility Support. Countermobility support tasks during the advance are focused on fixing enemy counterattack or counterpenetration forces and improving flank protection. Tasks include:

a. constructing tactical obstacles, enhancing natural obstacles and conducting demolitions on potential enemy avenues of approach;

b. planning and emplacing situational obstacles such as remotely delivered mines and reserve demolitions;

c. consolidating the defence of a secured objective;

d. utilising the protection of reconnaissance and/or screening forces, mining and booby trapping of unoccupied enemy fighting positions; and
5-9

e. consolidating the defence of secured objectives by constructing obstacles, conducting demolitions and constructing expedient force protection measures to defend against enemy counterattacks.

5.9 **Survivability Support.** Survivability support during the advance includes constructing physical force protection measures, supporting deception and combating CBRN, fire and explosive hazards. Likely support tasks include:

a. **Constructing Physical Force Protection Measures.** Physical force protection measures may be constructed:
   
   (1) for forces in assembly areas prior to the advance or attack;
   
   (2) for advancing manoeuvre forces during a temporary pause in the advance, in the consolidation of the defence of a secured objective or in the adoption of a hasty defence;
   
   (3) to support the scheme of manoeuvre of flank protection forces;
   
   (4) for supporting forces, such as artillery and GBAD assets, that are less mobile than manoeuvre forces or which will be stepping forward through pre-prepared positions; and
   
   (5) for HQ, reserve and exploitation forces or CSS elements as they step forward between pre-prepared positions.

b. **Supporting Deception.** Engineer tasks to support deception in the advance include:

   (1) constructing decoy vehicles, aircraft, HQ, stores dumps, routes or bridges;

   (2) providing multi-spectral smoke obscuration;

   (3) constructing dummy defensive positions;

   (4) using key engineer assets (such as equipment bridges) in dummy activities; and
(5) creating the impression that the hasty defence of a secured objective is further progressed than it is.

c. **Combating Chemical, Biological, Radiological, Nuclear, Fire and Explosive Hazards.** Likely support tasks during the advance associated with CBRN and fire and explosive hazards include:

   (1) reconnoitring, surveying and reporting hazards;
   
   (2) clearing explosive hazards along routes of advance;
   
   (3) decontaminating equipment and personnel;
   
   (4) decontaminating areas that need to be occupied by friendly forces; and
   
   (5) fighting fires and rescuing personnel.

### 5.10 Sustainability Support

During the advance, engineer sustainability support is closely linked to mobility support and includes tasks such as the following:

a. maintaining road lines of communication such as the main and secondary supply routes and their associated bridges;

b. maintaining airfields and landing zones that facilitate the forward movement of personnel, equipment and supplies;

c. maintaining and repairing ports and their supporting facilities and services;

d. maintaining and repairing railheads and railways and their supporting facilities and services; and

e. maintaining and repairing ammunition and fuel storage areas.

### 5.11 Geospatial Support

The provision of geospatial support is consistent through all offensive activities and is described in
Chapter 4. During the advance, engineer geospatial support includes:

a. provision of geospatial data in the form of paper and digital terrain maps applicable to the advance;

b. specific terrain analysis and advice on roads, soil types, going, infrastructure, and restricted and very restricted terrain;

c. advice on probable locations and types of enemy defensive obstacle systems; and

d. advice on climate and weather and their impact on terrain.

Advance in Contact

5.12 Advance in contact is an offensive activity conducted when contact is established with the enemy. Forward momentum is maintained and the ISR effort focuses on identifying weaknesses and gaps that can be exploited. During the advance in contact, mobility and survivability support are generally accorded the highest priority, as the enemy will be attempting to break contact in order to provide time to establish a defensive position or withdraw.

5.13 Mobility Support. Mobility support tasks are similar to the advance to contact. However, engineers continually assess the terrain, obstacles and enemy dispositions in an attempt to identify and breach enemy obstacles designed to fix or turn the advance. Support may also be required to assist the assault of hardened enemy defensive positions.

5.14 Countermobility Support. Countermobility support during the advance in contact may be required to create obstacles or enhance natural obstacles on likely avenues of approach for counterattack forces. In complex terrain, this may be blocking streets, bridges and walkways and internal access through buildings to prevent advancing forces being outflanked.

5.15 Survivability Support. The focus of engineer survivability support during an advance in contact differs slightly from the
advance to contact in that greater emphasis is placed on creating physical force protection measures for stationary FEs and consolidating the defence of a secured objective.

5.16 **Sustainability Support.** Engineer sustainability effort during the advance in contact remains similar to that of advance to contact.

5.17 **Geospatial Support.** During the advance in contact, geospatial support focuses on terrain analysis in the immediate area particularly to inform the provision of mobility, countermobility and survivability support. In open terrain, minimal effort would be afforded to geospatial advice. However, in complex terrain, considerable effort must be applied to analysing a range of geospatial data, aerial photographs and construction methods to determine alternate routes, potential obstacle locations and traps. Potential withdrawal routes for enemy forces are also analysed with a view to transitioning to a pursuit and providing a cut-off force, defence or withdrawal.

**SECTION 5-4. ATTACK**

**Deliberate Attack**

5.18 A deliberate attack is conducted when a well-prepared defence must be defeated. It is characterised by extensive planning, reconnaissance and careful coordination of all available resources. Engineer effort for a deliberate attack is directed toward mobility support and geospatial support.

5.19 **Mobility Support.** Mobility support for a deliberate attack includes:

a. engineer reconnaissance to assess the strength of obstacles and defences, identify surfaces and gaps and provide engineer advice about the best approaches;

b. advice on obstacle reduction using offensive fire;

c. obstacle breaching and crossing;
d. explosive entry, as illustrated in Figure 5–7; and

e. assisting the assault of hardened enemy defensive positions.

Figure 5–7: Assault – Explosive Entry

5.20 Geospatial Support. Geospatial support provided in the lead-up to and during a deliberate attack focuses on the approaches to the objectives and enemy defences. Combined with reconnaissance, the analysis indicates the best approaches and assists the engineers to prepare to breach the fixed defences. Analysis of enemy counterattack routes indicates the best options for flank countermobility protection.
Quick Attack

5.21 A quick attack seeks to take advantage of an enemy’s lack of preparedness or to destroy lightly defended positions. Quick attacks are often used during the advance and pursuit and are conducted from the line of march. Similar to a deliberate attack, engineer effort for a quick attack is directed toward mobility and geospatial support. However, there is seldom time for engineer reconnaissance. If engineer support is required, engineer reconnaissance must be located well forward in order to be able to marshal personnel and equipment at the right time and place. Additionally, the engineers themselves must be located in a forward position to be able to respond quickly.

5.22 Mobility Support. Engineer mobility support for a quick attack is similar to that of a deliberate attack, except that there is less time for reconnaissance and, therefore, more reliance must be placed on the analysis of geospatial data.

5.23 Geospatial Support. In a quick attack, there is less time for preparation and hence less time for specific terrain analysis. Time constraints also generally preclude sourcing additional specific geospatial data. Consequently, geospatial advice is limited to a quick analysis of the data on hand and any reconnaissance information available.

SECTION 5-5. PURSUIT

5.24 Pursuit is an offensive activity designed to catch or cut off a hostile force attempting to escape, with the aim of destroying the enemy. Noting that the pursued force is likely to be conducting a delay, the enemy will be attempting to use obstacles and other tactics to delay the pursuing force. Engineer support to pursuit is similar to the advance, with mobility support being afforded the highest priority.

5.25 Mobility Support. Engineer mobility support tasks to maintain the momentum of the pursuit primarily include:

a. breaching, crossing and clearing obstacles including minefields;
b. clearing and maintaining routes (see Figure 5–8) including disposal of explosive hazards such as improvised explosive devices; and
c. neutralising unfired enemy demolitions.

Figure 5–8: Sappers Clearing a Route – 1943 and 2007

5.26 **Survivability Support.** Engineer survivability support tasks in the pursuit primarily include:
   a. constructing physical force protection measures,
   b. supporting deception,
   c. combating CBRN, and
d. providing emergency response.

5.27 **Sustainability Support.** Engineer sustainability support to the pursuit primarily includes maintaining routes, infrastructure and
installations such as airfields and landing zones required to sustain the force prosecuting the pursuit.

5.28 Geospatial Support. Geospatial support to the pursuit focuses on providing geospatial data and advising on primary and alternate routes, particularly through complex terrain. Engineer advice also includes terrain analysis that may indicate likely points that the enemy will attempt to engage pursuing forces, the type and location of obstacles and the time required by enemy forces to construct those obstacles.

SECTION 5-6. TACTICAL TECHNIQUES

Airborne

5.29 An airborne operation is a joint activity involving the movement of combat forces into an objective area by air. The troops employed may be a combination of parachute and airlanded elements, depending on the mission and the tactical situation.

5.30 The common types of airborne tactical techniques are paratroop, airmobile, airland, airdrop and special operations. Dependent on the circumstances, these techniques may be used to lodge an FE, manoeuvre within the battlespace to gain advantage, assault an objective or administratively move FEs and materiel. Airborne activities are usually a precursor to follow-on land forces.

5.31 Airborne Assault. Airborne assault is an airborne activity delivering the assault echelon by air into the objective area, which is expected to be strongly contested by the enemy. Depending on the objective, it is probable that engineers will form part of the assault echelon. Engineer tasks in support of airborne assault may include:

a. mobility support:
   
   (1) constructing, maintaining and repairing aircraft landing strips, zones and points at both the air point(s) of embarkation and air point(s) of disembarkation;
(2) clearing routes and areas of mines and other obstacles;
(3) constructing drop zones for aerial resupply;
(4) neutralising unfired enemy demolitions;
(5) clearing explosive ordnance from areas and facilities that need to be moved through or occupied by friendly forces; and
(6) constructing, maintaining and repairing aviation FARPs,

b. countermobility support:
(1) constructing obstacles and conducting demolitions on likely enemy avenues of approach to consolidate the defence of a secured objective, and
(2) planning and emplacing situational obstacles such as remotely delivered mines and reserve demolitions,

c. survivability support:
(1) constructing physical force protection measures, and
(2) consolidating the defence of a secured objective or the adoption of a hasty defence, and

d. geospatial support:
(1) provision of geospatial data and terrain and infrastructure analysis, including the identification of flying hazards as well as landing and drop zones;
(2) advice on the impact of weather and meteorology; and
(3) advice on the flight paths that provide the best concealment and obscuration from enemy radar and GBAD weapon systems.
5.32 **Airmobile.** Airmobile techniques include airmobile assault and airmobile movement in which combat forces and equipment manoeuvre about the battlespace in helicopters to engage in ground combat. Engineer tasking in support of airmobile is similar to that of airborne assault. Engineer equipment is heavy, and only certain equipment in limited numbers will be air transportable. This limitation restricts the scope and rate of engineer support. Construction materials are heavy and bulky and are therefore generally not suitable for transport by air. Therefore, engineers will place emphasis on improvisation and maximising use of local resources, including local or captured equipment. This requires a greater emphasis on the development of engineer intelligence.

Amphibious

5.33 An amphibious activity is launched from the sea by naval and land forces against a hostile or potentially hostile shore, in which land forces land and are supported from the sea as a combat activity, prepared to meet armed opposition. Amphibious activities may involve amphibious assault, amphibious raid, amphibious demonstration and amphibious withdrawal.

5.34 In amphibious activities, engineer support is almost identical to offensive activities. The following additional planning factors must be considered:

a. It is essential that engineers participate from the beginning of the planning processes. Initial planning is undertaken before embarkation of the landing force, but subsequent detailed planning may be done at sea. As equipment is embarked before the amphibious activity plan is finalised, the equipment may not be able to be disembarked in the appropriate order. In this case, equipment may need to be rearranged at sea (cross-decking) to facilitate the optimal disembarkation order.
b. Geospatial support is required to permit analysis of the following physical conditions:

1. general configuration of the coast;
2. offshore conditions such as wind, water temperature, currents, swells, tides, reefs, bars, shoals, and so forth;
3. coastal terrain including beaches, foreshores and underwater approaches; and
4. inland terrain such as exits and routes, natural obstacles (cliffs, sea walls, etc.), defensible positions, cover and concealment, and natural landmarks.

5.35 Engineer Tasks. Engineer tasks in support of amphibious activities may include:

a. Mobility Tasks. Likely support tasks to assist combat mobility include:

1. crossing or reducing complex obstacles as part of obstacle breaching;
2. assisting the assault of hardened enemy defensive positions;
3. clearing routes and areas of mines and other explosive hazards;
4. constructing, maintaining and repairing routes;
5. constructing, maintaining and repairing aviation FARPs;
6. constructing, maintaining and repairing aircraft landing strips, zones and points; and
7. constructing, maintaining and repairing ports at the sea point(s) of disembarkation.
b. **Countermobility Tasks.** Engineer countermobility tasks in amphibious activities may include:

1. constructing obstacles and conducting demolitions on likely enemy avenues of approach to consolidate the defence of a secured objective, and
2. planning and emplacing situational obstacles such as remotely delivered mines and reserve demolitions.

c. **Survivability Tasks.** Engineer survivability tasks in amphibious activities may include:

1. constructing physical force protection measures to consolidate the defence of a secured objective or in the adoption of a hasty defence,
2. supporting deception by providing multi-spectral smoke obscuration, and
3. combating CBRN and fire hazards.

d. **Conducting Explosive Ordnance Clearance.** Engineer support tasks in amphibious activities may include:

1. neutralising unfired enemy demolitions, and
2. clearing explosive ordnance from areas and facilities that need to be moved through or occupied by friendly forces.
CHAPTER 6
ENGINEERS IN DEFENSIVE ACTIVITIES

SECTION 6-1. INTRODUCTION

6.1 Defensive activities are undertaken to provide favourable conditions for the resumption of offensive and stability activities. They are aggressive and employ a variety of tactical actions and techniques in order to regain the initiative. Defensive activities are usually undertaken when the enemy has the initiative and are intended to prevent the enemy from seizing terrain or breaking through into a defended area. The aim is to break the enemy attack and destroy their forces.

6.2 The enemy's aim is to break through the defensive area and destroy friendly forces. To achieve this, the enemy will rely upon the following:

a. surveillance and reconnaissance to identify, locate and target obstacles and the positions of our own troops – particularly reserves, counterattack forces, HQ and CSS elements;

b. mobility to move their forces quickly to the battle, adopt tactical formations and concentrate forces in sufficient strength to achieve a breakthrough;

c. mobility to maintain the appropriate force ratio to sustain the attack by replenishing, reinforcing or replacing front-line forces; and

d. fire power to suppress and destroy friendly positions.

6.3 This chapter describes engineer support to defensive activities through mobility, countermobility, survivability, sustainability and geospatial support.
SECTION 6-2. SUPPORT TO DEFENSIVE TACTICAL ACTIONS

Overview

6.4 In defensive activities, engineer support is focused on hindering the mobility of the enemy and protecting friendly forces. Countermobility support, in concert with manoeuvre and offensive support, shapes the enemy’s movement. Survivability support enhances concealment and protection of friendly forces. Counterpenetration and counterattack forces will require mobility support. Geospatial support assists understanding the terrain to determine the likely enemy avenues of approach and integrate the defence.

6.5 The achievement of these support tasks depends on adequate advice and reconnaissance, the proper grouping and control of engineer elements, and on the timely provision of the necessary equipment and stores. Guiding principles for the employment of engineers during defensive activities are as follows:

a. Engineers must be intimately involved in the planning process. This ensures that a comprehensive terrain analysis can be generated to support decision-making, that the ISTAR effort can be informed, and that specialist equipment and defence stores can be prepared and positioned.

b. Engineer reconnaissance parties must be located with forward elements and have effective communications so that their reports can be quickly actioned at the appropriate HQ.

c. In order to optimise the amount of effort available, engineers should be grouped to higher levels than normal habitual support relationships, commensurate with tying in the defence with manoeuvre units.

d. The engineer effort should be generally completed from the front to the rear noting, however, that, given
increasing nonlinearity of the battlespace, tasks may be completed in order of their importance to the supported commander’s plan.

e. Engineer assets and resources should not be tasked or earmarked as a dedicated engineer reserve but identified as a situational engineer reserve for unforeseen tasks.

f. Engineers should be employed in preparing subsequent defensive positions in preference to being used in their secondary role as infantry.

**Mobility Support**

6.6 Mobility support is action taken to enhance the mobility of the force, thereby allowing the commander the freedom to physically manoeuvre. Mobility tasks in defensive activities focus on maintaining combat and tactical mobility and explosive ordnance clearance.

6.7 **Assisting Mobility.** The likely mobility support tasks in defensive activities are as follows:

a. assisting the combat mobility of counterpenetration and counterattack forces within and around the defensive position;

b. assisting mobility between primary and alternate and dummy defensive positions;

c. assisting mobility within a defensive position for combat replenishment;

d. obstacle breaching and crossing in the case of mobile defence;

e. clearing routes and areas of mines and explosive ordnance;

f. constructing, maintaining and repairing routes, particularly for counterpenetration and counterattack forces, and the relocation of artillery assets;
6.8 Conducting Explosive Ordnance Clearance. The likely explosive ordnance clearance support tasks for engineers in defensive activities are as follows:

a. conducting explosive hazard awareness and protection training for the force, and

b. clearing areas and facilities that need to be occupied by friendly forces.

Countermobility Support

6.9 Countermobility support is action taken to deny the enemy freedom to physically manoeuvre, thereby allowing the commander to select the time and place to engage the enemy. During defence or retrograde actions, the purpose of countermobility support is to delay the enemy to permit engagement with stand-off weapons and break their attack or pursuit. Countermobility tasks in defensive activities focus on constructing obstacles and conducting demolitions, noting that the most efficient obstacles are created by modifying existing terrain. Consequently, there needs to be detailed integration of obstacles and weapon systems.

6.10 Constructing Obstacles. Likely countermobility support tasks in defensive activities are as follows:

a. constructing obstacles to support the scheme of manoeuvre of screening and/or covering forces;
b. constructing nuisance obstacles, particularly on fired demolitions;

c. constructing tactical obstacles in the main defensive area;

d. planning and emplacing situational obstacles such as remotely delivered mines, particularly to prevent the enemy reinforcing successfully or to disengage and withdraw;

e. closing of gaps and lanes in tactical obstacles;

f. denying terrain between defensive positions;

g. constructing obstacles on the flanks of counterpenetration and counterattack routes; and

h. refurbishing obstacles that have been unsuccessfully breached by the enemy.

6.11 Conducting Demolitions. Likely engineer support tasks involving the conduct of demolitions in defensive activities are as follows:

a. conducting demolitions to support the scheme of manoeuvre of screening and/or covering forces;

b. conducting preliminary and reserve demolitions along routes and the enemy’s avenues of approach, particularly bridges (see Figure 6–1), roads and airfields;

c. conducting demolitions of facilities and materiel that may be of utility to the enemy such as roads, airfields, railways, ports, storage facilities, equipment and CSS supplies;

d. conducting demolitions on the flanks and denial of terrain between defensive positions; and

e. conducting demolitions on the flanks of counterpenetration and counterattack routes.
Survivability Support

6.12 Survivability support is action taken to reduce the impact of hazards created by the enemy, our own forces or nature. In defensive activities, engineer survivability support is focused on constructing physical force protection measures, supporting deception and combating CBRN and fire hazards.

6.13 Constructing Physical Force Protection Measures. Likely engineer support tasks in defensive activities include constructing physical force protection measures for the following purposes:

a. to support the scheme of manoeuvre of screening and/or covering forces;

b. for defending forces including primary, secondary and alternate defensive positions, as illustrated in Figure 6–2;

c. for dedicated reserve forces;
d. for counterpenetration forces in assembly areas and pre-prepared counterpenetration positions;
e. for counterattack forces in assembly areas; and
f. hardening facilities, stores dumps, bridges and other potential enemy targets against attack.

Figure 6–2: Constructing Physical Force Protection in Afghanistan

6.14 Supporting Deception. Likely engineer support tasks to support deception in defensive activities are as follows:

a. creating the impression that the defence of a position is further progressed than it really is;
b. constructing decoy vehicles, aircraft, HQ, stores dumps, routes or bridges;
c. providing multi-spectral smoke obscuration;
d. constructing dummy pre-prepared defensive positions; and
e. using the signature of engineer assets (eg. bridging equipment) in dummy activities such as movement,
assembly or rehearsals – the assets used in dummy activities risk potential enemy action and must be appropriately protected.

6.15 Combating Chemical, Biological, Radiological, Nuclear and Fire Hazards. Likely support tasks involving CBRN and fire hazards in defensive activities are as follows:

a. reconnoitring, surveying, reporting and possibly reducing hazards;

b. decontaminating equipment and personnel, as illustrated in Figure 6–3;

c. decontaminating areas that need to be occupied by friendly forces; and

d. fighting fires and rescuing personnel, as illustrated in Figure 6–4.
Sustainability Support

6.16 Sustainability support in defensive activities is limited because the majority of engineer support is allocated to countermobility and survivability support in order to prepare the defensive position. Engineer effort allocated to sustainability support would be for high-priority tasks such as maintaining infrastructure critical to the success of the defensive plan, replenishment and reinforcement of forward troops or the long-term success of the campaign. Figure 6–5 depicts an aircraft hangar constructed by engineers as part of a long-term sustainability plan.
In defensive tactical actions, geospatial support focuses upon terrain analysis to determine the most likely enemy approaches and probable tactical formations. Once the enemy’s probable avenues of approach and tactical formations have been determined, the terrain analysis is used to develop a plan that integrates the most effective obstacles with the terrain based on projected enemy forces and tactical formations. The obstacle plan is then integrated into the deception object and the overall defensive plan.

SECTION 6-3. DEFENCE

Area Defence

The purpose of area defence is to occupy an area within which a force seeks to gain tactical dominance, and weaken the threat to the extent that offensive activities can be mounted or
resumed. Area defence is normally conducted within defined boundaries in an area chosen because of its natural tendency to aid the defender.

6.19 **Mobility Support.** Within the defended area, mobility support effort is directed to keeping internal routes open to facilitate combat replenishment and employ reserves and counterpenetration or counterattack forces. Mobility support outside the defended area may be allocated to employing counterattack forces or keeping the main and secondary supply routes open.

6.20 **Countermobility Support.** Engineer effort allocated to countermobility support is focused on denying mobility to the enemy by constructing obstacles. Once the defences are completed, effort is allocated to closing and reinforcing the gap in obstacles and defences after the covering force has returned to the defensive position and is conducting their passage of lines.

6.21 **Survivability Support.** Engineer survivability support within defended areas is allocated to hardening the highest priority targets such as CPs and HQ, and key assets such as artillery or logistic supplies. Effort is also allocated to those FEs who are likely to engage the main force of the enemy attack.

6.22 **Geospatial Support.** Geospatial support is important in preparing for the defence. It is important to understand the terrain and how that terrain can be used in support of the defence to hinder the enemy and preserve friendly forces. Geospatial support in the actual defence is minimal.

**Mobile Defence**

6.23 A force conducting a mobile defence requires a high degree of battlespace mobility to achieve its mission. Commanders depend on manoeuvre and offensive action and usually surrender terrain to shape the threat into areas suitable for launching a counterattack.

6.24 **Mobility Support.** Mobility is an essential component of mobile defence. If an FE conducting a mobile defence is fixed, the full
fighting power of the enemy can be applied to an FE that is not in a prepared defensive position. High-priority mobility support tasks for engineers supporting mobile defence are opening and clearing routes and breaching and crossing obstacles.

6.25 Countermobility Support. Countermobility support is also a high priority in mobile defence. While mobility support effort is directed to keeping the force mobile, countermobility effort is applied to delaying or denying the enemy force by enhancing natural obstacles, creating new obstacles and closing routes so that the mobile force has the freedom of action to pursue its objectives. Forces conducting mobile defence rarely have sufficient engineers to have a mobility FE forward and a countermobility FE rearward. Therefore, elements of the engineer FEs will need to transition between mobility and countermobility tasks. Consequently, countermobility tasks need to be quick and effective and lend themselves to the use of explosives and mines.

6.26 Survivability Support. A mobile defender must shape the enemy into areas suitable for launching an attack. The attack, if launched, is usually combined with offensive support. FEs conducting mobile defence must remain mobile to avoid decisive engagement, and therefore seldom allocate engineer effort to survivability tasks. During mobile defence, engineer effort is normally allocated to mobility support and survivability support assets are normally allocated to preparing the next defended locality.

6.27 Geospatial Support. Geospatial support is crucial in mobile defence because the defender is continuously moving over new terrain. Geospatial effort is allocated to terrain analysis and determining the best routes for the defending force, and how to utilise the terrain and its natural obstacles to shape the enemy into areas suitable for attack.

SECTION 6-4. RETROGRADE

6.28 The purpose of retrograde actions is to undertake organised manoeuvre away from a threat. The enemy may force these
actions or a commander may execute them voluntarily. Retrograde actions are considered transitional and are not considered in isolation from other activities. These actions are preferably undertaken to gain time, for force preservation in unfavourable conditions, to deceive or to conform to a higher plan.

Delay

6.29 Delay is a common defence activity undertaken to gain time by imposing delay on a threat in a particular area for a specified time. It should be noted that delaying activities would be undertaken at formation level, with battlegroups and combat teams participating through the conduct of area defence in successive or alternate positions away from the threat.

6.30 Mobility Support. Delay forces must impose delay but avoid decisive engagement. Mobility support in the delay focuses on opening and maintaining routes to ensure that the FE can break contact. Mobility effort is also allocated to counterattack forces to ensure that they can respond to prevent the FE becoming decisively engaged.

6.31 Countermobility Support. The purpose of delay is to trade space for time and to slow the enemy’s momentum while inflicting maximum casualties, but avoiding decisive commitment of the delaying forces. Consequently, the balance of engineer effort in delay is allocated to countermobility, in order to slow the enemy and engage them as they cross obstacles. Engineer effort is therefore allocated to enhancing natural obstacles or creating new obstacles.

6.32 Survivability Support. To impose significant delay on a pursuing force, a mobile defender must force the enemy to repeatedly deploy for battle without becoming decisively engaged themselves. Ideally, the pursuing force should have to deploy and fight through obstacles. Although survivability support tasks are often time-consuming, an FE accepting engagement in a delaying action must be able to survive and break contact, necessitating some level of survivability support for the key assets. Above this minimal level of survivability...
support with the delaying force, engineer survivability support is normally allocated to preparing the next defended locality.

6.33 Geospatial Support. Geospatial support in delay is focused on using the terrain to impose maximum delay on the enemy by identifying suitable locations for route denial and obstacle emplacement.

Withdrawal

6.34 The purpose of a withdrawal is to disengage from the threat and redeploy to a new position or task with a minimum of interference and casualties. Withdrawal is a task employed regularly during mobile defence or the delay to accomplish the overall aim of resuming offensive activities. It may also be necessary as a consequence of an unsuccessful action.

6.35 Mobility Support. Withdrawal is an organised and coordinated activity. Depending on the size of the force, the degree of notice and the time frame allowed, a withdrawing force may need multiple routes available for extended periods. Mobility support focuses on opening and maintain the withdrawal routes.

6.36 Countermobility Support. Countermobility support in the withdrawal is similar to that of delay and is designed to prevent enemy follow-up. The balance of engineer effort is likely to be allocated to countermobility support.

6.37 Survivability Support. Engineer effort allocated to survivability support is normally preparing the next defensive position, hardening C2 facilities, managing the withdrawal or maintaining infrastructure in rear areas.

6.38 Geospatial Support. Geospatial support in the withdrawal includes terrain and weather analysis and supporting routes and suitable defendable locations for withdrawing forces. It also examines the terrain, seeking to use it to hinder any enemy advance.
6.39 Defensive tactical techniques are methods for accomplishing a result in particular situations, which may arise unexpectedly in the course of conducting a defensive tactical action, or may be planned as a contingency.

6.40 **Break-out from Encirclement.** The purpose of break-out from encirclement is to enable the commander of an encircled force to regain the initiative and freedom of action by breaking out of the encirclement. Engineer effort in a break-out from encirclement will be primarily allocated to mobility support to breach and cross obstacles and select, open and maintain routes.

6.41 **Convoy Escort.** The purpose of a convoy escort is to act as a security FE, which is task-organised to provide support to a convoy. If engineers are part of a combined arms team tasked to provide convoy escort, their main task is likely to be mobility support.

6.42 **Counterattack.** The counterattack tactical technique is an attack by a part or all of a defending force against a threat attacking force for the purposes of regaining lost terrain or cutting off or destroying threat FEs, with the general objective of denying the enemy their purpose in attacking. In sustained defensive activities, counterattacks are undertaken to restore the battle position and are directed at limited objectives. Engineer FEs are likely to be part of any counterattack force to provide mobility support and assist in the attack against hardened facilities.

6.43 **Defend a Battle Position.** The success of any defence hinges critically on the defending force’s ability to defend its battle position. The defence may be designed to destroy the enemy in an engagement area, block an avenue of advance, control key or decisive terrain, or fix the enemy to allow another FE to manoeuvre and destroy it. Engineer support to defended positions is primarily allocated to countermobility and survivability support. Countermobility support is designed to fix, turn or otherwise disrupt the enemy’s advance to enable the
defenders to engage the enemy in selected engagement areas. Survivability support is designed to harden defences, particularly of CPs and key assets, to improve the survivability of personnel and materiel and allow them to continue the defence.

6.44 **Defend in Sector.** The general defensive task of defending within assigned boundaries may often require an FE to conduct a defence in their assigned sector when flexibility is desired and retention of specific terrain is not necessary. It is essentially a threat-oriented defensive task, one of the least restrictive defensive missions and not restricted to being conducted in area defence alone. It relies on the ability of the defending force to manoeuvre and have maximum freedom of action within assigned sector boundaries. Defending in sector requires an intimate knowledge of the terrain facilitated by geospatial support, and freedom of manoeuvre facilitated by mobility support. Countermobility effort will be allocated to denying the most likely routes of enemy advance.

6.45 **Defend a Strongpoint.** During any defence, FEs are required to occupy and defend their respective battle positions within their locality, but there are also occasions when specific strongpoints are required. Strongpoints are usually associated with the defence of specific areas, such as weapon sites or gun emplacements (often referred to as bunkers); important CSS facilities, such as stores and ammunition natures of all types; or other key installations, such as power plants, dams and railway yards. Engineer effort in the defence of a strongpoint is primarily survivability support and countermobility support. The most probable method of enemy attack against a strongpoint is initially offensive support. Engineers construct the strongpoint to survive the initial offensive support. Countermobility effort is allocated to disrupt the ground offensive action.

6.46 **Reserved Demolition.** The purpose of a reserved demolition is to provide a prepared demolition on a critical feature, such as a bridge, crossing or other feature, for destruction on the instructions of the formation commander. Reserved demolitions are an engineer countermobility task.
6.47 **Route Security.** The purpose of route security techniques is to protect lines of communication and friendly forces moving along them. Route security techniques and tasks are defensive in nature and terrain-based. A route security force prevents a threat from impeding, harassing or destroying traffic along the route or portions of the route itself. The engineer role in providing for route security is mobility and sustainability support to keep the route open and trafficable. This involves route maintenance and route search to identify and clear explosive hazards.
CHAPTER 7
ENGINEERS IN STABILITY ACTIVITIES

SECTION 7-1. INTRODUCTION

7.1 Stability activities are activities designed to maintain or establish a secure environment, creating the conditions for the provision of essential government services, emergency infrastructure reconstruction and humanitarian relief. Stability activities may or may not involve the use or threat of force. Tasks range from humanitarian assistance to training indigenous forces and the transition to the endstate after major combat. Conducted throughout all campaigns, in conjunction with offensive and defensive activities, stability activities may be the main effort to achieve a campaign objective. Military activities provide the conditions in which the other whole-of-government effort can be applied to achieve stable conditions and the desired endstate.

7.2 Stability activities are usually conducted in complex physical terrain, with mixed populations and within a complex information environment. They are manpower- and time-intensive and incidents at the tactical level can have significant higher-level consequences.

7.3 This chapter outlines engineer support to stability activities by addressing the engineer contribution to the tactical tasks associated with the applicable stability tactical actions.

SECTION 7-2. SUPPORT TO STABILITY TACTICAL ACTIONS

7.4 Stability activities are undertaken as part of a whole-of-government effort to establish control so that the balance of effort can then be applied to reform the security forces, restore essential services and assist the government to function. Interagency cooperation is fundamental to stability...
activities. The tactical actions that support stability activities are control, reform, restore and assist.

7.5 Stability actions may include the full range of offensive, defensive and enabling activities to varying degrees. Engineer support to stability tactical actions and many of the subordinate tactical techniques are similar to their support for offensive, defensive and enabling activities and apply the same engineer capabilities with a different focus and priority of effort.

7.6 Engineer support may include:

a. mobility support to keep roads, tracks and pathways clear;

b. countermobility support to control personnel and vehicles at critical points and in the vicinity of critical infrastructure;

c. survivability support to protect personnel and key infrastructure from attack, as illustrated in Figure 7–1;

d. sustainability to maintain ports, airfields and landing zones and to provide essential services; and

e. geospatial support to provide paper and electronic maps for damage assessment, search and rescue, route reconnaissance and maintenance.
SECTION 7-3. CONTROL

Overview

7.7 Control tactical actions are employed to reduce disorder and violence to an acceptable level. Establishing a secure environment achieves the conditions required for other civil actors to operate; provides opportunity for the development or resumption of normal social, political and economic activity; and allows dialogue between the opposing factions. The purpose of control is to create the conditions in which reform, restore and assist actions can occur.

7.8 Tactical Tasks. The tactical tasks associated with control are as follows:

a. conflict containment;

b. crowd control;
c. curfew;
d. enforcement of out-of-bounds areas;
e. key point protection (KPP) and vital asset protection (VAP);
f. internment and detention;
g. population protection;
h. refugee and internally displaced persons movement;
i. separation of hostile forces; and
j. supervision of ceasefire.

Contribution

7.9 Potential engineer contribution to control tactical actions includes:

a. mobility tasks to enable friendly forces and the legitimate authority (including police and emergency services) to manoeuvre within the battlespace;

b. countermobility support for the construction of physical barriers and physical force protection measures required to manage crowds and traffic; and

c. survivability support for:

(1) the construction and maintenance of facilities for internally displaced persons, as illustrated in Figure 7–2;

(2) construction and maintenance of internment and detention facilities; and

(3) conducting high-risk search to support population protection.
SECTION 7-4. REFORM

Overview

7.10 Reform involves the effective development of security structures to enable the population to live in safety. Reform is likely to be required in countries emerging from conflict where indigenous security forces are no longer effective. It makes a significant contribution to conflict prevention in fragile or failing states. In all cases it is a critical tactical action to provide the basis for long-term stability. To be successful, reform requires a comprehensive, whole-of-government approach and coordination with other donors and the recipient or host nation. The purpose of reform is to ensure the following:

a. that the quality of governance in the state, in terms of relationships between security institutions, the wider government and the general public, is established and maintained; and
b. that the technical competence and professionalism of those within the security institutions are established and maintained.

7.11 Tactical Tasks. The tactical tasks associated with reform are as follows:

a. allocation and control of equipment and infrastructure;
b. disarmament, demobilisation and reintegration;
c. selection and recruitment of future security forces;
d. training, mentoring and transfer of responsibility to indigenous authorities, including training and mentoring of existing security and police forces; and
e. supporting the rebuilding of the criminal justice system, including the deployment of interim justice personnel to supplement the indigenous criminal justice system.

Contribution

7.12 Potential engineer contribution to reform tactical actions includes:

a. maintenance and restoration of public utilities, facilities and services to support the government and security forces;
b. development of essential public utilities, facilities and services where such utilities, facilities and services did not exist before, and training personnel to operate the subsequent services;
c. collating and destroying weapons, munitions and explosives confiscated from insurgents, belligerents and the population; and
d. training for indigenous security forces, particularly in the areas of search and high-risk search.
SECTION 7-5. RESTORE

Overview

7.13 Restore is the process of ‘post-conflict reconstruction’ or ‘provincial reconstruction’. Initially, restore involves the provision of immediate health assistance, essential services and facilities and invariably is associated with disaster relief. The results of restore should be tangible and lend themselves to publicity as part of influence actions. The local population should be able to clearly make the connection between the military forces and their success at restore. The purpose of restore is to re-establish essential services, facilities and infrastructure and providing humanitarian aid and health assistance.

7.14 Tactical Tasks. The tactical tasks conducted as part of restore are as follows:

a. provision of immediate health assistance;
b. restoration of essential public utilities;
c. restoration of essential public services;
d. restoration of essential facilities and national infrastructure, such as the bridge in Figure 7–3;
e. restoration of post-conflict special services; and
f. restore intellectual and institutional infrastructure.
Contribution

7.15 Potential engineer contribution to restore tactical actions includes:

a. support to the restoration of essential services, including:
   (1) health support infrastructure and facilities,
   (2) sanitation and waste,
   (3) potable water distribution, and
   (4) provision of electricity and gas supplies;

b. assessing the structural integrity of buildings;

c. assessing of damage to roads and bridges;
d. undertaking expedient repairs to roads and bridges;
e. constructing of bridges;
f. construction, maintenance and repair of aircraft landing strips, zones and points;
g. clearing of debris;
h. clearing the explosive remnants of conflict; and
i. training members of the indigenous population in a range of trade skills to enable the restore effort, as illustrated in Figure 7–4.

Figure 7–4: Restore – Training and Employment of Local People
SECTION 7-6. ASSIST

Overview

7.16 Assist aims to preserve the rule of law, enable the conduct of elections and provide humanitarian and environmental assistance (in the form of selected services), which may be conducted on Australian territory or abroad. Examples of assist on Australian territory include those activities conducted under the auspices of Defence assistance to the civil community comprising various categories, ranging from public displays through to disaster relief and Defence Force aid to civilian authorities (comprising mainly internal security actions in support of government requirements). Figure 7–5 depicts interagency cooperation in a counterterrorism activity. A recent offshore example is the Regional Assistance Mission to the Solomon Islands, which also included aspects of control, restore and reform.

Figure 7–5: Assist – Counterterrorism Interagency Cooperation
7.17 The purpose of assist is to enable the preservation of the rule of law, the conduct of free elections and the provision of environmental health and humanitarian assistance.

7.18 **Tactical Tasks.** Assist tactical tasks are supporting the rule of law, supporting elections and enabling humanitarian assistance.

**Contribution**

7.19 It is unlikely that engineers will be allocated significant tasks in support to the rule of law and elections. In assist, engineer effort is likely to be allocated to improving environmental health and enabling humanitarian assistance as follows:

a. surveying damage;

b. opening roads and constructing temporary bridges;

c. clearing debris and disposing of waste materials, as illustrated in Figure 7–6;

d. restoring essential services;

e. providing sanitation and waste;

f. producing water, as illustrated in Figure 7–7;
Figure 7–7: Assist – Provision of Large Volumes of Potable Water

g. operating small boats for local evacuation;
h. constructing flood control measures and draining areas of excess water;
i. assessing the structural integrity of buildings and demolishing unsafe structures;
j. constructing and maintaining facilities for internally displaced persons;
k. constructing, repairing and maintaining airfields and landing zones; and
l. assisting in search and rescue.

7.20 Humanitarian Assistance. The provision of humanitarian assistance within Australia is closely aligned to the provision of Defence assistance to the civil community.

7.21 Defence Assistance to the Civil Community. Engineer FEs have provided support to the civil community under the auspices of Defence assistance on many occasions. Recent support tasks include bushfires in the ACT and Victoria (2003 and 2009), Operation SUMATRA ASSIST (2004/2005) and the
7.22 **Army Aboriginal Community Assistance Program.** The Army Aboriginal Community Assistance Program (commonly known as AACAP) is an Australian Government initiative established between the Commonwealth Department of Families, Housing, Community Services and Indigenous Affairs (commonly known as FaHCSIA) and the Army. The program utilises the resources and expertise of the Army to improve primary and environmental health and living conditions in remote indigenous communities. The RAE involvement in the Army Aboriginal Community Assistance Program includes design and project management provided by 19 CE Works, and construction and training provided by the construction regiments and squadrons.

**SECTION 7-7. TACTICAL TECHNIQUES**

**Overview**

7.23 Stability activity tactical techniques are military ‘methods’ for accomplishing a result in particular situations. They are intended to improve efficiency and uniformity of action, and ensure consistency. Tactical techniques provide an opportunity for commanders to exercise a series of options according to the dictates of the situation.

7.24 Stability activity tactical techniques that engineers normally provide support for include:

a. enforcement of out-of-bounds areas;

b. cordon and search;

c. KPP and VAP;

d. strongpoint defence;

e. noncombatant evacuation;

f. route security; and
g. traffic control posts (TCPs) and vehicle checkpoints (VCPs).

Enforcement of Out-of-bounds Areas

7.25 Key infrastructure, vulnerable communities and other key facilities may be kept out-of-bounds, as may other areas deemed necessary for public protection or security of military forces. Means of enforcing out-of-bounds areas includes dominating approaches; patrols and searches; and barriers, patrols and checkpoints.

7.26 Engineer Contribution. Likely engineer contribution to enforcement of out-of-bounds areas is creating and maintaining physical barriers to separate the population from the specified areas and perimeter lighting and watchtowers.

Cordon and Search

7.27 Cordon and search involves the isolation of a chosen area and then its systematic search. The establishment of the cordon and the conduct of the search are two separate tasks that should be conducted as a joint military and interagency (including police forces) task.

7.28 Engineer Contribution. The primary engineer support tasks in cordon and search are as follows:

a. high-risk search;

b. disposal of explosive ordnance and improvised explosive devices, illustrated in Figure 7–8; and

c. temporary barriers.
Key Point Protection and Vital Asset Protection

7.29 KPP (including VAP) is the process of protecting installations, products or services which are of such importance that their total loss or severe destruction would critically impair defence or security or the functioning of government. Specifically, KPP and VAP are undertaken to do the following:

a. avoid disruption to normal life and the welfare of the civil population,
b. maintain law and order,
c. prevent any adverse impact on the economy,
d. maintain the morale of the population, and
e. maintain military superiority.

7.30 Key Point. A key point is a concentration, site or installation that, if it were destroyed or captured, would seriously affect military activities. Key points may include communication centres, power stations, refineries, transportation facilities and
7.31 **Vital Asset.** A vital asset is a facility, installation or resource, the loss of which would severely disrupt the orderly life of the community or damage to which would cause a major public hazard. Nodal points within a vital asset are called critical points; the loss, damage or destruction of which would render the vital asset inoperable. Therefore, these must be provided with close protection.

7.32 **Engineer Contribution.** The primary engineer support tasks for KPP and VAP are as follows:

a. constructing physical force protection measures,

b. hardening of potential targets against attack through structural reinforcement and hazard removal,

c. conducting explosive hazard awareness and protection training,

d. conducting explosive ordnance clearance, and

e. combating CBRN and fire hazards.

### Strongpoint Defence

7.33 The purpose of a strongpoint is the retention of specific terrain in order to deny its use to the enemy. Strongpoints require intensive effort to develop and defend but, if sited correctly, also require a major enemy effort to overcome. The hub of the defence of a strongpoint is dug-in infantry, supported by tanks and other weapons. Defending a strongpoint is discussed in Chapter 6. A strongpoint constructed for stability activities may have a life expectancy of several years.

7.34 **Engineer Contribution.** The primary engineer contribution to strongpoint defence is countermobility and survivability support. Engineers design and develop the obstacles and assist in the design and construction of the strongpoint itself. The expected life of the strongpoint determines its construction method. For a short-term strongpoint, it may be enhanced primary and alternate weapon pits with overhead cover and
tranches with wire obstacles. A longer term strongpoint may be concrete bunkers with extensive reinforced trenches, obstacles and protected tank and heavy weapon emplacements.

Noncombatant Evacuation

7.35 The purpose of noncombatant evacuation is to seek to relocate noncombatants at risk to a safe place. Noncombatant evacuation may be conducted in permissive or hostile circumstances and requires land forces, as part of a joint interagency task force, to conduct, participate in, or contribute to evacuation of Australian nationals and/or other approved foreign nationals from an area of threat. Permissive and hostile noncombatant evacuation are defined as follows:

a. *Permissive*. A noncombatant evacuation conducted in a permissive environment most commonly occurs following natural disaster or civil unrest, where no resistance to evacuation is expected. In such circumstances, there is host nation consent and support for those wishing to leave.

b. *Hostile*. A noncombatant evacuation conducted in a hostile environment most commonly occurs when the host nation’s civil and military authorities have lost control and there is a general breakdown in law and order.

7.36 Engineer Contribution. Potential engineer contributions to noncombatant evacuations are as follows:

a. mobility support to the evacuation force, including:
   (1) clearing mission-essential routes and areas of explosive hazards;
   (2) constructing and maintaining FARPs;
   (3) constructing and maintaining aircraft landing strips, zones and points;
   (4) constructing and maintaining an evacuee handling centre;
(5) repairing airfields and ports to minimum mission essential standards; and

(6) searching evacuees for weapons and other hazardous materials;

b. providing survivability support to the evacuation force, diplomatic staff and evacuees with the construction of expedient physical force protection measures; and

c. providing sustainability support to the evacuation force and evacuees with the construction of temporary facilities and services.

Route Security

7.37 The security of routes and lines of communication presents one of the greatest security challenges in stability activities. Route security techniques and tasks are defensive in nature and terrain-based. A route security force may prevent insurgent forces from impeding, harassing or destroying traffic along the route or portions of the route itself. However, protection and security require dedicated resources at almost infinite points or reaction forces to counter possible threat action.

7.38 Engineer Contribution. Engineer support to maintaining route security is primarily route sanitation and maintenance. Route sanitation is the identification and neutralisation of explosive hazards. Route maintenance requires engineers to source road building/maintenance materials and transport them to the point of maintenance. This normally requires significant effort to be allocated to quarrying, cartage stockpiling and the security of the personnel and equipment involved. Frequent route maintenance grooms the road surface and verges which makes it easier to identify suspicious activity and changes in the road and its surrounds. High-threat routes require surveillance, which may be from fixed watchtowers or armed patrols. Identified explosive threats require a rapid response by an armed FE and subsequent disposal.
7.39 TCPs and VCPs form an integral part of general road and track movement control. TCPs can be established by security forces or any land-based force and are established to control monitor the flow of road traffic. A VCP is established to block or close a route to vehicles and may be also be used to restrict or monitor the movement of pedestrians. VCPs can also be used to restrict the flow of arms, personnel and materiel.

7.40 **Engineer Contribution.** In stability activities, there are significantly more engineer tasks than engineers available to complete those tasks. Consequently, engineers are unlikely to be allocated to man TCPs/VCPs unless there is a high threat that warrants a high-risk search. The primary engineer contributions to TCPs and VCPs relate to survivability support, and are as follows:

a. providing advice on suitable locations for TCPs and VCPs,

b. providing advice on design and construction, and

c. constructing permanent or semipermanent TCPs and VCPs in accordance with specified priorities.
CHAPTER 8
ENGINEERS IN ENABLING ACTIVITIES

SECTION 8-1. INTRODUCTION

8.1 Enabling activities provide the link between offensive, defensive and stability activities. They do not have any associated specific tactical actions, as they are conducted to enable offensive, defensive and stability tactical actions across the comprehensive range of military activity.

8.2 Enabling activities encompass link-up, march, obstacle crossing and breaching, passage of lines, patrol, reconnaissance, relief in place and surveillance. Enabling activities may be conducted as missions in their own right and may have subordinate enabling activities to enable their prosecution. For example, passage of lines may be required before an engineer FE begins the engineer reconnaissance of an enemy defensive position in preparation for a deliberate attack.

SECTION 8-2. SUPPORT TO ENABLING ACTIVITIES

Link-up

8.3 A link-up is conducted where two forces are to join up in enemy-controlled territory. The aim of a link-up is to establish contact on the ground between two FEs that may have the same or differing missions. In a link-up, it may be necessary to defeat an enemy between those two forces before contact can be established. Usually, a moving force is required to link up with an isolated stationary force. Additional information on link-up is contained in LWD 3-0-3, Land Tactics (Developing Doctrine), 2009 [Chapter 17].

8.4 Engineer Support. Link-up demands a considerable effort to coordinate engineer activity, not only with the other arms, but
also between the engineers supporting the two forces. Engineer support is likely to include:

a. **Engineer Support to the Moving Force.** Engineer support to the moving force is similar to that for offensive activities, and may include:

   (1) mobility support to opening and maintaining axes of advance and link-up – engineers supporting the stationary force may be able to contribute to this requirement;

   (2) countermobility support to protect the flanks of axes of advance and link-up; and

   (3) survivability support to defend objectives taken for the purposes of the link-up.

b. **Engineer Support to the Stationary Force.** Engineer support to the stationary force is similar to that for defensive activities, and may include:

   (1) mobility support to breach or cross obstacles at planned link-up points, or to assist in the break-out of the stationary force;

   (2) countermobility support to protect the flanks of the axes of advance and link-up, as well as to protect the stationary force’s position on approaches not required for the link-up; and

   (3) survivability support similar to that for other defensive activities.

### March

**8.5** A march is conducted to move a military land force to its place of tactical employment efficiently. The underlying intent for every march is to reach the destination in the best possible condition to execute the mission. The term ‘march’ does not necessarily involve dismounted troops but is more appropriately used to describe movement of the FE as an entity. The march is the critical link between deployment and
subsequent engagement in military activities. For most FEs it is an SOP which enables the generation of tempo.

8.6 March may be mounted or dismounted, forward or rearward, tactical or administrative. Additionally, a march should be conducted over multiple routes wherever possible.

8.7 **Engineer Support.** Engineer support to march is similar to the support provided to other moving forces, and includes:

a. mobility support to opening march routes;

b. countermobility support to protect the flanks of the marching FE;

c. geospatial support for digital and electronic maps and advice on the selection of routes, going and potential areas for enemy interdiction; and

d. maintaining routes.

**Obstacle Crossing and Breaching**

8.8 Obstacles are impediments or restrictions to movement which normally require special equipment, munitions and procedures to overcome. Threat defences usually incorporate natural and artificial obstacles that are designed to disrupt, turn, fix or block an attack or advance. The purpose of obstacle breaching and crossing tactical actions is to minimise the impact of obstacles and hostile force actions on friendly force mobility and survivability.

8.9 **Engineer Support.** Engineers are a fundamental enabler for obstacle breaching and crossing. Engineer support includes:

a. mobility support to create the breach and the crossing points, as determined during the engineer reconnaissance;

b. countermobility support to protect the flanks of the FE waiting to cross the obstacle; and

c. geospatial support to analyse the terrain and its impact on the breach, the development of the crossing points and the FE crossing the obstacle.
Passage of Lines

8.10 A passage of lines is an enabling activity in which a moving force moves through a stationary force. The passage may be forward or rearward, and the stationary force may or may not be in contact with the enemy. The purpose of a forward passage of lines is to pass one force through another while maintaining the overall momentum of any task or tactical action. The purpose of a retrograde action (rearward passage of lines) through a rearward position is to enable one force to disengage from the threat and pass through another force to which it hands over the battle so that the withdrawing force can prepare for subsequent activity.

8.11 The moving force is under the control of the stationary force until it moves past a clearly delineated line of responsibility. The coordination and timing of actions associated with the moving force crossing this line is critical. Liaison between the commanders of each FE and the engineer FE commanders is essential. Additional information on passage of lines is contained in *LWD 3-0-3, Land Tactics (Developing Doctrine)*, 2009 [Chapter 17].

8.12 Engineer Support to Forward Passage of Lines. Engineer support to a forward passage of lines is likely to include:

a. Engineer support to the stationary force may include:

   (1) providing the moving force with engineer information and intelligence, particularly about the location of enemy and friendly obstacles forward of the position;

   (2) constructing expedient physical force protection measures in harbours and forming-up places for the moving force;

   (3) providing sufficient well-marked gaps and lanes through stationary force obstacles, with guides when necessary, for the moving force;

   (4) keeping routes open for the moving force; and
(5) providing support to the moving force’s deception plan.

b. Engineer support to the moving force is similar to that for other offensive activities.

8.13 Engineer Support to a Rearward Passage of Lines. The support is likely to include:

a. Engineer support to the moving force is similar to that for defensive activities, with an emphasis on the following:

   (1) mobility support to open and maintain routes to the rear – engineers supporting the stationary force may be able to contribute to this requirement; and

   (2) countermobility support to protect the flanks of routes to the rear.

b. Engineer support to the stationary force is similar to that for defensive activities, with an emphasis on the following:

   (1) providing sufficient well-marked gaps and lanes through stationary force obstacles, with guides when necessary, for the moving force;

   (2) keeping routes open for the moving force;

   (3) closing any unnecessary gaps and lanes in obstacles once the moving force has passed; and

   (4) completing any demolitions once the moving force has passed.

Patrol

8.14 Patrolling is the responsibility of any combined arms team across the range of military activities and in all environments. The purpose of patrols and active patrolling is extensive but there are three primary reasons engineers undertake patrolling activities, as follows:

a. engineer reconnaissance,
8.15 **Engineer Support.** Engineer support to patrolling is similar to the support provided for the advance but depends on the size and composition of the patrolling FE and may include:

a. mobility support to select, open and maintain routes, and breach and cross obstacles;

b. countermobility support to protect the flanks;

c. survivability support to defend objectives taken or repel attacks;

d. geospatial support to interpret the terrain and advise on routes, going and weather;

e. EOD; and

f. emergency response.

**Reconnaissance**

8.16 Reconnaissance is an enabling activity undertaken to obtain, by visual observation or other detection methods, information about the activities and resources of an enemy or potential enemy threat. It is also to secure data concerning the meteorological, hydrographic or geographic characteristics of a particular area. Engineer reconnaissance has an increased focus on terrain, facilities, infrastructure and enemy defences so that engineers can advise commanders, plan and breach enemy defences.

8.17 **Engineer Support.** Engineer support to reconnaissance is similar to the support provided for patrolling. Similarly, the available assets depend on the size and composition of the FE and may include:

a. mobility support to maintain the momentum of the FE and to breach and cross obstacles,

b. countermobility support to protect the flanks and the withdrawal once the reconnaissance is complete,
c. survivability support to defend against enemy attacks if the FE is unable to break contact, and

d. geospatial support to facilitate movement to and from the reconnaissance site.

Relief in Place

8.18 Relief in place is used to replace one FE with another, usually in static defensive positions. It is a force preservation measure and a tool for allowing a commander to rotate forces before they reach their culminating point or to employ them on other tasks.

8.19 Engineer Support. Engineer support to a relief in place is similar to that provided for defensive activities, although the level of support is likely to be reduced due to requirement for the engineers to conduct their own relief in place. Consequently, any engineer tasks such as strengthening defences and fortifications are normally completed before the relief in place commences. If time is available, it may be desirable to offset the engineers’ relief in place with other elements of the forces involved.

8.20 Engineer Relief in Place. The handover of engineer items from the in-place force to the relieving force is likely to be a substantial undertaking, particularly between forces from different nations. Consequently, engineers from both forces must be given sufficient notice and time to carry out the handover, including the transfer of equipment, and must be free to liaise directly. The engineer items likely to be handed over include:

a. geospatial data sets and products;

b. engineer information and intelligence;

c. obstacle records, plans and related documentation;

d. unused mines, explosives, construction materials and defence stores;

e. non-unit engineer equipment required to remain in the AOR; and
Surveillance

8.21 Surveillance is the systematic observation of areas, persons or things by visual, aural, electronic, photographic or other means. The purpose of surveillance is to detect activity or change over a period of time in an assigned area. Engineers are not generally tasked to undertake surveillance.

8.22 Engineer Support. Surveillance is often a clandestine activity. Consequently, engineer support to surveillance is sometimes limited to geospatial support and advice. Although engineers may provide some survivability support to harden clandestine surveillance locations, their signature is likely to compromise the location. Engineer survivability support to overt surveillance positions is a more likely task and may include:

a. construction of watchtowers to provide elevated observation;

b. clearing fields of observation; and

c. hardening remote sensors, including ground sensor systems, to reduce battle damage.
CHAPTER 9

ENGINEER COMBAT SERVICE SUPPORT

SECTION 9-1. INTRODUCTION

9.1 CSS is the support provided to combat forces, primarily in the fields of administration and logistics. CSS includes supply, transport, maintenance, sustainability and personnel and health support. With the exception of sustainability support which is predominantly provided by engineers, CSS is provided by the logistics corps, essentially in corps groupings.

9.2 Engineer units require similar CSS to other combat and combat support units. The major differences are the requirement for construction and defence stores and the support required for engineer equipment, predominantly transport, supply and maintenance. Most construction stores are not catalogued items and need to be provided from industry either as raw materials or finished products.

9.3 As a general rule, mainstream CSS personnel and systems are not familiar with or equipped to source and transport the CSS requirements for engineer units. This situation has arisen over recent decades when engineer training in Australia has had a relatively low requirement for engineer stores and equipment compared to operational requirements. Consequently, when engineers deploy, the CSS personnel are not trained and equipped to efficiently and effectively supply and distribute engineer requirements.

SECTION 9-2. ORGANISATION

Planning for Sustainment

9.4 CSS planning is an iterative process requiring input from operations staff as well as CSS staff. CSS is planned in parallel with the manoeuvre plan using the MAP. Once the concept is known, the details of the actual provision of CSS are planned
at unit and formation levels in consultation with the CSS provider. The application of the CSS planning factors of destination, demand, distance and duration are used to quantify the CSS requirement of the unit.

9.5 **Destination.** CSS planners must be cognisant of the destination of each engineer FE. The destination sets the overall environment of wear patterns, terrain, climate, length of lines of communication and the replenishment cycle. The destination critically influences the FE’s CSS requirements.

9.6 **Demand.** Demand is the sum of steady state, cyclical and surge requirements. Prediction of demand, accurate provisioning and management of resources are major factors in achieving mission success. Demand will generally be focused on fuel, construction and defence stores, and repair parts.

9.7 **Distance.** Distance is a combination of the length of the line of communication and the range over which an FE travels. In reference to engineers, it is a combination of the physical distance and the work rate.

9.8 **Duration.** Duration defines the length of the task, the operational viability period and the frequency of replenishment. However, the loss or failure of mission-essential equipment without prompt replacement or maintenance may result in mission failure even if the duration is not exceeded.

9.9 **Combat Service Support Staff Integration.** Integration of engineer CSS LOs with the supported HQ and higher HQ for joint planning is essential to ensure the appropriate planning of CSS to support battlespace engineer tasks.

9.10 **Engineer Construction Stores.** Specialist engineer equipment, resources and materials require procurement, management, distribution and maintenance. During the procurement process, there may be a need to follow complex procurement guidelines and specialist contract management and training systems. The provision of these items is essential to the completion of engineer tasking, and delay in delivering one particular item can delay an entire project. Therefore, when planning CSS to engineer FEs, the requirements for specialist...
stores and equipment, including procurement, must be considered and logistics and engineer personnel dedicated to the task. This may range from embedding an engineer LO in the supporting second line logistic support unit for lower levels of engineer work rate, to establishing a dedicated engineer stores element with the second line CSS unit to procure and manage high volume requirements for activities with a higher work rate over extended periods. Where essential materials cannot be procured, engineers will win the materials locally. Figure 9–1 and Figure 9–2 show engineers milling timber and quarrying rock respectively.

Figure 9–1: Winning Materials – Milling Timber
9.11 Substitution. Engineer staff develop a bill of materials for each construction task. When specific items on the bill of materials cannot be sourced, engineer staff must be consulted before an alternative item is substituted. For example, on a recent operation, CSS personnel substituted a number of 4.2 m lengths of timber with 2.4 m lengths but provided twice as many. Although the timbers were easier to transport, they could not be used to manufacture the roof trusses for which they were required. Consequently, the roof on the building could not be completed, which had adverse repercussions for the project.

Engineer Unit Combat Service Support

9.12 Combat Engineer Regiment. The CSS capability in the CERs consists of a CSS squadron with a logistics and workshop platoon and a medical troop. The CSS squadron provides first line CSS to the regiment.
9.13 **Engineer Support Regiment.** The CSS capability in the ESRs consists of a CSS platoon in the construction squadron and a CSS platoon in the topographic survey squadron. The CSS platoons provide first line CSS to their squadrons.

9.14 **Incident Response Regiment.** The CSS capability in the IRR consists of a CSS squadron, which provides first line CSS to the regiment.

9.15 **Chief Engineer Works.** The CSS capability in the CE Works consists of a CSS section, which provides first line CSS.

9.16 **Construction Regiment.** The CSS capability in the construction regiments consists of a CSS squadron, which provides first line CSS to the regiment.

**Providing Combat Service Support**

9.17 The provision of first line CSS to engineer units is an engineer responsibility. The provision of close and general CSS to engineer units is coordinated by the JTF HQ and provided by the CSS unit and the force support battalion. If the engineer FE is participating in a coalition operation, elements of their second and third line support may be provided by the lead nation or another coalition partner. However, Australian engineer specific CSS, particularly Class 9 repair parts, is generally provided through the Australian supply chain.

9.18 **Lines of Support.** CSS to land FEs is organised along lines of support. The lines of support are as follows:

a. **First Line Support.** This is support which is provided by the unit under the control of the CO.

b. **Second Line Support.** This is support which may be provided from the CSS unit of the JTF or Brigade.

c. **Third Line Support.** When available, this is support which may be provided by organisations not organic to the supporting or supported formation or JTF, such as a force support battalion.

d. **Fourth Line Support.** This is support which may be provided by the DMO and the national support base (of
people, resources and industry), which is linked to military activities.

SECTION 9-3. FUNCTIONS

9.19 Supply Support. Supply support is the CSS function responsible for the management of stores and equipment, and deals with activities such as procurement; provisioning; warehousing; inspection and quality control; issuing, receipting and disposal and inventory management. First line supply support is supplied by the integral CSS capability. It should be noted that engineers warehouse a diverse array of repair parts to support the large variety of equipment.

9.20 Transport Support. Transport support is the CSS function responsible for the movement of stores, equipment and personnel throughout the CSS system. First line transport is provided by the integral transport assets.

9.21 Maintenance Support. Maintenance support is the CSS function responsible for the maintenance and care of unit equipment at specified levels of serviceability, and incorporates maintenance engineering, materiel maintenance, configuration management and recovery. First line maintenance support is provided by the integral maintenance element. Some specialist equipment, such as CBRN items, cannot be maintained by Army personnel and must be repaired by civilian contractors.

9.22 Engineer Sustainability. Engineer sustainability support is generally provided in-house according to the priority it is assigned among the other sustainability tasks. It should be noted that applying sustainability effort to the engineer FE’s facility generally results in increased engineer capacity to provide engineer support to other FEs.

9.23 Personnel Support. Personnel support is a shared responsibility, and it must be noted that personnel management is a command responsibility and not part of CSS functions. However, the delivery of personnel support services is a CSS function and may include pay and financial services,
Postal services, amenities, laundry and bath facilities in the field, catering services and mortuary support. First line personnel support is provided by integral administrative elements.

9.24 **Combat Health Support.** First line health support is provided by integral medical staff. Second line health support is provided by the supporting CSS battalion or by other agreed medical FEs. It should be noted that when engineer troops are dispersed undertaking separate tasks, health support must be provided by second line health support assets.

9.25 **Equipment Recovery.** Equipment recovery forms an important component of the maintenance function. Recovery of engineer equipment is normally undertaken by integral recovery assets.

9.26 **Military Police Support.** The majority of engineer tasks do not require the support of MPs. However, when undertaking sustainability tasking on main and secondary supply routes, an MP presence considerably increases safety.

**SECTION 9-4. APPLICATION**

**Military Units and Assets**

9.27 Application of CSS to engineer FEs is similar to that for other combat and combat support FEs. First line and specific second line CSS are provided by integral CSS assets and the supporting logistic unit. Third line CSS is provided by 17 CSS Bde elements.

9.28 Construction squadrons have an integral resources troop which is responsible for sourcing and/or procuring the bill on materials for construction projects. If there are no commercial suppliers in the AO, engineers use the logistic system to provide the construction materials.

**Civilian Contractors**

9.29 Contractors do not normally provide CSS to FEs undertaking tactical activities. However, with the increasing level of
contractors in the operating environment, contractor provision of stores and equipment is becoming a viable option for non-tactical activities in low-threat areas and some tactical activities. Sourcing materials and stores in-theatre relieves the burden of a long supply chain and contributes to the development of the local industry and economy. Contractors may be used for many tasks, including:

a. strategic and theatre transport of engineer equipment, stores and construction materials;

b. tactical transport of equipment, stores and construction materials, depending on the circumstances; and

c. maintenance of equipment, including the use of specialists to maintain equipment such as CBRN detectors.

9.30 Contractors and local labour can also be engaged to undertake skilled and non-skilled tasks under engineer control. Locally employed civilians may ease the pressure on engineer CSS personnel. However, locally employed civilians may need training and supervision to achieve satisfactory competence levels. Figure 9–3 depicts engineers working with local contractors.
Host Nation Support

9.31 HNS for major engineer tasks like bridge or road building can provide considerable assistance to engineers. Depending on government capability and capacity, the host nation may manage contractor support, the provision of labour or the provision of materials sourced locally.

SECTION 9-5. TASKS AND RESPONSIBILITIES

9.32 Engineer Staff. The main CSS tasks and responsibilities of the engineer unit staff are as follows:

a. Executive Officer. The XO is responsible for all aspects of unit administration.
b. **S1.** The S1 is primarily responsible for the delivery of personnel support services to the unit and liaising with the higher HQ on personnel matters.

c. **S3.** In terms of CSS, the S3 is responsible for coordinating the operational aspects of the provision of CSS, such as movement and protection of CSS teams delivering support to deployed FEs.

d. **S4.** The S4 is responsible for planning and coordinating the provision of CSS to the unit. Depending on unit manning, the S4 may also be the OC Op Spt Sqn or equivalent.

e. **Officer Commanding Operational Support Squadron.** The OC is responsible for planning and providing all aspects of first line supply, maintenance, transport and health support, and coordinating and liaising with second and third line CSS elements as required.

f. **Liaison.** The CSS staff must maintain close liaison with the CSS staff in the supporting CSS unit in order to facilitate the provision of stores and material. LOs must be very clear about the requirements, time and location of provision and the consequences of non-supply. To ensure that the CSS unit understands the requirements and priorities, the LO should brief CSS staff on the project plan.

**9.33 Supporting Logistic Units.** Logistic units providing support to engineer units must be cognisant of the project time lines of engineer tasks and the consequences and flow-on effects of delays in providing the equipment and stores required. CSS staff must actively manage engineer requirements to ensure that the bulky and heavy items are delivered in time to meet the project plan requirements and are not bumped off vehicles, aircraft or vessels because they are difficult to accommodate due to their size and weight.
9-34 During coalition operations Australian engineers may be attached to, take under command or otherwise work with allied engineer units. Australian engineers may either be reliant on coalition CSS or be required to provide CSS to allied engineers, depending on the contributing forces agreement. Coalitional operational considerations relating to engineers are outlined in the ABCA Coalition Operations Handbook, Edn 4, 2008, [Chapter 9].

9.35 The major engineer CSS issues in a coalition environment include:

a. Engineer Stores and Materials. The provision of engineer stores and materials is a primary consideration for the majority of engineer tasks, and details should be agreed upon during the coalition building. If the majority of stores and equipment are being sourced through the lead nation, engineers will be limited to the type of materials supplied by that nation. The differences in standards and specifications used by different nations may adversely impact upon task completion.

b. Equipment Maintenance. Equipment maintenance is normally provided by the owner nation. However, when maintenance is provided by another, the capability and capacity are unlikely to meet all the needs of the force. The maintenance requirements, capability and capacity should be agreed upon as early as possible to allow the CSS system to adequately prepare.

c. Supply Systems. The varying types of supply systems used by different nations may impact upon the identification and provision of materials, equipment and supply items such as spare parts.
CHAPTER 10
ENGINEER SUPPORT IN SPECIFIC ENVIRONMENTS

SECTION 10-1. INTRODUCTION

10.1 The nature of the environment can severely affect the provision of engineer support. The majority of environmental factors can be overcome by using specialised equipment, procedures and training. This chapter briefly describes the factors that impact on the provision of engineer support in specific environments, including:

a. tropics,
b. desert,
c. cold,
d. urban,
e. CBRN, and
f. other specific conditions.

SECTION 10-2. TROPICS

Overview

10.2 Tropics are areas of high annual and monsoonal rainfall, high temperature and high humidity where the growth of trees and other vegetation is quite dense. The vegetation impedes military activities and tends to obstruct lines of communication. Tropical vegetation includes lowland and highland tropical rain forests, dry deciduous forest, secondary growth forest, swamps, swamp forest and tropical savannahs. Movement of troops and supplies through jungle growth is most difficult. Visibility is often limited to a few metres. Paved roads are rare outside population centres and are usually narrow, winding and
Incapable of supporting sustained military traffic. Consequently, the reliance on air support increases but its availability may be restricted due to weather.

**Impact on Capability**

**10.3 Mobility Support.** The construction and maintenance of roads and tracks are the initial means of improving mobility. Heavy rainfall, clearance of vegetation, drainage and the movement of heavy equipment and resources combine to make this a long and painstaking task. Once constructed, routes require regular maintenance. Landing sites and drop zones must be constructed to enhance the ability to move personnel and materiel by air. Crossing obstacles such as large rivers will be necessary; therefore, bridging and other special engineer equipment will be required. Minefields in the jungle are likely to be of the nuisance or protective types and remain an engineer task for clearance. Engineers may also be required to breach enemy defensive positions and to clear booby traps.

**10.4 Countermobility Support.** The main countermobility task for engineers, providing countermobility support in the tropics is to block roads, lay mines and booby traps and carry out demolitions. Blocking roads or tracks is particularly effective in preventing vehicle movement and providing opportunities for actions such as ambush or air strike.

**10.5 Survivability Support.** Engineers may be required to construct defensive positions, field fortifications (including gun positions) and protective locations for combat supplies.

**10.6 Sustainability Support.** The requirement for accommodation for unit HQ, medical support and the protection of personnel, stores and equipment from the rain is high. Maintenance facilities, particularly for aircraft and electronic equipment, and the maintenance of landing zones, airfields and roads are also accorded a high priority. The environment dictates careful selection of base locations and living and working locations. There is also increased availability of timber and water. This may be an advantage for some construction tasks, but there is
an increased requirement for sustainability support to public health tasks such as drainage to reduce vector proliferation.

10.7 Geospatial Support. It will be important to determine the influence of vegetation on the navigation and movement of troops and equipment, concealment, observation and use of weapons. Engineers must also determine the impact of the climate (particularly the rainy season) on drainage features, roads and cross-country routes, river navigation and visibility. In mountainous and jungle areas in the tropics it can be difficult to obtain/establish geodetic control due to the mountains, and difficult to evaluate the terrain below the forest canopy.

SECTION 10-3. DESERT

Overview

10.8 The desert environment can profoundly affect military activities. Equipment and tactics must be modified and adapted to cope with a dusty and rugged landscape where temperatures vary from extreme highs during the day to below freezing at night, and visibility may change from 10 km to 10 m in a matter of minutes. It is important to realise that deserts are affected by seasons. The desert accelerates physical and mental fatigue. Factors such as heat illness, climatic stress, radiant light and desert wildlife can adversely impact soldiers’ effectiveness.

Impact on Capability

10.9 In some desert areas, natural obstacles such as wadis or other terrain features can be found. Often, however, it will be necessary to use artificial obstacles if enemy movement must be slowed. A minefield, to be of any tactical value in the desert, must usually cover a relatively large area, so mechanical laying 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.

10.10 Mobility Support. The open terrain of the desert makes mobility a prime concern. Cross-country mobility may be poor
in soft sand, rocky areas and salt flats. A greater engineer reconnaissance effort is required to identify routes, existing obstacles and minefield locations. Engineers may not be able to provide routes in some areas because the effort and resources expended to develop and maintain the routes due to the type of soil would be impractical and unsustainable. Engineer tasks may include:

a. assistance to manoeuvre by reducing slopes, smoothing rock steps and route maintenance;

b. provision of dry-gap crossings, including those required to traverse oil pipelines;

c. increasing weight-bearing capacity by soil stabilisation to provide good roads or sites for aircraft landing strips;

d. dust suppression using, for example, diesel fuel or oil mixtures; and

e. obscuration of enemy lines of sight during breaching tasks.

10.11 Countermobility Support. Due to the generally longer lines of sight in the desert, target-oriented obstacles often may 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. Shifting sand can also cause mines to drift. Antitank 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 by dismounted enemy forces.

10.12 Survivability Support. Longer lines of sight mean that weapons can be effectively employed at longer ranges. Consequently, greater engineer effort must be allocated to hardening fixed facilities. Local housing in desert areas tends to have flat roofs that can provide concealment from ground
troops. Survivability of dismounted troops may be increased by constructing pathways through groups of buildings rather than around them.

10.13 **Sustainability Support.** The desert climate increases the requirement for dust suppression on roads and general sand and dust control. There is a general lack of construction materials important for engineer tasks. Additionally, there is a need to stabilise or deflect moving sand to prevent facilities being buried.

10.14 **Geospatial Support.** Many desert areas have never been mapped at medium scales, and engineers must be prepared to provide substitute products at short notice. Deserts often provide few natural features, and engineers will be required to provide assistance to aid navigation and interpretation of map products. Geodetic positioning will be important where there is little or no framework. Influence of surface materials on trafficability and dust, light conditions and location of water sources will also be main concerns.

**SECTION 10-4. COLD**

**Overview**

10.15 Cold conditions comprise cold, cold weather and cold climate. The Army is primarily postured for temperate and tropical environments. This infrequent exposure means that FEs require periods of acclimatisation, specialist training and special equipment in order to undertake their role successfully in cold conditions. Cold conditions can have a significant impact, particularly where there is little knowledge of the area and conditions into which the FE deploys. Engineer equipment requires specialist oils, lubricants and coolants to reduce the impact of the cold.

10.16 Cold weather can complicate military activities with freezing rain, fog, hard frost, ice and cold winds. In these conditions, many tasks become difficult and some are impossible to achieve. Tempo slows, time becomes a more critical factor and
the effort required to overcome a hostile environment can sometimes be more urgent than the defeat of an enemy. Factors affecting engineers in cold conditions include:

a. Wind Chill. If the atmospheric temperature is already low, wind quickly lowers the body temperature further; the higher the wind, the quicker body heat will be lost and the colder the body will become. Wind chill is one of the main contributors to hypothermia and cold weather casualties.

b. Precipitation. Precipitation in the form of rain, sleet or snow can occur anywhere in cold conditions and degrade mobility, visibility and the effectiveness of ISR and ISTAR capabilities.

c. Snow. The main impact of snow will be to limit mobility, create concealment problems and degrade ISR and ISTAR capabilities. As the temperature rises, the snow will compact more easily. Temperatures above freezing will cause wet snow conditions, while lowered night temperatures will refreeze snow, causing icy crusts on the surface that further restrict mobility.

d. Permafrost. If the ground is permanently frozen, it is very difficult to undertake construction tasks that require earthmoving. If the upper layers seasonally thaw, the surface may quickly become a quagmire and the periodic freeze/thaw cycle causes expansion and contraction which affects buildings, roads and other structures, necessitating careful design and construction, and additional maintenance.

e. Altitude. The impacts of altitude are unpredictable; light breezes can become cyclonic in minutes at higher altitudes. The weather conditions can change so much that in the same place in quick succession there may be hot sun and cool shade, chill wind and calm, thick fog or clear visibility, storms of rain or snow and then hot sun again in a single day. Higher altitudes will increase the risk of altitude sickness due to thinning air, with attendant
complications to personnel, particularly a reduced capacity to work.

f. **Fog.** Some of the coastal regions of Arctic countries, the Pacific and Australia are areas of frequent fog. These fogs are thick and low-lying but seldom extend far inland or out to sea. Fog degrades mobility and visibility, and reduces the efficacy of enhanced vision equipment.

g. **Glare.** Cold conditions can provide clear, stable air, which allows sunlight to be reflected from snow and ice, causing glare and potential damage to unprotected eyesight.

h. **Psychological Factors.** Cold snow, wet conditions, darkness and wind increase the difficulty of operating effectively. Fear of the snow and the accumulating effects of cold and exposure on untrained and inexperienced troops can have a stronger impact than the fear of being a battle casualty. Cold weather phobia can reduce even the hardest soldiers to inertia, increase fatigue, lower morale and create a general unwillingness to respond to orders. Careful and progressive training regimes and education can overcome this phobia and create positive attitudes conducive to the effective continuance of the mission.

**Impact on Capability**

10.17 **Mobility Support.** The main priority for mobility support in cold conditions is keeping routes open and maintained. Mobility is restricted in snow and ice conditions, and roads need to be kept clear. Reconnaissance may be required to determine the depth of snow and stability of ice to enable an assessment of the viability of routes.

10.18 **Countermobility Support.** Apart from the increased effort required to create obstacles, countermobility support in cold conditions is similar to that of other conditions.

10.19 **Survivability Support.** Survivability support in cold conditions requires additional focus on the construction and maintenance
of accommodation to protect personnel, equipment and stores from the impact of the cold. Snow can be used effectively to absorb blast effects in some circumstances. If sufficient water is available, it can be used with snow to construct snow-crete defences, which are effective against direct fire weapon systems.

10.20 **Sustainability Support.** Additional effort must be applied to shelter for personnel, stores and material to minimise the adverse impacts of the cold. If periodic freezing and thawing occur, additional considerations for design, construction and maintenance are required. The cold increases the requirements for fuel, and vehicles and plant equipment may need to be kept warm using heating systems when not in use, to prevent them from freezing.

10.21 **Geospatial Support.** Additional geospatial support associated with cold conditions is related to the depth and stability of snow and ice, impending weather conditions and their impact on personnel, equipment, stores, munitions and terrain.

**SECTION 10-5. URBAN**

**Overview**

10.22 Urban areas, including cities, towns, villages and concentrations of industrial installations, are increasing in number, size and complexity throughout the world. Consequently, the tactics and techniques of fighting in urban areas are becoming increasingly important. Urban areas are normally the centres of physical and electronic communications networks including roads, railways, waterways and telecommunications. Due to the overwhelming influence of terrain on activities in urban areas, engineers have a significant role in offensive, defensive and stability activities.

10.23 Activities in urban areas are characterised by the following:

a. Surveillance and reconnaissance capabilities tend to be degraded by reduced lines of sight.
b. Fields of fire tend to be limited. The performance of high-technology weapon systems (direct, indirect and air-delivered) and conventional artillery may be degraded; dismounted forces and short-range weapons may tend to dominate.

c. There is excellent protection, cover and concealment for troops and equipment, which increases the difficulty of estimating the strength of the defending forces.

d. There are reduced possibilities for manoeuvre caused by building rubble, particularly for mounted units, but increased possibilities for infiltration and bypassing.

e. The likelihood of close-quarter combat presents risks, including the increased vulnerability of vehicles and personnel to short-range attack with little warning.

f. The presence of a civilian population may seriously limit military action.

g. There may be difficulties in C3.

h. Urban operations is a battle that is likely to be fought at four levels:
   (1) on the surface at street level,
   (2) above the ground on rooftops and in buildings,
   (3) in the air between and above the two preceding levels, and
   (4) underground in sewers and subway systems.

Impact on Capability

10.24 Mobility Support. Reconnaissance requirements are increased due to the three-dimensional nature of urban combat. Obstacle types, locations and depth are difficult to determine in urban rubble. Engineer missions include clearing mines and rubble, crossing gaps and breaching walls and other types of obstacles. Engineers are necessary to neutralise
booby traps. Other special engineer considerations are as follows:

a. Armoured engineer equipment, with earthmoving blades and buckets to demolish strongpoints and push debris, winches and booms to move obstacles, and demolition guns are invaluable, but their manoeuvrability is likely to be limited.

b. Engineers provide close assault forces with demolition and breaching assistance using demolition guns and satchel or pole charges. Covered and concealed routes may be constructed for both personnel and combat vehicles. Routes are cleared of debris by engineer equipment. Personnel access holes are blown into buildings and dug to gain access to sewers. Cleared buildings and structures may also be demolished to prevent their reoccupation by the enemy.

10.25 Countermobility Support. Obstacles are planned and emplaced in depth, starting well forward of the urban area, to allow penetration only on routes selected by the defender. Within the urban area, engineers are employed primarily for emplacing point route-denial obstacles including:

a. road craters,
b. off-route mines,
c. demolition of bridges and overpasses,
d. the blocking of sewers and subterranean access, and
e. construction of expedient obstacles using abandoned vehicles and rubble.

10.26 Survivability Support. Engineers assist in the selection of the most survivable structures for defensive positions. They make the urban area safe for defence by neutralising specific hazards like electrical systems, gas storage facilities and fuel depots. They also construct firebreaks in high-risk areas. Engineers reinforce structures against direct and indirect fire, as well as producing construction materials by dismantling unneeded
structures. They may provide tools, equipment and expertise to help the defenders prepare. Emergency response assets will also be actively involved in firefighting and/or emergency rescue, possibly in cooperation with civilian agencies. In offensive activities, engineers can control services to dislocate defenders.

10.27 Sustainability Support. In urban areas, there will be an increased use of civilian infrastructure, which may reduce the liability for sustainability support. Higher water consumption rates may demand increased water production. The removal of waste, and the maintenance of waste treatment facilities, will receive a high proportion of engineer effort. Invariably, activities in urban areas will demand increased effort in CIMIC, and this may impact significantly on engineers’ effort to restore infrastructure.

10.28 Geospatial Support. The density of features and clutter in urban terrain makes the terrain analysis of urban areas complex and time-consuming. There may be significant time pressures to develop visualisation and decision support products. The speed and level of resolution will be dependent on the quantity and quality of geospatial information available from existing sources, coupled with that which can be generated in the field. Early advice on the decision to operate in urban areas will prompt the acquisition of the relevant geospatial data. Terrain analysis of an urban environment is likely to consider the following:

a. the impact of urban landscape patterns, urban zones and urban sectors;
b. overwatch positions;
c. internal building structure; and
d. the impact on communication systems.

10.29 Geospatial support considerations are as follows:

a. The acquisition of geodetic control may require movement to insecure areas, which will require protection.
b. Geospatial data will have to be gained from several sources, including field collection, and fused into a geospatial database.

c. It may be difficult to determine terrain from overhead imagery due to the size and large number of variations in vertical elevation.

d. Geospatial products will be required in greater quantities due to the distributed nature of the fight.

e. Geospatial products may need to be issued more frequently, given changes to the urban environment.

SECTION 10-6. CHEMICAL, BIOLOGICAL, RADIOLOGICAL AND NUCLEAR

Overview

10.30 CBRN hazard environments are characterised by the potential for large numbers of fatalities, either through direct exposure to chemical agents, biological toxins and radiation, or from their effects. CBRN hazards include the accidental or deliberate release of toxic industrial waste materials. On a less extreme scale of threat, it must also be borne in mind that both friendly force and enemy commanders may normally be authorised to use certain chemical agents, such as incendiaries, smoke, riot-control agents, herbicides or flame weapons, which are not considered special weapons, and their use is not regarded as chemical warfare. Similarly, the use of tactical nuclear weapons by enemy commanders cannot be ruled out.

Impact on Capability

10.31 Mobility Support. Engineer mobility support is likely to be focused on opening routes through or around CBRN-affected areas.

10.32 Countermobility Support. Engineer countermobility support effort is likely to be directed to constructing barriers to prevent personnel from entering CBRN-affected areas.
10.33 **Survivability Support.** Survivability support includes the provision of collective protection against the impact of CBRN agents. Area decontamination is an engineer task. However, for any large scale release, engineers will assist other FEs to decontaminate and conduct area decontamination. Engineers may also be called upon to construct traffic circuits and facilities in a decontamination point. As in many other armies, they will provide the water and may also operate the water point. Additionally, the engineers will conduct the decontamination of selected facilities and areas of terrain.

10.34 **Geospatial Support.** Geospatial support for CBRN preparation and response is likely to include the production of paper and digital maps that indicate contaminated areas and the areas that are likely to be contaminated by the downwind plume of airborne CBRN elements. The location of toxic industrial materials and the associated industrial sites, distribution networks, retail outlets and the users of said materials can all be identified and plotted on maps with the advice of emergency responders.

10.35 **Impact of Chemical, Biological, Radiological and Nuclear Hazards on Engineers.** Engineers are more often and continuously engaged in hard physical work than any other arm or service. The adverse impact on engineer units of long periods in full CBRN protection will be higher than for other FE. Therefore, engineer efficiency will be considerably reduced and there will be an adverse impact on the engineer support plan.

10.36 Engineer units are often widely dispersed in small groups, and special arrangements for CBRN warning may therefore be necessary. These arrangements should also allow engineers to continue to work at reduced states of CBRN preparedness for as long as possible.
SECTION 10-7. SPECIFIC CONDITIONS

Forest

10.37 Forested areas are characterised by conditions of limited mobility, poor visibility and limited fields of fire. The following factors require special consideration when planning for activities in forested areas:

a. Engineers may need to be deployed in small, widely dispersed, dismounted detachments.

b. C3 will be more difficult.

c. Commanders at each level will require greater freedom of action.

d. Forested areas are generally unsuitable for reserved routes, though routes will need to be kept open for rapid redeployments and counterattack.

e. Forests are not necessarily impenetrable to armoured vehicles. Some areas will need to be reinforced with antitank mines and other obstacles.

10.38 Impact on Capability. Forested areas will have the following influence on engineer tasks:

a. Mines. Forested areas facilitate the use and camouflage of mines.

b. Obstacles. There is, by definition, plenty of raw material (tree trunks) for obstacles in the wooded areas. Abatis obstacles may be employed.

c. Road Network. Route maintenance, improvement and obstacle clearance will assume particular importance. Many routes through forests are unsuitable for heavy tracked and wheeled vehicles. Considerable effort may be required to improve tracks.

d. Vegetation Clearing. Other possible tasks for engineers include the clearing of vegetation for:

(1) direct fire lanes,

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10.39 **Mobility Support.** The initial emphasis 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, zone clearance (of routes, landing sites and artillery positions, etc.) may assume a higher priority and will be conducted by mechanical and/or manual means. The removal of obstacles may be achieved by armoured vehicles equipped with cranes, dozer blades and winches. Personnel will be equipped with chainsaws. Road network maintenance will require the use of plant, materiel and possibly track-way. The personnel and materiel mentioned previously can also be used for the construction of helicopter landing sites, air drop sites and the preparation of artillery firing positions.

10.40 **Countermobility Support.** Antitank obstacles can easily be created in wooded areas using surface-laid mines, road cratering charges and abatis. The use of antipersonnel obstacles between trees will significantly delay enemy progress.

10.41 **Survivability Support.** Other FEs 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 for camouflage, concealment and deception may be required. Firebreaks may need to be constructed to enhance the survivability of friendly positions.

10.42 **Sustainability Support.** Sustainability support in forested areas does not differ from that support provided in other environments. The ability to provide potable water may become more difficult in elevated forest areas.
10.43 Geospatial Support. It is important to determine the impact of vegetation on the navigation and movement of troops and equipment, concealment, observation and use of weapons. Assessment of forested areas as natural obstacles and sources of material will be required. When considering geospatial support, the following factors should be noted:

a. It may be difficult to establish geodetic control.

b. It may be difficult to determine details about terrain beneath canopies from overhead imagery.

Mountains

10.44 Mountainous terrain is characterised by marked differences in elevation, with steep slopes and valleys over an extended area. It includes urban areas and plains between mountain ridges, plateaus, passes and mountain sides. Success in mountains is usually achieved by the forces that gain control of key terrain, such as ridge tops, valley outlets, mountain passes, defiles and routes. Some of these have a canalising effect and can be controlled by forces dominating the surrounding heights. The battle for the heights will, therefore, be the governing factor in mountains. Accordingly, they will be likely objectives in an attack and will be the key terrain on which the defences will be based. Due to the restricted mobility of ground vehicles, the use of helicopters for tactical mobility, reconnaissance, resupplies and evacuation may be a decisive factor. Engine performance decreases as altitude increases; therefore engineer productivity declines and tasks take longer to complete.

10.45 Planning. C2 of engineers may become more difficult because of the terrain and possible extremes of climate. A comprehensive assessment of likely tasks will allow the engineer commander to pre-position engineers and equipment in the right places. Engineer reconnaissance must be positioned well forward during any advance. Plant and equipment must be readily available to the lead engineer elements.

10.46 Offensive Activities. Plans should be based on seizing the dominant terrain features as objectives and maintaining the
momentum so as to prevent the enemy from regrouping, reacting and regaining the initiative. Possible tasks for engineers include:

- construction of landing zones for troop movement, resupply and casevac;
- clearance of explosive and other obstacles;
- clearance of potential avalanches before they occur or can be triggered by the enemy;
- destruction of strong points and fortifications; and
- maintenance and, where possible, improvement of routes to allow friendly forces movement.

10.47 Defensive Activities. Engineer task organisation will be influenced by the terrain’s features. However, the size of units allocated to specific tasks must allow the commander to form a reserve. Defensive planning may be based on the following considerations:

- There are areas which may seem to be impassable or extremely difficult for ground troops to use; however, the ability of an enemy to overcome such obstacles must never be underestimated. There may be the opportunity to create obstacles using avalanches.
- A scarcity of roads restricts the employment of tanks and other combat vehicles, making them vulnerable.
- Considerable time must be allowed for the preparation of defensive positions; this time will be reduced where permanent fortifications already exist.
- Equipment can be moved quickly using those helicopters which are capable of all-weather flying at the required altitude.

10.48 Mobility Support. Mobility support is likely to be the primary engineer task, particularly the construction, improvement and maintenance of routes. 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. Due to the shortage of routes and restricted access, the following mobility tasks will also assume particular significance:

- obstacle clearance,
- construction of passing and parking areas,
- snow clearance,
- helicopter landing sites, and
- tasks related to resupply by air.

10.49 Countermobility Support. As routes are restricted, the impact of obstacles will be greatly enhanced. The blocking of roads and passes, the destruction of tunnels and mine-laying are particularly effective in rugged terrain. Anti-helicopter mines and other measures may be required to restrict the enemy’s freedom of movement. Care must be taken not to restrict the movement of friendly forces and obstacles may have to be coordinated at a higher level than normal.

10.50 Survivability Support. Digging in may be difficult even using explosive means. It is likely that defensive positions will largely be based on raised fortifications. The construction of such defences remains an all-corps responsibility, but engineers may be called upon to provide advice and assistance. Irregular mountain terrain provides many opportunities for cover and concealment. Light engineer equipment, transported by helicopters, 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.

10.51 Sustainability Support. In mountainous areas, particular emphasis will be placed on the supply and treatment of water and the construction of medical facilities. Repair and
maintenance of infrastructure may consume sparse resources in terms of raw materials and manpower.

10.52 Geospatial Support. Terrain features such as slopes, valleys, character of roads (grades, curves, tunnels, natural bottlenecks, etc.) and the abundance of defensive positions require specific analysis. Commanders will also be interested in the effects of relief on drainage, observation, radar and communications and command sites. High altitudes and limited air corridors take on added significance in advising air and aviation planners. Air support may be required to acquire geodetic control. Mountainous terrain degrades the ability to exploit overhead imagery.

Coastal

10.53 Friendly force activities against a secured beachhead or countering the enemy's advance inland is similar to that in the discussion in earlier chapters on offensive and defensive activities. The enemy will be more vulnerable during the landing phase (airland, airmobile and amphibious) than after a foothold has been established. The mission of the land force is likely to be to prevent the enemy from establishing a beachhead. Plans must be coordinated with those of the naval forces. The defence will be concentrated around key terrain and the most likely landing sites, with other areas along the coast being kept under surveillance. Friendly forces will be deployed with the following aims:

a. to destroy the enemy before they reach the beaches or destroy them on the beaches, and

b. to permit rapid and flexible concentration of mobile reserves to destroy any enemy penetration of the beach defences before a beachhead is established or a break-out occurs.

10.54 Mobility Support. Mobility support will be required to ensure that reserves can move to counter any enemy penetration of the beach defences or airmobile and/or airborne landings. Obstacle plans must take account of the requirements for such movement. Reserves must be provided with adequate obstacle
breaching and crossing equipment and have planned and
rehearsed its use. Routes may require engineer FEs at river
crossings to maintain bridges and operate ferries. This is
particularly relevant in tropical coastal areas where the number
of rivers will normally exceed the capacity of bridging assets.

10.55 Countermobility Support. Obstacles should be used
extensively offshore, on beaches and inland to deny suitable
landing sites to the enemy, to assist in reducing the strength of
enemy landing units and to complicate their tasks. The main
engineer effort should be directed towards beach obstacles.
The obstacle plan must be carefully coordinated at the highest
level and be tied in closely with the plan for fire support. The
techniques for constructing obstacles in defensive activities will
apply, but there will be considerable scope for improvised
obstacles using local resources. Considerations for the
construction of obstacles in defensive activities are as follows:

a. Offshore Obstacles. Offshore obstacles are designed to
damage landing craft or amphibious vehicles or to
prevent them landing their loads in shallow water. The
obstacle plan must be coordinated with naval forces. In
addition to sea mines, the following may be used:

   (1) Underwater Obstructions. Obstacles should not
       be visible at high water. Metal stakes, concrete
       blocks, barbed wire or a combination of these can
       be used to hinder or damage craft. Explosive
       charges can be attached, which detonate when a
       craft contacts the obstacle. Mines with electronic
       sensors may be effective against landing craft.

   (2) Improvised Floating Obstacles. In deeper water,
       floating obstacles carrying explosive charges can
       be tethered to the seabed on likely approaches.

b. Beach Obstacles. Beach obstacles are designed to
disrupt the offloading of vehicles and soldiers from
landing craft to cause maximum casualties and to hinder movement off the beach. The following may be used:

1. **Mines.** Land and shallow water mines may be used although, their effectiveness may be reduced by drifting sand or wave actions. If available, mines with magnetic and/or seismic sensors should be used.

2. **Tetrahedrons.** These can be positioned below the low water mark, and up to and beyond the high water mark to hinder the movement of watercraft and vehicles.

3. **Reinforcement of Sea Walls.** In some locations, egress from the beach may be restricted by a sea wall. The effectiveness of this can be enhanced and exits through it blocked. Sea walls should be supplemented with mines.

4. **Ditches.** Antitank and shallow ditches increase the complexity of the obstacles and may degrade the effectiveness of obstacle breaching equipment.

5. **Wire.** This can be particularly effective if partially buried in sand, where it will impede vehicle tracks or wheels in conditions where traction is already reduced. It can also be used to degrade the effectiveness of mine-breaching equipment.

6. **Antihandling Devices.** The removal or breaching of obstacles can be made more difficult by the use of antihandling devices.

c. **Exit Routes.** There are likely to be limited exit routes from beaches. These should be disrupted with obstacles, but care must be taken not to inhibit routes required for the movement of friendly forces.

d. **Airborne and Airmobile Force Landing Sites.** Obstacles should be constructed on possible landing sites for airborne or airmobile forces.
10.56 Survivability Support. The enemy may be able to anticipate defence locations. Well-concealed positions and well-protected shelters will be required to reduce the impact of enemy naval gunfire support and air attack, which are likely to be heavy. Alternative and dummy positions will enhance survivability.

10.57 Sustainability Support. Coastal areas pose particular problems for engineers, in the supply and treatment of desalinated water and the repair and maintenance of infrastructure. Both activities may consume sparse resources in terms of raw materials and manpower. Onshore prevailing winds and sand progression provide unique challenges similar to those in desert environments, with the requirement for construction to negate sand and salt ingress into structures and/or equipment.

10.58 Geospatial Support. Geospatial support should include hydrographic information to facilitate visualisation of the littoral environment. Terrain analysis should provide assessments on suitable landing sites, considering such factors as natural obstacles in the water and clearances in and around the beach, as well as routes inland. Coastal areas are generally tidal and more affected by seasons and weather.