FM 3-34

Engineer Operations

DECEMBER 2020

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This publication supersedes FM 3-34, dated 2 April 2014 and ATP 3-34.23, dated 10 June 2015.

HEADQUARTERS, DEPARTMENT OF THE ARMY

Foreword

Engineer units, Soldiers, and Department of the Army Civilians continue to support ongoing contingency operations, but these activities only represent a small portion of what we do for the nation. The United States (U.S.) Army Engineer Regiment provides continuous support to homeland defense, disaster response, ongoing military operations, and the dedicated work by our United States Army Corps of Engineers. As battlefields are expanding across all domains and decision cycles continue to compress, we have an opportunity to refocus our training, modernization, and leader development on future peer and near-peer threats to ensure that U.S. forces can gain strategic positional advantage and freedom of movement.

With the focus on large-scale ground combat operations provided by the release of the 2017 FM 3-0, all engineers must be ready for a fight that is incredibly fast-paced, complex, and lethal. Our resources, training, and capability development must evolve to incorporate the critical engineer tasks required during shape, prevent, large-scale ground combat, and consolidation of gains. With a decrease in forward-stationed forces, critical tasks include setting the theater, improving lines of communications, providing geospatial products, and ensuring freedom of movement and maneuver for any offensive or defensive mission on any type of terrain.

FM 3-34 provides the foundational doctrine for all engineers to meet the challenges of this paradigm. All engineers must understand our regiment's capabilities, be able to integrate those capabilities into the mission, and recommend how to best mass our engineer effects. FM 3-0 incorporated enabler integration across warfighting functions and domains at division, corps and field army levels, and now FM 3-34 subsumes ATP 3-34.23 and incorporates engineer tasks planned and executed by these larger echelons. Command and support relationships must be second nature to ensure that engineer units are integrated into the force—from the Sappers in the breach to forward engineer support teams who may help a small town repair infrastructure.

To accomplish our missions, we must be able to describe our capabilities to maneuver commanders during the planning process and during mission transitions to contribute effectively to plans of actions that support the commander's intent. This integration ensures that our capabilities are in the right place at the right time. Engineer leaders must take on tough, realistic and repetitive training to build readiness. Through the Army's reform and modernization efforts, engineers will validate their standard operating procedures based on varying environments and conditions. We must share, update, and incorporate our lessons learned to operate, fight and win for the next battle.

I am proud of what we do every day. ESSAYONS…We Will Succeed!

MARK C. QUANDER
BRIGADIER GENERAL,
UNITED STATES ARMY
98TH COMMANDANT

This publication is available at the Army Publishing Directorate site (https://armypubs.army.mil) and the Central Army Registry site (https://atiam.train.army.mil/catalog/dashboard).

Field Manual
No. 3-34

Headquarters
Department of the Army
Washington, D.C., 18 December 2020

Engineer Operations

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Preface

FM 3-34 is the Army doctrinal publication that contains the capstone doctrinal guidance for U.S. Army engineers. FM 3-34 demonstrates how engineers contribute to decisive action and provides a common framework and language for engineer support to operations. It also constitutes the doctrinal foundation for developing other fundamentals and tactics, techniques, and procedures detailed in subordinate engineer publications. This manual is the integrating publication that nests engineer doctrine with Army capstone doctrine and joint doctrine. It focuses on synchronizing and coordinating the diverse range of capabilities in the Engineer Regiment to support the Army and its mission successfully. FM 3-34 provides operational guidance for engineer commanders and trainers at all echelons and forms the foundation for the United States Army Engineer School (USAES) curricula.

To comprehend the doctrine contained in FM 3-34, leaders must first understand the elements of unified land operations, operational design, and combat power and the operations process as described in ADP 3-0 and addressed in ADP 2-0, ADP 3-37, ADP 4-0, ADP 5-0, ADP 6-0, and ADP 6-22. Readers must be familiar with ADP 3-07, ADP 3-28, and ADP 3-90. Leaders must understand how offensive, defensive, and stability and defense support of civil authorities (DSCA) operations complement each other. They must also understand the terms and symbols described in FM 1-02.2.

The principal audience for this manual is engineer leaders, commanders, noncommissioned officers, and staff officers, but all Army leaders benefit from reading it. Trainers, educators, and combat developers throughout the Army also benefit from using this manual.

Commanders, staffs, and subordinates ensure that their decisions and actions comply with applicable United States, international, and in some cases host-nation laws and regulations. Commanders at all levels ensure that their Soldiers operate in accordance with the law of war and the rules of engagement. (See FM 6-27.)

FM 3-34 uses joint terms where applicable. Selected joint and Army terms and definitions appear in the glossary and the text. Terms for which FM 3-34 is the proponent (the authority) are marked with an asterisk (*) in the glossary. Definitions for which FM 3-34 is the proponent publication are boldfaced in the text. For other definitions shown in the text, the term is italicized and the number of the proponent publication follows the definition.

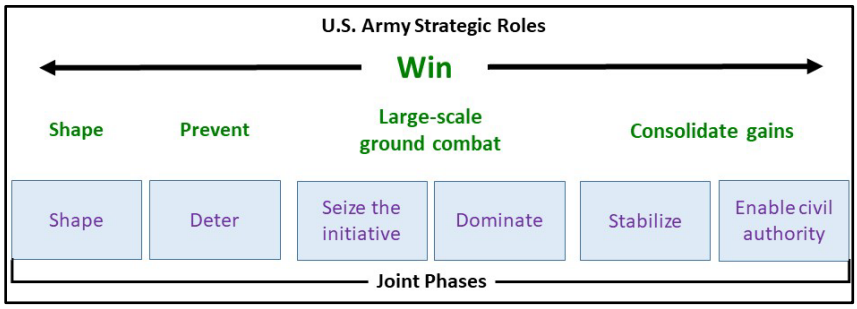
FM 3-34 uses *the Engineer Regiment* as a means to singularly describe the whole of the Army's engineer capability and capacity provided to support Army, Joint, and unified action partner operations.

FM 3-34 applies to the Active Army, Army National Guard/Army National Guard of the United States and United States Army Reserve unless otherwise stated.

The proponent of FM 3-34 is the USAES. The preparing agency is the G-3/Directorate of Training and Doctrine (DOTD), Maneuver Support Center of Excellence (MSCoE). Send comments and recommendations on DA Form 2028 (*Recommended Changes to Publications and Blank Forms*) to Commander, G-3/DOTD, MSCoE, ATTN: ATZT-OPD-D, 14000 MSCoE Loop, Suite 270, Fort Leonard Wood, Missouri 65473-8929; by e-mail to usarmy.leonardwood.mscoe.mbx.engdoc@mail.mil; or submit an electronic DA Form 2028.

Introduction

This revision of FM 3-34 aligns with the joint phases as described in FM 3-0. Most joint operations share certain activities or actions in common. There are six general groups of military activities that typically occur in preparation for and during a large-scale joint operation. These six groups are shape, deter, seize the initiative, dominate, stabilize, and enable civil authorities. These six general groups of activities provide a basis for thinking about a joint operation in notional phases. These phases often overlap, and they are not necessarily sequential. Introductory figure-1 shows the Army's strategic roles in a general relationship to joint phases.



Legend:
U.S. United States

Introductory figure-1. Army strategic roles and their relationships to joint phases

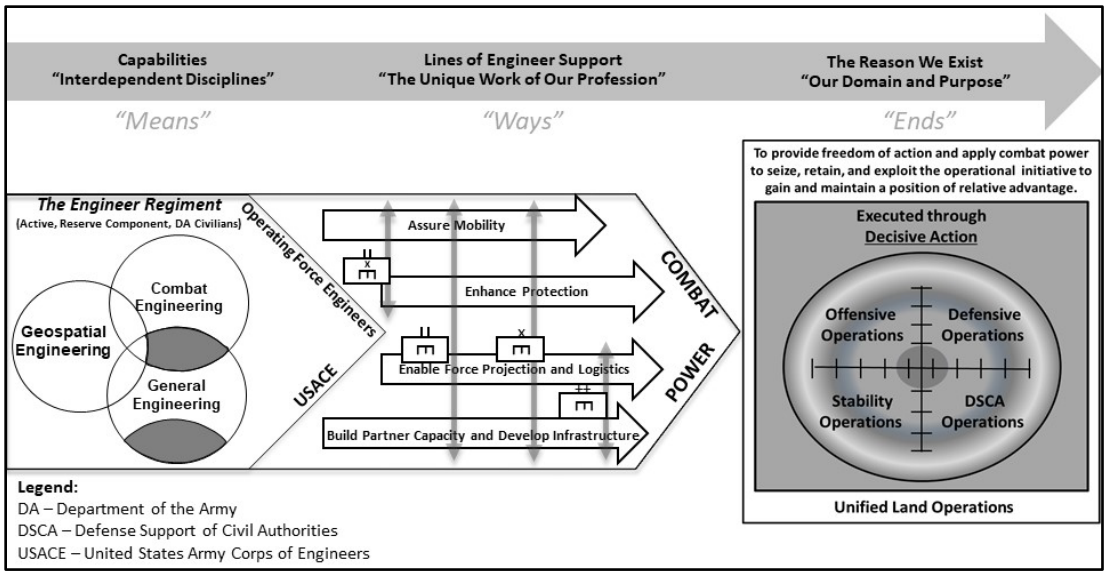
The Army Engineer Regiment is a mix of capabilities which spans from the Active and Reserve Component to the USACE and Civilian corps capabilities. There are two basic categories of operating force engineers of the Regiment—organic and force pool. The capabilities and capacity in the force pool exist to augment organic brigade combat team (BCT) engineers and provide echelons above the BCT complementary engineer capability and capacity. Force pool engineers units and capabilities available from either the Forces Command or from those assigned to the Headquarters, Chief of Engineers.

The Engineer Regiment provides specialized capabilities across the range of military operations. These capabilities include sappers, construction engineers, divers, firefighters, geospatial cells, and military working dog teams. However, after 17 years of counterinsurgency operations, the Army has shifted its focus to large-scale ground combat to ensure that U.S. forces are trained and ready to meet emerging threats. This refocus to large-scale ground combat does not suggest a shift in the simultaneous nature of decisive action.

The latest revision of the engineer framework (see introductory figure-2, page vi) provides the intellectual underpinnings for the Engineer Regiment and refines the Regiment's purpose and major activities. These are referred to as the lines of engineer support. The engineer framework describes how engineers combine the skills and organizations of the three interrelated engineer disciplines (combat, general, and geospatial engineering) to provide support to commanders that assures mobility, enhances protection, enables force projection and expeditionary logistics, builds partner capacity, and develops infrastructure among populations and nations.

The three engineering disciplines are commonly interdependent, interrelated, and foundational to how engineer units are organized and lines of engineer support. The geospatial engineering discipline is also considered the foundation that supports the combat and general engineering disciplines and lines of engineer support. In introductory figure-2, the combat and general engineering tasks commonly overlap because of the support they provide to the Army's missions and end states. The lower section of general engineering is also greyed as an acknowledgement of general engineering's inseparable link to United States Army Corps of Engineers (USACE) civil works. The engineer disciplines provide the means of enabling the lines of

engineer support. The Army engineer disciplines are the means with which the Regiment applies its capabilities to achieve the ends. The ways are how the capabilities, inherent in engineer formations and organizations, are applied to enable combat power. The ends provide freedom of action to enable engineer ground forces to gain, retain, and exploit the initiative to enable unified land operations. The Engineer Regiment consists of the three disciplines found in the operating force and USACE who conduct multiple engineer tasks along each line of engineer support to enable combat power and ensure freedom of action.



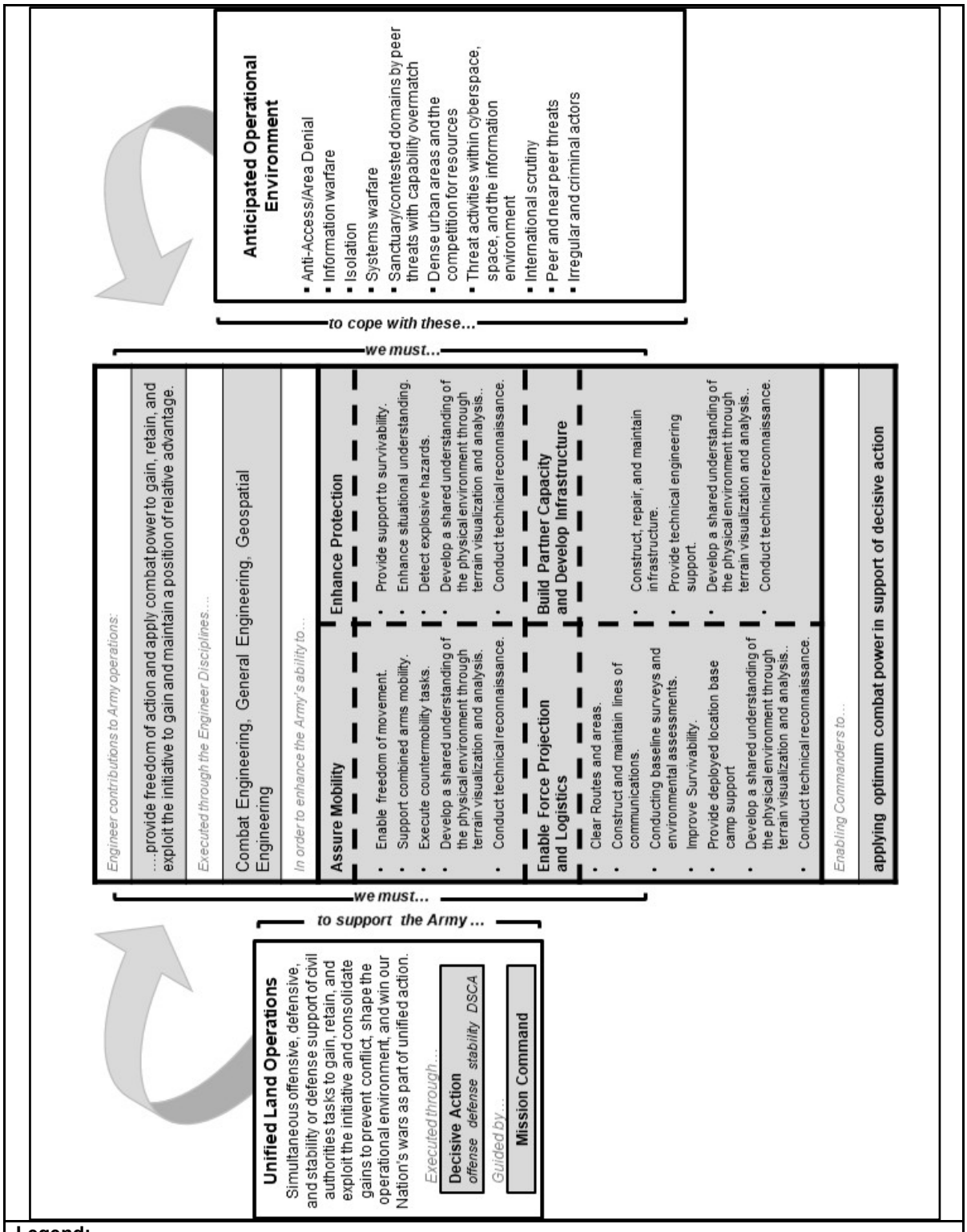
Introductory figure-2. Lines of engineer support

The Engineer Regiment exists to provide the freedom of action for land power by mitigating the effects of terrain in the operational environment (OE). This manual explains how (not what) to think about exploiting the capabilities of the Engineer Regiment in support of unified land operations. Engineer operations are executed through combat, general, and geospatial engineering capabilities. Each discipline focuses on capabilities that support, or are supported by, the other disciplines. Engineers enhance the Army's ability to visualize, understand, and exploit the terrain that facilitates the lines of effort: assures mobility, enhances protection, enables force projection and logistics, builds partner capacity, and develops infrastructure. The engineer disciplines are interdependent areas of expertise formed by engineer technical capabilities and tactical tasks. This is true whether conducting operations at home or abroad. See introductory figure-3 for a logical representation of the Regiment's contribution to Army operations.

Based on current doctrinal changes, certain terms for which FM 3-34 is proponent have been added, rescinded, or modified for purposes of this publication. The glossary contains acronyms and defined terms. See introductory table-1 for specific term changes.

Introductory table-1. Modified Army terms

Term	***Remarks***
field force engineering	Modifies the definition.



Legend:

DSCA	defense support of civil authorities

Introductory figure-3. The engineer framework

The doctrinal engineer foundations provided in this manual support the actions and decisions of engineer commanders. But, as with ADP 3-0, the manual is not meant to be a substitute for thought and initiative among engineer leaders. Regardless of how robust the doctrine is or how advanced the new engineering capabilities and systems are, it is the engineer Soldier who must understand the OE, recognize shortfalls, and adapt to the situation on the ground. It is the adaptable, innovative, and professional engineer Soldiers and Civilians of the Regiment who are most important to the future, and they must be able to successfully perform basic skills and accomplish the mission with or without the assistance of technology. FM 3-34 chapter outlines are as follows:

- **Chapter 1** provides an overview of the Army engineer, organization, and capabilities. It defines and highlights the interdependence of the engineer disciplines.
- **Chapter 2** explains the engineer framework, defining the four lines of engineer support and describing the relationships to the engineer disciplines, decisive action, and the warfighting functions.
- **Chapter 3** provides information on shaping and preventing engineer mission support to Army operations.
- **Chapter 4** explains engineer support to large-scale ground combat operations and consolidating gains.
- **Chapter 5** discusses engineer planning.
- **Chapter 6** discusses engineer echelon perspectives.
- **Chapter 7** discusses sustainment considerations.

Chapter 1
The Army Engineer

The Army engineer is a military engineering profession within the Army profession that represents the Army engineering capabilities. The Army engineers are composed of people—not just of equipment, organizations, or technologies—who possess unique technical skills that are grouped together into three engineer disciplines: combat, general, and geospatial engineering. It consists of Regular Army, Army National Guard, and United States Army Reserve engineer organizations; USACE; Department of Defense (DOD) Civilians; and affiliated contractors and agencies in the civilian community. It has a diverse range of capabilities that is focused on providing the required engineer expertise and skills needed to support the combined arms team.

ENGINEER DISCIPLINES

1-1. The engineer disciplines are areas of expertise within engineer units and headquarters. Each discipline is focused on capabilities that support, or are supported by, the other disciplines. Within these disciplines are personnel and equipment that provide unique technical knowledge, services, and capabilities that make engineers a valued member of the Army profession.

1-2. Army engineers are ground forces who conduct operations on, in, above, or below the terrain in the land domain. The ground forces are affected by the terrain, and they often have an effect on it. Engineer operations are unique because, regardless of the intended purpose, they are directly aimed at affecting terrain or at improving the understanding of the terrain. In this context, terrain includes natural and man-made terrain features. As a result, terrain is central to the three engineer disciplines. Combat and general engineering are focused on affecting the terrain, while geospatial engineering is focused on improving the understanding of the terrain.

1-3. Regardless of the disciplines, engineers must be prepared to conduct missions in close combat. Combat engineering is the only discipline that is trained and equipped to support movement and maneuver while in close combat. The general and geospatial engineering disciplines are not organized to maneuver within combined arms formations or to apply fire and maneuver. The general and geospatial engineering disciplines have small arms and a limited number of crew-served weapons that are capable of engaging in close combat with fire and movement, primarily in a self-defense role.

COMBAT ENGINEERING

1-4. *Combat engineering* is the engineering capabilities and activities that directly support the maneuver of land combat forces that require close and integrated support (JP 3-34). This engineer discipline focuses on affecting terrain while in close support to maneuver. Combat engineering is integral to the ability of combined arms units to maneuver. Combat engineers enhance force mobility by shaping the physical environment to make the most efficient use of the space and time necessary to generate mass and speed while denying the enemy mobility. By enhancing the supported unit ability to maneuver, combat engineers accelerate the concentration of combat power, increasing the ability of the force to exploit critical enemy vulnerabilities. By reinforcing the natural restrictions of the physical environment, combat engineers limit the enemy ability to generate tempo and mass forces. These limitations increase enemy reaction time and degrade their will to fight.

GENERAL ENGINEERING

1-5. *General engineering* are those engineering capabilities and activities, other than combat engineering, that provide infrastructure and modify, maintain, or protect the physical environment (JP 3-34). This engineer discipline is primarily focused on providing construction support. It is the most diverse of the three engineer disciplines and is typically the largest percentage of engineer support that is provided to maneuver units (except in the offense and defense) at the tactical level, when combat engineering is typically predominant. General engineering occurs throughout the area of operations (AO), at all levels of war, and during every type of military operation. It may include the employment of all engineer military occupational specialties. See ATP 3-34.40 for additional information on general engineering.

1-6. General engineering is primarily focused on construction support. Tasks most frequently performed under general engineering include—

- Restoring damaged areas.
- Constructing and maintaining lines of communication (LOCs).
- Establishing small base camps.
- Repairing and restoring infrastructure.
- Providing environmental assessments.
- Providing master facility and design support.
- Developing and maintaining facilities.
- Providing power generation and distribution.
- Acquisitioning real estate.

GEOSPATIAL ENGINEERING

1-7. *Geospatial engineering* is the engineering capabilities and activities that contribute to a clear understanding of the physical environment by providing geospatial information and services to commanders and staffs (JP 3-34). Geospatial engineers generate geospatial products and provide services to enable informed running estimates and decision making. It is the art and science of analyzing and visualizing geospatial information to enable an understanding of the effects of the physical environment (terrain) on military operations. The art is to understand mission variables, apply the relevant geospatial information, and describe the military significance of the terrain and the other spatial and temporal aspects of the OE to the commander. The science is the application and exploitation of relevant geospatial information and mission-specific variables, to include spatial and temporal aspects, through the use of a geospatial information system to produce geospatially precise measurements and modeling in support of the six warfighting functions. Geospatial engineers work with, and as part of, the Army Geospatial Enterprise to deliver a standard and sharable geospatial foundation (SSGF) to create a common operational picture (COP) for the warfighter. The Army Geospatial Enterprise allows geospatial data to be collected, stored, conflated, analyzed, and disseminated across echelons, networks, and network security domains. This geospatial data is comprised of the SSGF and functional geospatial data and information. See ATP 3-34.80, JP 2-03, and TC 3-34.80 for additional information on geospatial engineering.

1-8. Geospatial engineers provide the following support, from the Army service component command (ASCC) to brigade combat team (BCT) levels:

- Terrain analysis, management, and other tactical decision aids that support the operations process.
- Terrain visualization, to include 3-D terrain mapping and fly-through representation.
- Nonstandard, tailored map products, to include cross-country mobility, view shed, zone of entry, and hydrology.
- SSGF data (maintaining, updating, managing, and disseminating) for the COP.
- The theater geospatial database (TGD) (maintaining, updating, and managing).

ENGINEER ORGANIZATIONS

1-9. The Army organizes engineer Soldiers and equipment into a variety of organizations, each with particular capabilities and capacities. Engineer units are primarily organized around combinations of engineer disciplines. Engineers are composed of organizations arrayed between the operating and institutional forces, operating force units assigned to USACE, and those capabilities organic to USACE. These organizations operate concurrently with one another and support combatant commanders (CCDRs) and unified action partners. The engineer's active Army organizations include USACE and Army military engineer units within the combatant commands and Army commands. Approximately three-fourths of Army military engineer units are in the Reserve Component. The United States Army Reserve provides two theater engineer command (TEC) headquarters, including a wide range of specialized capabilities in its Army National Guard and United States Army Reserve Component. Engineers are experienced in providing interagency support and in leveraging nonmilitary and nongovernmental engineer assets to support mission accomplishment.

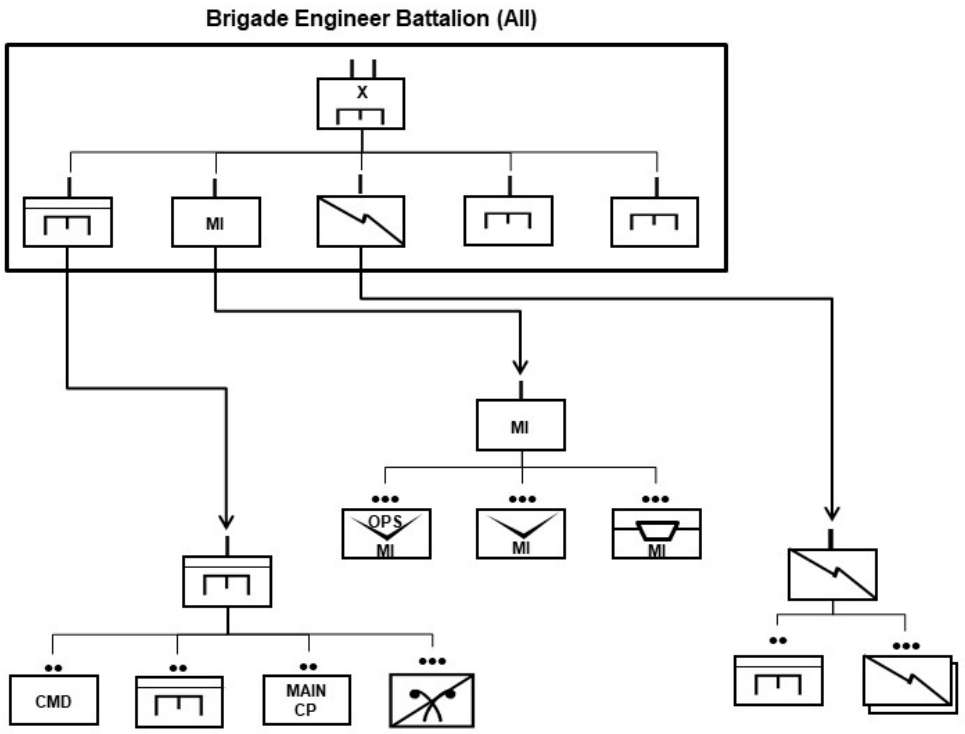
1-10. The USAES provides specialized unit and individual training, including the Joint Engineer Operations Course, Combat Engineer Heavy Track Course, Route Reconnaissance and Clearance Course, Explosive Ordnance Clearance Agent (EOCA) Course, Mine Detection Dog Course, Master Breacher Course, Crane Course, and Sapper Leader Course. The Engineer Branch works closely with USACE to leverage a vast pool of additional technical engineer expertise provided by DOD Civilians, affiliated contractors, and agencies within the civilian community. Technical support is available directly in support of the engineer staff and forces through the USACE Reachback Operations Center (UROC). The Counter Explosive Hazards Center coordinates doctrine, organization, training, materiel, leadership and education, personnel, and facilities policy solutions and integration to counter explosive hazards.

OPERATING-FORCE ENGINEERS

1-11. Engineers in the operating force operate at the strategic, operational, and tactical levels across the range of military operations. Units are organized in a scalable, adaptable manner to support combat, general, and geospatial engineering requirements. Army engineer forces operate as integral members of the combined arms team during peace and war to provide a full range of engineering capabilities in conjunction with USACE. This section provides an overview of engineers in the operational force.

ORGANIC

1-12. The BCT brigade engineer battalion (BEB) commander is the senior engineer in the BCT and advises the maneuver commander on how best to employ combat, general, and geospatial engineering capabilities to conduct combined arms integration in support of decisive action, especially during early-entry operations. The BEB provides organic engineer planning and execution capabilities to the BCT. The BEB has the capacity to maintain command and control (C2) of task-organized engineer organizations; assigned signal and military intelligence companies; and a chemical, biological, radiological, and nuclear (CBRN) reconnaissance platoon (located in the headquarters and headquarters company). The BEB is a comprehensive unit that provides maneuver support for bridging, breaching, route clearance, explosive hazards identification, and horizontal construction support. See figure 1-1, page 1-4 for the structure of the brigade engineer battalions.



Note. Combat engineer companies shown are generic. Add the appropriate organizational icon to the basic function symbol for the brigade combat team affiliation.

Legend:

BEB	brigade engineer battalion
CMD	command
CP	command post
MI	military intelligence
OPS	operations

Figure 1-1. Brigade engineer battalion

1-13. The BEB is responsible for administrative, logistical, training, and protection support of subordinate units. The BEB has a typical functional staff; however, the staff is predominantly engineers. The typical staff is as follows:

- **S-1—Personnel.** The personnel section is responsible for the personnel administration of the many specialized military occupational skills of the battalion.
- **S-2—Intelligence.** The military intelligence officer in the intelligence section is primarily responsible for providing intelligence to the BEB and assisting the military intelligence company. The military intelligence company receives administrative and sustainment support from the BEB.
- **S-3—Operations.** The operations section includes combat, general, and geospatial engineers who are at the center of technical planning and estimating. The operations section is responsible for training, operations, and plans for the battalion.
- **S-4—Logistics.** The logistics section is responsible for coordinating the integration of supply, maintenance, transportation, and services for the battalion.
- **S-6—Signal.** The signal section is primarily responsible for network management, knowledge management, and information assurance to the BEB. The signal company receives administrative and sustainment support from the BEB.
- **CBRN reconnaissance platoon.** The CBRN reconnaissance platoon provides reconnaissance and surveillance of CBRN hazards to protect the force during decisive action and is responsible for providing technical advice to the BEB. The CBRN reconnaissance platoon may be detached to other units within the brigade to provide early warning in the deep areas or provide CBRN route

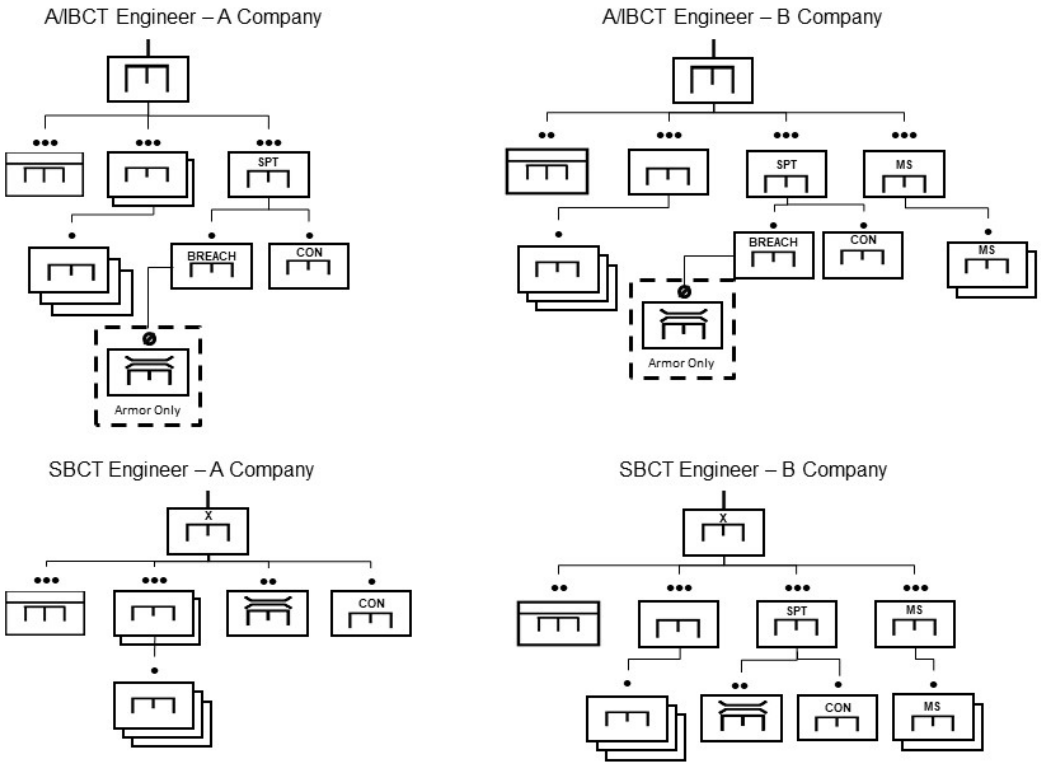
reconnaissance and site assessment support to the BEB. The CBRN reconnaissance platoon receives administrative and sustainment support from the BEB. See FM 3-11 for more information on the employment of CBRN reconnaissance platoons.

1-14. The BCT commander directs command and support relationships within the BCT. These dictate whether the BEB will logistically support or coordinate support with the BCT for attachments. Unless the BCT directs otherwise, the BEB retains a command or support relationship with organic and attached units. Organic companies and companies that are operational control (OPCON) to the BEB may be further task-organized to maneuver task forces, the reconnaissance squadron, or a subordinate company or troop. Unless the BCT directs otherwise, the BEB retains command and support relationships with organic and attached units, regardless of their physical location. The companies may be further task-organized to maneuver task forces, the reconnaissance squadron, or a subordinate company or troop.

1-15. Two engineer companies provide the BCT the minimum capability to support the offense and defense (breach and cross obstacles, assist in the assault of fortified positions, emplace obstacles to protect friendly forces, construct or enhance survivability positions, conduct route reconnaissance and information collection, identify and clear improvised explosive devices). This maintains the BCT freedom of maneuver and inhibits the enemy ability to mass and maneuver. Each company is slightly different, but the primary focus is to support the combat engineering discipline with breaching, gap crossings, digging assets, and route-clearance capabilities.

Company A

1-16. Engineer Company A is identical in the armored and infantry BCTs. This engineer company provides combat engineer support, and it consists of a company headquarters, two combat engineer platoons, and one engineer support platoon. The company provides mobility, countermobility, and survivability (M/CM/S), and limited construction support to the BCT. The combat engineer platoons provide the BCT assets for breaching and obstacle emplacement. The engineer support platoon consists of a platoon headquarters; a horizontal squad that provides specialized engineer equipment to support limited general engineering tasks assigned to the company; and a breach squad that provides specialized equipment to support mobility, countermobility, and sustainment tasks assigned to the company. In a Stryker BCT, Engineer Company A has a company headquarters and two combat engineer platoons; but instead of an engineer support platoon, it has a bridge section. The breach squad of the Stryker BCT is limited to mine-clearing line charges and proofing equipment in the company. Generically, each company organization is depicted in figure 1-2, page 1-6.



Note. The combat engineer companies shown are generic. Add the appropriate modifier(s) to the basic function symbol for the brigade combat team affiliation.

Legend:

A/IBCT	armored/infantry brigade combat team
BREACH	breach asset (mine-clearing line charge)
CON	construction
MS	mobility support (including route clearance teams)
SBCT	Stryker brigade combat team
SPT	support

Figure 1-2. Engineer Companies A and B

Company B

1-17. Engineer Company B is slightly different in the armored, infantry, and Stryker BCTs. Engineer Company B is generally of the same composition as engineer Company A, but it also has a route clearance platoon. This platoon provides the detection and neutralization of explosive hazards and reduces obstacles along routes that enable force projection and logistics. This route clearance platoon can sustain LOCs as members of the combined arms team or autonomously in a low-threat environment. The armored and infantry organization for this company is organized the same; however, the breach section contains different equipment and capabilities. The armored and Stryker BCT breach section consists of bridging, whereas the infantry BCT breach section consists of mine-clearing line charges. With the exception of the airborne variant, the infantry BCT currently does not have a bridging capability and requires augmentation from EAB engineers if the capability and capacity are required.

Brigade Combat Team Geospatial Engineering Staff

1-18. Two types of geospatial engineer elements exist in brigade and BCT staffs. The two types of geospatial teams are the geospatial engineer team and the geospatial intelligence team. Geospatial engineering teams support functional and multifunctional brigades (aviation, engineer, sustainment, division artillery, expeditionary military intelligence, fires, maneuver enhancement and security force assistance). Geospatial intelligence teams support BCTs, divisions, and corps and are typically assigned to the assistant chief of staff, intelligence (G-2), but they can also be task-organized into other staff sections. Geospatial engineers within a geospatial engineering team or geospatial intelligence cell provide geospatial support to the assigned echelon and lower.

SECURITY FORCE ASSISTANCE BRIGADE—BRIGADE ENGINEER BATTALION

1-19. The BEB under the Security Force Assistance Brigade is designed to provide C2 to the Security Force Assistance Brigade BCT and to provide engineer technical and tactical advisory support to HNs. The mission of the Security Force Assistance Brigade BEB is to provide C2 of attached and assigned units in support of the Security Force Assistance Brigade's and CCDR's objectives to train, advise, and assist foreign security forces by teaching, coaching, mentoring, and providing direct access to coalition capabilities. The sizes and numbers of advising teams may adjust based on the assigned mission. The headquarters at company and battalion support dispersed teams across the AO.

ECHELONS ABOVE BRIGADE

1-20. Engineer headquarters C2 subordinate elements. Each EAB headquarters has a staff that assists the commander to C2 engineer organizations and other task-organized units, supporting multifunctional missions (combined arms breaching, combined arms gap crossing). The units in this category consist of the TEC, engineer brigade, and engineer battalion.

1-21. Baseline engineer units provide combat and general engineering capabilities that are primarily focused on enabling tactical operations. Baseline engineer units are used to augment BCT engineers and to provide engineering capabilities to EAB engineer headquarters. When supporting a division or a corps, baseline engineer units are typically attached to, or are under the OPCON of, an engineer brigade or a maneuver enhancement brigade (MEB). When supporting echelons above corps, the baseline engineer units are normally attached to, or are under the OPCON of, a functional engineer brigade, TEC, or MEB.

1-22. Specialized engineer units are technically oriented (often low-density) units that provide specialized capabilities in construction support, infrastructure development, explosive hazards mitigation, geospatial support, well drilling, military working dog units, prime power, diving, and firefighting. The specialized engineer units primarily support the operational to strategic levels, but they also provide selected support at the tactical level.

Engineer Headquarters

1-23. There are three echelons of engineer headquarters units—the TEC, engineer brigade, and engineer battalion. Multifunctional units may also provide C2 for engineer forces when engineer support is integral to the multifunctional mission. The engineer battalion is most often found in the engineer brigade, in a MEB, or in support of a BCT. The engineer brigade, one of the Army functional brigades, provides C2 for up to five engineer battalions at the division and corps levels. While not an engineer headquarters unit, the MEB is a significant headquarters for the employment of engineering capabilities. See FM 3-81 for additional information on the MEB.

1-24. The theater army normally receives one TEC. The TEC is designed to have C2 of assigned or attached engineer brigades, other engineer units, and contracted construction engineers within the supported theater army area of responsibility (AOR). When directed, the TEC serves as the core for the creation of a joint forces engineer component command. The TEC focuses on operational-level engineer support across the

three engineer disciplines. Upon deployment, it serves as the senior engineer headquarters for a land component headquarters or theater army, based on mission requirements. The TEC—

- Maintains primary responsibility for theater infrastructure development.
- Synchronizes engineer efforts for the ASCC. The ASCC commander provides contingency training support and support of military engagement for supported respective commands.
- Deploys staff elements and organizations under ASCC authority.
- Provides a wide range of technical engineering expertise and support.
- Consists of a command section and a deputy command section and deploys their main command post (CP) and two deployable CPs.

1-25. Engineer unit task organization is tailored to meet anticipated requirements based on mission analysis. The divisional engineer force is typically organized under a functional engineer brigade headquarters or multifunctional headquarters, such as a MEB. In some situations, the division may require a combination of engineer forces that are organized under both functional and multifunctional headquarters.

1-26. Typically, an engineer brigade is aligned to a corps or division. The brigade can control up to five mission-tailored engineer battalions that are not organic to maneuver units. The battalions have capabilities from any of the three engineer disciplines. The engineer brigade may serve as a joint engineer headquarters and may be the senior engineer headquarters deployed in an AO if a full TEC deployment is not required. The engineer brigade headquarters—

- Provides C2 for assigned, attached, or OPCON units of nonengineer units performing missions in support of a deliberate gap (river) crossing.
- Plans, supervises, and coordinates for engineer support to combat operations, construction, facility rehabilitation, task organization, resource management, river crossings, barrier placements, countermines, and counterobstacles.
- Provides one deployable CP with engineer staff expertise in technical planning, design, quality assurance and control, geospatial and terrain analysis, and the oversight of contract construction and labor.
- Provides support at an SPOD or APOD (missions are terrain-focused) during early-entry operations or support to a movement corridor within a corps AO.
- Assists with the generation, management, analysis, and dissemination of geospatial data for the TGD. The geospatial engineer team captures and includes field-collected data into the TGD for use by all units.

1-27. The engineer battalion provides organic C2 for one headquarters and headquarters company and one forward support company. The engineer battalion is assigned any variation of up to five engineer companies. When appropriately task-organized, it can provide C2 for combat and general engineering capabilities in support of a BCT, engineer brigade, or another unit. The engineer battalion can simultaneously support forces at all theater echelons. Due to habitual training relationships, some battalion headquarters are more capable in combat engineering than in general engineering or vice versa. Some battalion headquarters have additional capabilities (airborne, air assault, survey, design). The battalion may be focused on a single mission (route clearance, security, construction, cache inspection, reduction). The engineer battalion may be organized to perform as a breach force command when the BCT is conducting a combined arms breach. During a gap-crossing (river-crossing) operation, the engineer battalion provides the option to be designated as the crossing-site command.

Baseline Engineer Units

1-28. Baseline engineer units include combat and general engineer units. The baseline engineer units are the primary building blocks for the organization of most engineer battalions. These units may augment the organic engineering capabilities of a BCT, or they may be task-organized under an engineer battalion headquarters to provide specific tailored capabilities to the EAB.

1-29. Baseline combat engineer units are focused on supporting combined arms operations at the tactical level. The baseline combat engineer units are designed to provide support to maneuver forces. Engineers have the capability to fight as engineers or, if required, as infantry. An engineer battalion headquarters is typically included to provide the necessary C2, logistics, and staff supervision for attached and assigned combat engineer units when two or more are assigned to a BCT, a MEB, or another organization. Combat engineer units may construct tactical obstacles, defensive positions, and fixed and float bridges; repair CPs, tactical routes, culverts, and fords; and conduct general engineering tasks related to horizontal and vertical construction when augmented with the appropriate tools, equipment, and training. Combat engineer units also provide engineer support for gap-crossing operations, assist in assaulting fortified positions, and conduct breaching operations. Airborne and air assault-capable engineer units have the unique ability to employ air-droppable, rapid runway repair kits to support forcible, early-entry operations. The more specialized combat engineering capabilities of assault bridging, breaching, and route and area clearance are added to the organic engineering capabilities in BCTs (or to deployed baseline Sapper companies) when required by the mission.

1-30. Baseline general engineer units include horizontal and vertical construction, engineer support, bridging, mobility augmentation, and clearance companies. The baseline general engineer units construct, rehabilitate, repair, maintain, and modify CPs, LOCs, supply installations, building structures, bridges, and other related aspects of the infrastructure. These units may also perform repairs and limited reconstruction of railroads and water and waste facilities. The basic capabilities of these units can be expanded by augmenting them with additional personnel, equipment, and training from specialized engineer units or other sources. Such augmentation gives them the capability to conduct quarrying and crushing, pipeline support, horizontal and vertical construction support, dive support, and major horizontal construction projects (highways, storage facilities, airfields).

Specialized Engineer Units

1-31. Specialized engineer units provide explosive hazards support and general and geospatial engineering capabilities at the operational and strategic levels, and they often augment those capabilities down to the tactical level. Many capabilities are lower density than those of the baseline engineer units. These smaller, more specialized units are designed to support technical aspects within larger, engineer-related missions or to augment headquarters elements with unique technical engineering skills.

1-32. Construction support includes the following capabilities:

- Asphalt teams.
- Concrete sections.
- Construction management teams.
- An engineer facility detachment.
- An engineer utilities detachment.
- A forward engineer support team–advanced (FEST-A).
- A forward engineer support team–main (FEST-M).
- Quarry platoons.
- Well-drilling teams.

1-33. Infrastructure support includes the following capabilities:

- Engineer prime power units that generate electrical power and provide advice and technical assistance on all aspects of electrical power and distribution systems. Prime power units have limited electrical engineering capability (design and analysis); provide electrical surveys; and operate, maintain, and perform minor repairs to other electrical power production equipment, to include HN fixed plants.
- Engineer facility detachments that support theater opening and closing, base camp development, construction management, contract technical oversight, base camp operations (to include waste management functions), and master planning.
- Firefighting teams that provide base and base camp fire protection and search and rescue.

Note. See ATP 3-34.40 for more information on infrastructure and construction support.

1-34. The engineer diving detachment performs scuba- and surface-diving-related activities, to a depth of 190 feet, in maritime geography in support of combat, general, and geospatial engineering. Divers provide reconnaissance, river-crossing, hydrographic survey, demolition, port construction and rehabilitation, harbor clearance, ship husbandry, salvage, joint logistics-over-the-shore, and hyperbaric life support operations. See ATP 3-34.84, TM 3-34.83, and TM 3-34.84 for additional information.

1-35. Explosive hazards support provides the commander specialized capabilities and integrates the tasks conducted to counter the explosive hazards threat. These capabilities include the linkage to Army explosive ordnance disposal (EOD) capabilities found in the Ordnance Branch and in Navy and Air Force EOD units of the joint Services. The engineer squad (canine) employs mine dog teams. These teams assist in locating firearms, ammunition, and explosives in rural and urban environments. The teams may be used to augment a variety of route and area clearance capabilities found in the clearance company.

1-36. The geospatial planning cell (GPC) provides geospatial support to deployed units that require augmentation. Geospatial engineering capabilities include analysis, collection, generation, management, finishing, and printing. GPCs generate, manage, and disseminate geospatial data, information, and products in support of ASCC headquarters and geographic combatant commands. GPCs are responsible for the management of the TGD, which contains detailed information about geographic features within the ASCC AOR. The intended goal of these organizations, in coordination with organic geospatial teams, is to apply the relevant geospatial information available, explain the military significance of the terrain and other spatial and temporal aspects of the OE to the commander, and facilitate informed decision making. Furthermore, these geospatial organizations conduct the exploitation of geospatial information and services (GI&S), producing spatially accurate products for commands and commanders, intelligence, measurements, mapping, visualization, and modeling.

Other Capabilities

1-37. Technical engineer reconnaissance is routinely formed for mission-tailored teams to collect engineer-specific tactical and technical information. These teams are a critical source of information for engineers and combined arms commanders, playing an important role in the intelligence preparation of the battlefield (IPB). ATP 3-34.81 provides a detailed discussion on the range of engineer reconnaissance capabilities.

REACHBACK SUPPORT

1-38. The UROC is the reachback management team for technical engineering requests to USACE. The UROC provides, relevant, and reliable solutions to Soldiers and Civilians in support of the armed forces and the nation. The reachback engineering capability allows U.S. personnel who are deployed worldwide to talk directly with experts when a problem in the field needs quick resolution. Deployed personnel are capable of linkage to subject matter experts within the U.S. government, DOD, USACE, private industry, and academia to obtain a detailed analysis of complex problems that would be difficult to achieve with the limited expertise or computational capabilities available in the field. While the UROC is capable of responding to a variety of complex technical problems, the team is also trained to exploit the entire array of expertise within USACE

laboratories, centers of expertise, base camp development teams, USACE divisions and districts, other DOD or U.S. government agencies, or other organizations for more complex engineering issues.

1-39. A base camp development team is a non-deployable team within a selected USACE district that can quickly provide base camp development engineering, master planning, and facilities design in support of field force engineering (FFE) and other reachback requests for information. Base camp development teams are trained and organized within USACE divisions, and they maintain a rotational readiness cycle. While these teams are capable of responding to a variety of complex technical problems, they are also trained to exploit the entire array of expertise within USACE laboratories or centers of expertise for more complex engineering issues. Focus areas for the base camp development teams are engineer-related planning and development issues involved in locating, designing, constructing, and eventually closing or transferring base camps. Base camp operations and maintenance activities are not within the scope of FFE support, but they may rely on FFE applications to address specific technical engineering requirements when necessary. The base camp development team resources and expertise are available to support FFE teams and operational forces through the USACE Reachback Operations Center Web site.

1-40. A USACE contingency engineer district supports combatant command requirements. Should contract construction exceed the capabilities of the major subordinate commander, USACE may establish an additional contingency support organization or simply augment the existing staff. These capabilities would align themselves with the theater level engineer staff element.

1-41. The USACE contingency engineer district provides responsive technical engineer support to U.S. forces, other U.S. government agencies, and headquarters and staff augmentation. Technical engineer support includes—

- Engineer reconnaissance.
- Estimates.
- Design and plan projects.
- Execution of contract construction.
- Project quality assurance and quality control.
- Real estate acquisition and disposal.
- Environmental assessments and operations.
- Operation and maintenance until projects are turned over to designated agencies.
- Technical engineering advice to the supported command and agencies in support of the operational campaign plan.

1-42. USACE contingency engineer district business management functions include—

- Project contracting.
- Resource management operations.
- Legal support for contract construction.
- Safety and occupational health.
- Logistics management operations.

1-43. The headquarters and staff augmentation cell is a USACE cell that synchronizes USACE construction effects and customer requirements at the theater level, provides oversight of USACE construction programs, and provides USACE major subordinate command-level of oversight of forward-deployed contingency engineer districts and other USACE assets. This augmentation cell provides the theater-wide synchronization of construction effects and program oversight. The augmentation cell roles and responsibilities include—

- Communicating construction effects to theater level decision makers and jointly developing an infrastructure plan that nests with the civil-military strategy as part of the theater campaign plan.
- Augmenting theater engineer staff with technical engineering expertise not resident within the staff.
- Engaging with the HN government and the U.S. government interagency to synchronize construction effects.

- Pulling information from contingency engineer districts, synthesizing the information into construction effects for reporting purposes, and providing programmatic oversight of construction programs.
- Advising the supported command on USACE core competencies and supporting construction decisions for work acceptance.
- Participating in the development of infrastructure construction requirements and providing strategic command guidance to deployed contingency engineer districts according to theater and USACE strategic command objectives.
- Providing oversight of the USACE major subordinate commander.
- Acting as the operational conduit between deployed elements and the USACE major subordinate commander.
- Pushing guidance to the deployed contingency engineer districts from the supported theater command.
- Prioritizing mission execution and ensuring the implementation of USACE business processes consistently throughout the theater.

Note. See USACE Engineer Pamphlet 500-1-2 for additional information on FFE.

ECHELON FORCE TAILORING

1-44. With input from appropriate corps and division headquarters, engineer planners at the joint and theater army (and the TEC when deployed) select engineer forces based on analysis of mission variables and recommend the deployment sequence. Actual requirements for engineer forces in a campaign seldom match planning figures; in fact, they typically exceed the planning figures. Tactical-level requirements are difficult to fully define at operational levels. The engineer planners at the theater army echelon gain a broad understanding of the operational-level requirements, but they must rely on subordinate echelons to assist in defining tactical-level requirements. Engineer planners must also consider and leverage the variety of other engineer capabilities that may be available to meet or mitigate requirements.

1-45. Echelons above brigade (EAB) engineer planners consider a variety of other engineer capabilities to meet operational- and, in some cases, tactical-level requirements. A designated DOD contract construction agent (normally, the USACE or Naval Facilities Engineering Command [NAVFAC]) that may have available mission support capabilities supports each theater. When not deployed, the TECs support ASCC campaign plans through persistent habitual engagement. Through these relationships, the TEC supports joint and theater army strategic and operational planning, assists in-theater posture construction program management, provides technical support, and provides tailorable support packages to ASCC operations in support of theater campaign plans. Planners review operational and mission variables and consider the availability of local engineer resources, including host-nation (HN) military and civilian sources. Unified action partner capabilities are also considered. Despite a full accounting of contract and other available resources, operational-level engineer planners may also identify a number of requirements for which the most effective engineer capability only exist in USACE or other institutional force engineer organizations.

1-46. Theater army engineer planners must understand some requirements more fully than others. The theater army echelon must comprehend the various engineer support requirements for accessing the theater and establishing a sustainment base. Many of these may be translated to potential military engineer missions and the related tasks. For example, theater engineer planners must know the requirements for upgrading selected seaport of debarkation (SPOD) and aerial port of debarkation (APOD) with enough clarity to include tentative designs, plans, and estimates. Similarly, a selected ground line of communication (LOC) may require construction activities that can be clearly defined. The most well-defined requirements tend to focus on operational-level support, and most engineer support at this level is organized in the general engineering and geospatial engineering functions.

1-47. Theater army engineer force planners do not disregard tactical-level requirements. They must analyze operational and mission variables to determine and shape the engineer forces required for the tactical-level operations of subordinate echelons. These forces include capabilities organized in the combat, general, and

geospatial engineering disciplines. Because the theater army echelon analysis may not include the full resolution of tactical-level requirements, the subordinate echelon corps and division headquarters offer refinements for the engineer forces required to support their more detailed concept of operations. For example, based on an understanding of the physical environment in a potential AO and an initial design for operational maneuver, the engineer planner may identify the requirements for numerous gap crossings by subordinate tactical elements. After consideration for joint, multinational, and other capabilities, the planner may determine and shape baseline engineer forces capable of supporting gap-crossing requirements. As corps, division, and subordinate planners add depth to the understanding of the AO and develop a scheme of maneuver, the shape of the baseline forces to support gap crossings allocated by the higher echelon design is impacted by decisions regarding timing, locations, and other factors, refining the gap-crossing design.

1-48. Prioritization occurs in applying the tailored engineer forces most effectively against actual requirements. EAB engineer staff and planners recommend priorities to the commander based on the continuous assessment maintained through the running estimate. EAB engineer staffs also shape the organization of the tailored forces for the conduct of engineer operations. Tailoring the engineer force should not be confused with task organizing. Tactical and operational commanders organize and reorganize groups of tailored engineer units for specific missions. This process of allocating available assets to subordinate commanders and establishing their command and support relationships is called task organizing. Flexibility to meet evolving engineer requirements while an operation is conducted depends directly on the ability to efficiently task-organize the tailored engineer force and integrate it within the gaining or supported force.

ENGINEER FORCE TAILORING

1-49. The organization of forces within the Army is dynamic. Actual requirements for forces are seldom identical to planning figures. Therefore, the theater army commander recommends the appropriate mix of forces and the deployment sequence for forces to meet the geographic combatant command requirements. This is called *force tailoring* (selecting forces based on a mission and recommended deployment sequence) and may include elements from the operational Army and the institutional force.

1-50. Tailoring the engineer force requires a different mind-set—one that thinks in terms completely divested from how the force is organized in a garrison. It requires a leader to think beyond garrison structures and embrace combinations of engineering capabilities and scalable C2 to provide each echelon of the force the right support. Engineers are organized and equipped to support unified land operations. Careful prioritization must occur for the limited engineer resources typical in the OE. To accomplish the identified tasks in the desired timeframes, commanders must consider augmentation requirements and recognize which mission requirements can be supported through reachback and geospatial products rather than enlarging the engineer footprint in the AO. Engineer units are more narrowly designed to accomplish specific types of tasks. Therefore, when tailoring the engineer force, it is imperative that a broad range of capabilities is allocated from the engineer force pool.

1-51. Engineer force packages must contain the right mix of capabilities to assure timely and relevant engineer support to the joint force command. This mix changes dramatically during transitions, and the joint force engineer must anticipate and plan for these changes. For example, combat engineers often make up the majority of engineer forces in-theater during sustained combat operations. However, combat engineers must be reinforced during the transition to operations that are dominated by stability operations, because they typically do not have the adequate capability or capacity to accomplish the required general engineering tasks.

1-52. The implications of Army force generation on the engineer force are similar to those on other maneuver support branches within the Army where a majority of forces are not organic to a BCT structure. Activating an engineer unit early in the Army force generation process has secondary and tertiary effects for operational, sustainment, and personnel planners. It reduces the availability of units later in the cycle. A surge of engineer units can be accomplished for short periods, but not indefinitely without looking at increasing engineer units in the inventory or using HN or contract engineers. Engineers are typically employed in modules, units, or companies, but they are deployed in a battalion level organization.

1-53. Military engineers may need to coordinate activities with other nation forces, U.S. government agencies, nongovernmental organizations, United Nations agencies, and HN agencies according to the operational mandate or military objective. In all cases, the authority must exist for direct coordination.

Military engineers must establish interagency relationships through negotiation. The specific agency varies, depending on who has federal or state jurisdiction for the situation (for example, disaster relief versus a firefighting mission). Agreements should be written as memorandums of understanding or terms of reference to ensure understanding and avoid confusion. Most agreements are made at the combatant command or joint task force (JTF) level and normally place legal restrictions on using military personnel and equipment. These agencies and organizations may have unique engineering capabilities that could be used as part of the overall operational effort. However, these agencies and organizations often request extensive engineer support of activities and programs. It is critical that an effective engineer liaison is established with the force headquarters civil-military operations center, or the civil military operations directorate of a joint staff (J-9) at the JTF level, to coordinate and execute any engineer support exchanged with these agencies.

JOINT CONSIDERATIONS

1-54. Army engineers frequently operate in a joint environment and must understand joint command and support authorities and relationships (described in JP 1), which are similar, but not identical to, Army command and support relationships. They must understand how these are applied in joint engineer operations, as described in JP 3-34. Particularly pertinent to engineer operations are—

- The directive authority for logistics that CCDRs have and the authority to delegate directive authority for common support capabilities, which include engineer support.
- The authority to employ mines, which originates with the President. See JP 3-15 for additional information.

SUPPORT TO SPECIAL OPERATIONS FORCES

1-55. Special operations forces provide an array of formations that are capable of rapidly reversing the conditions of human suffering by decisively resolving conflicts. Engineers support Army special operations forces through a number of unique capabilities and tasks that include GI&S, infrastructure development, facility construction and maintenance, training an indigenous population on how to construct protective obstacles, mobile electric power, and facility hardening. Special operations support can be performed at the company, platoon, squad, or Soldier level. Support to special operations tends to require smaller elements with multifunctional capabilities. Operational contract support, logistics, and engineering operations work hand-in-hand throughout the special operations AOR.

SUPPORT TO CYBER ELECTROMAGNETIC ACTIVITIES

1-56. Cyber electromagnetic activities are continuous and unimpeded by geography. This domain leverages the electromagnetic spectrum through wireless systems. Wireless systems are enablers to modern telecommunications, computer networks, and weapon systems. Engineers are enablers and users of cyber electromagnetic activities. Engineers support these activities through tasks that include—

- Hardening facilities.
- Constructing protective obstacles.
- Providing uninterrupted medium-voltage electrical power.
- Providing clean and secure power/energy supply and grid systems to mitigate and minimize cyber electromagnetic disruptions from adversary systems.

SPACE-BASED DEPENDENCIES

1-57. Engineers rely on space-based capabilities and systems (global positioning systems, communication and weather satellites, intelligence collection platforms) to be successful in combat, general, and geospatial engineering. The planning and coordination of space support with national, Service, joint, theater, and commercial resources take place at the corps and division levels to provide expertise, advice, and planning that may directly affect and impact engineer missions to plan, communicate, maneuver, and maintain situational awareness; conduct reconnaissance; and protect and sustain U.S. forces. Space-enabled capabilities are widely used to maintain situational awareness. Space-based systems are critical during engineer operations because they—

- Provide rapid communication that enables a commander to gain and maintain the initiative.
- Provide communication links between forces and commanders within the theater.
- Provide updates of the solar environment and its impact to terrestrial and space-based segments of friendly communication systems.
- Monitor terrestrial areas of interest through information collection assets to help reveal enemy location and disposition and to conduct route, area, zone, and force reconnaissance.
- Provide global positioning system status and accuracy for planning and conducting geospatial engineering.
- Provide meteorological, oceanographic, and space environmental information that is processed, analyzed, and leveraged to produce timely, relevant, and accurate weather effects.

INTERAGENCY CONSIDERATIONS

1-58. Interagency cooperative agreements expand the scope and capabilities of any given response because of the wide variety of expertise and funding resources that are potentially available. Not only do interagency operations increase the resources engaged in an operation, but they also increase and complicate the coordination necessary to conduct operations. Engineer support to operations may be significantly impacted by the participation of interagency organizations. Engineer support may be a key enabler to these operations. During the conduct of stability, interagency organizations employ contract or other construction capabilities concurrently with ongoing military engineer support. Coordination can help identify and avoid conflicting issues and unify the effect of these efforts. The following interagency organizations may be involved:

- United States Department of Homeland Security.
- United States Environmental Protection Agency.
- United States Justice Department Drug Enforcement Administration.
- National Oceanic and Atmospheric Administration.
- United States Geological Survey.
- United States Public Health Service.
- United States Air Force Auxiliary Civil Air Patrol.
- United States Department of Agriculture.
- United States Department of State.
- United States Agency for International Development.
- Office of United States Foreign Disaster Assistance.
- United States Department of the Interior.
- United States Fish and Wildlife Agency.
- United States General Accounting Office.
- United States Department of Homeland Security.
- United States Customs and Border Protection.
- United States Coast Guard.
- National Geospatial-Intelligence Agency (NGA).

MULTINATIONAL CONSIDERATIONS

1-59. North Atlantic Treaty Organization (NATO) and the American, British, Canadian, Australian, and New Zealand Armies Program engineering capabilities are well-known, and data about them is readily available. (See FM 3-16 for additional information on multinational operations.) Standardization agreements between national armies facilitate engineer interoperability and cooperation. The capabilities of engineers from other nations are normally available through intelligence channels or formal links with the nations involved. Several nations have engineers that are experts in specific combat engineering tasks (such as mine detection and removal). Other national engineers are focused on specific missions (such as disaster relief). Engineers require an appreciation for the engineering capabilities and limitations of other nations. Allied Tactical Publication-3.12.1 provides a necessary starting point for working with allied engineers.

1-60. Depending on the multinational force arrangement in-theater, Army engineers may control or work closely with engineers from other nations. Command and support relationships for multinational engineer forces are established to enable unity of effort. Providing adequate U.S. engineer liaison officer (LNO) support (linguist support, communications equipment, and transportation) is critical to this process.

1-61. When projecting the force, the initial engineering capabilities in-theater can employ a mix of HN, contracted, and multinational capabilities. As Army engineers deploy into a theater, they may be joined by multinational and joint engineers. When coordinating multinational engineer plans and operations, the theater army engineer staff should consider the joint considerations that are addressed in JP 3-34 and the following:

- Requesting the latest information and intelligence concerning the HN or multinational engineer structures and logistics requirements.
- Requesting the latest engineer intelligence data from the HN or deploying multinational engineer elements to help identify force projection theater army engineer requirements and enemy engineering capabilities.
- Requesting HN geospatial data, including terrain, feature, cultural, demographic, explosive hazards, obstacle, and other available geospatial data.
- Establishing multinational engineer staff links between the theater army, HN, and multinational engineer force staff sections through the JTF or combatant commands engineer staff and headquarters.
- Providing NATO multinational C2 with the NATO operation order (OPORD) format and the NATO decisionmaking process.
- Providing necessary Army engineer LNO support.
- Developing the multinational task organization relationships that enhance HN and multinational engineering capabilities following the deployment of Army engineers.
- Assessing the need for HN and multinational engineer support following the arrival of Army engineer units in-theater.
- Determining if multinational engineer units need augmentation from Army engineer units.
- Developing procedures for Army engineer units to support multinational engineers with additional Class IV construction materials and engineer equipment.

HOST-NATION CONSIDERATIONS

1-62. In a forward-deployed theater, the theater army identifies wartime facility and construction requirements for the Army as part of the deliberate war planning effort. The planning module in the joint construction management system (JCMS) is used to identify construction requirements. Construction plans may also be requested from one of the USACE Centers of Standardization to site-adapt existing drawings. Subsequent analyses further refine construction requirements and provide a basis for—

- Force structuring.
- Procurement.
- Lease provisions and HN agreements.

1-63. The product of these analyses is the engineer support plan (ESP). The goal is to reach HN support agreements in peacetime to provide maximum facilities within the theater. Advanced planning and the commitment of resources by HNs reduce the early lift requirements needed to support reception, staging, onward movement, and integration (RSOI). Written agreements with HNs regarding support items foster an understanding of the assistance levels and increase the likelihood of execution. Engineer support from the HN usually involves providing—

- All available geospatial data.
- Land.
- Facilities.
- Construction support.
- Manpower.
- Equipment.

- Materials.
- Services.
- Waste disposal.

HOST-NATION SUPPORT AGREEMENTS

1-64. Wartime HN support agreements in forward-presence theaters (Europe and Korea) have been negotiated to provide HN construction support (facility modifications, LOC maintenance and repair, utility services). During contingency operations, HN support agreements tend to be less formal; however, these agreements are no less critical to mission success in the event of an operation. Such HN support is used when possible to free U.S. engineer units for critical missions where HN support alternatives are not viable. Support agreements negotiated in peacetime are on a resource basis. Resources may be facilities, contracts, or equipment. Again, this support is particularly critical during the initial stages of a contingency, when RSOI requirements are high and engineer assets are limited.

PREPOSITIONING OF EQUIPMENT

1-65. Pre-positioning engineer equipment within the region reduces the response time in a particular theater by allowing engineer forces to deploy by air and fall in on war stocks within the region. These pre-positioning locations are a critical element of the U.S. force projection national strategy and represent a significant contribution of HN support. Beyond direct HN support, multinational elements directly or indirectly involved in the crisis may provide other support. Other nations sympathetic to the cause may be limited in direct participation because of constitutional restrictions or political sensitivities. However, these nations may provide engineer equipment, supplies, or funding, much like the Japanese provided during the Gulf War.

1-66. During a conflict, the HN may provide local contractors to repair or construct facilities. Construction materials (cement, asphalt, aggregate, lumber, steel) and contract labor may also be available. HN assets may also be available for providing local security and for transporting construction materials and equipment. Third country nationals may be available by request through the HN or by direct contact with nationals to support engineer activities. Engineer reconnaissance and assessment teams engaged in planning during peacetime or dispatched early in contingency operations are the key to identifying and accessing available HN assets.

NONGOVERNMENTAL ORGANIZATIONS

1-67. Relationships with international and domestic nongovernmental organizations must be established through negotiation. Most agreements are made at the strategic level; however, the operational and tactical commanders may have some latitude delegated to them. Agreements normally have serious legal restrictions on using military personnel and equipment. Some of these agencies may have unique and significant engineering capabilities that may be used as a part of the overall operational concept. These capabilities may be a useful source of Class IV supplies, not only for agency projects, but also as a negotiated barter for services rendered in support of the mission. However, these agencies and organizations typically request extensive engineer support for activities and programs. These organizations play an important part in the CCDR achievement of strategic objectives; therefore, the demands must be coordinated. It is critical that an effective engineer liaison be established and maintained with the force headquarters civil-military operations center.

1-68. The United Nations may designate a regional organization, which has a greater vested interest and appreciation for the forces at work in a given region, as its operational agent to exercise control. These organizations have different operational concepts and organizational procedures. U.S. forces are familiar with some of these concepts and procedures (such as NATO exercise control procedures), but they are not familiar with others.

ENGINEER SUPPORT ACROSS THE RANGE OF MILITARY OPERATIONS

1-69. While violence varies across the range of military operations, the magnitude of requirements for engineers may remain consistently high from peace through war. This demand results in the application of the engineer disciplines to provide a menu of actions available to support military operations.

1-70. Engineer requirements to support peace during military operations may include geospatial engineering support to provide a clear understanding of the physical environment. Military engagement, security cooperation, and deterrence activities sometimes require large numbers of forces. These forces need infrastructure, facilities, LOCs, and bases or base camps to support sustainment. Even in areas with well-developed existing infrastructure, significant engineer effort is required for the planning, design, construction, acquisition, operation, maintenance, or repair necessary to support operations in-theater. Assistance in response to disaster and humanitarian relief usually includes significant engineering challenges and opportunities to affect the situation immediately and positively.

1-71. Engineer activities to support war during military operations require support for ground combat (or the possibility of ground combat). Engineers and other supporting units integrate with fires and maneuver to assure the mobility of friendly forces, alter the mobility of threats, and enhance the survivability of friendly forces. It also involves the significant challenges associated with sustaining the operation.

1-72. During transitions between peace and war, engineers are often required to improve stability through projects that develop infrastructure and create or improve HN technological capacity. There may also be requirements to provide specialized engineer support to other agencies. The USACE uses the Foreign Military Sales program to support intergovernmental relations and to enhance capacity through construction. Engineers involved in unconventional warfare help overcome challenges to the commander's ability to move and maneuver freely, protect the forces employed, and sustain the operation. Other requirements include directly impacting threat freedom of action and improving stability.

ENGINEER ACTIVITIES SPANNING THE LEVELS OF WAR

1-73. The challenges of planning, preparing, executing, and continuously assessing operations within diverse theaters are numerous and varied. The engineer staff must be involved in the operations planning process at each level of war (strategic, operational, and tactical). (See ADP 3-0 for additional information.) Understanding the challenges and opportunities identified from an engineer view equips the staff with relevant information to form a more comprehensive understanding. The omission of engineer considerations at any level may adversely affect the effectiveness of the operation. Engineer support to operations must be synchronized from the strategic level to the tactical level.

STRATEGIC

1-74. Engineer planners must determine the means, ways, and ends as part of a joint force to prevent, shape, and win decisively. Activities include planning the right engineer force with the right mixture of capabilities, engineer policy, and doctrine development in place to mobilize, deploy, employ, sustain, and redeploy forces. Engineer activities at the strategic level seek ways to contribute to preventing, shaping, and winning by setting conditions for decisive action. Engineers conduct force planning, develop engineer policy, and support campaigns and operations, focusing primarily on the means and capabilities to generate, deploy, employ, sustain, and recover forces.

1-75. Additionally, infrastructure development is a critical aspect of enabling and sustaining force deployments, and it places a heavy demand on engineer requirements. Engineers at the strategic level advise on terrain and infrastructure, to include—

- GI&S.
- TGD management.
- SPOD.
- APOD.
- Force generation.

- Engineer support priorities.
- LOCs.
- Air base and airfield operations.
- The theater basing strategy.
- Joint targeting.
- Foreign humanitarian assistance.
- Environmental considerations.
- Engineer interoperability.
- Input to the rules of engagement.
- Rules for the use of force.
- Support to protection.
- Explosive hazards mitigation and explosive remnants of war.

1-76. Environmental issues can have strategic implications. They can also affect mission success and end states if the issues are not recognized early and incorporated into planning and operations. Environmental considerations may include input to the rules of engagement for targeting cultural sites, developing guidance for targeting industrial infrastructure, deciding which laws and treaties pertain to the environmental situation, and determining the level at which the military may conduct environmental remediation and restoration. Environmental baseline surveys, annual re-inspections, and base closeout surveys are vital to protecting Service members' health and government liability for the remediation of issues not caused by U.S. government entities. Natural resource protection can be a key strategic mission objective and is important to HN reconstruction. The failure to recognize environmental hazards can result in significant risk to the JTF, adversely affecting readiness. If not appropriately addressed, environmental issues have the potential to negatively affect local community relations, affect insurgent activities, and create diplomatic problems for the JTF. See ATP 3-34.5 for environmental considerations.

OPERATIONAL

1-77. Engineer activities at the operational level focus on the impact of geography and force projection infrastructure on the CCDR operational design. Engineer planners must determine the basic (yet broad) mobilization, deployment, employment, and sustainment requirements of the CCDR concept of operations. Engineer planners must secure funding within authorities and plan for the procurement of Class IV supplies and services. Operational planning merges the operation plan (OPLAN) or OPORD of the joint force, specific engineer missions assigned, and available engineer forces to achieve success. Combatant command engineer planners also need to understand the capabilities and limitations of Service engineer forces. See JP 3-34 for a full explanation of Service capabilities, contributions, and limitations.

1-78. Many of the engineer activities conducted for strategic operations are also performed at the operational level. Engineers conduct operational area and environmental assessments and work with intelligence staff to analyze the threat. Engineers anticipate requirements and request the capabilities to meet them. They provide the scheme of base camps, geospatial products and services, and recommendations on joint fires and survivability for the forces employed. (See ATP 3-37.10 for additional information on base camps.) As the link to tactical engineer integration, operational planners set the conditions for success at the tactical level by anticipating requirements and ensuring that capabilities are available to accomplish engineer support requirements. An example of this includes field forces that are assigned to the operational Army (FESTs, multirole bridge companies, engineer construction companies, prime power teams, additional engineer brigades).

1-79. Engineer staff officers assigned to the United States Army Special Operations Command or the 1st Special Forces Command are responsible for planning, coordinating, and executing engineer support. Engineers at this echelon provide policy and direction in the aspects of engineering, to include coordination for engineer support from conventional forces. Due to the nature, scope, and remote environments in which special operations forces operate, theater infrastructure is not always available. Despite recent increases in special operations force structure, conventional force engineers across the three disciplines are capable of providing additional engineer support. Requests for conventional engineers at this level could be to support special operations in core activities—ranging from augmenting special operation forces in training exercises

to providing technical capabilities to restore essential services, to providing infrastructure reconstruction and humanitarian relief, to showing U.S. commitment in the area of interest. Engineers must be familiar with fiscal policy, and they must have the ability to translate special operations requirements in terms that the supporting conventional forces can understand and execute.

TACTICAL

1-80. Engineer planners must determine the best methods to task-organize forces at the lowest level to support the maneuver of combat forces to win at the least cost. Engineer activities at the tactical level focus on support to the ordered arrangement and maneuver of forces—in relationship to each other and to the enemy—that are required to achieve combat objectives. At the same time, engineer support is critical to achieving necessary stability tasks.

1-81. Tactical planning in the context of engineer support to operations translates to a primary focus on combat engineering tasks and planning done within tactical organizations. The senior engineer staff officer in the brigade is the primary planner at the tactical level. Engineer tactical planning is typically focused on maneuver support and sustainment support that are not addressed by the higher-echelon commander. Construction planning at the tactical level typically focuses on survivability tasks in support of the protection warfighting function and infrastructure development that are primarily in support of the sustainment warfighting functions. Engineer planners at the tactical level use the engineer assets provided by operational planners to support the tactical mission tasks assigned to the combat maneuver units they support. With the support of engineers, subordinate commanders ensure that engineering capabilities are effectively integrated into the scheme of maneuver and the performance of assigned tasks. Tactical missions are complex, and the planning staff must consider threat capabilities.

1-82. Geospatial engineers provide unique graphical representations and terrain analysis that enable commanders to visualize the AO. Additionally, geospatial engineers provide SSGF, which serves as the geospatial background for the unit COP on all C2 systems. Engineer reconnaissance (tactical and technical) is a critical capability to the maneuver commander at the tactical level. At the tactical level, geospatial engineers collect the technical feature data (such as bridge, road, and tunnel dimensions) from reconnaissance elements within the supported unit, validate the data, and submit the data to a higher echelon for inclusion into the TGD. See ATP 3-34.80 and ATP 3-34.81 for additional information.

1-83. Engineer support to special operation forces at this echelon has been allocated to provide engineer expertise across the engineer disciplines. Engineer units at this echelon should be prepared to provide an engineer LNO to be integrated into the receiving special operations forces headquarters. Engineer planners should be able to provide engineer support that is no different than the support provided to other organizations, with the exception that contingency and crisis action planning are the two primary methodologies used. At this level, planning and execution are decentralized. Engineer staff officers must plan for the right personnel and equipment package to conduct engineer operations in austere environments without extensive support until follow-on conventional forces arrive. Engineer organizations do not execute missions differently than they would for any other decisive action, but they do execute these missions with an emphasis on speed and resource ingenuity.

CONSIDERATIONS FOR UNIFIED LAND OPERATIONS

1-84. The Army operational concept is unified land operations. *Unified land operations* describes how the Army seizes, retains, and exploits the initiative to gain and maintain a position of relative advantage in sustained land operations through simultaneous offensive, defensive, and stability operations in order to prevent or deter conflict, prevail in war, and create the conditions for favorable conflict resolution (ADP 3-0).

1-85. Organic engineering capabilities in each of the BCTs provide close support to the maneuver of those forces. Based on a mission variable analysis, the BCTs task-organize with additional engineering capabilities to meet mission requirements. For the offense and defense, engineer augmentation may consist of additional combat engineering capabilities and an engineer battalion headquarters to provide the necessary C2 for the mix of engineer units and capabilities augmenting the BCT. Other, more technically specialized engineering capabilities support the BCT requirements related to the movement and maneuver, protection, and

sustainment warfighting functions. These same capabilities may be employed at division, corps, and theater army echelons to primarily enable force mobility, survivability, and sustainment. Force-tailored engineering capabilities from the force pool can provide critical nonlethal capabilities to conduct or support stability and DSCA operations. Geospatial engineering capabilities, organic and from the force pool, provide support by adding to a clear understanding of the physical environment.

1-86. During combat operations, engineer units normally have command and support relationships aligned to maneuver commanders. (See ADP 6-0 for additional information.) Engineer commanders advise the maneuver commanders on which appropriate command or support relationship best enables the execution of the mission while limiting the burden on the supported or supporting headquarters. Although the forms of offensive maneuver have different intentions, the planning phase must always begin with predicting enemy intent through a thorough understanding of the threat, engineer capabilities, and the effect of terrain on operations. Geospatial products and information become the foundation and common reference for planning. Of all forms of maneuver, the knowledge of enemy disposition is especially critical and required for an infiltration or penetration due to the requirements for stealth and surprise. Engineer planning tends to focus on mobility support, including a robust reconnaissance effort. (See ATP 3-34.81 for a full discussion of engineer reconnaissance.) A greater degree of planning is required for a penetration from the breach to the ultimate control of the objective.

1-87. Engineering capabilities are a significant force multiplier in unified land operations, facilitating the freedom of action necessary to meet mission objectives. Decisive action requires simultaneous combinations of offensive, defensive, stability, and DSCA operations. Higher-echelon engineer activities are intrinsically simultaneous—supporting combinations of operational components, occurring at every echelon, influencing each level of war, and influencing the entire range of military operations. Engineer activities modify, maintain, provide an understanding of, and protect the physical environment. In doing so, they enable the mobility of friendly forces and alter the mobility of a threat. This enhances survivability; enables the sustainment of friendly forces; contributes to a clear understanding of the physical environment; and provides support to noncombatants, other nations, and civilian authorities and agencies. Indeed, engineer activities may be so widespread and inclusive that they may be viewed as a stand-alone objective, but they are not stand-alone. Engineer applications are effective within the context of the supported objective. Military engineer support is focused on the combined arms objective. To identify and maintain that focus for the widespread application of engineering capabilities, engineer support is integrated within the combined arms operation.

THE INTEGRATION OF CAPABILITIES

1-88. Decisive action follows a cycle of planning, preparation, execution, and continuous assessment. The operations process is the context within which engineer capabilities integrate into combined arms maneuver. See chapter 5 for more discussions on enabler integration and command and support relationships.

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Chapter 2
Foundations of Engineer Operations

Army engineers support operations by using a variety of engineer capabilities. Commanders use engineers to assure mobility, enhance protection, enable force projection and logistics, build partner capacity, and develop infrastructure. This chapter describes engineer tasks, the lines of engineer support, and engineer support to the warfighting functions.

ENGINEER MISSIONS

2-1. Engineer missions seek to provide freedom of action for supported forces. Engineer missions that affect terrain deal with obstacles (including gaps), bridges, roads, trails, airfields, fighting positions, protective positions, deception, and a wide variety of other structures and facilities (base camps, aerial ports, seaports, utilities, buildings). Engineers affect these by clearing, reducing, emplacing, building, repairing, maintaining, camouflaging, protecting, conserving, or modifying them in some way through tasks (obstacle clearance, obstacle reduction, infrastructure and environmental assessments, geospatial engineering).

2-2. Regardless of category, engineer missions have different purposes in different situations. For example, a task to clear explosive hazards from a road that is designated as a direction of attack may have the purpose of assured mobility. Two days later, that same road may be designated as a main supply route, and a task to clear explosive hazards from the road may have the purpose of protecting critical assets or enabling logistics. The same task is involved, but with different purposes. In addition to the different purposes that an engineer task can have at different times, engineer support often involves simultaneous tasks with different purposes that support different warfighting functions. This chapter explains how engineer missions are grouped by purpose into the lines of engineer support, how they are grouped into the types of operations, and how they contribute to the warfighting functions.

LINES OF ENGINEER SUPPORT

2-3. Fundamental to engineer support to operations is the ability to anticipate and analyze the problem and understand the OE. Based on this understanding and the analysis of the problem, engineer planners select and apply the right engineer discipline and unit type to perform the required individual and collective tasks. They must think in combinations of disciplines, which integrate and synchronize tasks in concert with the warfighting functions to generate combat power. Finally, they establish the necessary command and support relationship for these combinations. The lines of engineer support are the framework that underpins how engineers think in combinations, and these lines provide the connection between capabilities and tasks.

2-4. Commanders use lines of engineer support to synchronize engineer missions with the rest of the combined arms force and to integrate them into the overall operation throughout the operations process. Lines of engineer support are categories of engineer missions and capabilities that are grouped by purpose for specific operations. Lines of engineer support assist commanders and staffs with understanding the engineer capabilities, organic to the engineer disciplines, and aligns activities according to purpose. The engineer disciplines are capabilities (based on knowledge and skills) that are organized in units. These units are organized based on the disciplines that are executed through individual and collective tasks. The combination of these tasks for a specific purpose, in the context of decisive action, achieves the lines of engineer support.

2-5. Regardless of where a task falls within the Army universal task list, task alignment with a line of engineer support is determined by the purpose of the task in a given situation. Engineer support is primarily focused on achieving the four lines of engineer support.

2-6. The three engineer disciplines encompass tasks along the lines of engineer support. The combat engineering discipline, due to its support to maneuver forces in close combat, is primarily focused on tasks that assure mobility and enhance protection. The general engineering and geospatial engineering disciplines perform tasks along all four lines of engineer support. Geospatial engineers provide standard and nonstandard geospatial products, mission-tailored analysis, tactical decision aids, and visualization products that enable the commander and staff to visualize the OE. Geospatial engineers also conduct data management of standard and nonstandard geospatial products and information necessary to plan and support operations.

ASSURE MOBILITY

2-7. The assure mobility line of engineer support orchestrates the combat, general, and geospatial engineering capabilities in combination to allow a commander to gain and maintain a position of advantage against an enemy (mobility) and deny the enemy the freedom of action to attain a position of advantage (countermobility). These tasks primarily focus on support to the movement and maneuver warfighting function, to include support to special operations forces. Although normally associated with organic combat engineers, general engineers may be task-organized to support this line of engineer support. This line of engineer support does not include engineer tasks intended to support the administrative movements of personnel and materiel. Such tasks are normally intended to enable logistics.

2-8. The assure mobility line of engineer support is achieved through the assured mobility framework described in ATP 3-90.4. The assure mobility line also supports countermobility, which enables combined arms forces to operate anywhere along the range of operations. Countermobility shapes enemy movement and maneuver and prevents the enemy from gaining a position of advantage. In the offense, countermobility operations are conducted to isolate objectives and prevent the enemy from repositioning, reinforcing, and counterattacking. See ATP 3-90.8 for more information.

Support to Mobility

2-9. Engineer support to mobility includes the following primary tasks:

- Conduct combined arms breaching.
- Conduct clearing (areas and routes).
- Conduct a gap crossing.
- Construct and maintain combat roads and trails.
- Construct and maintain forward airfields and landing zones.

2-10. *Mobility* is a quality or capability of military forces which permits them to move from place to place while retaining the ability to fulfill their primary mission (JP 3-17). As described in FM 3-90-1, mobility is the key to successful operations. The primary purpose for mobility is to mitigate the effects of natural and man-made obstacles and to enable friendly forces to move and maneuver freely. Mobility tasks include bypassing, reducing, or clearing obstacles (including gaps) and marking lanes and trails to enable friendly forces to move and maneuver freely. These tasks frequently occur under conditions that require combat engineer units and most frequently occur when conducted at the tactical level in support of maneuver. Support to early-entry operations includes reconnaissance that would mitigate anti-access and area-denial mechanisms to clear and open APOD and SPOD. These tasks are often considered combat engineering tasks, even though general engineer units can perform them when the conditions allow.

2-11. Engineer tasks to repair, maintain, or build roads, bridges, and airfields usually do not occur under conditions that require combat engineer units. As a result, these tasks are often considered general engineering tasks, even though combat engineer units can perform them if they are provided additional training and augmentation. Combat engineers can perform these tasks if performed under conditions of close support to maneuver forces that are in close combat.

2-12. Engineer contributions to the planning of mobility occur at all levels of war and throughout decisive action. The execution of engineer tasks in support of mobility usually occurs at the operational and tactical levels of war, but it often has strategic-level implications. At the tactical level of war, combat engineer units are frequently required, especially in offensive and defensive operations. At the operational level, engineer tasks are typically performed by general engineer units. During the conduct of offensive and defensive operations, engineer tasks are focused on the mobility of friendly forces. In stability and DSCA, engineer tasks are often focused on the mobility of the first responders and the population.

2-13. Engineer tasks that support mobility typically support the assure mobility line of engineer support, but they may also support the other three lines. Similarly, a road constructed for an LOC has the purpose of enabling sustainment. Likewise, a bridge might be constructed to develop infrastructure, allowing the local population to transport goods to the market. Engineers perform these tasks most frequently as part of the movement and maneuver warfighting function, but they may perform them in support of the other warfighting functions. Combat engineering is typically focused on mobility at the tactical level, while general engineering is typically focused on mobility at the operational level (although general engineering may impact strategic mobility at times).

2-14. Mobility tasks are typically identified as essential tasks and may require integration into the synchronization matrix to account for the assets and the time required to implement them. See chapter 3 for a discussion of planning considerations for M/CM/S.

Support to Countermobility

2-15. Engineer support to countermobility includes the following engineer tasks:

- Siting obstacles.
- Constructing, emplacing, or detonating obstacles.
- Marking, reporting, and recording obstacles.
- Maintaining obstacle integration.

2-16. *Countermobility operations* are those combined arms activities that use or enhance the effects of natural and man-made obstacles to deny enemy freedom of movement and maneuver (ATP 3-90.8). The primary purpose of countermobility is to slow or divert the enemy, increase the time for target acquisition, and increase weapon effectiveness. The advent of rapidly emplaced, remotely controlled, networked munitions enables engineers to conduct an effective countermobility operation as part of the offense, defense, or stability operation and during the transitions among these operations.

2-17. Countermobility tasks typically involve engineers and must always include proper obstacle integration with the maneuver plan, adherence to the obstacle emplacement authority, and rigid obstacle control. The engineer advises the commander on how to integrate the obstacle, coordinates for the obstacle emplacement authority, establishes obstacle control, recommends directed obstacles, supervises the employment of obstacles, and maintains obstacle status throughout the operation. Most obstacles have the potential to deny the freedom of maneuver to friendly and enemy forces. Therefore, it is critical that the engineer accurately understands the countermobility capabilities and limitations of the available engineer forces and properly weighs the risks of employing various obstacle types. The engineer must also plan for the clearing of obstacles at the cessation of hostilities and for minimizing obstacle effects on noncombatants and the environment.

2-18. The engineer tasks that support countermobility operations include those that construct, emplace, or detonate obstacles and those that track, repair, and protect obstacles. Combat engineer tasks are performed by engineers in close support to land combat forces. These conditions frequently occur when the tasks are conducted at the tactical level as part of the offense or defense. They are often considered combat engineering tasks, even though general engineer units can perform them when the conditions allow.

2-19. The effects of natural and man-made obstacles are considered during planning at every level of war. At the tactical level of war, combat engineers play a prominent role in assessing and predicting the effects and integration of tactical obstacles in support of offensive and defensive operations. General engineers may also be involved in countermobility operations intended to achieve operational (or strategic) effects. Countermobility operations typically reinforce the terrain to block, fix, turn, or disrupt the enemy's ability to move or maneuver, giving the commander opportunities to exploit enemy vulnerabilities or react effectively to enemy actions. In stability, countermobility tasks may support missions such as traffic or population control. See ATP 3-90.8 for information on countermobility.

2-20. Engineers usually perform these tasks under the first two lines of engineer support (assure mobility and enhance protection), although they may also be applicable in selected cases for the other two lines of engineer support. These tasks typically support the movement and maneuver and protection warfighting functions.

2-21. As of 1 January 2011, U.S. forces are no longer authorized to employ persistent and undetectable land mines (land mines that are not self-destructing or self-deactivating). The current U.S. land mine policy acknowledges the importance of protecting noncombatants while enabling legitimate operational requirements. The United States employs self-destructing and self-deactivating mines (scatterable mines) to provide countermobility for the force. Additionally, newly developed weapon systems (called networked munitions) provide the flexible and adaptive countermobility and survivability capability required by the Army. Networked munitions are remote-controlled, ground-emplaced weapon systems that provide lethal and nonlethal effects; they have the ability to be turned on and off from a distance and can be recovered for multiple employments.

Other Tasks Associated with Assure Mobility

2-22. Geospatial engineering provides the necessary geospatial information and products to help combat and general engineers visualize the terrain and perform tasks along the assure mobility line of engineer support. Geospatial information is the foundation upon which information about the physical environment is referenced to form the COP. (See ATP 3-34.80 for additional information.) Geospatial information that is timely, accurate, and relevant is a critical enabler throughout the orders process. Geospatial engineers work as staff members to aid in the analysis of the meaning of activities and significantly contribute to the anticipating, estimating, and warning of possible future events. They provide the foundation for developing shared situational understanding, improving the understanding of capabilities and limitations for friendly forces (and the enemy), and highlighting other conditions of the OE. Geospatial engineers must possess a thorough understanding of tactics and the application of combat power to tailor geospatial information to support the commander's visualization and decision making. Geospatial engineers provide the following to the assure mobility line of engineer support:

- 3-D perspective fly-through views.
- Mobility corridor and combined obstacle overlays to identify assembly areas, plan air and ground missions, and develop EAs.
- Fields-of-fire and line-of-sight analysis products to locate defensible terrain, identify potential EAs, and position fighting systems to allow mutually supporting fires.
- Urban tactical planners that display key aspects of urban terrain in thematic layers overlaid on high-resolution imagery or maps to facilitate mission planning in urban areas.
- Hydrologic, bathymetric, and gravimetric data analysis to determine soil conditions on land and underwater and to verify the depth of the ocean or lake floors in support of surface and subsurface mobility within the AO.
- LOC analysis and overlays to identify structures (roads, airfields, railroads, bridges, tunnels, ferries) capable of facilitating the transportation of people, goods, vehicles, and equipment.

2-23. The engineer diving detachment provides equipment and personnel to conduct underwater operations. The diver's unique skills provide critical support to commanders during river-crossing operations by conducting nearshore and far-shore reconnaissance; performing hydrographic surveys to depict bottom composition; conducting underwater and surface reconnaissance of bridges to determine structural integrity and capacity; repairing or reinforcing bridge structures; and emplacing, marking, or reducing underwater obstacles. See ATP 3-34.84 and TM 3-34.84 for additional information.

2-24. Engineer reconnaissance teams may operate independently, but they normally support BCT, cavalry squadrons, or scout platoons to classify routes, locate obstacles, and determine how to overcome the effects of obstacles by recommending bypass or reduction. Engineer reconnaissance teams also conduct the reconnaissance of proposed obstacle placement locations and ensure that obstacles remain integrated with the maneuver plan. All terrain, obstacle, and reconnoitered data collected is submitted to geospatial engineers for updating the unit COP and for inclusion in the TGD. See ATP 3-34.81 for more information on engineer reconnaissance tasks.

2-25. EOCA are combat engineers trained to defeat explosive hazards. They can perform limited identification and disposal of unexploded ordnance in support of mobility.

ENHANCE PROTECTION

2-26. The enhance protection line of engineer support is the combination of the three engineer disciplines to support the preservation of the force so that the commander can apply maximum combat power. This line of engineer support consists largely of survivability operations, but it can also include selected mobility tasks (such as the construction of perimeter roads), countermobility tasks (such as the emplacement of protective obstacles), and explosive-hazards operations tasks. It also includes survivability and other protection tasks performed or supported by engineers. See ADP 3-37 and ATP 3-37.34 for additional information.

Support to Survivability

2-27. Engineer support to survivability consists of the following areas:

- Fighting positions.
- Protective positions.
- Hardened facilities.
- Camouflage and concealment.

2-28. Survivability operations—those military activities that alter the physical environment to provide or improve cover, concealment, and camouflage—are used to enhance survivability when existing terrain features offer insufficient cover and concealment. This is one of the tasks under the protection warfighting function found in ADP 3-37. Engineers employ capabilities from the three engineer disciplines to support survivability operations. Engineer support to survivability operations is most often aligned with the enhance protection line of engineer support.

2-29. Although units conduct survivability operations within capability limits, engineers have a broad range of diverse capabilities that can enhance survivability. Engineer tasks in support of survivability operations include tasks to build, repair, or maintain fighting and protective positions and to harden, conceal, or camouflage roads, bridges, airfields, and other structures and facilities. These tasks tend to be equipment-intensive and may require the use of equipment timelines to optimize the use of low-density, critical equipment.

2-30. Engineer tasks that support survivability operations occur predominately at the operational and tactical levels of war. At the tactical level of war, they often occur in support to maneuver and special operations forces that are in close combat, which require combat engineer units. This often occurs for tasks to build, repair, or maintain fighting and protective positions. Those tasks are often considered combat engineering tasks, even though general engineer units can perform them when the conditions allow. At the operational level, engineer tasks that support survivability operations are typically performed by general engineer units. In the offense and defense, they are focused on the protection of friendly forces, but during the conduct of stability and DSCA, they sometimes focus on the protection of the population or civilian assets. See ATP 3-37.34 for additional information about survivability operations.

2-31. Engineers enhance the survivability of forces, in part, by maintaining the tempo of the offense. Engineer mobility efforts and counter-obstacle operations assist in synchronizing the offense by preventing a loss of momentum or an incomplete commitment of forces. Engineer digging assets provide survivability to key systems or units during operational halts or when transitioning to the defense. Because they have distinct appearances and uses, engineer assets can assist in deception operations. For example, moving bridge trucks to various river-crossing sites can deceive the enemy about the actual crossing location. The ability to

mass combat power and conduct continuous offensive operations for an extended time is key to the success of the offense. General engineering focuses on the requirements to sustain operations and ensure that commanders can commit follow-on forces decisively. Besides maintaining LOCs, engineers—

- Develop or improve transportation nodes (airfields, ports, railroad terminals).
- Manage real estate.
- Provide and operate large-scale power-generation capabilities.
- Find and drill for water.
- Perform vertical and horizontal construction in support of the theater.
- Validate and disseminate current geospatial information.

Other Tasks

2-32. Engineers also enhance protection through the execution of countering explosive hazards tasks. See ATP 3-34.20 for more information about countering explosive hazards. These include area and route clearance; specialized searches using engineer mine-detection dogs and patrol explosive-detection dogs; and the collection, analysis, and dissemination of explosive hazards information. These tasks mitigate the effects of explosive hazards and can be performed by engineers at all echelons or by specialized units (explosive-hazards teams, area clearance platoons). Where the tactical situation permits, area clearance is accomplished by a USACE-contracted capability.

2-33. Engineers who are trained by EOD trained personnel and have explosive ordnance clearance experience not only play a vital role in the assure mobility line of engineer support, but are also equally vital for the enhance protection line of engineer support. EOCA trained personnel advise the on-scene commander on recommended personnel and equipment protective measures and isolate blast and fragmentation danger areas within the AO. EOCA trained personnel may assist EOD personnel in disposing of explosive hazards.

2-34. Engineer mobility and countermobility tasks typically support the assure mobility line of engineer support, but they may also support the enhance protection line of engineer support. Examples include constructing a trail for use as a perimeter road to secure a base and providing protective obstacles or entry control points for the protection of base camps. See ADP 3-37 for additional information.

2-35. Engineer divers enhance protection through force protection dives by identifying and removing underwater hazards. Engineer divers improve underwater security measures by checking for the enemy tampering of ships, docks, piers, intakes, and other marine facilities. Engineer divers are trained in explosives and can identify and remove explosive hazards through sympathetic detonation. Planners and senior staffs should be aware of diver capabilities and integrate them into early-entry operations.

2-36. Firefighting teams are limited assets that provide fire prevention and fire protection services. Some of the key protection tasks provided to commanders are fire prevention inspections and investigations, fire suppression, search and rescue, and hazardous material response. Additionally, these teams provide medical response and assistance to victims and offer technical oversight of nonfirefighting personnel when supporting firefighting operations.

2-37. Other specialized engineer support teams can be embedded at the tactical level to conduct baseline surveys and environmental assessments that enhance protection. These teams identify potential hazards before force projection or base and base camp establishment. See ATP 3-34.5 for additional information on environmental considerations.

Enable Force Projection and Logistics

2-38. Tasks in the enable force projection and logistics line of engineer support free combat engineers to support maneuver forces, establish and maintain the infrastructure necessary to support follow-on forces, and sustain military operations to enable force projection and logistics to continue after hostile action and to provide recommendations for the site selection of facilities, joint fires, and protection. Engineers combine capabilities from the three engineer disciplines to enable force projection and logistics. Primarily through the general engineering discipline, these capabilities are applied to enhance strategic through tactical movements. Tasks in this line of engineer support sustain military operations in-theater.

Tasks That Support Enable Force Projection and Logistics

2-39. The engineer-focused tasks are typically performed by engineer units or commercial contract construction management assets, such as USACE (FFE and districts), for specialized and reachback support. They can be performed by a combination of joint engineer units, civilian contractors, and HN forces or multinational engineers. They may also require that various types of technical and tactical reconnaissance and assessments be performed before or early on in a particular mission. This may include countermobility, site selection, master planning, support to disaster preparedness planning response, and support to consequence management. See ATP 3-34.81 for additional information.

2-40. Geospatial engineers can provide geospatial products to enable terrain visualization and situational understanding to support operations. This provides early-entry forces with terrain information and analysis on landing sites, movement corridors, AAs, and follow-on objectives, just as it provides follow-on forces information on potential locations of bases and base camps for initial operations.

2-41. Combat engineers can provide support that enables force projection and logistics by conducting reconnaissance and clearance tasks. Combat engineers conduct route reconnaissance to determine trafficability and route classification within an AO. These engineers also detect and mark explosive hazards and can clear the hazards that are within capability to ensure the freedom of movement along LOCs, APODs, and SPODs.

2-42. Engineer personnel augment sustainment units to support joint logistics over the shore to assist planning efforts. Engineer personnel prepare access routes to and from the beach when port facilities are unavailable, damaged, or denied; and they prepare landing sites and staging areas.

Other Tasks That Enable Force Projection and Logistics

2-43. These tasks are primarily general engineering tasks that are not normally performed under conditions of support to maneuver forces that are in close combat. (See ATP 3-34.40 for additional information.) These tasks include—

- Constructing and maintaining strategic and operational LOCs, airfields, seaports, railroads, bases and base camps, pipelines, bulk and distribution storage facilities, and standard and nonstandard bridges.
- Providing facilities engineer support.
  - Mobile electrical power.
  - Utilities and waste management.
  - Real estate acquisition, management, remediation, and disposition.
  - Firefighting.
- Conducting battle damage repair.
- Conducting baseline surveys and environmental assessments.
- Improving fighting and protective positions and hardening facilities.
- Providing prime power.
- Providing Corps of Engineers real estate teams.
- Providing engineer divers.
- Neutralizing water-borne obstacles that block shipping channels in port and other navigable waterways.
- Repairing or reinforcing damaged subsurface structures as port facilities, dams, and bridges.
- Conducting search and recovery to locate and salvage submerged equipment, supplies, and personnel.
- Providing support to joint logistics over-the-shore operations.

BUILD PARTNER CAPACITY AND DEVELOP INFRASTRUCTURE

2-44. Engineers combine capabilities from across the three disciplines to support the build partner capacity and develop the infrastructure line of engineer support, which are vital to stability and counterinsurgency

tasks that do not align with a specific phase of operations. This line consists primarily of building, repairing, and maintaining various infrastructure facilities; providing essential services; and, ultimately, building partner capacity to codevelop HN capabilities to perform such tasks. Linkages to stability are predominant in this line. Most infrastructure development takes place during shape, deter, stabilize, and enable civil authority. It is often a series of technical tasks (build a road, build a water treatment facility) that fall under different sectors (electricity, road and rail transportation, water supply and sanitation, water treatment and sewage).

Tasks That Support Build Partner Capacity and Develop Infrastructure

2-45. This line of engineer support consists primarily of general engineering tasks. Many of the tasks that support this line of engineer support are the general engineering tasks listed previously in the enable logistics line of engineer support. However, the key differences from the enable logistics line of engineer support are the purpose and the desired effect. The primary purpose of the tasks in the build partner capacity and develop infrastructure line of engineer support is to support the commander in improving the conditions for HN leaders, institutions, and infrastructure development capabilities and in influencing them to achieve military objectives for self-defense.

2-46. The different purposes of build partner capacity and develop infrastructure to enable force projection and logistics significantly change the manner in which a task is executed in most cases. For example, building a road could be a task for the enable force projection and logistics line of engineer support or the build partner capacity and develop infrastructure line of engineer support. While the completed road may be the same, the conditions and requirements to build it may be very different due to its intended purpose. If the road is being built to improve the local economic conditions, using local labor to increase employment may be more important than just completing the work in the quickest manner possible. Additionally, a road for the local populace may require coordination with many different local agencies, organizations, and ministries to support the local government and assist them in establishing legitimacy. Engineers may be required to provide technical training to HN managers on engineer tasks for planning, designing, and constructing roads. The interaction with the population during the process of building the road may take priority over the quality and speed of completion of the road itself.

2-47. Included in the build partner capacity and develop infrastructure line of engineer support is the engineer role in capacity building. (See FM 3-07 for additional information on building partner capacity.) Engineers may support the United States Agency for International Development, the State Department, and special operations forces to improve HN infrastructure and the human or intellectual capacity to sustain the sector over time. Tasks to improve HN infrastructure require coordination with local- or national-level government agencies or ministries that maintain or control infrastructure. The tasks may emphasize the development of local technical and engineering institutions. Engineers may be required to train, educate, and develop local leaders, engineers, and organizations in the process of executing a task in this line of engineer support. For example, an engineer unit that is assisting the local populace in improving drinking water systems may also train the local public works to operate and maintain the system.

2-48. While engineers at all echelons build partner capacity requirements, USACE FFE units have additional expertise to advise and assist HN capacity building that spurs long-term relationships. Engineers supporting BCTs may build partner capacity by providing training teams and reconstruction teams, sharing institutional knowledge, and conducting key leader engagements.

Other Tasks That Build Partner Capacity and Develop Infrastructure

2-49. General and geospatial engineers contribute to the build partner capacity and develop infrastructure line of engineer support because geospatial engineers and other USACE experts can provide technical advice and assistance. Specialized units can locate and map water sources. Well-drilling teams are limited assets that can be applied to solve long-term water restoration issues.

2-50. Engineers in all of the disciplines may support tasks that build partner capacity and develop infrastructure by participating in foreign exchange programs and attending conferences. Participation in joint exercises is another opportunity that allows engineers to exchange information, build relationships, and develop infrastructure simultaneously.

ENGINEER SUPPORT TO WARFIGHTING FUNCTIONS

2-51. Unified land operations require the continuous generation and application of combat power, often for protracted periods. *Combat power* is the total means of destructive, constructive, and information capabilities that a military unit and formation can apply at a given time (ADP 3-0). Army forces (ARFOR) generate combat power by converting potential into effective action. (See ADP 3-0 for additional information on warfighting functions.) There are eight elements of combat power—leadership, information, C2, movement and maneuver, intelligence, fires, sustainment, and protection. Leadership and information also multiply the effects of the other six elements of combat power—C2, movement and maneuver, intelligence, fires, sustainment, and protection. These six elements of combat power are collectively described as the warfighting functions. In unified land operations, ARFOR combine the elements of combat power to defeat the enemy and master each situation.

2-52. The engineer disciplines are well-suited to provide engineer support for special operations—from an advisory role to augmentation support. Engineering capabilities are scalable and can be tailored to provide horizontal and vertical construction capabilities to improve austere conditions. Because special operations forces tend to deploy into smaller formations, engineers provide support through the supervision of HN contractors and laborers.

2-53. Engineer support contributes significant combat power (lethal and nonlethal) to unified land operations. To effectively support the combined arms team, engineering capabilities are organized by the engineer disciplines and synchronized in the application through the warfighting functions. These warfighting functions also provide the framework for engineer tasks in the Army universal task list.

2-54. Every unit, regardless of type, generates combat power and contributes to the operation. A variety of engineering capabilities and unit types are available to contribute to combat power. Engineer disciplines are each generally aligned in support of specific warfighting functions, although they have impact in and across the others. Figure 2-1, page 2-10, depicts these primary support relationships. For example—

- Survivability support may be provided linkages to the fires and protection warfighting functions.
- Combat engineering is aligned primarily with the movement and maneuver and protection warfighting functions.
- General engineering aligns with the sustainment warfighting function and has a secondary functional relationship with the protection warfighting functions.
- Geospatial engineering is primarily aligned with the C2 warfighting function, but it also serves as a direct liaison with the intelligence warfighting function and as a secondary functional relationship to the remaining warfighting functions.

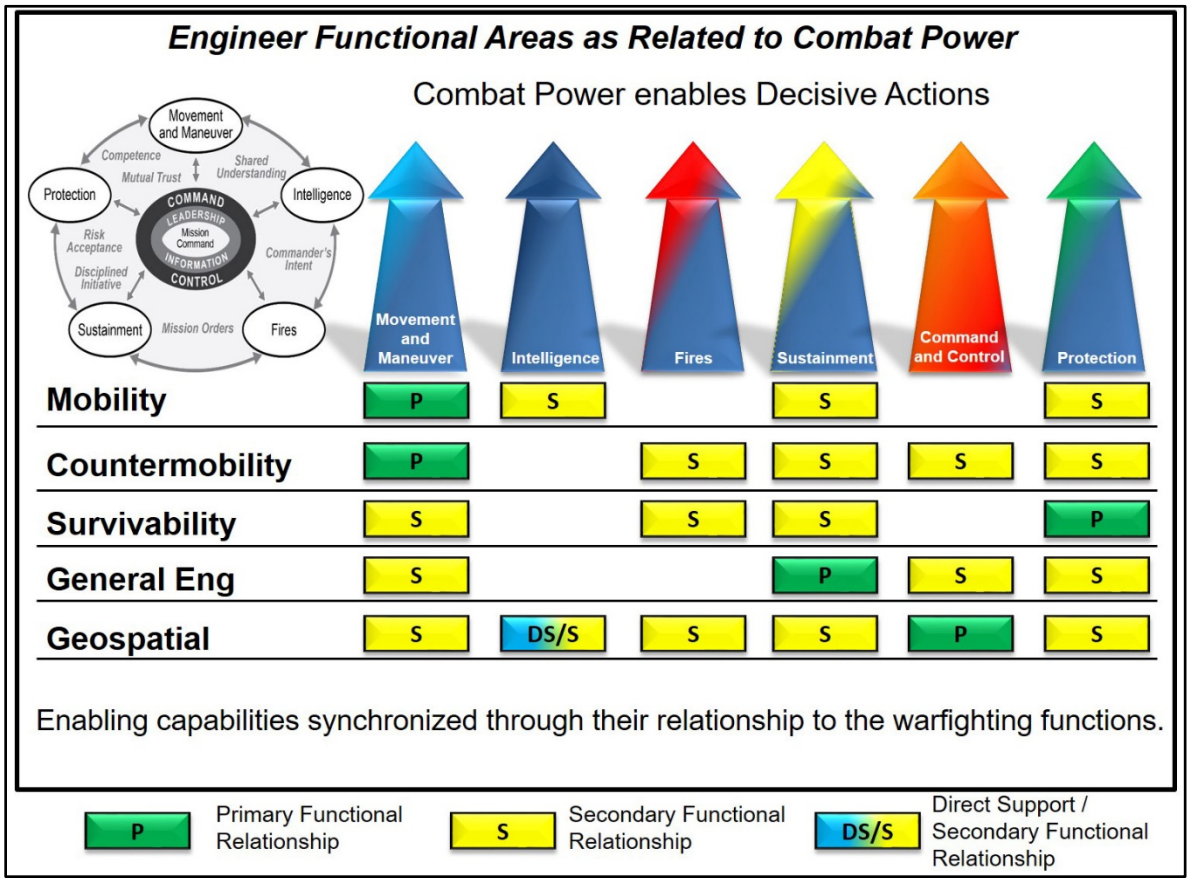

Figure 2-1. Engineer application of combat power

2-55. *Combined arms* is the synchronized and simultaneous application all elements of combat power that together achieve an effect greater than if each arm was used separately or sequentially (ADP 3-0). The warfighting functions provide engineers a common framework to link the required engineering capabilities to the synchronized application of combined arms.

COMMAND AND CONTROL

2-56. The *command and control warfighting function* is the related tasks and systems that develop and integrate those activities enabling a commander to balance the art of command and the science of control in order to integrate the other warfighting functions (ADP 3-0). It is unique in that it integrates the activities of the other warfighting functions.

2-57. Engineer units must integrate the operations process activities for the unit while interacting with the activities of the unit being supported. The interaction may be primarily through an engineer staff assigned to the supported unit or through staff counterparts. In some cases, a supported unit may not have assigned engineer staff, so the supporting unit provides support as well. This relationship and degree of interaction is determined by many factors, including the type of unit and echelon being supported and the command or support relationship established. This manual addresses the C2 of engineer forces separately from engineer staff participation in the supported commander processes.

2-58. There are typically not enough engineering capabilities available to accomplish the desired engineer tasks. Careful prioritization must occur. Even more challenging is that once they are in the AO, force-tailored engineer units must be able to rapidly transition among elements of operations.

2-59. Because the available force-tailored engineer units are designed for specific tasks, engineering capabilities must be dynamically shifted within the AO to match the requirements with the capabilities of engineer units. Transitions occur at the strategic, operational, and tactical levels; and flexibility in the task organization permits the shifting of engineering capabilities.

2-60. Control measures are essential tools designed to help engineers accomplish the mission. One such control measure is the engineer work line, which is a graphic control measure used to designate areas of work responsibility for subordinate engineer organizations. **An *engineer work line* is a coordinated boundary or phase line used to compartmentalize an area of operations to indicate where specific engineer units have primary responsibility for the engineer effort.** The engineer work line may be used at the division level to discriminate between an AO supported by division engineer assets, and an AO supported by direct or general support corps engineer units. See ATP 3-34.40 for additional information on general engineering operations.

2-61. Whether a subordinate or supporting unit, engineer unit commanders must understand and exercise the mission command approach of C2. (See ADP 6-0 for additional information about C2.) Organic units operating within assigned BCTs operate within that structure as a matter of routine. However, the augmenting units face challenges by quickly task-organizing and integrating into the receiving unit. Similarly, as units and headquarters elements are allocated to division, corps, and theater armies, those unit commanders and staffs must integrate within the receiving headquarters. The engineer headquarters provides control of ongoing engineer operations, to include monitoring engineer forces and assets, mitigating explosive hazards, coordinating engineer reconnaissance, and providing geospatial support through GI&S. This adds depth to the engineer staff capabilities within the supported or gaining headquarters. Similarly, task-organized units face challenges in quickly integrating into the distinct character of the new unit that they have been task-organized to support. A thorough understanding of, and practice with, the C2 warfighting function and the operations process that it drives enables the flexibility necessary for engineer forces to integrate into supported units. In unique cases where an engineer headquarters serves as the foundation around which a task force or JTF is formed (a disaster relief operation), it is critical for the C2 warfighting function and the operations process it drives to adhere closely to the ideal described in Army and applicable joint doctrine.

2-62. Finding ways to accomplish the mission with an appropriate mix of lethal and nonlethal actions is a paramount consideration for every Army commander. Through synchronization, commanders mass the lethal and nonlethal effects of combat power at the decisive place and time to overwhelm an enemy or dominate the situation. Engineer leaders and staff planners at each echelon play a pivotal role in ensuring the synchronization of a variety of engineering capabilities that are available to conduct or support unified land operations.

MOVEMENT AND MANEUVER

2-63. The *movement and maneuver warfighting function* is the related tasks and systems that move forces to achieve a position of advantage in relation to the enemy and other threats (ADP 3-0). Engineers support the movement and maneuver warfighting function by performing tasks associated with geospatial engineering, engineer reconnaissance, and M/CM/S. The three engineer disciplines support the movement and maneuver warfighting function. Combat engineer support applied through the movement and maneuver warfighting function is focused on assured mobility because combat engineers are trained and equipped to support forces in close combat. A BCT organic engineer unit shapes the battlefield to support early-entry operations with mobility and countermobility tasks, which enables initial lodgments and further expands lodgments to enable force projection.

Performing as Combat Engineers

2-64. Operating in close combat support to maneuver forces requires combat engineer units to be able to integrate and coordinate actions with the fire, movement, or other actions of combat forces. To do that, combat engineer units must be organized, manned, equipped, and trained differently than general engineer units that are not optimized to operate in combat conditions. For example, combat engineer units are organized similarly to infantry squads and platoons, manned with additional medical personnel, equipped with specific weapons and vehicles, and trained with supported close combat force. These requirements limit the ability of combat engineer units to perform many tasks to the same standard as general engineering units.

With additional equipment, training, and augmented technical expertise, combat engineer units can perform as general engineers, and vice versa.

Fighting as Engineers

2-65. Fighting as engineers is inherent to the primary mission of engineer units. Combat engineers are well forward because they fight alongside maneuver units as part of a combined arms team. When supporting unified land operations, engineers must be prepared to fight and employ combat skills and integrate activities with fire and maneuver. On the battlefield, the enemy makes every effort to detect and engage engineers quickly, regardless of location. In addition to the primary responsibilities within combat engineering, combat engineers are trained, organized, and equipped to fight and destroy the enemy. Combat engineers engage in close combat to accomplish engineer missions and to—

- Neutralize explosive hazards by locating, assessing, and rendering them incapable of interfering with the conduct of operations (except render-safe procedures).
- Enhance mobility by conducting route and obstacle reconnaissance, obstacle reduction, assault gap crossing, construction and repair of combat roads and trails, and forward aviation combat engineering.
- Deny the enemy the freedom of movement and maneuver (countermobility) by lethal and nonlethal means with land mines, network munitions, and demolition and constructed obstacles.
- Enhance protection through survivability operations (fighting and protective positions, hardening facilities, camouflage and concealment).

Fighting as Infantry

2-66. Throughout history, engineer organizations have been required to fight as infantry as a secondary mission. A combat engineer organization is capable of executing infantry tasks or task-organizing to fight as infantry with other combat units. When reorganized, combat engineers require additional positions normally found in maneuver formations (fire support, medical personnel). If an engineer battalion has been designated to reorganize and fight as infantry, it requires the same support and integration as maneuver units (armored, fire support) in its task organization to accomplish the mission. It may also require significant reorganization. A commander who commands combat engineers has the authority to reorganize them as infantry, unless otherwise reserved. However, a commander must carefully weigh the gain in infantry strength against the loss of engineer support.

2-67. Reorganizing engineer units as infantry requires careful consideration, and the command decision for its reorganization is normally determined at the operational-level command. Reorganization involves extensive equipment and training that are specific to the reorganization, and it must be coordinated with the higher headquarters. Employing engineers merely implies that the gaining commander employs the engineers for a short period of time. Reorganization also requires additional resources, time, and training.

2-68. An emergency or immediate requirement for infantry may not require the reorganization of engineers. Engineers may simply be required to engage in close combat. Commanders should consider this option in limited scope and task application. The commander makes a decision after weighing the mission variables; determining an acceptable risk level; and considering the resources, time, and training required to reorganize engineer units as infantry.

Executing General Engineering Tasks

2-69. General engineer support to movement and maneuver accomplishes the tasks that exceed the capability of the combat engineer force. General engineer support to movement and maneuver also accomplishes extensive upgrades or new construction of LOCs and base camps. (See ATP 3-34.40 for additional information about general engineering.) Although general engineer support is typically applied through the

sustainment warfighting function, it may include many of the following tasks that also cross over to support movement and maneuver:

- Constructing and repairing combat roads and trails that exceed the capability of combat engineer assets.
- Providing forward aviation combat engineering that exceeds the capabilities of combat engineer assets.
  - Repairing paved, asphalt, and concrete runways and airfields.
  - Conducting airfield surveys.
  - Providing firefighting and aircraft rescue services.
  - Marking airfield landing and parking surfaces.
- Constructing field-expedient landing strips for manned and unmanned aviation assets.
- Constructing standard and nonstandard bridging.
- Ensuring theater access through the construction and upgrade of LOCs, main supply routes, ports, airfields, and base camps.

INTELLIGENCE

2-70. The *intelligence warfighting function* is the related tasks and systems that facilitate understanding the enemy, terrain, civil considerations and other significant aspects of the operational environment (ADP 3-0). Engineering capabilities are employed to add to the situational understanding of the commander. Engineers play a major role during IPB supporting the G-2/battalion or brigade intelligence staff officer (S-2) and assistant chief of staff, operations (G-3)/battalion or brigade operations staff officer (S-3) analysis of terrain, weather, and civil considerations. Engineers also anticipate and provide digitized mapping and terrain analysis products. Geospatial engineering improves terrain visualization and understanding of the physical environment and provides SSGF to geospatial intelligence. During IPB, engineer staffs and planners provide a predictive and deductive analysis of enemy engineering capabilities to intelligence, provide civil infrastructure considerations for the operational variables (political, military, economic, social, information, infrastructure, physical environment, and time and strategic variables), and support the information collection plan through engineer reconnaissance. See chapter 5 for further support to IPB.

2-71. Engineer information collection is a deliberate process. The engineer information collected assists commanders in determining the feasibility of areas for use based on the aspects of the terrain. Engineer information collection may be conducted remotely or physically, but it is an essential task performed during planning. An assessment of the AO begins well before the deployment of forces, and continuous assessments ensure that accurate information is provided to the COP. Engineer information collection may include, but is not limited to, conditions and capacities that support mobility, potential sources of construction materials, local construction standards, power generation and transmission capabilities, and geotechnical data in the AO (soils, geology, and hydrography). Engineer staffs at division, corps, theater army echelon, and in-theater engineer headquarters determine engineer information requirements in an AO; and they collect and analyze engineer information in coordination with the respective G-2.

2-72. Engineer reconnaissance provides data and information that contribute to answering the commander's critical information requirements and is necessary in the lines of engineer support. (See ATP 3-34.81 for additional information on engineer reconnaissance and the engineer reconnaissance teams.) To accomplish all four lines of engineer support, engineers must designate the specialized assets available to collect the information needed to answer these requirements. Reconnaissance is inherent in the three disciplines; however, the information collected may be different and tactical or technical in nature. The engineer disciplines provide a menu of reconnaissance capabilities. These vary in linkages to warfighting function tasks. They also vary in the type and degree of tactical or technical expertise and effort. The capabilities are provided and organized by combat and general engineer units, with overarching support from geospatial means. These units do not have organized and dedicated reconnaissance elements within the structure (except for the armored BCT), but they are organized with a mix of engineer specialties, expertise, and equipment. Commanders task-organize combat and general engineers with other elements from across the engineer disciplines or warfighting functions based on the mission and situation.

2-73. Reconnaissance in support of M/CM/S is conducted primarily by engineer reconnaissance teams. Engineer reconnaissance teams are composed of combat engineers and are focused on the collection of tactical and technical information to support the BCT freedom of maneuver and survivability of friendly forces and facilities. This requires the engineer company commanders to form and train ad hoc teams for tactical reconnaissance tasks that focus on collecting technical information and performing a limited analysis.

2-74. Geospatial engineering teams apply information and services to improve the situational understanding of terrain. GI&S is the collection, information extraction, storage, dissemination, and exploitation of geodetic, geomagnetic, imagery, gravimetric, aeronautical, topographic, hydrographic, littoral, cultural, and toponymic data accurately referenced to a precise location on the Earth's surface (see JP 2-03). The Army Geospatial Center (AGC) is a reachback capability that includes instruction, training, and guidance for the use of geospatial data to enable users to access and manipulate data. Common military applications of GI&S include support to—

- Planning.
- Training.
- Geospatial intelligence planning.
  - Navigation.
  - Mission planning.
  - Mission rehearsal.
  - Modeling.
  - Simulation.
  - Targeting.

FIRES

2-75. The *fires warfighting function* is the related tasks and systems that provide collective and coordinated use of Army indirect fires, air and missile defense, and joint fires through the targeting process (ADP 3-0). Engineering capabilities significantly contribute to this warfighting function when they are used to facilitate targeting. Geospatial engineers may provide template observer and firing points based on the line of sight and the slope restrictions and may analyze the mobility and suitability of potential targets and EAs to facilitate the repositioning of artillery systems. Combat engineers may be used to shape terrain by emplacing obstacles that enhance the effect of fires, construct survivability positions for fires units, and support mobility during displacements.

2-76. Integrating engineer effects, missions, and capabilities into combined arms operations at BCT and above includes integrating the respective target or mission into the targeting process. This enables the selection and prioritization of engineer targets into the larger Army and air tasking orders. Engineer leaders on staffs must understand preplanned situational obstacle integration and how to shift family of scatterable mines systems during dynamic targeting. See ATP 3-60 for additional information on engineer tasks in the targeting process.

SUSTAINMENT

2-77. The *sustainment warfighting function* is the related tasks and systems that provide support and services to ensure the freedom of action, extend operational reach, and prolong endurance (ADP 3-0). Engineers support the sustainment warfighting function by performing tasks associated with mobility and survivability. Engineers contribute by constructing base camps, ammunition holding areas, and revetments or other types of hardening of distribution facilities and by clearing LOCs.

2-78. General engineer applications are primarily linked through a major category of tasks that provide logistics support in the sustainment warfighting function. As previously discussed, general engineering capabilities in support of combat engineer applications link across the movement and maneuver warfighting function and protection warfighting function.

2-79. During the conduct of stability and DSCA, sustainment support may shift to the establishment of services that support civilian agencies and to the normal support of U.S. forces. The conduct of stability

operations tends to be of a long duration compared to the other operations. As such, the general engineering level of effort, including support from USACE, is very high at the onset and gradually decreases as the theater matures. As the AO matures, the general engineering effort may transfer to theater or external support contracts (logistics civil augmentation program, Air Force contract augmentation program, Navy global contingency construction contract).

2-80. Operational contract support obtains and provides supplies, services, and construction labor and materiel—often providing a responsive option or enhancement to support the force. (See ATP 4-92 and ATP 4-94 for more information on the theater sustainment command and operational contract support.) General engineers provide subject matter expertise for the oversight of contracted services and materials use.

PROTECTION

2-81. The *protection warfighting function* is the related tasks and systems that preserve the force so the commander can apply maximum combat power to accomplish the mission (ADP 3-0). Engineers have unique equipment and personnel capabilities that can be used to support survivability operations and related protection tasks. Combat engineers, supported by general engineer capabilities when required, provide selected survivability operations through the protection warfighting function. (See ATP 3-37.34 for additional information on survivability operations.) Combat engineers typically provide the basic hardening and field fortification support, while general engineer support is focused on long-term survivability efforts. General engineer support is also applied through the protection warfighting function to control pollution and hazardous material and to harden facilities. Survivability operations include the following engineer tasks:

- Protecting against enemy hazards within the AO.
  - Constructing vehicle fighting positions, crew-served weapon fighting positions, or individual fighting positions.
  - Constructing protective earth walls, berms, and revetments or constructing vehicles, information systems, equipment, and material protective positions.
  - Employing protective equipment (vehicle crash barriers, entry control points, security fences).
  - Installing bridge protective devices for an existing float bridge or river-crossing site to protect against waterborne demolition teams, floating mines, or floating debris.
  - Installing or removing protective obstacles.
  - Conducting environmental assessments to identify and protect against environmental conditions.
- Conducting actions to control pollution and hazardous material. See ATP 3-34.5 for additional information on environmental pollution and hazardous materials.
- Conducting tactical firefighting. See TM 3-34.30 for additional information on firefighting.

2-82. When conducting stability and DSCA, survivability remains a key concern. Although the likelihood of combat operations is reduced, key resources and personnel remain vulnerable to other types of hostile action or attack. Commanders must consider protecting vital resources such as fuel sites, sustainment convoys, base camps, and logistics support areas because the entire AO has an equal potential for enemy attack. The priority of work for construction assets is focused more on protecting these types of resources than on constructing fighting positions for combat vehicles or crew-served weapons. Vital resources requiring survivability may also include facilities that are critical to the civil infrastructure (such as key industrial sites, pipelines, water treatment plants, and government buildings). Engineers also employ protective obstacles as a key tool in protecting these important assets and locations. Protective obstacles range from tetrahedrons and concrete barriers to networked munitions. Physical barriers provide a relatively inexpensive, inflexible survivability capability. Networked munitions, with built-in sensor capabilities and central control, provide a flexible intrusion detection and denial system.

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Chapter 3
Engineer Support to Shape, Prevent, and DSCA

Conflict prevention is primarily diplomatic actions that are taken in advance of a crisis to prevent or limit violence, deter parties, and reach an agreement short of conflict. Military operations are tailored to meet political demands and may require deploying forces to contain a dispute or prevent it from escalating into hostilities.

OPERATIONS TO SHAPE AND OPERATIONS TO PREVENT

3-1. A primary function of the theater army, in its role as the ASCC, is executing the CCDR's daily operational requirements. These activities occur during large-scale ground combat, but they also occur during operations to shape and operations to prevent. The theater army's four primary tasks occur across all phases of the joint operations construct: provide Title 10 United States Code (10 USC) administrative control of ARFOR; conduct theater security cooperation; assess and develop infrastructure; and develop concept and OPLANs. Additional tasks completed by the theater army enabling commands include conduct regional information collection and analysis, communications architecture, land-based air and missile defense, and detainee operations.

3-2. During operations to shape and operations to prevent, the theater army engineer effort typically requires more general engineering-related activities. Engineers at the theater level are one of many key enablers as the ASCC commander drives both Army design methodology and tactical concept of operations to shape conditions and achieve objectives. The ASCC designates the routes for ground forces well in advance of their intended use so that engineer units can upgrade them, as necessary, and keep them open or repaired. The ASCC makes recommendations for initial and temporary land-based lodgments.

3-3. The theater army engineer provides a focus on the relationship of the physical environment and infrastructure to the developing Army design methodology. Other relevant information gained from the engineer analysis of the OE assists the commander in framing (and reframing) the problem, formulating the design, and refining the design. Operational-level engineer concepts are synchronized with and expressed through the framework of Army design methodology, as described in ADP 5-0. Unified action partners must be considered for those tasks which Service engineers do not have the capability or capacity to perform.

3-4. Between the levels of war and theater echelons of command, the horizons for planning, preparation, and execution are vastly different. Operational-level commanders typically orchestrate the activities of military and other U.S. government organizations across large physical areas and across the range of military operations. Theater commanders seek to create the most favorable conditions possible for subordinate commanders by shaping future events. The theater army echelon maintains a broad perspective, typically considering simultaneous major operations across the range of military operations and throughout the theater. The theater army engineer views a similarly broad perspective of challenges and opportunities, considering the range of military operations from peacetime military engagement to large-scale ground combat and the various administrative and support functions required throughout the theater.

3-5. At the theater army echelon, the engineer staff uses operational art (through design methodology) to assist in translating the broad Army conceptual plan into a coherent, feasible concept for employing forces. The engineer examines the functional and multifunctional mobilization, deployment, employment, and sustainment requirements of the concept of operations. From the operational perspective, those requirements typically include RSOI, construction, real estate, and other general engineering support through the sustainment and protection warfighting functions. The operational perspective also includes initially aligning combat and general engineer capabilities to provide the most favorable outcomes for each subordinate echelon. Geospatial information and terrain analysis provide the foundation on which understanding the

physical environment is based. Figure 3-1 shows an example of how the warfighting functions, engineer tasks, and engineer disciplines are used to organize and integrate theater echelon engineer requirements.

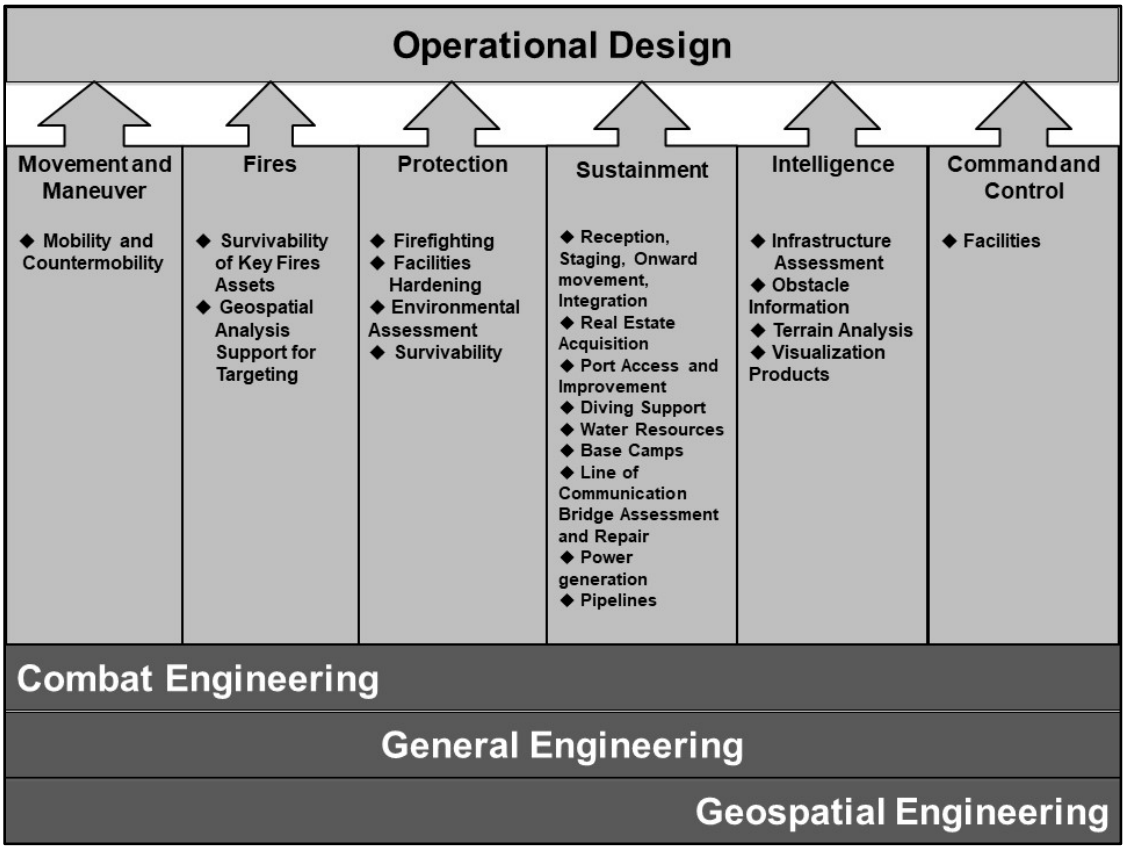


Figure 3-1. Theater-level engineer shape and prevent

3-6. Setting the theater for engineers includes establishing, maintaining, and defending bases or base clusters—from an APOD/SPOD to an intermediate staging base. Managing the basing process and individual bases spans across the basing life cycle. It ranges from considering the acquisition (and later disposal) of real estate; real property; materials; construction labor; base setup; decommissioning; and transfer back to an HN or other authority. Most of this planning and management is logistical in nature. A key part of the logistical puzzle is managing Class IV (barrier and construction material) and Class V explosives. It is important to manage these classes of supply separate from the others because they help to serve very distinct and separate purposes (base defense, infrastructure security, general force protection measures, and occasionally breaching).

3-7. Infrastructure survey teams use infrastructure assessments to prioritize the categories and parts of the infrastructure that require reexamination during the infrastructure survey. The FEST-A is capable of providing infrastructure assessment. The following are some considerations used to evaluate infrastructure operational requirements:

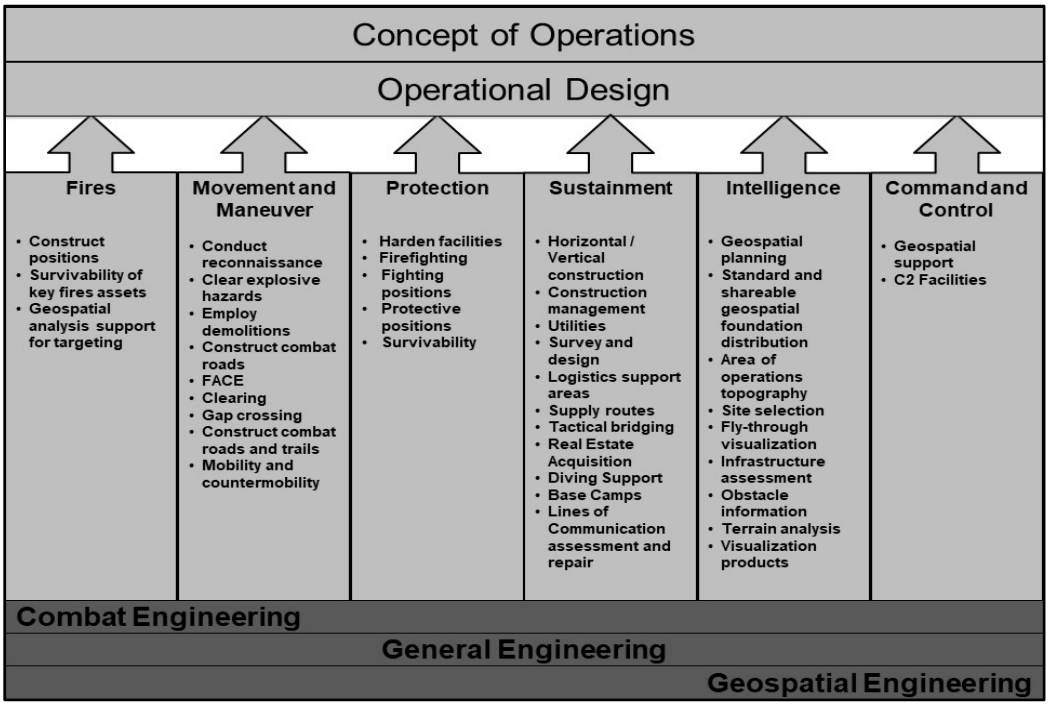
- Does existing or planned infrastructure meet the operational needs over those of the campaign phases in terms of quantity, quality, location, and force protection?
- Will infrastructure meet coalition, unified action partner, and host-nation needs over time?
- Should infrastructure be repaired, upgraded, maintained, or newly constructed?
- What are the infrastructure defense and protection needs over time, by type and scalability?
- Is any part of the infrastructure on the critical asset list, defended asset list, or protection prioritization list?

CORPS ENGINEER ECHELON

3-8. The corps headquarters is organized, trained, and equipped to serve as the Army force in major operations and campaigns (with command of two or more Army divisions) with supporting theater-level organizations across the range of military operations. As the Army force for the joint force commander (JFC), the corps serves as an operational-level headquarters conducting land operations as the Service component. The corps normally has one expeditionary sustainment command and one medical brigade (support). Other theater-level assets are attached, as required. The C2 capabilities organic to the corps allow it to adapt to operational- or tactical-level roles, depending on the CCDR's requirements.

3-9. With minimum joint augmentation, the corps can function as a JTF or joint force land component command (JFLCC) for small-scale contingencies. When a corps is a JTF or JFLCC, a TEC's deployable CP or engineer brigade can be assigned as the senior engineer organization. The corps can also serve as a deployable base for a multinational headquarters directing protracted operations. The corps' flexibility allows the Army to meet the needs of JFCs for an intermediate land command while maintaining a set of headquarters for contingencies. It provides a capability that views challenges and opportunities associated with the operational approach and concentrates on the substance and shape of required tactical actions.

3-10. An example of engineers supporting a theater is the USACE—Pacific Ocean Division (headquartered in Hawaii) being a critical enabler to help set the theater in support of the United States Army Pacific Command and the United States Indo-Pacific Command. The USACE—Pacific Ocean Division focuses more heavily toward supporting set the theater construction, though it also supports basing and infrastructure. The Pacific Ocean Division designs and constructs facilities for the Army and Air Force in Alaska and Hawaii and for all Department of Defense agencies in Kwajalein Atoll (in the Republic of the Marshall Islands). In support of the United States Indo-Pacific Command (USINDOPACOM) strategy, it designs and constructs facilities for all U.S. forces in Korea and Japan. Figure 3-2 shows an example of tasks upon which the corps echelon engineer builds as a foundation of operational requirements while detailing tactical-level requirements for a contingency.



Legend:

C2	command and control
FACE	forward aviation combat engineering

Figure 3-2. Corps design considerations

ENGINEER SUPPORT TO DIVISION AND BELOW OPERATIONS

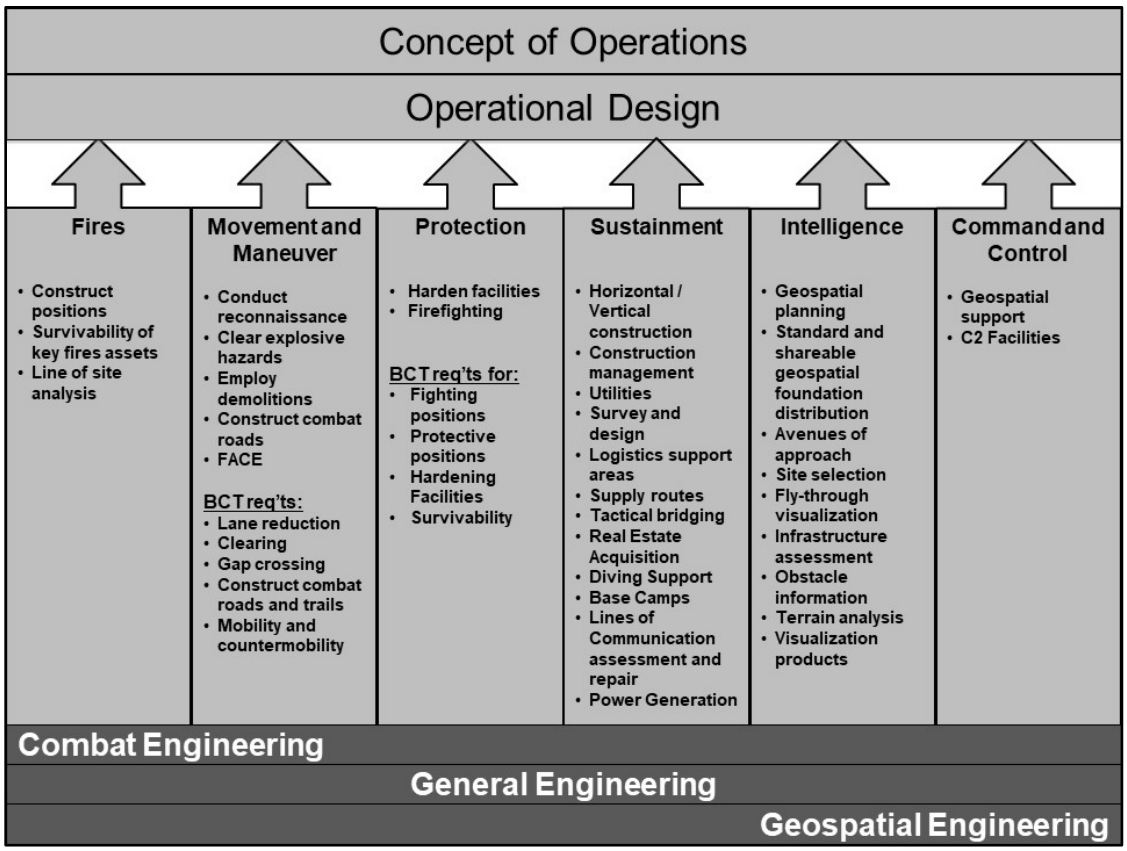
3-11. The division is the Army's primary tactical warfighting headquarters. Its primary role is to serve as a tactical headquarters exercising C2 of BCTs and supporting brigades in decisive action. Depending on mission, enemy, terrain and weather, troops and support available–time available and civil considerations, it commands up to five BCTs and a mix of functional brigades. The division combines offensive, defensive, stability, or DSCA operations in an AO assigned by its higher headquarters, normally a corps. It task-organizes its subordinate forces according to mission variables to accomplish its assigned mission.

3-12. With staff augmentation, the division headquarters may serve as a joint force land component headquarters in a smaller-scale contingency or as an ARFOR headquarters (primarily for operational tasks) in smaller-scale contingencies without additional Army augmentation. With extensive augmentation, it may serve as a JTF for a small-scale contingency. When serving as the ARFOR, JFLCC, or JTF, the division is primarily concerned with the conduct of operational tasks. The theater army provides most of the administrative control and Army support to forces deployed in the joint operations area (JOA)

3-13. Joint manning documents determine other Service officer and noncommissioned officer augmentation that the division staff requires to perform duties as a JTF or JFLCC headquarters. When serving as a JTF headquarters, the division headquarters organizes and operates in accordance with joint doctrine. (See JP 3-31 for more doctrine on the JFLCC, and see JP 3-33 for more doctrine on the JTF.) When conducting operations, the division synchronizes and integrates warfighting functions primarily from the tactical-level perspective.

3-14. At the division echelon, the engineer staff officer and other engineer staff assist in understanding and translating the Army design methodology into a division concept of operations. The division engineer staff analyzes the operation and begins to concentrate on courses of action (COAs) for arranging forces in relation to each other and employing combat power to accomplish the mission. Just as corps echelon engineers validate analysis supporting the operational echelon engineer design, the divisional engineer analysis adds detail or offers new information for operational consideration. Ultimately, as operational-level engineers refine and address requirements at their echelon, the division echelon engineers gain understanding of the operational requirements that must be included in the conduct of division operations. Division echelon engineers concentrate on the substantial development of engineering requirements and capabilities necessary to the division concept of operation. The divisional engineer analysis is operationally broad enough to include general and geospatial engineering support not included in the Army design methodology. The analysis is more comprehensive and detailed in considering and shaping combat, general, and geospatial engineering requirements for arranging and employing divisional forces. Figure 3-3 shows an example of how the division echelon engineer integrates tactical engineer actions (shown in the preceding paragraphs as the top-most set of tasks, resting on the foundation from theater and corps echelons in the illustration) through warfighting functions to support the division concept of operations.

3-15. Operational echelon commanders seek to create the most favorable conditions possible for the employment of divisions. The division meets the needs of JFCs by enabling the tactical command to be capable of translating designs into concepts and decisions into actions. It synchronizes forces and warfighting functions in time, space, and purpose to accomplish missions. The division perspective is substantially shaped by the operational approach described by the theater and is focused on the tactical actions inferred from that approach. The division echelon engineer perspective similarly includes a solid operational foundation from which to focus on the detailed tactical level requirements for shape and prevent activities (see figure 3-3).



Legend:

BCT	brigade combat team
C2	command and control
FACE	forward aviation combat engineering

Figure 3-3. Division design perspective

3-16. Engineers at the division and below focus on effective leader development. Training and leader development form the cornerstone of operational readiness and they are part of Army operations to shape. The priority focus for engineer forces not committed to specific CCDR requirements is building and sustaining readiness to conduct large-scale combat. Units, leaders, and Soldiers achieve the tactical and technical competence that builds mutual trust, esprit de corps, and adaptability by overcoming challenges through realistic training. Combat training centers facilitate training and leader development and that of unified action partners.

3-17. Operational planning and contingency training exercises facilitate understanding of engineer perspectives of OEs. A complete understanding of an OE may be hindered if the focus is solely on adversary information and actions. Additional information collection with a focus on area access/area denial is often required for and is key to enabling division freedom of mobility. People and populations within a region can present significant security and countermobility challenges. Operations to shape are accomplished through a variety of missions, tasks, and actions, and they are often focused toward understanding, engaging, influencing, changing, or countering human perceptions. From an engineering perspective, this is executed through engineering partnerships that improve LOCs, APOD/SPOD, local population, and engineering expertise. This requires study and analysis to ensure that the right decisions and actions are taken at the right time to get positive outcomes. The complexity of the human aspects of conflict are dynamic. Therefore, operations to shape must be ongoing, consistently maintain positive engagements, and be flexible enough to adjust to changing political conditions.

BRIGADE COMBAT TEAM ENGINEER ECHELON

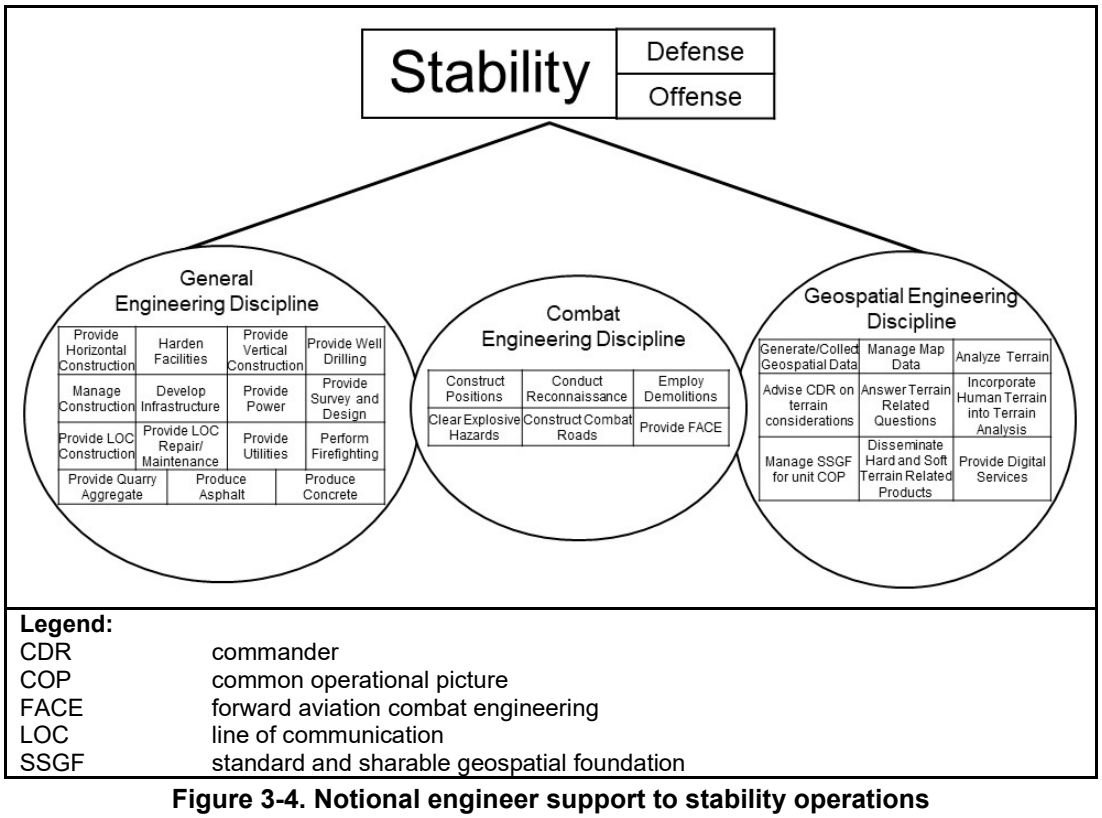
3-18. The BEB commander is the brigade engineer in the BCT. The BEB commander advises the maneuver commander on how best to employ combat, general, and geospatial engineering capabilities in support of decisive action. The brigade engineer integrates engineers into the brigade planning process and coordinates engineer activities in the brigade area. The BEB is typically responsible for all engineer units assigned or attached to the brigade or for those working in the brigade AO. The BEB also provides organic engineer, military intelligence, signal, planning, and execution capabilities to the BCT.

3-19. Brigade and below engineer support to operations that shape and prevent typically includes the state partnership program, infrastructure repair, restoration to reconstruct, and the establishment of services that support the population. Home station training enhances BEB personnel skills in areas that are normally instructed as USACE-provided specialized training. This training includes reconnaissance tools, tele-engineering communications equipment, and the Joint Construction Management System facilitate shape and prevent tasks by enhancing standardized construction practices.

STABILITY OPERATIONS

3-20. Stability operations consist of six primary tasks—establish civil security, support civil control, restore essential services, support to governance, support to economic and infrastructure development, and conduct security cooperation. The primary tasks are discussed in detail in ADP 3-07.

3-21. Engineer support to stability operations includes the simultaneous application of combat, general, and geospatial engineering capabilities through synchronizing warfighting functions and throughout the depth of the AO. General engineering support for the restoration of essential services and infrastructure development is the primary engineer focus in stability; however, the three disciplines are applied simultaneously to some degree. Figure 3-4 shows a notional application of engineering capabilities providing support to stability. The participation of engineer institutional force elements (USACE tasks provided during stability tasks) are significant and typically realized as general or geospatial engineering support.



Legend:

CDR	commander
COP	common operational picture
FACE	forward aviation combat engineering
LOC	line of communication
SSGF	standard and sharable geospatial foundation

Figure 3-4. Notional engineer support to stability operations

3-22. Often, stability operations are required to meet the critical needs of the populace. Engineer forces may be critical enablers in the provision of essential services until the HN government or other agencies can provide essential services. Engineer tasks primarily focus on establishing or reconstructing infrastructure to provide essential services that support the population. The effort is typically conducted in conjunction with civilian agencies and other engineer support of U.S. forces. The support for infrastructure development may be extended to assist the HN in developing capability and capacity. Essential services for engineer consideration include food and water, emergency shelter, and basic sanitation (sewage and waste disposal). Engineer stability tasks are similar to those required during DSCA, except that engineer stability tasks are conducted overseas. Engineer DSCA tasks include—

- Constructing and repairing rudimentary surface transportation systems, basic sanitation facilities, and rudimentary public facilities and utilities.
- Detecting and assessing water sources and drilling water wells.
- Constructing feeding centers.
- Providing environmental assessments and technical advice.
- Constructing waste treatment and disposal facilities.
- Providing base and base camp construction and power generation.
- Conducting infrastructure reconnaissance, technical assistance, and damage assessments.
- Conducting emergency demolitions.
- Conducting debris- or route-clearing operations.

3-23. Engineer support to stability operations may include the typical integration with, and support for, combined arms forces in their missions. Combat engineer route clearance and other close support capabilities may be critical tasks that are applied through the movement and maneuver warfighting function. Geospatial engineer support continues to provide SSGF that supports the COP. General engineer support may be required for the sustainment and protection requirements of the force. However, during stability, a focus of the engineer effort is likely to be the general engineering capabilities applied to restore essential services and support infrastructure development.

3-24. Many of the technical capabilities only found in the institutional force are essential to providing engineer reachback. Many of the engineer capabilities sought are provided through for specialized expertise and capabilities only available through reachback or forward USACE contingency element. Stability operations tend to be of a long duration compared to the other unified land operations. As such, the general engineering level of effort is very high at the onset and it gradually decreases as the theater matures; support is required to some degree for the duration of stability. Preparation activities include the identification of significant infrastructure and base development construction projects and the nomination of those projects for funding. The highest priority projects may be executed using military general engineer capabilities, while others may compete for contingency funding and execution through a contract capability. As the AO matures, the general engineering effort in support of sustainment requirements may transfer to theater or external support contracts (logistics civil augmentation program, Air Force contract augmentation program, Navy global contingency construction contract).

3-25. Engineer support may be critical to civil affairs activities, enabling the relationship of military forces with the civil component of the OE, including inter-governmental agencies, nongovernmental organizations, the interagency, indigenous populations and institutions, and the private sector. Similarly, engineering capabilities may be applied to provide specific construction and other technical support integrated within the commander's plan. Integration occurs throughout the operations process, and it is facilitated by coordination between the engineer staff officer and civil affairs staff at the civil-military operations center.

3-26. Preparing for stability operations may be more difficult than preparing for combat operations because of the technical nature of the requirements and the broad range of potential engineer missions associated with them. An early, on-the-ground assessment can be critical to tailor the engineer force with required specialties and engineer resources. The results of this assessment are passed to planners to ensure that an adequate engineer

force arrives in the AO in a timely manner. This early, on-the-ground engineer reconnaissance and associated assessment or survey identify the—

- Status of the infrastructure in the AO (airfields, roads, ports, logistics bases, troop bed-down facilities); real estate acquisition; environmental standards, conditions, and considerations; construction material supply; construction management; and line-haul requirements.
- Status of theater- and situation-specific protection requirements.
- Availability of existing geospatial products and requirements for new terrain visualization products.
- Requirements for specialized engineer support (prime power, well drilling, quarry, firefighting) and support to other emergency services.
- Status of specialized engineer requirements available only from the institutional force or USACE.
- Requirements of the C2 system, to include headquarters staffing, communications, and information systems support.
- Requirements for engineer liaison, to include linguists and civil affairs personnel.
- Potential for contract construction or other engineering capabilities.

Stability Planning

3-27. The conduct of stability operations emphasizes the construction tasks performed by Soldiers who are normally working among noncombatants and local populations. In planning to conduct stability operations, engineers consider the requirements necessary for the support of the primary stability tasks. Engineers are typically critical enablers and may lead in the restoration of essential services. The planner (with input from the assistant chief of staff, civil affairs operations [G-9]/battalion or brigade civil affairs operations staff officer [S-9] on civil considerations) determines the capabilities needed to establish or restore the most basic services for the provision of water, emergency shelter, and basic sanitation (sewage and garbage disposal), as required. Terrain products continue to have a great deal of importance, but political and cultural considerations are equally important. Terrain analysts work with the intelligence staff to develop usable products for the commander to reflect this information. When analyzing the troops available, the engineer staff officer considers unified action partner engineering capabilities as a whole, not simply those assigned to the organization. Interaction with these other parties requires engineers to address interoperability, common standards, and mutual agreements. Combined arms forces have a major role in this interaction, working with and through HN agencies and other civilian organizations to enhance the HN government legitimacy.

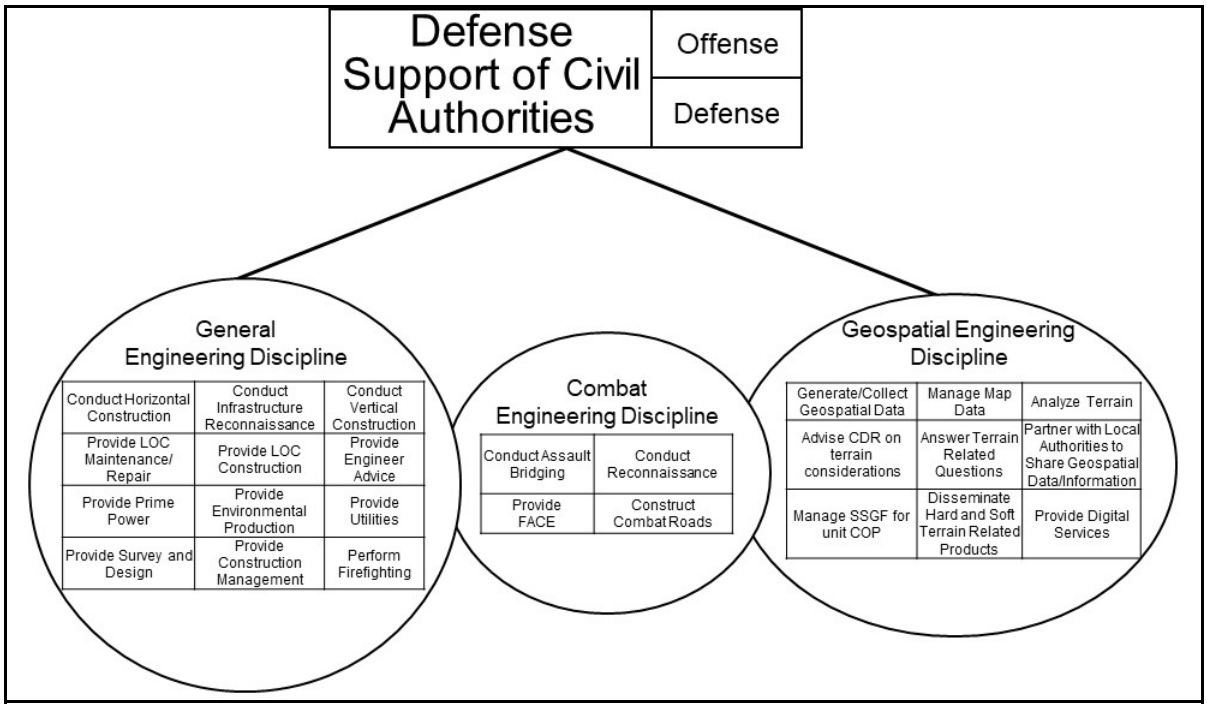
DEFENSE SUPPORT OF CIVIL AUTHORITIES

3-28. DSCA includes operations that address the consequences of natural or man-made disasters, accidents, and incidents within the United States and its territories. ARFOR conduct DSCA when the size and scope of events exceed the capabilities or capacities of domestic civilian agencies. The Army National Guard is often the first military force to respond on behalf of state authorities. DSCA includes four primary tasks (discussed in detail in ADP 3-28):

- Provide support for domestic disasters.
- Provide support for domestic CBRN incidents.
- Provide support for domestic civilian law enforcement agencies.
- Provide other designated support.

3-29. Engineering in DSCA may include the simultaneous application of combat, general, and geospatial engineering capabilities through synchronizing the warfighting functions throughout the AO. General engineering support for the restoration of essential services is the primary engineer focus in DSCA. Engineer support may also be required for ARFOR providing C2, protection, and sustainment to government agencies until they can function normally. Figure 3-5 shows a notional application of engineering capabilities supporting DSCA. The institutional force elements, including USACE, play a critical and substantial role in DSCA.

3-30. There are few unique engineer missions performed in DSCA that are not performed during other operations. The difference is the context in which they are performed. The U.S. law carefully limits the actions that military forces, particularly Regular Army units, can conduct within the United States and its territories. In addition to legal differences, DSCA is always conducted in support of local, state, and federal agencies, and ARFOR cooperate and synchronize efforts closely with them. These agencies are trained, resourced, and equipped more extensively than similar agencies involved in the conduct of stability operations overseas. Policies issued by the federal government govern the essential services that ARFOR provide in response to disasters. Within this context, a focus for engineers during DSCA is the restoration of essential services. Combat and general engineering capabilities may be applied to restore essential services. Engineer equipment is well suited for the removal of rubble and debris associated with rescue and for access to affected areas. Other likely requirements include the construction of temporary shelters and the provision of water and sanitation services. Likely engineer missions are similar to those required during the conduct of stability operations, except that they are conducted within U.S. territorial jurisdiction.



Legend:

CDR	commander
COP	common operational picture
FACE	forward aviation combat engineering
LOC	line of communication
SSGF	standard and sharable geospatial database

Figure 3-5. Notional engineer support to DSCA operations

3-31. Engineer support to DSCA may include the typical integration with, and support for, combined arms forces during missions. Combat engineer route clearance and other capabilities may be critical tasks that are applied through the movement and maneuver warfighting function. Geospatial engineering support continues to provide SSGF that supports the COP. General engineering support may be required for the sustainment and protection requirements of the force and may be extended to support other agencies. This may include the following missions:

- Base camp construction and power generation.
- Debris- or route-clearing activities.
- Road construction and repair.
- Forward aviation combat engineering, to include the repair of paved, asphalt, and concrete runways and airfields.
- Expedient landing strip construction for manned and unmanned aviation assets.

- Installation of assets that prevent foreign object damage to rotary-wing aircraft.
- Temporary bridge construction.
- Port, airfield, and RSOI facility construction and upgrades to ensure access to the region.

3-32. DSCA may require an immediate response. USACE maintains significant response capability, and they are normally involved in providing engineer support to civil authorities. USACE leverages capabilities and expertise developed through responsibility for military construction and civil works programs to prepare for assigned and anticipated DSCA missions.

3-33. Engineer units tasked to support DSCA must be qualified urban search and rescue rescuer and urban search and rescue extraction through formal training. Formal training includes training on rescues involving rope, confined spaces, vehicles and machinery, trenches, and structural collapse as a level one or level two rescuer.

DEFENSE SUPPORT OF CIVIL AUTHORITIES PLANNING

3-34. Planning DSCA is significantly different from planning offense, defense, or stability operations because of the unique nature of the hazard or threat, although the basic missions may be very similar to those associated with the conduct of stability operations. The hazard (or threat) is a natural or man-made disaster with unpredictable consequences. Planners must be aware of the number of statutes and regulations that restrict the Army interaction with other government agencies and civilians during DSCA. Geospatial engineers can provide terrain visualization products that provide predictive analysis of potentially impacted and support areas. Local and state responses normally lead the effort, with a federal response providing support as required. Interagency response during DSCA operations is governed by the National Response Framework, which delegates responsibility to various federal agencies for emergency support functions. The USACE and other general engineering capabilities of the institutional force have the preponderance of the roles in DSCA operations. See ADP 3-28 for additional information about DSCA and the National Response Framework emergency support functions.

3-35. As a military partner in DSCA, Army commanders assume a support role to one or more designated agencies. Engineers can expect to be involved in planning for the support of relief operations by providing geospatial products and analysis of potential areas to establish life-support areas. Engineers may be called on to provide manpower support or general engineering support from units with unique capabilities (water well drilling, temporary shelter, power generation, and firefighting). Engineer commanders and staff work with the planners to identify requirements and plan engineer applications.

SPECIAL CONSIDERATIONS

3-36. Army commanders assess the relevance and impact of one or more urban areas as part of the mission. They also need to determine if urban operations may be the sole focus of the commander or if they are only one of several tasks nested in an even larger operation. Urban operations are often conducted as a single battle, an engagement, or an operation. They are often conducted as a major operation, requiring joint resources. ATP 3-06 provides a framework (assess, shape, dominate, and transition) for urban operations. These are not phases or sequential operations, but rather a means to visualize the fight (or potentially the stability or DSCA operations).

3-37. Geospatial engineers can partner with local authorities to share geospatial data and information. Geospatial engineers assist with the generation, management, analysis, and dissemination of geospatial data and information, enabling the commander to understand the physical environment. Geospatial engineers continue to support the unit COP by providing SSGF in a DSCA operation. See ATP 2-22.7 for a further discussion of geospatial intelligence cells.

3-38. The assured mobility framework enables commanders to frame its fundamentals (predict, detect, prevent, avoid, neutralize, and protect) as a method to think about how to shape and dominate in urban terrain. General engineering tasks are prevalent throughout operations, but they are the major function during the transition to stability or during DSCA operations. Combat engineers work closely with the elements that enable M/CM/S. They must ensure close coordination with EOD in the reduction of explosive hazards (improvised explosive devices and unexploded ordnance) to minimize collateral damage. Engineers may

have to coordinate with military police to enable the movement of civilians along routes or with CBRN elements to detect and identify potential CBRN threats and hazards along routes and other locations within the AO.

3-39. Engineers must be familiar with the history of the AO, terrain, and conflict. The knowledge of threat doctrine, engineer methods, and engineer functions is critical. Engineers should consider patterns of obstacle employment—do they infer threat doctrinal employment? Not all threat forces or nonstate actors mark their minefields, and many non-first-world countries rely on improvised explosive devices or mark minefield locations and hazard areas unconventionally. Many nonstate actors lay mines and mark them with readily available materials rather than by formal marking methods or by adhering to any doctrine. These markings are generally used to warn their own troops and local civilians of the presence of mines. Friendly units operating in these threat environments must know and understand these markings.

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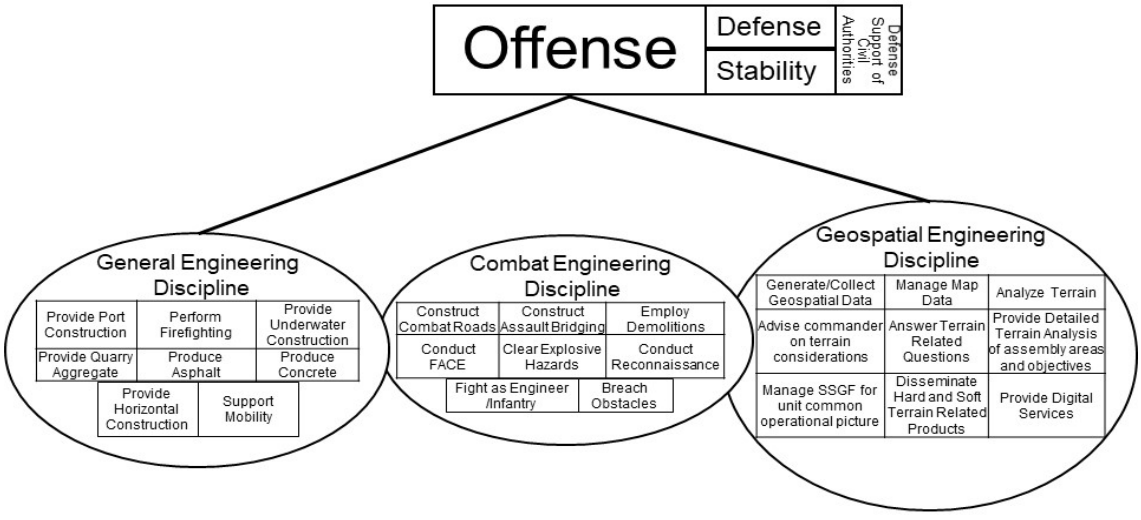
Chapter 4
Support to Large-Scale Ground Combat

Engineer support in large-scale ground combat occurs throughout the depth of the AO. Engineers provide simultaneous and synchronized support to deep, close, and support area operations. Engineers plan obstacles that forces can emplace in the enemy rear AO. Knowledge of the terrain and terrain visualization can identify locations at which friendly forces can stop enemy reinforcements. Engineer reconnaissance identifies areas at which friendly forces require engineer effort in support of mobility. Attacking forces task-organize engineer units to provide mobility support to the main and supporting attacks and to the reserves. Engineers provide countermobility support to secure vulnerable flanks or prepare defenses.

OFFENSIVE OPERATIONS

4-1. Engineer support to the offense includes the simultaneous application of combat, general, and geospatial engineering disciplines through synchronizing warfighting functions and throughout the depth of the AO. Combat engineering in support of maneuver forces is the primary focus of engineers involved in the conduct of offensive operations; however, the three disciplines simultaneously apply their capabilities to some degree. The primary focus supports movement and maneuver. Figure 4-1 shows a notional application of engineering capabilities supporting offensive operations.



Legend:

FACE	forward aviation combat engineering
SSGF	standard and sharable geospatial foundation

Figure 4-1. Notional engineer support to offensive operations

4-2. Combat engineers use preparation activities to posture engineer assets with the task-organized gaining or supported headquarters. Engineer units establish early linkups with the maneuver units they support. As combat engineer units prepare for offensive operations, they focus on inspections and combined arms rehearsals. Combined arms breaching forces are task-organized, and they conduct rehearsals for the breach, assault, and support forces. The engineer staff officer at the appropriate echelon coordinates for engineer reconnaissance that is focused to support the collection of the appropriate information to collect obstacle and mobility information. If route clearance is anticipated, clearance teams are task-organized and focused on combined arms rehearsals. Combat engineer preparations are aligned and integrated with their supported maneuver force preparations.

4-3. Engineer staff officers at every echelon coordinate the movement and positioning of general engineer assets that are task-organized to augment combat engineering capabilities. Although general engineer assets can be placed in command or support relationships with the maneuver force, a command relationship with the supported engineer unit is often more effective. General engineer equipment requires more time for movement, regular refueling, dedicated maintenance personnel and supplemental maintenance tools, and dedicated haul assets. For significant construction, preparation activities may require a more technical engineer reconnaissance to enable adequate project planning and design, including the provision of construction materials, as required. Specialized engineer assets may also be necessary to accomplish certain missions. General engineer activities may occur independently. When this is the case, they must be fully coordinated with the maneuver commander responsible for the AO. Such general engineer support is primarily applied to enable sustainment, but it may also be critical to the preparation for an offensive operation, including support to operational mobility.

4-4. During the conduct of offensive operations, fighting and protective position development is minimal for tactical vehicles and weapons systems. The emphasis lies on the mobility of the force. Protective positions for artillery, air and missile defense, and logistics positions may be required in the offense and defense, although more so in the defense. Stationary command facilities require improved survivability to lessen vulnerability. During halts in the advance, the terrain enables varying degrees of survivability. Therefore, based on the threat level and unit vulnerabilities, units should develop as many protective positions as possible for key weapon systems, command nodes, and critical supplies. For example, the sites of expedient earth excavations or parapets are determined based on the locations that make the best use of existing terrain. During the early planning stages, geospatial engineering teams can provide information on soil conditions, vegetative concealment, and terrain masking along movement routes to facilitate survivability for the force.

4-5. When executing offensive operations, the maneuver force uses its COP to link detection efforts to maneuver to avoid encountering obstacles along the route of attack. The maneuver force can actively avoid obstacles by interdicting threat countermobility efforts before emplacement or passively avoiding obstacles by identifying, marking, and bypassing them. Assessments by on-site engineers assist in the decision to bypass or breach obstacles. If the friendly force commander is compelled to neutralize obstacles, the force employs the breach tenets of intelligence, breach fundamentals, breach organization, mass, and synchronization. When possible, bypasses are preferred. They are marked and handed off to follow-on engineer units for maintenance and improvement. Similarly, line-of-communication bridging replaces assault bridging, so assault bridging assets remain available for future missions. Assessments that are more technical are made as soon as possible to determine feasible and suitable improvements to LOCs.

BASICS OF THE OFFENSE

4-6. Offensive operations are combat operations conducted to defeat and destroy enemy forces and to seize terrain, resources, and population centers. They impose the commander's will on the enemy. A commander may also conduct offensive operations to deprive the enemy of resources, seize decisive terrain, deceive or divert the enemy, develop intelligence, or hold an enemy in position. This chapter discusses the basics of the offense from an engineer perspective, in support of maneuver. To find weaknesses in the enemy's defense, a thorough engineer battlefield assessment is essential. Accurately templating the obstacle system facilitates attacks through gaps and against flanks and helps to avoid the enemy's strength. The template also provides the basis for the engineer reconnaissance plan.

Engineer Reconnaissance

4-7. Reconnaissance is vital to verify the accuracy of the assessment. Detailed information on existing (natural or cultural) and reinforcing obstacles identifies obstacle limits. It also determines whether a bypass or an in-stride breach is an option. Engineers identify specific reconnaissance requirements and augment patrols and scouts to identify obstacle characteristics. The maneuver unit must integrate engineer reconnaissance into the reconnaissance plan. Because engineer reconnaissance teams are ad hoc formations for engineers, commanders must understand the risk involved in creating them from organic resources and the drain it creates on platoons and squads. Data gathered by an engineer reconnaissance team should be transferred to the echelon intelligence section. The geospatial engineering team updates data, extracts data, and updates the TGD as directed.

4-8. During the attack, engineer reconnaissance teams and engineer units provide continuous assessments of the friendly axis of advance and make recommendations on the use and repair of key routes. They pay special attention to the main supply routes, bypassed obstacles, and engineer materials in their assigned areas of operations.

4-9. Engineer support to the offense occurs throughout the AO. Engineers provide continuous and coordinated support to close, consolidation, and support areas. Engineers recommend obstacles, such as scatterable minefields, that shape the friendly scheme of maneuver. Geospatial engineers provide terrain visualization products that aid in identifying locations at which friendly forces can affect enemy reinforcements and employ obstacles. Engineer reconnaissance identifies areas limiting friendly force mobility and areas requiring additional engineer effort.

Support to Offensive Operations

4-10. Engineers support offensive operations by enabling movement and maneuver. The division engineer ensures that subordinate BCTs conducting offensive operations are task-organized with additional combat engineering capabilities to enable the maneuver commander's freedom of action. The division engineer recommends sustainable command and support relationships for elements augmenting the BCT, which allows the gaining commander the maximum flexibility to employ assets.

4-11. Engineer support to the offense considers tasks when task-organizing additional engineers. The primary offensive operations are—

- Movement to contact.
- Attack.
- Exploitation.
- Pursuit.

Note. See FM 3-90-1 for more information on Army offensive operations. See ATP 3-90.4 for more information on combined arms mobility. Table 4-1 provides a summary of engineer considerations for each type of offensive operation.

Table 4-1. Engineer considerations in the offense

Offensive Operations	*Engineer Consideration*
Movement to contact	• Priority for combat engineer support is typically on mobility, although it may rapidly shift to countermobility in anticipation of an enemy counterattack. • The task organization of engineers must balance task-organizing mobility capabilities with the lead element to optimize response time and tempo without increasing risk to the mobility of the main body or limiting the ability to mass breaching assets against complex obstacles.

Table 4-1. Engineer considerations in the offense (continued)

Offensive Operations	*Engineer Consideration*
Attacks	• The employment of engineer reconnaissance as part of the information collection effort helps generate obstacle information that provides the necessary detailed COP of the enemy situation. If breaching is anticipated, the breach organization is established based on detailed reverse breach planning. Combined arms rehearsals are critical to the success of combined arms breaching. • Engineer priority of effort is on mobility with priority of support to the main effort. • Countermobility is provided through the employment of situational obstacles. It is initially intended to support the isolation and fixing of enemy forces and to protect friendly flanks. • Upon seizure of the objective, and depending on the follow-on mission, engineers are prepared to conduct countermobility and survivability in support of a defense, while mobility focuses on clearing obstacles or improving lanes to support friendly mobility.
Exploitation	• Engineers support an exploitation by breaching obstacles to facilitate the maneuver of ground forces, keeping movement routes open, and emplacing situational obstacles to protect the flanks.
Pursuits	• Direct-pressure and encircling forces require engineers to be forward in maneuver unit formations to quickly breach obstacles that cannot be bypassed to ensure unimpeded mobility. Engineers also conduct countermobility and survivability tasks in support of the encircling force.
Legend: COP common operational picture	

4-12. The types of offensive operations and the forms of maneuver describe relationships between friendly forces and the enemy. Planning must always begin with understanding the commander's desired endstate. Analyzing and understanding the threat, threat engineer capabilities, and how the terrain affects friendly action are the best methods of determining the enemy's intent. FM 6-0 provides a common foundation and reference for planning. Engineer planning tends to focus on mobility support and likely includes a robust engineer reconnaissance effort. Because engineer units tend to have habitual command and support relationships with maneuver commanders conducting the offensive, parallel planning between division and subordinate echelons is vital in allowing engineer units to position essential assets, establish early linkups, and task-organize into their supported units. A significantly greater degree of planning centralized at the division echelon is required when resources from the division are needed to control the maneuvering of brigade forces, such as a river crossing.

4-13. *Mobility* is a quality or capability of military forces which permits them to move from place to place while retaining the ability to fulfill their primary mission (JP 3-17). Mobility tasks are those combined arms activities that mitigate the effects of obstacles to enable freedom of movement and maneuver. Freedom of mobility is the key to successful military operations.

4-14. Engineers shape the terrain. Terrain shaping begins with a thorough visualization of both the enemy and friendly perspectives of the terrain. Reconnaissance answers information gaps in the understanding of terrain. Engineers conduct reconnaissance as far in advance of the initial maneuver formation as possible. The following vignette provides an example of when properly conducted reconnaissance assisted the ground commander.

Bloody River

The Allied Landings in Italy in September 1943 were followed quickly by the liberation of Naples. The crossing of the Volturno River in October had tied down German forces in southern Italy, and the next river crossing (into the Liri Valley) was needed to draw German troops south to ensure success of the Anzio Landing on Italy's west coast. In theory, the enemy would be caught in a great pincer movement (now called a double envelopment).

By year's end, a reinforced German army of 23 divisions consisting of 215,000 troops engaged in the south as 265,000 troops in reserve in the north were conducting a slow withdrawal under pressure from the United States Fifth Army, the Commonwealth, and the Allied forces of the British Eighth Army. South of Rome, the Germans constructed three major defensive lines: the Barbara Line, the Bernhard (or Reinhard) Line, and the most formidable of the three belts—the Gustav Line. The Gustav Line was a system of sophisticated interlocking defenses, anchored on Monte Cassino, that stretched across the rugged, narrowest point of the peninsula along the Garigliano and Rapido Rivers.

The Rapido River was incorporated into the Gustav Line and formed a natural moat, protecting Monte Cassino. *Rapido* is an Italian word that means fast or rapid, and the river was appropriately named. The banks of the Rapido were very steep and, in some places, vertical. The shallow crossing areas of the Rapido had been scouted by the Germans, allowing for concentrated, accurate artillery fire. Artillery fire originated from well concealed gun pits that had been blasted out of the solid rock in the mountainside.

Before the Allied soldiers could get close to the river and attempt the crossing, they had to contend with flooded ground along the river banks. The Germans had diverted the Rapido by damming the river near crossing points. Allied soldiers were forced to walk and crawl across the submerged, near-freezing ground to reach the river, carrying all of their heavy equipment across the flooded fields. The soggy terrain had made it impossible to use heavy, tracked vehicles. Tanks could only move single-file on steel matting laid down by engineering companies. The Germans had only to knock out the lead tank to render the remaining tanks helpless.

After they crossed the river, the Allied soldiers encountered entanglements of barbed wire and extensive minefields. While clearing paths across the minefields, the soldiers were exposed to interlocking machine gun fire from concrete pillboxes. The Germans cleared the river banks of all obstructions to provide clear fields of fire. After Allied tanks crossed the river, they then had to contend with antitank ditches. As Allied troops finally began their attack uphill, the rocky hillsides proved to be a natural, well protected, concealed fighting position for the Germans. The man-made obstacles of the Gustav Line added to the natural Italian terrain features, making Monte Cassino a defender's dream and an attacking army's nightmare.

4-15. ATP 3-90.4 describes the following primary mobility tasks:

- Conduct breaching.
- Conduct route and area clearance.
- Conduct a gap crossing.
- Construct and maintain combat roads and trails.
- Construct and maintain forward airfields and landing zones.
- Conduct traffic management and enforcement.

Conduct Breaching

4-16. A *breach* is a synchronized combined arms activity, under the control of the maneuver commander, conducted to allow maneuver through an obstacle (ATP 3-90.4). Breaching allows maneuver, despite the presence of enemy reinforcing obstacles covered by fire. Breaching enables the projection of combat power through enemy obstacles.

Conduct Route and Area Clearance

4-17. Route and area clearance are conducted to eliminate enemy obstacle effects or residual obstacles that affect the operational area or route. Based on the requirements of the mission, commanders may order route and area clearance to facilitate mobility within an AO.

Conduct a Gap Crossing

4-18. A *gap crossing* is the projection of combat power across a linear obstacle (wet or dry gap) (ATP 3-90.4). Gap crossings have historically been described only in the context of crossing rivers. A gap-crossing mission requires the allocation of specialized crossing resources and a force dedicated to the security of the bridgehead. While a river crossing is still considered one of the most challenging of gap crossings, a river is only one type of gap that can obstruct freedom of movement and maneuver. The fundamentals of crossing wet or dry gaps are essentially the same. Gap crossings are conducted in every type of environment and use organic and augmented engineer (and other) elements best suited to accomplish the mission. See ATP 3-90.4 for more information on gap-crossing planning and execution.

4-19. A successful gap crossing is characterized by applying gap-crossing fundamentals. These fundamentals are applied when a gap is encountered in the operational area. These fundamentals are—

- Surprise.
- Extensive preparation (less for a hasty crossing).
- Flexible planning.
- Traffic management.
- Organization.
- Speed.

Construct Combat Roads and Trails

4-20. Combat roads and trails facilitate the movement of personnel, equipment, and essential supplies throughout the AO to achieve the commander's intent, despite terrain restrictions. Combat roads and trails enable movement through otherwise untrafficable areas. They also allow forces to bypass obstacles (natural and man-made), including populated areas and areas with cultural, historical, or religious significance. Combat roads and trails are a combat engineering mission because they are typically performed in close support of ground maneuver forces. However, general engineering units also construct combat roads and trails.

Construct and Maintain Forward Airfields and Landing Zones

4-21. Forward aviation combat engineering describes the engineering capabilities that are employed for the hasty construction or repair of aviation facilities (landing strips, landing zones, forward arming and refueling points) that support fixed-, rotary-, and tilt-wing aircraft (manned and unmanned). Forward aviation combat engineering missions are employed to shorten the distance between an aviation unit's objective areas, improve unit sustainment, reduce turnaround times, and enhance the availability and responsiveness of aviation assets.

Conduct Traffic Management and Enforcement

4-22. Engineering supports traffic management and control by repairing and clearing roads to improve trafficability and facilitate movement. These efforts may range from studying traffic patterns to installing

permanent traffic control devices. In support of traffic studies, engineers also provide technical expertise on the design and installation of permanent traffic control devices into the road network.

THEATER ARMY ENGINEER SUPPORT

4-23. Engineers at the theater echelon are primarily responsible for building and managing engineer capabilities during RSOI. This echelon of engineer support also focuses on the challenges associated with intermediate staging bases and on supporting other types of lodgments, such as ports and airfields. When a force is able to quickly build combat power, it allows the theater army commander greater flexibility in the use of that combat power.

4-24. A successful operational approach results when commanders orchestrate coherent movements and the systematic defeat of an opposing force distributed over time and space. The use and denial of man-made infrastructure coupled with the natural terrain (including waterways) within an AO contribute to this approach. Properly implemented plans facilitate freedom of maneuver. Creative planning and execution of engineer disciplines in concert with that framework provide advantages to the ground commander.

CORPS ECHELON ENGINEER SUPPORT

4-25. The corps has specific fundamental planning and resourcing responsibility. The corps engineer and his staff are responsible for developing detailed schemes of engineer support and for providing the extensive engineer forces and assets required for both missions. EAB combat team engineer units retained by the corps as operational resources primarily support barrier reduction and river crossings not conducted by the BCT. Mobility support for corps close operations focuses on the movement of large tactical unit formations from the corps support area to the brigade rear boundary. Corps-assigned engineer units—

- Expand lanes through minefields and other obstacles breached by assault-division engineers.
- Breach obstacles bypassed by assault forces.
- Upgrade combat roads and trails.
- Keep open key routes designated by the corps G-3.

4-26. Corps-assigned bridging capabilities provide assault float bridging and follow-on LOC bridging. General engineering tasks are executed to maintain LOCs.

4-27. The engineer brigade staff mainly acquires and positions resources needed for future operations. The staff is limited to coordinating the activities of the brigade subordinate groups or battalions and to solving problems that hinder corps operations. The engineer brigade staff completes the detailed planning necessary to implement the tasks assigned by the corps order. The staff mainly acquires and positions resources needed for future operations.

DIVISION ECHELON SUPPORT

4-28. The division engineer staff performs many of the same activities for the division as does the corps engineer staff. Upon deployment into a theater, the division may undergo significant task organization to enable operations. The division engineer should be prepared to conduct live, virtual, and constructive offensive operations training exercises with multinational military engineering partners that demonstrate friendly capabilities. In an immature theater, the division engineer staff should be prepared to modify the headquarters command building to accommodate the command structure of the next higher echelon for an interim time. See ATP 3-91 for additional information on division operations.

4-29. During large-scale ground combat, a division typically operates in an AO. In combat, the offense is the decisive element of decisive action. Offensive operations are the primary means for gaining and maintaining the initiative. The offense aims at defeating, destroying, or neutralizing the enemy. A commander may conduct offensive operations to deprive the enemy of resources, seize decisive terrain, develop intelligence, hold an enemy in position, or facilitate other friendly operations. Surprise, concentration, audacity, and tempo characterize successful offensive operations.

4-30. Surprise includes the tempo and intensity in executing the attack plan and in employing unexpected factors (such as selecting a less than optimal COA), varying tactics and methods, conducting deception

operations, and ensuring operations security. An enhanced COP and enhanced terrain visualization enable engineer commanders to achieve the element of surprise because enemy defensive preparation is better understood. Engineers assist the ground commander in achieving surprise through obstacle reduction and situational obstacle employment. The element of surprise is enabled by rapidly overcoming obstacles, thus increasing the force tempo.

4-31. Concentration requires careful prior coordination within the combined arms team, other Services, and multinational partners. Engineers consider the concentration of effects in planning by integrating geospatial products and templating threat obstacles and hazards. This effort is further enhanced with the employment of engineer reconnaissance, which can provide the necessary obstacle information and other technical information essential for detailed planning. This allows the maneuver force and the engineers who support them to concentrate reduction assets and overcome complex obstacles as part of the maneuver unit breaching plan.

4-32. Engineers who understand the commander's intent and operate in a decentralized role can enable the commander to see the OE and anticipate future operations. With enhanced situational understanding, commanders can be more audacious. Engineer speed and flexibility are crucial to the attack. The ability to quickly reduce, mark, and guide the supported maneuver unit through an obstacle is the engineer's signature function.

BRIGADE COMBAT TEAM ECHELON SUPPORT

4-33. The BCT conducts offensive operations to defeat and destroy enemy forces and to seize terrain, resources, and population centers. Offensive operations impose the BCT commander's will on the enemy. Offensive operations capitalize on accurate and timely intelligence and other relevant information regarding enemy forces, weather, and terrain. Maintaining the momentum of the offense requires the BCT to quickly pass through obstacles as it encounters them. The commander plans how and where subordinate forces breach obstacles that are encountered. Commanders at brigade and task force levels configure engineer capabilities to emplace obstacles rapidly once on the objective to protect attacking forces from enemy counterattacks.

4-34. The commander must carefully consider the most effective command and support relationship for engineers in support of maneuver elements. In the offense, engineers must be positioned well forward within maneuver formations to be able to be most responsive. A habitual relationship between engineer and supported maneuver units enhances effectiveness and efficiency. Engineers must link up with their supported maneuver unit early in the planning process. During an offensive operation, the commander should keep changes to the engineer task organization to a minimum. Task organization changes during the offense are normally linked to time- or event-based triggers. The engineer's main effort may reinforce the maneuver commander's main effort and help ensure the success of the commander's overall intent. Through a supporting effort, the engineer's main effort often ensures the success of a maneuver commander. The engineer commander may weigh the main effort through the presence of the commander, senior staff, or additional mobility or countermobility or through an emphasis on resource resupply. The designated priorities of engineer support should identify the focus of support (M/CM/S) and a point of application.

DEFENSIVE OPERATIONS

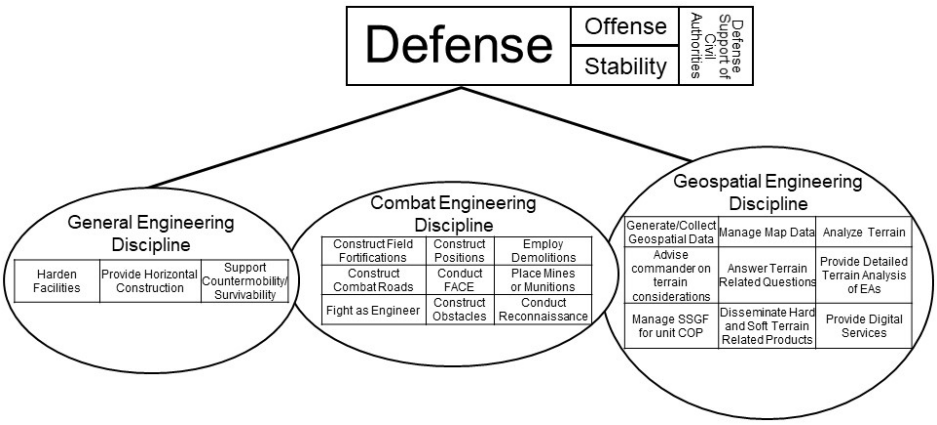
4-35. The defense is conducted to defeat an enemy attack, gain time, economize forces, and develop conditions favorable for offensive or stability operations. Defense plans should not be designed to simply resist enemy attack. Defensive operations should be concentrated toward reverting to the offense and decisively defeating the enemy. The engineer focus is on attacking the ability of the enemy to influence operating areas (countermobility through combined arms obstacle integration and survivability of the defending force) and on assuring mobility for friendly repositioning or counterattacking forces.

4-36. The defending force arrives first on the battlefield and, with the help of engineers, shapes the battlefield to its advantage. Based on the higher commander's intent, maneuver commanders, the fire support officer, and engineers site tactical obstacles to enhance the effects of direct and indirect fires on the enemy. Engineers provide technical expertise and advice to the commander on tactical obstacle emplacement. Fortifications allow fires from positions that best disrupt and destroy the attacker. Due to defending force survivability, the

defender can postpone the commitment of major forces until the attack develops and then strike the extended enemy over selected, prepared terrain.

4-37. Disruption, flexibility, maneuver, massing effects, operations in depth, preparation, and security characterize successful defensive operations, as depicted in FM 3-90-1. Defensive operations have a distinct preparation phase, which is vital to setting the conditions for combat and to giving the defender the tactical advantage against an attacker. The mission of the engineer staff officer and engineer commanders is to plan and execute engineer efforts that enhance the ability of the defending unit to combine fires, obstacles, and maneuver to destroy an attacking enemy. The success of engineers in the preparation of the defense depends largely on the ability of the division echelon engineer to conduct integrated planning with the division staff and parallel planning with supporting and subordinate engineer units. The division echelon engineer uses parallel planning to disseminate the information and intent needed to foster early planning and the preparation efforts required at subordinate levels. The division scheme of engineer operations, task organization, obstacle control, survivability guidance, and allocation of resources (barrier materials, munitions, and construction equipment) enable and focus subordinate unit engineer efforts. With the information provided, subordinate units can anticipate the limitations of allocated capabilities and prioritize efforts and resources to mitigate limitations.

4-38. Engineer support to the defense includes the simultaneous application of combat, general, and geospatial engineering capabilities through synchronizing warfighting functions throughout the depth of the AO. Combat engineering in close support of maneuver forces is the primary focus in the defense; however, the three disciplines apply simultaneously to some degree. Figure 4-2 shows a notional application of engineering capabilities supporting the defense and the preponderance of the weight of activities performed.



Legend:

COP	common operational picture
EA	engagement areas
FACE	forward aviation combat engineering
SSGF	standard and shareable geospatial foundation

Figure 4-2. Notional engineer support to defensive operations

4-39. The primary focus for combat engineers in support of defensive operations is to enable combined arms obstacle integration (countermobility) to facilitate mobility for friendly repositioning or counterattacking forces. Defensive operations demand the greatest survivability effort. Activities in the defense include constructing survivability positions for headquarters, artillery, air and missile defense, and critical equipment and supplies. Activities also include preparing individual and crew-served fighting positions and defilade fighting positions for combat vehicles. The use of engineer work timelines is essential, and digging assets are intensively managed. During this period, countermobility efforts compete with survivability resources and assets. Because of this, it is critical that maneuver commanders provide clear guidance on resources and priorities of effort. General engineers support tasks that exceed the capability of the combat engineer force and provide more extensive support to the mobility of repositioning counterattack forces. Examples of expected missions include the—

- Construction and integration of obstacles.
- Preparation of fighting positions and survivability positions in depth.
- Upgrade and repair of routes that facilitate the repositioning of forces throughout the AO.

4-40. During preparation, engineer assets are postured with the task-organized gaining or supported headquarters, and they initiate the engineer work effort. The equipment work effort is a balance between countermobility and survivability, as determined by the commander. The effort continues throughout preparation activities until it is complete or until it is no longer feasible. Significant coordination is required to resource the materials required for constructing obstacles and fighting positions and to integrate the obstacles with friendly fire effects. Designated combat engineers provide mobility support for the reserves or mobile strike force. The engineer staff officer, at appropriate echelons, coordinates for engineer reconnaissance and surveillance assets to identify specific enemy engineering capabilities (breaching, bridging, and countermobility assets) to nominate those capabilities for targeting, ensuring timely destruction.

4-41. At the theater level, general engineer support is continuously conducted to harden and prepare protective positions for facilities and installations. These activities are primarily applied through the protection warfighting function. General engineering support to protection and survivability continues throughout operations as improvements are continuously reassessed and an additional effort is made available. The theater may employ barriers in support of countermobility. (See JP 3-15 for a further discussion of barriers.) Other general engineer activities applied to enable the sustainment warfighting function may also be critical to the preparation and conduct of the defense. Enabling mobility throughout the depth of the AO will remain an engineer mission.

BASICS OF THE DEFENSE

4-42. The types of defensive operations are mobile defense, area defense, and retrograde. These types have significantly different concepts and must be dealt with differently during planning and execution as follows:

- **Mobile defense.** Engineer support to a mobile defense focuses on using obstacles to defeat enemy maneuver and on providing mobility to the striking force and reserves. Countermobility and survivability assets support the fixing force, while many mobility assets support the striking force. Obstacle control coordinated at the division echelon is directed at the most likely enemy COA rather than the terrain and may be restricted to assure striking force mobility. Situational obstacles are advantageous in the mobile defense. These obstacles allow the commander to exploit enemy vulnerabilities, exploit success, separate follow-on forces, and provide flank protection.
- **Area defense.** In an area defense, the focus of engineer effort is on providing the maneuver commander with the ability to hold terrain while enabling maneuver units to concentrate fires from static positions. Engineers help identify key and decisive terrain that supports the commander's concept of operations, with a focus on where the commander wants to kill the enemy. During obstacle planning, obstacle control measures are designed to give maximum flexibility to subordinate units while focusing the tactical obstacle effort on terrain retention. The engineer staff officer must advise the commander of the resource requirements of each subordinate unit based on its assigned essential M/CM/S and other engineering tasks. The division echelon must balance these engineer resource requirements. Planning for scatterable mines enables commanders to accept less risk by not allowing the enemy to cross terrain-shaping obstacles.

- **Retrograde.** Mobility and countermobility are normally the focus of engineer support to a retrograde. The priority of effort depends on whether the unit is in contact with the enemy. The underlying purpose of engineer support to the retrograde is twofold as follows:
  - The mobility of the force must be maintained, regardless of the type of retrograde being conducted. Mobility focuses on maintaining the ability of the force in contact to disengage while preserving the main body freedom of maneuver.
  - The force must be protected because they are particularly vulnerable to enemy actions during retrograde operations. Consequently, a retrograde is normally conducted under limited-visibility conditions. Engineers support units left in contact and extend the time available to the commander by reducing enemy mobility through obstacles, fires, and terrain optimization.

4-43. The primary defensive tasks use mobile and static elements. In mobile defense, static positions help control the depth and breadth of enemy penetration and retain ground from which to launch counterattacks. In area defense, commanders closely integrate mobile patrols, security forces, sensors, and reserves to cover gaps among defensive positions. In retrograde operations, some units conduct area or mobile defenses and security operations to protect other units that are executing carefully controlled maneuver or rearward movement. Static elements fix, disrupt, turn, or block attackers and gain time for other forces to pull back. Mobile elements constantly maneuver to confuse the enemy and prevent enemy exploitation.

Defensive Operations Planning

4-44. Planning for the defense is inextricably linked to offensive operations and, for planning purposes, planners conducting the military decisionmaking process (MDMP) should consider the transition from the offense and the follow-on offensive operations. Engineers work directly with tactical maneuver units during the seven steps of enagement area (EA) development. EA development (explained in ATP 3-90.8) consists of the following steps:

- **Step 1.** Identify likely enemy avenues of approach (AAs).
- **Step 2.** Determine likely enemy scheme of movement and maneuver.
- **Step 3.** Determine where to kill the enemy.
- **Step 4.*** Plan and integrate obstacles.
- **Step 5.*** Emplace weapon systems, to include the preparation of fighting positions.
- **Step 6.*** Plan and integrate observation and indirect fires.
- **Step 7.** Conduct an EA rehearsal.

Note. Although the steps are listed sequentially, the steps marked by an asterisk (*) should be conducted simultaneously.

4-45. During the preparation of the defense, engineers use geospatial products to assist with all aspects of EA development (AAs, mobility corridors, obstacle emplacements to enable overwatch, an array of friendly forces to depict the most advantageous lines of sight, indirect fire target reference points). Engineers then work with intelligence staffs to describe the threat and to predict where the enemy is likely to attack friendly forces. Engineers also work in conjunction with intelligence staffs to determine sensor capabilities that would be leveraged to prevent the enemy from maneuvering freely into the defended area. Defensive operations planning includes security and survivability considerations. The consideration of counterattack planning or support for the mobile strike force is the same as the typical mobility planning for the offense. The engineer staff officer works with the other staff members to ensure that the counterattack force can mass its effects on the enemy for decisive operations. This form of defense helps to define the amount and focus of engineer effort required. An area defense typically requires a more robust engineer effort due to an increased survivability requirement. A mobile defense typically requires less effort because it has greater flexibility and takes advantage of the terrain in depth.

Mobile Defense

4-46. The focus of mobile defense is the destruction of the enemy attacker. The mobile defense is organized to permit the enemy to advance into a position that exposes them to counterattack and envelopment by a

mobile reserve. Therefore, the mobile defense trades space and time for achieving a decisive advantage against the enemy. The defeat mechanism is a large, mobile reserve that must have combat power and mobility that are equal to or greater than the targeted force.

4-47. The division engineer must understand the implications of a force-oriented defense on engineer functions and operations. Engineer support to the mobile defense concentrates on using obstacles to attack enemy maneuver and on preserving the mobility of the friendly force. Obstacle planning is more closely linked to the enemy's most probable maneuver COA than to terrain. It must support attacking the enemy's maneuver in a way that supports destruction by counterattack. Consequently, obstacle planning is more restrictive than permissive and reduces the flexibility of the brigades. This masses the brigade obstacle effort at critical areas and preserves the mobility of the counterattack force in the main battle area.

4-48. Survivability effort is also tailored to a force-oriented defense that trades space and time for creating an enemy weakness to exploit by counterattack. To create the conditions for counterattack, brigades must fight the depth of their sectors from multiple primary and subsequent battle positions. Fortification efforts support fighting quick engagements from multiple positions by providing primary and alternate hull defilade fighting positions in primary and subsequent battle positions. The nature of the fight reduces the overall need for protective obstacles throughout the defense. Protective obstacle effort is concentrated in final subsequent positions, where the penetration must be blunted to allow counterattack.

4-49. The defeat mechanism of the mobile defense is the counterattack by a large, mobile reserve with combat power and mobility that are superior to the targeted enemy force. The division engineer supports the mobility of the mobile reserve in two ways. First, obstacle control measures are used to ensure that brigade obstacle efforts do not limit the mobile reserve's freedom to maneuver. Second, the division engineer ensures that the mobile reserve has the necessary dedicated engineer support to maintain its mobility during the counterattack. It must be able to counter the enemy's offensive use of obstacles or reduce friendly obstacles as required by changes in the situation. Above all, the counterattack cannot be stalled by a lack of mobility. The division engineer must weigh the trade-offs between dedicating engineer forces to the counterattack and meeting the obstacle and survivability requirements of the main battle area.

Area Defense

4-50. The focus of the area defense is on the retention of terrain. The area defense is organized to absorb the enemy into an interlocked series of positions from which the enemy can be destroyed. In this pattern, the defeat mechanism is the interlocking nature of defensive positions and the small mobile reserves within subordinate defenses to defeat local penetrations. The area defense does not promise outright destruction of the attacker and may require other simultaneous or subsequent operations to achieve a decisive defeat of the enemy.

4-51. The division engineer must understand the implication of the area defense on mobility and survivability requirements and engineer operations. Likewise, the scheme of engineer operations orients on the retention of terrain and on enabling the division to concentrate fires from fixed positions. The location of key and decisive terrain plays a major role in organizing the area defense and becomes the focus of obstacle and survivability efforts. Division obstacle planning uses obstacle control measures to give maximum flexibility to the brigades while still focusing tactical obstacle effort on the retention of terrain.

4-52. Survivability effort must enable brigades to concentrate fire power from fixed positions. The division engineer must be sensitive to the increased hardening needs of the brigades in a division area defense. To fight from more fixed positions, the brigades may require primary, alternate, and supplementary turret-defilade positions. This is particularly true of brigades defending decisive terrain. The increased requirement for survivability also entails heavier employment of protective obstacles to break the attacker's assault.

4-53. Integrating defensive positions and small, decentralized, mobile reserves is a key component to enabling a complete defeat mechanism. The division engineer must ensure that the tactical obstacle effort of adjacent brigades is coordinated and mutually supporting and achieves an interlocking defense. Additionally, the division engineer must ensure that the engineer task organization provides the brigades dedicated mobility support of their respective mobile reserves.

Retrograde

4-54. Retrograde operations involve organized movement away from the enemy (including delays, withdrawals, and retirements). Retrograde operations—

- Gain time.
- Preserve forces.
- Place the enemy in unfavorable positions.
- Avoid combat operations in undesirable conditions.

Engagement Area Development

4-55. Terrain shaping affects the enemy's ability to move and maneuver. Terrain shaping enables friendly forces to engage the enemy at a desired place and time. The employment of obstacles must be linked with the maneuver commander's intent on how and where to deploy the bulk of the unit's combat power and conduct decisive operations to defeat an attacking enemy. To mass resources, EAs are critical maneuver corridors that are important to both friendly and enemy forces. Every obstacle, barrier, and minefield is created to support the maneuver plan and to be evaluated from both an offensive and a defensive posture. Successful EAs allow for obstacles to be linked to restrictive terrain or natural obstacles. These constructed obstacles vary by type and with time and supply constraints. Resources and barrier types include networked mines, scatterable mines, demolition obstacles (such as road craters), constructed obstacles, and field expedient obstacles.

4-56. Obstacle siting is a support rehearsal that is focused on the integration of obstacles and fires. It is considered a support rehearsal because it supports the EA rehearsal that occurs as the last step in the EA development process. Engineers must walk the terrain in conjunction with the supported maneuver unit to ensure that fires cover the EA. See ATP 3-90.8 for more information on the seven steps of EA development.

ENGINEER SUPPORT TO THE THEATER ARMY

4-57. The goal of the defense is to defeat the enemy's attack and to quickly transition to the offense. To reach this goal, engineers provide synchronized engineer efforts to prioritized deep, close, and support areas. See ATP 3-90.8 and FM 3-90-1.

4-58. Theater army engineer operations apply technical capabilities to create favorable conditions for any combination of operational elements. While the influence of distinct operational elements may be lessened for some technically focused engineering tasks, the overall engineer effort must remain integrated within a combined arms framework. The theater echelon engineer staff (either from the TEC or echelon engineer staff section) participate in the operations process to synchronize the orchestration and sustainment of primarily subordinate echelon engineer actions and the application of more technically focused engineer capabilities. Some generalities can be observed when considering the operational elements and strategic objectives.

4-59. For large-scale ground combat, a significant portion of the tailored engineer force tends to have command relationships to maneuver commanders. The tailored engineer force is pushed using command relationships in the task organization to tactical echelons for close support of combat operations. This is true for some general engineering capabilities and for most combat engineering capabilities. Movement and maneuver requirements are not well defined at higher echelons and are more dynamic in combat operations. Tailored forces are pushed to subordinate echelons to address these requirements and add flexibility for those maneuver commanders to react to unforeseen challenges and opportunities.

4-60. For defensive operations, operational echelon engineer planners are not typically able to generate adequate construction capabilities to support the subordinate requirements for movement and maneuver (countermobility) and protection (survivability). Operational requirements compete for these same capabilities. Planners recommend priorities for engineer capabilities and then work collaboratively with unified action partners and subordinate elements to mitigate shortfalls.

4-61. Obstacle-emplacement authority is the authority that a commander has to emplace reinforcing obstacles. Theater commanders are normally delegated the emplacement authority, which is aligned with the theater rules of engagement. Theater commanders delegate that authority to corps commanders who delegate

it to division commanders. Division commanders retain authority unless a higher commander withholds or restricts it.

ENGINEER SUPPORT TO THE CORPS

4-62. Corps engineers aid in the disruption of the enemy attack throughout the depth of the AO. The corps engineer works closely with the corps staff to ensure that engineer disciplines are integrated into deep, close, support, and consolidation areas.

4-63. The engineer effort in support of deep operations includes providing terrain visualization and identifying enemy AAs. It also includes planning and executing situational obstacles to disrupt enemy forces. These forces may include committed, reserve, or follow-on enemy units.

4-64. In close areas, engineers shape EAs by integrating the effects of obstacles with direct and indirect fires. Engineers plan, coordinate, and synchronize survivability to support protecting friendly forces. Finally, they allocate mobility assets to the counterattack force.

4-65. In support areas, Engineers ensure the survivability of C2 facilities by hardening key and critical infrastructure and creating protective barriers. They strengthen base and base camp defenses. Engineers also maintain LOCs and facilities.

ENGINEER SUPPORT TO THE DIVISION

4-66. A significant consideration for the division echelon is ensuring that subordinate BCTs conducting defense operations provide adequate additional combat and general engineering capabilities to meet the requirements. The division echelon must balance the availability of combat and general engineering capabilities against extensive requirements in support of the protection and movement and maneuver warfighting functions. Typically, these assets are task-organized in support relationships to optimize their availability. An exception is that some general engineering units may be task-organized in a command relationship to a combat engineering unit or an engineer headquarters unit to facilitate integration into the combined arms team.

4-67. Divisions in the defense generally take one of two traditional patterns: mobile defense and area defense. The fundamental difference between these patterns is their focus-and-defeat mechanism. The scheme of engineer operations to support the division in the defense is tailored to the type of defense used. The focuses of engineer efforts, unit missions, and task organization are all inseparably linked to the focus-and-defeat mechanism of each type of defense. Therefore, the division engineer must understand the area and the mobile defense and their implications on engineer functions and unit operations.

BRIGADE COMBAT TEAM SUPPORT

4-68. The brigade engineer echelon provides a critical function in supporting the defense. As with offense operations, the ultimate goal is to integrate and synchronize engineer operations with other warfighting functions. Maneuver and engineer commanders must understand the relationship between maneuver planning and obstacle integration. The brigade commander's intent for obstacle and survivability operations provides the impetus for directing the engineer effort. The engineer estimate process is the base planning tool for integrating into brigade defensive operations plans. While the process remains the same, each step is tailored to the needs of defensive operations planning. See ATP 3-34.22 and ATP 3-90.8 for more information on BCT echelon engineer defense planning.

ENGINEER SUPPORT TASKS TO CONSOLIDATE GAINS

4-69. *Consolidate gains* are the activities to make enduring any temporary operational success and to set the conditions for a sustainable security environment, allowing for a transition of control to other legitimate authorities (ADP 3-0). Commanders continuously consider activities necessary to consolidate gains and achieve the end state. Consolidate gains is integral to winning armed conflict and achieving enduring success. It is essential to retain the initiative over determined enemies because it ultimately removes their capability and will for further resistance. It is the final exploitation of tactical success. Engineer forces, when supporting

ARFOR and integrating or reinforcing the efforts of all unified action partners, provide the JFC the significant capability to support the consolidation of gains.

4-70. Consolidate gains is not a synonym for stability, counter-insurgency, or nation-building. It describes activities designed to make the achievement of the military objective enduring. Engineer support to offensive and defensive operations may continue, and the broad array of stability operations may continue over time in specific OEs. Maneuver forces adjust their AO to mass effects and to ensure that C2 covers critical areas in the AOR. Engineers must deliberately plan and prepare for a shift in vital engineer resources to support the consolidation of gains that capitalizes on operational success. Expect engineers and their supporting enablers (such as military police, EOD, and medical and civil affairs) to conduct stability or security tasks.

4-71. Engineer C2 shifts to place headquarters nodes on key missions or locations. Follow-on forces may bring critical units and resources that are not required for large-scale ground combat but are essential to support the consolidation of gains and stability of the region.

4-72. Engineer tasks that support the consolidation of gains are similar to tasks in shape and prevent operations. These tasks include the following:

- Assess civil infrastructure.
- Conduct area clearance to remove explosive hazards.
- Recon additional LOCs, roads, and bridges to support freedom of maneuver.
- Improve force protection measures for critical infrastructure.
- Improve combat roads and trains; replace tactical bridging with long-term LOC bridging.
- Increase contracts for CLASS IV construction/barrier materials, construction equipment, or construction labor.
- Construct base camps and infrastructure as forces and logistics are relocated within the AO.

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Chapter 5
Engineer Planning

The engineer planning process is the primary tool for developing engineer estimates. The engineer estimate enables the early integration of engineer capabilities into combined arms operations. The engineer estimate is an extension of the MDMP.

SECTION I – INTEGRATED PLANNING

5-1. Commanders direct their staffs and integrate input from subordinate commanders into their planning processes. Engineer leaders must understand (and be integral participants in) the planning processes that impact engineer operations at their echelon of employment. Supporting engineer unit commanders and leaders conduct parallel planning processes that provide effective outcomes for the engineer units employed and appropriate input to the higher commander's process. Geospatial support elements and engineer staff planners integrate directly within the planning staff at each echelon to participate in the planning process.

ENGINEER SUPPORT TO THE PLANNING PROCESS

5-2. Engineer operations are complex and resource- (time-, manpower-, equipment-, and material-) intensive, and they require extensive and proactive coordination. Additionally, a successful engineering effort requires an understanding of all engineer disciplines (combat, general, and geospatial) and their role in supporting the concept of operations. Engineer operations must be directed and synchronized through planning as one of the critical activities in the operations process. Many engineer activities also require logic, technical expertise, and problem-solving techniques that form the base logic for the planning processes, as shown in ADP 5-0. Engineer operations involve the use of some functionally unique analytic tools to solve construction, design, facility, and other engineer-specific problems.

5-3. As a significant part of the planning process, the staff recommends the appropriate command and support relationship between engineer and maneuver units to the commander. Each situation is unique and requires its own solution. Whatever the selected relationship, engineer commanders are inherently responsible for ensuring that engineer support tasks are accomplished by subordinate units. In a command relationship, command authority over engineer units is given to a maneuver commander for the immediate availability of engineer forces, when needed. This relationship is well-suited for offensive tasks and fluid situations, allowing the maneuver commander more flexibility in using engineer assets. Command, administrative, and logistical responsibilities remain with the parent engineer unit in a support relationship. Commanders are assigned a support relationship during the conduct of offense, defense, stability, and DSCA operations when subordination of one unit to another is inappropriate. The engineer unit commander organizes the unit and allocates tasks so that they effectively meet the needs of the maneuver commander.

5-4. In some cases, the command and support relationship changes during the conduct of operations at a time or place at which assigned tasks terminate or resources have been exhausted, such as during the execution of a breach. During the breach, a supporting engineer unit may revert from OPCON task organization to their organic unit. Similarly, engineers who are task-organized as tactical control during the preparation of a BCT defense can be reassigned as tactical control to the United States Army Reserve.

5-5. Table 5-1, page 5-2, depicts the Army command relationship responsibilities of the gaining and losing commands. Army command relationships define superior and subordinate relationships between unit commanders. By specifying a chain of command, command relationships unify effort and enable commanders to use subordinate forces with maximum flexibility. Army command relationships identify the degree of control of the gaining Army commander. The type of command relationship often relates to the

expected longevity of the relationship between the headquarters involved and quickly identifies the degree of support that the gaining and losing Army commanders provide.

5-6. Table 5-2 depicts the Army support relationships. Army support relationships are not a command authority and are more specific than joint support relationships. Commanders establish support relationships when subordination of one unit to another is inappropriate.

Table 5-1. Army command relationships

If relationship is—	*Then inherent responsibilities—*							
	Have command relationship with—	**May be task-organized by[1]—**	**Unless modified, ADCON responsibility goes through—**	**Are assigned position or AO by—**	**Provide liaison to—**	**Establish/ maintain communi-cations with—**	**Have priorities established by—**	**Can impose on gained unit further command or support relationship of—**
Organic	All organic forces organized with the HQ	Organic HQ	Army HQ specified in organizing document	Organic HQ	NA	NA	Organic HQ	Attached; OPCON; TACON; GS; GSR; R; DS
Assigned	Gaining unit	Gaining HQ	Gaining Army HQ	OPCON chain of command	As required by OPCON	As required by OPCON	ASCC or Service-assigned HQ	As required by OPCON HQ
Attached	Gaining unit	Gaining unit	Gaining Army HQ	Gaining unit	As required by gaining unit	Unit to which attached	Gaining unit	Attached; OPCON; TACON; GS; GSR; R; DS
OPCON[2]	Gaining unit	Parent unit and gaining unit; gaining unit may pass OPCON to lower HQ[1]	Parent unit	Gaining unit	As required by gaining unit	As required by gaining unit and parent unit	Gaining unit	OPCON; TACON; GS; GSR; R; DS
TACON	Gaining unit	Parent unit	Parent unit	Gaining unit	As required by gaining unit	As required by gaining unit and parent unit	Gaining unit	TACON;GS GSR; R; DS

[1] In NATO, the gaining unit may not task-organize a multinational force. (See TACON.)

[2] Other relationships attributional to ADCON and OPCON are described in ADP 3-0.

Legend:

ADCON	administrative control	HQ	headquarters
AO	area of operations	NA	not applicable
ASCC	Army Service component command	NATO	North Atlantic Treaty Organization
DS	direct support	OPCON	operational control
GS	general support	R	reinforcing
GSR	general support–reinforcing	TACON	tactical control

Table 5-2. Army support relationships

If relationship is—	*Then inherent responsibilities—*							
	Have command relationship with—	**May be task-organized by—**	**Receive sustainment from—**	**Are assigned position or an area of operations by—**	**Provide liaison to—**	**Establish/ maintain communications with—**	**Have priorities established by—**	**Can impose on gained unit further support relationship of—**
Direct support[1]	Parent unit	Parent unit	Parent unit	Supported unit	Supported unit	Parent unit; supported unit	Supported unit	See note[1]
Reinforcing	Parent unit	Parent unit	Parent unit	Reinforced unit	Reinforced unit	Parent unit; reinforced unit	Reinforced unit; then parent unit	Not applicable
General support–reinforcing	Parent unit	Parent unit	Parent unit	Parent unit	Reinforced unit and as required by parent unit	Reinforced unit and as required by parent unit	Parent unit; then reinforced unit	Not applicable
General support	Parent unit	Parent unit	Parent unit	Parent unit	As required by parent unit	As required by parent unit	Parent unit	Not applicable

[1] Commanders of units in direct support may further assign support relationships between their subordinate units and elements of the supported unit after coordination with the supported commander.

5-7. Engineers conduct planning at the strategic, operational, and tactical levels. It is important to understand planning within the context of the levels of war. The scope, complexity, and length of planning horizons differ between operational and tactical planning, yet as echelons of responsibilities have blurred, any engineer headquarters may find itself supporting a maneuver unit at any level of war. For example, an engineer battalion may deploy to support a JTF or an Army corps at the operational level or a division or BCT at the tactical level.

5-8. The engineer planning concepts of the CCDR or senior Army commander focus on the relationship between the geography and force projection infrastructure and the concept of operations. Engineer planners must determine the basic—yet broad—mobilization, deployment, employment, and sustainment requirements of the CCDR concept of operations. The senior engineer commander or the engineer staff officer at each echelon must support the development of the supported commander's OPLAN or OPORD and an internal OPLAN or OPORD for the engineer organization. As previously discussed, the engineer staff officer is the special staff officer responsible for coordinating engineer assets and operations for the command, including engineer planning. The engineer staff officer is normally the senior engineer officer on staff, but a senior engineer commander may be supporting the force.

5-9. In planning at every level, the engineer planner should consider a number of the following general considerations:

- **Speed.** Engineer tasks are resource-intensive in terms of time, materials, manpower, and equipment. Practices that support speed include the use of existing facilities, standardization, simplicity of design and construction, modular systems, prefabricated or pre-engineered components, and phased construction.
- **Economy.** Engineering demands the efficient use of personnel, equipment, and materials. Practices that support the economy include the conservation of resources and the application of environmental considerations early in the process.
- **Flexibility.** Standard plans that allow for adjustment, expansion, and contraction will be used when possible. For example, forward airfields should be designed and located so that they can be expanded into more robust facilities.

- **Decentralization of authority.** The dispersion of forces requires that engineer authority be decentralized as much as possible. The engineer commander at a particular location must have authority that is consistent with responsibilities.
- **Establishment of priorities.** Priorities and resource allocation must be established to determine how much engineer effort is devoted to a single task. All levels of command, beginning with the JFC, will issue directives establishing broad priorities. Resources are initially assigned to the highest priority tasks, and low priority tasks are left undone while recognizing and mitigating the risk.

STAFF INTEGRATION

5-10. While staffs differ by echelon and unit type, all staffs include similar staff sections. The staff consists of the chief of staff or executive officer and of coordinating, special, and personal staff sections. Commanders organize the staff into CPs for operations. Commanders organize their headquarters into CPs to help them exercise a mission command approach throughout the conduct of operations. By organizing their C2 system into CPs, commanders distribute their staff and C2 system capabilities in the AO. This increases the commander's ability to expand their operational reach and makes the C2 system more survivable. The number and internal structure of CPs are based on available resources, planning horizons, and warfighting functions.

5-11. Doctrine and a unit's modified table of organization and equipment provide commanders a starting point for organizing their engineer staff. Each operation is unique based on mission variables. Just as commanders organize their entire force for an operation, they organize their staff and other control systems for effective C2. Mission variables are considered in determining the operational configuration for the headquarters, and the mission also determines which activities the operationally configured headquarters must accomplish. These activities determine how commanders organize, tailor, or adapt their staff to accomplish the mission. The mission also determines the size and composition of the staff. For example, a division headquarters may serve as the base for a JTF headquarters. Based on an analysis of mission variables, the division staff is augmented with additional staff members and C2 capabilities to accomplish the JTF mission.

GEOSPATIAL SUPPORT AND JOINT ENGINEER STAFF

5-12. Each JFC has a unique engineer staff structure. The specific joint manning document describes the engineer staff organization and should reflect representation from each Service. Staff engineers should work closely with civilian and multinational partner organizations to develop wartime organization augmentation manning. The joint manning document should be built based on analysis of the mission and the engineer staff capabilities required to support the operation.

GEOSPATIAL INTEGRATION

5-13. Within ARFOR, geospatial capabilities are distributed at BCT, division, corps, and theater army echelons to provide geospatial engineering support. Geospatial engineering support provided to the Army and other Services varies in focus at each echelon. It is focused on geospatial data generation, geospatial data analysis, geospatial data management, and quality control at the theater army and combatant command level. At the corps and division levels, the majority of the workload is required to support database management, mission planning, and the IPB. Below the division level, geospatial engineering is increasingly focused on current operations and updating the SSGF for the COP.

5-14. The corps and division teams (and the geospatial intelligence cell, if available) support the G-2 and G-3 planners to fuse intelligence and geospatial information into a COP for the commander, staff, and subordinate units. See ATP 2-22.7 for more information about geospatial intelligence. The geospatial engineer team requires access to the classified tactical network to update and disseminate SSGF. The geospatial engineer team organic to the corps and division collects and provides updated geospatial data and products in support of corps and division operations.

5-15. A GPC is assigned to each Army command and Special Operations Command to provide geospatial operational planning; the generation, analysis, and preparation of maps, map updates, and tactical decision

aids; and coordination with other geospatial engineer elements and higher headquarters. GPCs are the only units with a unique, dedicated geospatial data generation capability within the Army force structure. The GPC requires access to the Global Information Grid and a classified tactical local area network to update and disseminate geospatial information and products. GPCs are responsible for managing the TGD.

5-16. The AGC provides timely, accurate, and relevant geospatial information, capabilities, and domain expertise for Army Geospatial Enterprise implementation in support of military operations. AGC provides reachback support to all echelons, may provide training to units, and supports the distribution of the SSGF.

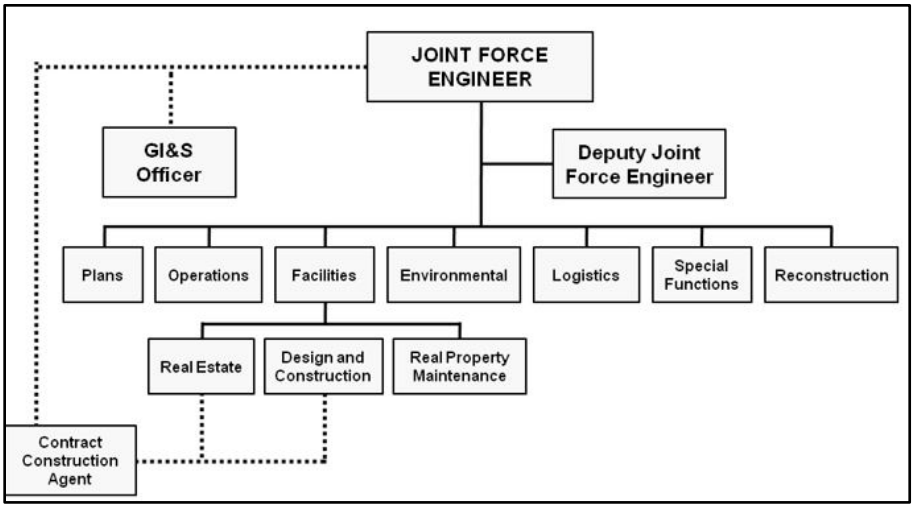
5-17. The NGA produces digital terrain and feature data, which is available to users via the Web or directly from the NGA. The Defense Logistics Agency distributes maps. The geospatial engineer can request imagery, which can be used for spatial and temporal reasoning or multispectral analysis products that are customized to meet particular operational requirements. Imagery enhances 3-D and fly-through perspectives. NGA geospatial analysts may be attached to units, normally at division and above, to supplement the organic geospatial engineers and staffs.

JOINT ENGINEER STAFF

5-18. The JFC will organize their staffs to carry out their respective assigned duties and responsibilities. Based on mission-specific requirements, the engineer staff may be placed within the operations directorate of a joint staff (J-3) or logistics directorate of a joint staff (J-4) or be organized as a separate staff to the JFC. The JFC may choose to organize geospatial engineers or GI&S officers within the intelligence directorate of a joint staff (J-2), J-3, J-4, or engineering staff section of a joint staff (J-7), depending on the specific organizational structure of the unit. Considerations for each option include—

- **Operations directorate staff.** When the focus of engineer effort predominantly supports the operational movement and maneuver, fires, and protection warfighting functions, the JFC should consider placing the engineer staff as a cell within the J-3. This option provides the fastest exchange of information during crisis action planning and optimizes the use of supporting capabilities.
- **Logistics directorate staff.** When the engineer effort predominantly supports sustainment of the joint force, the JFC should consider placing the engineer staff as a cell within the J-4. This option facilitates planning and coordination among engineers and logisticians for the construction and repair of roads, airfields, other logistic facilities, and infrastructure in general.
- **Separate engineer staff.** When the engineer effort is a significant focus or a key element of the joint operation, or when the engineer effort is equally divided between combat and general engineer disciplines, the JFC should consider establishing a separate engineer staff element that reports directly to the JFC. This option provides the greatest flexibility in orchestrating diverse engineer operations, and it provides the greatest visibility of engineer capabilities, requirements, and responsibilities throughout the staff. This is the preferred option.

5-19. A combatant command engineer staff assists the geographic combatant commander (GCC) by performing a variety of functions to synchronize engineer operations in the AOR. A joint force engineer serves as the principal advisor to the JFC for matters pertaining to the planning and execution of joint engineering support operations. The GCC and subordinate JFC organize their staffs to carry out their respective assigned duties and responsibilities. When a functional component command employs forces from more than one Service, the staff should reflect on each Service represented. Based on mission-specific requirements, the engineer staff may be placed within the directorate for operations (J-3) or the directorate for logistics (J-4) or be organized as a separate staff to the JFC. The JFC may choose to organize geospatial engineers or GI&S officers within the directorate for intelligence (J-2). Regardless of the option or combination of options used, the requirement for the staff engineer remains, as does the need for constant communication, liaison, and coordination throughout the entire staff. A notional joint engineer staff is depicted in figure 5-1, page 5-6.



Legend:

…..	lines of coordination
GI&S	geospatial information and services

Figure 5-1. Notional joint engineer staff

5-20. Typical joint engineer responsibilities are as follows:

- Planning and coordinating theater engineering support.
- Providing recommendations on the assignment of engineering missions to subordinate commanders. Recommendations may include which subordinate commander (Service or functional component, subordinate JTF, or subunified commander) will be assigned the mission or the scope of the project and which commanders will be placed in supporting roles.
- Furnishing recommendations on the tasking of components for theater engineering missions, tasks, or projects.
- Recommending policies and priorities for construction and real estate acquisition and for Class IV construction materials.
- Compiling a joint integrated priority list for construction projects for U.S.-funded contingency construction and for HN-funded construction.
- Furnishing advice on the effect of joint operations on the physical environment according to applicable U.S., international, and HN laws and agreements.
- Recommending construction standards.
- Identifying engineering support requirements that exceed component funding authorizations and organized engineer capabilities.
- Furnishing advice on the assessment of the risk to mission accomplishment of engineering support shortfalls.
- Furnishing advice on the feasibility, acceptability, and suitability of component engineering plans.
- Preparing, as part of the joint operation planning process, the engineer parts of OPLANs and OPORDs.
- Reviewing all engineer-related annexes and appendixes of OPLANs and OPORDs.
- Providing input to the theater security cooperation plan.
- Developing program construction projects, to include exercise-related construction program and humanitarian and civic assistance program construction projects to support theater security cooperation strategies.
- Developing training and exercise programs to evaluate and improve preparedness for engineering missions.

- Planning and coordinating the procurement and distribution of Class IV construction materiel based on established priorities. Service components are responsible for the procurement and distribution of its Class IV requirements.
- Coordinating with DOD and department of state construction agents and other engineer support agencies.
- Participating in joint engineering boards and engineer-related working groups, as required.

5-21. Key joint engineer staff functions are as follows:

- Develops and coordinates combat, general, and geospatial engineering requirements for the joint force.
- Acts as the intermediary, facilitator, and coordinator between JTF elements (including nonmilitary elements) requesting engineering services. Receives guidance and reports actions to the joint civil-military engineering board, if established.
- Develops and coordinates tasks for component engineer forces.
- Coordinates and facilitates the joint facilities utilization board, joint civil-military engineering board, and joint environmental management board. Integrates actions from these boards, assigns taskings based on board recommendations, and monitors the completion of tasks.
- Screens, validates, and prioritizes all engineering projects and mission assignments. Participates in the management of the logistics civil augmentation program, when used, to validate operations and maintenance services and construction requirements.
- Plans, programs, and controls facility utilization. Receives guidance and reports actions to the joint facilities utilization board, if established.
- Prepares logistic reports on engineer resources using the Joint Operation Planning and Execution System (JOPES).
- Develops the ESP.
- Plans and coordinates the distribution of construction and barrier materials and engineer munitions based on established priorities. Participates on the joint acquisition review board to validate requests for construction equipment leases and purchases.
- Functions as the primary interface between the joint force, HN, and other theater construction organizations.
- Establishes lead Service engineer contract support requiring activity responsibilities, to include writing the statement of work, writing the contracting officer representative nomination, and managing tasks.
- Plans and provides guidance for environmental considerations that impact joint operations (to include the impact of international and HN environmental legal requirements on operations, required environmental surveys and documentation, and planning and reporting for spill response).
- Serves as the program manager for all engineer-related functions.

5-22. Engineer forces, units, and individual augmentees must be requested through the request for forces process to meet force projection requirements. Engineer staffs at the GCC and theater army headquarters are primary points of contact to initiate a request for engineering forces as part of force tailoring. Subordinate commanders may forward requests to the theater army echelon. Once validated, the request is forwarded to the CCDR and then to the joint staff for sourcing after final validation. For further information on the request for forces process, see JP 1-0.

PLANS AND ORDERS

5-23. Plans and orders are key tools used by commanders (with staff assistance) in directing operations, including engineer operations. Engineer operations typically require direction expressed both within the plans and orders of the supported combined arms headquarters and in the plans and orders of controlling engineer unit headquarters. The engineer staff assists combined arms commanders with input to the mission orders that direct supporting engineer operations. Engineer staff planners collaborate with mission-tailored engineer headquarters commanders and staffs to enable their use of plans and orders to direct engineer unit operations.

Interaction with joint operations planning increases at higher echelons; therefore, EAB echelon engineer planners will also frequently take information from and use the ESP. The ESP does not provide a format guide for either, but it does broadly follow an order outline. See FM 6-0 for a detailed discussion of order formats. The format for the ESP is described in CJCSM 3122.05.

5-24. Commanders issue plans and orders to subordinates to communicate their visualization of an operation. Plans and orders summarize the situation (current conditions) and describe the operation's end state (desired future conditions). Effective plans focus on the results that commanders expect to achieve rather than on how to achieve them. Plans and orders convey the unit mission, commander's intent, and concept of operations. These serve as the guiding constructs for coordinating the force during execution. A concept of operations sequences forces in time, space, and purpose to accomplish the mission and achieve the operation's end state. Plans and orders task-organize the force, allocate resources, and assign tasks to subordinate units. A concept of sustainment and a concept of C2 complete the base plan or order. Details regarding the situation and the instructions necessary to synchronize the force are contained in the annexes. FM 6-0 provides the format for Army plans and orders. The format for joint plans and orders is in CJCSM 3122.05 and JP 5-0.

5-25. Plans and orders vary in scope, complexity, and planning horizon length. Different types of plans and orders include the OPLAN, concept plan with or without time-phased force deployment data, OPORD, service support order, warning order, and fragmentary order.

5-26. The Army OPORD format must be usable at all echelons and in all situations. Strategic plans cover the overall conduct of a war or a crisis from a national perspective. Operational and campaign plans include a series of related military operations aimed at accomplishing strategic and operational objectives within an AOR or a JOA. Tactical plans cover the employment of corps and lower level units in operations. Tactical plans and orders also vary greatly. For example, a division OPORD covering the conduct of a 12-month operation and a rifle platoon OPORD for an ambush patrol are significantly different in scope, complexity, and length of planning horizon. While each type of plan or order serves a particular purpose, they all follow the basic five-paragraph format: situation, mission, execution, administration and logistics (service support), and C2.

Engineer Support Plan

5-27. Joint interdependence requires higher headquarters to understand joint planning doctrine. Army force headquarters must be prepared to serve as the Army component of a joint force. Army division and corps headquarters may serve as the base for a JTF headquarters. Engineer staff and engineer organizations supporting these headquarters participate in joint planning and must understand the ESP. The ESP is produced by a joint engineer staff for input to a joint OPLAN as part of the planning process. It ensures that essential engineering capabilities are identified and will be provided at the required locations and times. It is the most critical appendix for engineering in a joint OPLAN.

Sustainment Support for the Engineer Unit

5-28. Support planning and execution must be closely integrated into tactical and operational battle rhythms. Successful engineer operations include the effective incorporation of sustainment support. Sustainment for engineer elements includes the functions of supply, field services, transportation, maintenance, EOD, health service support, human resources support, financial management support, legal support, religious support, and band support. For units augmenting the BCT engineers and all other units operating at EAB, integration into an area and/or theater support structure is required. This chapter focuses on sustainment support for engineer capabilities and highlights the sustainment considerations that affect engineer operations. See FM 4-0 for an additional discussion of logistics support.

5-29. Engineers operating above the BCT level work closely with, and receive sustainment support from, the sustainment brigade. Sustainment brigades are one of the five types of support brigades and are subordinate commands of the theater support command. They consolidate selected functions previously performed by corps and division support commands and area support groups into a single operational echelon. They provide C2 of the full range of logistics operations conducted at the operational (theater level) or higher tactical (corps and division) levels. They perform theater opening, distribution, and sustainment

functions. Each of these functions is interrelated, and throughout the course of an operation, a sustainment brigade will likely perform one or more of these functions simultaneously.

5-30. Engineer staffs and commanders are essential to the sustainment of engineer organizations and capabilities operating at every echelon. Sustainment for engineer units and capabilities that are organic, assigned, or attached directly to a supported unit is the responsibility of the leaders and staffs of the unit they support, but the higher echelon engineer staff officer will retain an interest in the status of their support. The engineer staff officer must also work closely with the supported unit logistics staff to assist in planning, preparing, executing, and assessing operations, which will most likely require extensive engineer materials and resources. When engineer or multifunctional headquarters units are provided, the organic logistics staff within that headquarters provides sustainment planning for the engineer force under its C2. Engineer battalions provide logistics support to subordinate units through organic forward support companies.

COMMAND AND CONTROL OF ENGINEER FORCES

5-31. The C2 of engineers consists of two distinct but interrelated functions: command of engineer forces conducting operations, and staff control of assets and activities critical to the supported commander's mission. Engineer units execute the operations process while remaining nested with the operations process of supported units. The interaction may be primarily through an engineer staff assigned to the supported unit or through staff counterparts. In some cases, a supported unit may not have assigned or attached engineer staff, so the supporting unit will provide this support as well. In situations where the supported unit does have an assigned engineer staff at EAB include the division, corps, and theater army headquarters. The engineer staff at these headquarters aid their commanders with the control of engineer forces by establishing control mechanisms and shaping the command and support relationships of the tailored force.

WORKING GROUPS, BOARDS, AND CELLS

5-32. Commanders at each echelon may establish working groups, boards, or cells to manage and coordinate functional or multifunctional activities. The engineer staff are key members on many of these and may chair construction-related groups. Working groups conduct staff coordination at the action officer level and prepare materials for decisions to be made at a board. Boards establish policies, procedures, priorities, and oversight to coordinate the efficient use of resources when imparted with decision-making authority. Cells group personnel from various sections on a headquarters authorization document to integrate key functions, such as cells focused on each warfighting function. See FM 6-0 for a full discussion of working groups, boards, and cells.

5-33. Commanders and staff engineers must manage their personnel to ensure that critical meetings, working groups, boards, and cells have the right engineer representation. Senior engineers must not only create cross-sharing systems on digital or analog systems to share information vertically between echelons, but also horizontally across the AO to create shared understanding across engineer formations. This may require routine situational reports sent to higher headquarters, operational reports such as obstacle and route reporting, and requests for support to reprioritize engineer capabilities across the AO. Inputs into a meeting include not only facts and data points, but also an analysis of why that data is relevant to the mission. Engineer meeting outputs have importance and must feed into other decision-making boards (such as the Joint Facility Utilization Board or the Joint Targeting and Coordination Board) to drive future actions, funding, approvals, or engineer effects in the AO.

5-34. The geospatial engineering units available to the commander may become part of the command's geospatial intelligence cell. The geospatial intelligence cell is comprised of the people and capabilities that constitute the geospatial intelligence support, to include imagery and geospatial assets. The cell ensures that geospatial intelligence requirements are coordinated through appropriate channels as applicable and facilitates shared access of various domains. This cell may be centrally located or distributed throughout the command and connected by networks. Cell members do not have to work directly for a designated geospatial intelligence officer; they may work for their parent unit, but coordinate efforts across staff directorates.

SECTION II – THE PLANNING PROCESS

5-35. The Army planning methodologies assist commanders and staffs with effective planning processes. The Army design methodology, MDMP, and troop leading procedures are three planning processes defined in ADP 5-0. Leaders determine the appropriate mix based on the mission or operation. Each is a means to an end, and its value lies in the result, not in the process. Processes can be performed in detail if time permits or in an abbreviated fashion in a time-constrained environment.

STAFF PROCESSES

5-36. Although they are not fully developed planning methodologies, engineers use a number of other processes, activities, and frameworks to facilitate the planning and integration of engineer support. They include the—

- Running estimate.
- Framework of assured mobility.
- Development of essential tasks for M/CM/S.

PLANNING

5-37. Except in the smallest echelon of Army units, commanders rely on assistance from a staff to conduct the planning processes that lead to the OPLAN or OPORD. ADP 6-0 describes the organization and responsibilities of the engineer staff. Engineer planners provide for the integration of engineer-focused considerations on the supported staff at each echelon. Throughout the planning process, the engineer staff must advise supported commanders and staffs about engineering capabilities, methods of employment, and the additional capabilities and depth of resources from the institutional force and USACE In those units without organic engineer staff support (including support type organizations), it may be important for the supporting engineer organization to provide planning support. Liaison may need to be provided in certain situations to ensure that proper and complete staff planning is accomplished.

5-38. The engineer staff officer at each echelon is responsible for engineer logistics estimates, and the engineer staff officer plans and monitors engineer-related sustainment support for engineering capabilities operating at that echelon. When an engineer unit or capability is task-organized in support of the unit, the engineer staff officer recommends the most effective command or support relationship, including considering the impact of inherent sustainment responsibilities. The engineer staff officer—

- Determines engineer intelligence requirements for an AO.
- Writes the engineer annex and associated appendixes to the OPLAN or OPORD to support the commander's intent, to include a recommended distribution for engineer-related, command-regulated classes of supply and special equipment.
- Assists in planning the location of forward supply points for the delivery of engineer-configured loads of Class IV and Class V supplies. This site is coordinated with the unit responsible for the terrain and the appropriate logistics staff officer (S-4) or assistant chief of staff, logistics (G-4).
- Assists in planning the location of the engineer equipment parks for the pre-positioning of critical equipment sets (tactical bridging). This site is coordinated with the unit responsible for the terrain and the appropriate S-4 or G-4.
- Works closely with the sustainment staff to identify available haul assets (including HN) and recommends priorities to the sustainment planners.
- Identifies extraordinary medical evacuation requirements or coverage issues for engineer units and coordinates with sustainment planners to ensure that the supporting unit can accomplish these special workloads.
- Identifies critical engineer equipment and engineer mission logistics shortages.
- Provides the appropriate S-4 or G-4 an initial estimate of required Class III supplies in support of construction.
- Provides the appropriate S-4 or G-4 an initial estimate of required Class IV and Class V supplies for the countermobility and survivability efforts.

- Provides the appropriate S-4 or G-4 an initial estimate of required Class IV supplies in support of construction. Monitors and advises on, as required, the implications of statutory, regulatory, and command policies for the procurement of construction materials. The critical issue for the engineer staff officer is the timely delivery at required specifications, regardless of the source of construction materials.
- Tracks the flow of mission-critical Class IV and Class V supplies into the support areas and then forwards the supplies to the supporting engineer units.
- Coordinates engineer assistance, as required, to accept the delivery of construction materials.
- Coordinates main supply route clearing operations and tracks its status at the main CP.
- Coordinates for EOD support and integration, as necessary.
- Serves as the primary staff integrator for the environmental program.

5-39. The staff assigned to the BCT and above includes many engineers in various sections and cells. One of these engineers, typically the senior engineer officer on staff, is designated as the engineer staff officer to advise the commander and assist in exercising control over engineer forces in the AO. The engineer staff officer is responsible for coordinating engineer assets and operations for the command. Although there may be more than one engineer officer on a staff, only one is designated as the engineer staff officer for the command. Each echelon, down to the BCT level, has an organic engineer planner and staff element to integrate engineers into the combined arms fight. The task force and company levels may have a designated engineer planner, but the engineer is not typically organic at these echelons. The engineer is a special staff member who is responsible for understanding the full array of engineering capabilities (combat, general, and geospatial) available to the force and for synchronizing them to best meet the needs of the maneuver commander.

5-40. The senior engineer should not be assigned duties as both commander and staff officer. Some specific considerations for determining the relationship of the senior engineer staff officer and the engineer unit commander include the following:

- What staff assets are available to support the engineer staff advisor versus the engineer unit commander? Are the elements from the same unit, or are they separate units resourced for each role?
- What experience level is needed for the engineer staff advisor? Should this role be resourced with a current or former commander?
- What duration of time will the augmenting engineer element, commanded by the senior engineer unit commander, be working for or with the force? Does the engineer commander have the time to acclimate and effectively advise the force commander?
- What working relationship is established between an existing engineer staff advisor and the force commander? Similarly, is there an existing working relationship between the engineer unit commander and this force commander? It is critical that the engineer staff officer for the supported unit maintains close coordination with the supporting engineer unit commander and staff to ensure a synchronization of effort.

5-41. The engineer staff provides key members for many of the working groups, boards, or cells established by commanders to coordinate functional or multifunctional activities. The engineer staff officer may chair construction-related groups.

5-42. The specific roles, responsibilities, and considerations for the engineer staff officer are similar, but not identical, at each echelon. ATP 3-34.22 addresses these for the BCT engineer staff officer.

5-43. The successful sustainment of engineer organizations and capabilities requires active involvement by engineer commanders and staffs at every echelon. In addition to ensuring the sustainment of the units, engineers must work closely with supported units. This is because the supported unit is responsible for providing the Class IV and Class V construction and obstacle materials needed for the tasks they assign to the supporting engineer unit, regardless of the command and support relationship between them. The higher-echelon engineer staff officer must retain an interest in the sustainment of subordinate engineer units and capabilities, regardless of the command and support relationships with the supported units. Within a supported unit, the engineer staff officer must work closely with the logistics staff to assist in planning, preparing, executing, and assessing operations requiring engineer materials and resources. Within engineer

or multifunctional headquarters units, the logistics staff provides sustainment planning for its subordinate units.

5-44. Within engineer units, leaders and staffs must monitor, report, and request requirements through the correct channels and ensure that sustainment requirements are met when sustainment is brought forward to the engineer unit. The accurate and timely submission of personnel and logistics reports and other necessary information and requests is essential.

5-45. Engineer commanders and the engineer staff officer must ensure that parallel planning occurs between the supported unit and the task-organized engineer units. This parallel process feeds into the force commander's decision-making process and provides input for an engineer unit OPLAN, OPORD, or annex to be published nearly simultaneously, maximizing the time available for execution.

5-46. To facilitate effective parallel planning at the engineer unit level, engineer unit commanders and staff planners must—

- Understand the commander's intent and planning guidance of the parent (engineer) unit and the supported unit.
- Analyze the terrain, obstacle information, and threat capabilities.
- Know the engineer systems and capabilities to accomplish the identified tasks within the time allotted.
- Identify risks where engineering capabilities are limited or time is short, and identify methods to mitigate the risks, ensuring that potential reachback capabilities have been leveraged.
- Consider the depth of the AO and the transitions that will occur among operational elements. This includes the integration of environmental considerations.
- Plan for the sustainment of engineer activities. Engineers ensure that the logistical requirements are analyzed and accounted for through the end state and resourced to accomplish the mission and facilitate future operations.

MILITARY DECISIONMAKING PROCESS

5-47. Engineers analyze the OE, using operational variables to add to the shared common understanding by identifying potential challenges and opportunities within the operation before and during mission execution. The resulting understanding of the OE (an engineer view of the OE) is not intended to be limited to considerations within the OE that may result in engineer functional missions. The resulting engineer view of the OE is, instead, organized by lines of engineer support and linked to the common overall understanding through the warfighting functions.

Operational Variables

5-48. Army doctrine describes an OE in terms of the following eight constantly interacting operational variables that are listed in the bullets below. The following examples are provided to show the added focus sought within each of the operational variables by the engineer view of the OE. These examples are not meant to restate the more complete treatment of the variable in the general terms provided in ADP 5-0 or to be an all-inclusive treatment of the engineer aspects within each of the variables; instead, they are meant to focus engineer perspectives on the following operational variables:

- **Political.** Understanding the political circumstances within an OE helps the commander to recognize key actors and visualize explicit and implicit aims and capabilities to achieve goals. The engineer view might add challenges associated with political circumstances that permit or deny access to key ports of entry or critical sustainment facilities. Opportunities in the form of alternative access routes might be added. The engineer and others may be impacted by the effect of laws, treaties, agreements, or positions of multinational partners (such as restrictions on shipments of hazardous materials across borders or a host of similar political considerations that can affect engineer planning and operations).
- **Military.** The military variable explores the military capabilities of relevant actors in a given OE. The engineer view might add the challenges associated with an enemy capability to employ explosive hazards or other obstacles and the capability to challenge traditional survivability

standards. Opportunities in the form of existing military installations and other infrastructure might be added. The engineer view includes a necessarily robust and growing understanding of engineering capabilities in a context of unified action within this variable of the OE.

- **Economic.** The economic variable encompasses individual behaviors and aggregate phenomena related to the production, distribution, and consumption of resources. The engineer view might add challenges associated with the production or availability of key materials and resources. Opportunities in the form of potential for new or improved production facilities might be added.
- **Social.** The social variable describes the cultural, religious, ethnic makeup, and social cleavages within an OE. The engineer view might add challenges associated with specific cultural or religious buildings or installations, the impact of language barriers or availability of laborers, and qualified local engineer resources. Opportunities in the form of potential to provide for culturally related building requirements might be a consideration.
- **Information.** This variable describes the nature, scope, characteristics, and effects of individuals, organizations, and systems that collect, process, disseminate, or act on information. Engineers assist the commander by providing information and influencing activities to shape the OE by improving infrastructure and services for the population. The engineer must consider how construction projects, especially in stability, ultimately support informational themes that are consistent with friendly military goals and actions and how the enemy might portray them. The engineer view might also add challenges associated with deficiencies in the supporting architecture, to include power considerations.
- **Infrastructure.** Infrastructure comprises the basic facilities, services, and installations needed for the functioning of a community or society. The engineer view might add challenges associated with specific deficiencies in the basic infrastructure. Opportunities in the form of access to existing infrastructure, improvements to existing infrastructure, and new projects might be added. The engineer view provides for a detailed understanding of infrastructure by using sewage, water, electricity, academics, trash, medical, safety, and other considerations. Infrastructure is not limited to the physical structures. Personnel, training, and maintenance procedures are also considerations. See ATP 3-34.40 and ATP 3-34.81 for additional information.
- **Physical environment.** The defining factors are urban settings (super-surface, surface, and subsurface features) and other types of complex terrain, weather, topography, hydrology, and environmental conditions. An enemy may try to counteract U.S. military advantages by operating in urban or other complex terrain requiring greater engineer effort to provide the freedom of action. The engineer view might add challenges associated with natural and man-made obstacles. Insights into environmental considerations are also a concern. See ATP 3-34.5 for additional information environmental considerations. Opportunities in the form of existing routes, installations, and resources might be added. The engineer view supports a broad understanding of the physical environment through geospatial engineering. Geospatial engineering is discussed in detail in ATP 3-34.80 and JP 2-03.
- **Time.** The variable of time influences military operations within an OE in terms of the decision cycles, operational tempo, and planning horizons. The duration of an operation may influence engineer operations in terms of whether to pursue permanent or nonpermanent base camp solutions for facilities and infrastructure. The CCDRs establish base camp strategy that is tailored to the joint operational area based on an assessment of the situation, unique characteristics of the region, and anticipated duration.

Mission Variables

5-49. While an analysis of the OE using the operational variables improves situational understanding, when commanders receive a mission, they require a mission analysis focused on the specific situation. The Army uses the mission variables as the categories of relevant information used for mission analysis. Similar to the analysis of the OE using the operational variables, the engineer uses the mission variables to seek the shared common understanding from an engineer perspective.

5-50. The following are some examples of the engineer perspective for each of the mission variables:

- **Mission.** Commanders analyze a mission in terms of specified tasks, implied tasks, and the commander's intent (two echelons up) to determine essential tasks. Engineers conduct the same analysis (with added focus on the engineer requirements) to determine the essential tasks and engineer priorities. The early identification of the essential tasks for engineer support enables the maneuver commander to request engineer augmentation early in the planning process.
- **Enemy.** The engineer view of the enemy concentrates on enemy tactics, equipment, and capabilities that could threaten friendly operations. This may include an analysis of enemy disposition, enemy engineering capabilities, obstacle intelligence, engineer reconnaissance, and mine strike reporting within the AO or area of interest that could have an impact on the mission.
- **Terrain and weather.** As the terrain visualization experts, geospatial engineers analyze terrain (man-made and natural) to determine the effects on friendly and enemy operations. Geospatial engineers analyze terrain using the five military aspects of terrain (observation and fields of fire, AAs, key terrain, obstacles, and cover and concealment). Geospatial engineers integrate geospatial products to help commanders and staffs visualize the terrain. The effects of weather coupled with terrain considerations define the total engineering operating environment. Air Force Staff Weather Officer personnel incorporate current and forecasted weather conditions into all engineering operations and decision aids. Knowledge of expected weather conditions (especially dealing with trafficability) is crucial for the effective completion of engineering tasks. Precipitation types and amounts drastically influence road usage and soil conditions.
- **Troops and support available.** Engineers consider the number, type, capabilities, and condition of engineer troops and support available from unified action partners.
- **Time available.** Engineers must understand the time required in planning engineer operations and the importance of collaborative and parallel planning to prepare and execute tasks. Engineers realize the time needed for positioning critical assets and the time associated with performing engineer tasks or projects.
- **Civil considerations.** The influence of man-made infrastructure; civilian institutions; and attitudes and activities of the civilian leaders, populations, and organizations within the AO impact the conduct of military operations. At the tactical level, they directly relate to key civilian areas, structures, capabilities, organizations, people, and events. This engineer view provides a detailed understanding of the basic infrastructure needed for a community or society. The engineer view might identify challenges, to include environmental stewardship, financial and economic feasibility, social and cultural impacts, and the implications associated with specific deficiencies in the basic infrastructure and opportunities for improvement or development of the infrastructure.

Engineer Staff Running Estimate

5-51. The engineer staff officer uses the running estimate as a logical thought process and as an extension of the MDMP. It is conducted by the engineer staff officer concurrently with the planning process of the supported force commander and is continually refined. This estimate allows for the early integration and synchronization of engineer considerations into combined arms planning processes. In running estimates, staff sections continuously consider the effect of new information and update assumptions, the friendly force status, effects of enemy activity, civil considerations, and conclusions and recommendations. A section running estimate assesses the following:

- Friendly force capabilities with respect to ongoing and planned operations.
- Enemy capabilities as they affect the section area of expertise for current operations and future plans.
- Civil considerations as they affect the section area of expertise for current operations and future plans.
- OE effects on current and future operations from the section perspective.

5-52. The development and continuous maintenance of the running estimate drives the coordination between the staff engineer, supporting engineers, the supported commander, and other staff officers in the development of plans, orders, and supporting annexes. Additionally, the allocation of engineer assets and resources assists in determining the command and support relationships that will be used. Table 5-3 shows the relationship between the MDMP and the engineer staff running estimate.

Table 5-3. Military decisionmaking process and engineer staff running estimates

Military Decisionmaking Process	*Engineer Staff Running Estimate*
Mission analysis. • Analyze the higher headquarters plan or order. • Perform the initial IPB. • Determine the specified, implied, and essential tasks. • Review the available assets, and identify resource shortfalls. • Determine the constraints. • Identify the critical facts, and develop assumptions. • Begin the risk assessment. • Determine the CCIR and EEFI. • Develop the information collection plan. • Update the plan for the use of available time. • Develop the initial information themes and messages. • Develop the proposed mission statement. • Present the mission analysis briefing. • Develop and issue the initial commander's intent. • Develop and issue the initial planning guidance. • Develop the COA evaluation criteria. • Issue the warning order.	**Analyze the mission.** • Analyze the higher headquarters orders. ▪ Commander's intent. ▪ Mission. ▪ Concept of operation. ▪ Timeline. ▪ Area of operations. • Conduct the IPB, and develop the engineer staff running estimate. ▪ Terrain and weather analysis. ▪ Enemy mission and M/CM/S capabilities. ▪ Friendly mission and M/CM/S capabilities. • Analyze the engineer mission. ▪ Specified M/CM/S tasks. ▪ Implied M/CM/S tasks. ▪ Available assets. ▪ Limitations. ▪ Risk as applied to engineering capabilities. ▪ Time analysis. ▪ Essential tasks for M/CM/S. ▪ Restated mission. • Conduct the risk assessment. ▪ Safety. ▪ Environment. • Determine the terrain and mobility restraints, obstacle intelligence, threat engineering capabilities, and critical infrastructure. • Recommend the CCIR. • Integrate the engineer reconnaissance effort.
COA development.	**Develop the scheme of engineer operations.** • Analyze the relative combat power. • Refine the essential tasks for M/CM/S. • Identify the engineer missions and the allocation of forces and assets. • Determine the engineer priority of effort and support. • Refine the commander's guidance for M/CM/S. • Apply the engineer employment considerations. • Integrate engineer support into the maneuver COA. • See FM 6-0 for additional information on the scheme of engineer operations and scheme of engineer support.

Table 5-3. Military decisionmaking process and engineer staff running estimates (continued)

Military Decisionmaking Process	*Engineer Staff Running Estimate*
COA analysis.	**War-game and refine the engineer plan.**
COA comparison.	**Recommend a COA.**
COA approval.	**Finalize the engineer plan.**
Orders production, dissemination, and transition.	**Create the input to the basic operation order.** • Scheme of engineer operations. • Essential tasks for M/CM/S. • Subunit instructions. • Coordinating instructions. • Engineer annex and appendixes.

Legend:

CCIR	commander's critical information requirements
COA	course of action
EEFI	essential elements of friendly information
IPB	intelligence preparation of the battlefield
M/CM/S	mobility, countermobility, and survivability

INTELLIGENCE PREPARATION OF THE BATTLEFIELD

5-53. IPB is an integrating process and is critical to the success of planning. IPB is a systematic process of analyzing the mission variables of enemy, terrain, weather, and civil considerations in an area of interest to determine their effect on operations. To be effective, IPB must—

- Accurately define the commander's area of interest to focus collection and analysis on the relevant aspects of the mission variables of enemy, terrain, weather, and civil considerations. *Relevant* is defined as having significant effect on friendly and threat operations.
- Describe how each of these four variables affect friendly operations and how terrain, weather, and civil considerations affect the enemy.
- Provide the IPB products necessary to aid each step of the MDMP in accordance with the planning timelines and guidance provided by the commander.
- Determine how the interactions of friendly forces, enemy forces, and indigenous populations affect each other to continually create outcomes that affect friendly operations. This aspect of IPB is not the sole responsibility of the intelligence staff. This complex analysis involves the commander and the entire staff working together to determine these effects.

5-54. IPB is most effective and best aids the commander's decision making when the intelligence staff integrates the expertise of the other staff and supporting elements into its analysis. The engineer must understand the S-2 threat capabilities statement and situation template to analyze enemy engineer capabilities. Engineer reconnaissance may be required to support IPB, and the engineer staff must be proactive in recognizing these requirements and tasking the appropriate engineer elements. Geospatial engineers provide the necessary tools and expertise to describe, analyze, and visualize the terrain so that commanders, staffs, and subordinate echelons can make better informed decisions. The following are the four steps of IPB:

- **Step 1. Define the OE.** Defining the OE results in the identification of significant characteristics of the OE as they relate to enemy, terrain, weather, and civil considerations that can affect friendly and enemy operations. This step also results in the identification of gaps in current intelligence holdings.
- **Step 2. Describe environmental effects on operations.** The staff describes how these characteristics affect friendly operations. The intelligence staff also describes how terrain, weather, civil considerations, and friendly forces affect enemy forces. Finally, the entire staff determines the impact and how it affects the population of friendly and enemy force actions.

- **Step 3. Evaluate the threat.** The purpose of evaluating the threat is to understand how a threat can affect friendly operations. This is a detailed study of enemy forces and their composition and organization, tactical doctrine, patterns of operation, weapons and equipment, and supporting systems. This step identifies threat capabilities based on threat missions and objectives.
- **Step 4. Determine threat COAs.** The staff identifies and develops possible threat COAs that can affect accomplishing the friendly mission. The staff uses threat COAs, along with other facts and assumptions about the OE, to drive friendly COA analysis and influence friendly COA development.

5-55. Tactically focused echelons typically gain substantial initial context for their assessments from a higher echelon's Army design methodology. Before receipt of a mission, the running estimate consists of a broad analysis of the OE and an assessment of engineer capabilities. Upon receipt of the mission, the running estimate parallels the MDMP and becomes focused on relevant information to assist the commander's decision making.

5-56. The result of the MDMP is a concept of operations. The running estimate is refined through detailed consideration of engineer requirements in support of the concept of operations. The assessment includes each of the elements of decisive action (see table 5-4).

Table 5-4. Elements of decisive action

Offense	
Operation: • Movement to contact. • Attack. • Exploitation. • Pursuit.	**Considerations:** • Planning begins with predicting the adversary's intent through a thorough understanding of the threat, threat engineer capabilities, and how the terrain will affect operations. • Engineer planning tends to focus on mobility support including a robust reconnaissance effort. • Engineer planning also includes planning to ensure a smooth, resourced transition from offensive to defensive or stability operations. • Engineer units tend to have command relationships to maneuver commanders.
Defense	
Operation: • Mobile defense. • Area defense. • Retrograde.	**Considerations:** • Planning begins with the use of terrain products to visualize how best to shape the terrain, to include describing the best positions from which to defend. • Engineer planning tends to focus on countermobility and survivability support including a significant construction effort. • Construction planning includes security and survivability considerations. • Engineer units tend to have support relationships to the maneuver commander except for those combat engineer forces task-organized to the reserve or the mobile strike force.

Table 5-4. Elements of decisive action (continued)

Stability	
Operation: • Establish civil security. • Establish civil control. • Restore essential services. • Support to governance. • Support to economic and infrastructure development. • Conduct security cooperation.	**Considerations:** • Assessment of the operational environment includes a greater focus on political and cultural considerations. • Engineer planning tends to focus on construction support, including engineer forces working among and in conjunction with civilians. • Engineer units are likely distributed among echelons of command. Engineer units tend to have support relationships with the maneuver commander; however, there are instances for which responsiveness and proximity to a higher engineer command will dictate a command and support relationship.
Defense Support of Civil Authorities	
Operation: • Provide support for domestic disasters. • Provide support for domestic chemical, biological, radiological, and nuclear incidents. • Provide support for domestic civil law enforcement. • Provide other designated support.	**Considerations:** • Engineer planners consider statutes and regulations that restrict the Army's interaction with other government agencies and civilians during defense support of civil authorities. • Engineer planning tends to focus on construction support, including engineer forces working among and in support of civilian agencies. • Engineer units are likely distributed among echelons of command. Engineer units tend to have support relationships with the maneuver commander; however, there are instances for which responsiveness and proximity to a higher engineer command will dictate a command and support relationship.

PLANNING INTEGRATION ACROSS THE WARFIGHTING FUNCTIONS

5-57. The CCDR plans joint operations based on an analysis of national strategic objectives and the development of theater-strategic objectives supported by measurable strategic and operational desired effects. At the operational level, a subordinate JFC develops supporting plans, which can include objectives supported by measurable operation-level effects. Joint interdependence requires that the theater army headquarters understand doctrine that addresses joint planning techniques. For the theater echelon engineer, operational planning merges the engineer plan of the joint force, specific engineer missions assigned, and available engineer forces to support the Army design methodology of the theater army commander.

5-58. Informed by their analysis of the OE, operational-level engineer planners assist in defining an AO, estimating forces required, and evaluating requirements for the operation. They use the commander's intent to develop and refine COAs that contribute to setting the conditions in the AO that support the end state. They maintain a broad focus and seek to exploit the extended planning horizon. As units are identified to participate in the operation, they collaborate as fully as possible to gain depth for their view of the OE and to add to their planning and problem solving capability. This collaboration also extends the subordinate engineer's planning, preparation, and execution horizon.

5-59. The MDMP serves as the primary tool for Army operational planning. Along with their staff counterparts, operational echelon engineer planners participate in the process to translate the commander's visualization into a specific COA for preparation and execution. The theater army engineers collaborate closely throughout the MDMP with their counterparts in the GCC joint engineer staff to develop a shared understanding of the mission. Theater-level engineers use the Joint Operations Planning Process instead of the Army MDMP. As the plan develops, engineer planners remain synchronized with their theater army staff counterparts through the warfighting functions, as shown in table 5-5.

Table 5-5. Planning integrated across warfighting functions

Warfighting Function	*Engineer Planning*
Movement and Maneuver: • Deploy. • Move. • Maneuver. • Conduct direct fires. • Occupy an area. • Conduct mobility and countermobility. • Battlefield obscuration.	• Analyze infrastructure and terrain to support operational deployment and movement. • Evaluate the mobility and countermobility required to preserve operational freedom of maneuver, including clearance, crossing, and marking considerations. • Develop engineer force and capabilities estimates. • Consider infrastructure improvements, reconstruction, and other nonlethal applications for stability and DSCA operations.
Intelligence: • Provide intelligence support to force generation. • Support to situational understanding. • Conduct information collection. • Provide intelligence support to targeting and information operations.	• Identify requirements for geospatial information. Coordinate to provide the necessary terrain analysis, products, and other support. • Estimate threat engineer capabilities. • Gather and coordinate for obstacle information. • Disseminate specific EH, hazardous material, or other recognition and warning information. • Coordinate for engineer assessments and surveys for technical information requirements.
Fires: • Deliver fires. • Conduct targeting. • Integrate all forms of Army, joint, and multinational fires.	• Plan for survivability of key fires assets. • Participate in the targeting process (includes identification of impacts to key infrastructure). • Coordinate for command guidance on employment of SCATMINEs and other munitions to shape the terrain.
Sustainment: • Provision of logistics. • Provision of personnel services. • Provision of health service support.	• Develop base development and support estimates. • Estimate real estate and other facilities engineering support. • Identify LOCs and other key routes, and determine support requirements for establishing and maintaining distribution system. • Identify potential sources of construction equipment and construction materials. • Estimate area damage control and other construction support. • Determine specialized engineer requirements, such as power, water, and firefighting. • Prepare construction and barrier material estimates. • Prepare munitions estimates. • Determine authorities, funding types and levels of support.

Table 5-5. Planning integrated across warfighting functions (continued)

Warfighting Function	*Engineer Planning*
Command and Control: • Execute the operations process. • Integrate the information superiority contributors. • Conduct information engagement. • Conduct CA operations. • Integrate airspace control. • Execute command programs.	• Coordinate for geospatial information, products, and analysis to enhance visualization of the OE, achieve situational understanding, and enable decision making. • Establish and participate on boards, working groups, and cells. • Recommend command and support relationships. • Recommend control measures; priorities, standards, and reports. • Establish and maintain liaison.
Protection: • Coordinate air and missile defense. • Conduct personnel recovery. • Conduct detention operations. • Conduct risk management. • Implement physical security procedures. • Apply antiterrorism measures. • Conduct survivability operations. • Provide force health protection. • Conduct CBRN operations. • Conduct police operations. • Conduct populace and resources control. • Coordinate EOD support.	• Evaluate base camp and other survivability requirements. • Consider facilities hardening. • Recommend assets and mitigation resources on the Critical Asset Lists and Defended Asset Lists. • Plan for area damage control. • Investigate environmental impacts. • Conduct EH threat assessment and support.

Legend:

CA	civil affairs	EOD	explosive ordnance disposal
CBRN	chemical, biological, radiological, and nuclear	LOC	line of communications
DSCA	defense support of civil authorities	OE	operational environment
EH	explosive hazard	SCATMINE	scatterable mine

PLANS AND ORDERS

5-60. The staff prepares the order or plan by turning the selected COA into a clear, concise concept of operations with the required supporting information. The concept of operations for the approved COA becomes the concept of operations for the plan. The COA sketch becomes the basis for the operation overlay. Orders and plans provide information that subordinates need for execution. Mission orders avoid unnecessary constraints that inhibit subordinate initiative. The staff assists subordinate unit staffs with planning and coordination.

5-61. The engineer staff planner provides input for the appropriate paragraphs in the base plan and the annexes and appendixes of the base plan, as found in FM 6-0. In addition to developing input for the functionally specific paragraphs, engineer planners must review other sections. Engineers ensure the integration of geospatial support in the appropriate sections and annexes. Engineers review the task organization to ensure sufficient capability to meet identified requirements. The engineer planner recommends the appropriate command or support relationships. Additionally, planners provide input to the flow of the engineer force as detailed on the time-phased force and deployment data. Engineers review operations sections, annexes, and overlays to ensure the inclusion of obstacle effects or other graphics and

assist in conveying the scheme of engineer operations. In the fires section, engineers work with the fire support officer and other members of the staff to integrate obstacles with fire. Employing scatterable mines and confirming that obstacles are covered by fire are of particular interest.

5-62. An engineer annex (normally found in annex G of the base plan or base order) is the principal means through which the engineer defines engineer operations to the maneuver commander's intent, essential tasks for M/CM/S, and coordinating instructions to subordinate commanders. It is not intended to function as the internal order for an engineer organization, where the engineer commander articulates intent, the concept of operations, and coordinating instructions to subordinate, supporting, and supported commanders. The preparation of the annex seeks to clarify the scheme of engineer operations to the OPLAN or OPORD and includes the—

- Overall description of the scheme of engineer operations, including approved essential tasks for M/CM/S.
- Priorities of work to shape the theater or AO (not in a tactical-level engineer annex).
- Operational project planning, preparation, and execution responsibilities (not in a tactical-level engineer annex).
- Engineer organization for combat.
- Essential tasks for M/CM/S for subordinate units.
- Allocations of Class IV and Class V obstacle material.

Note. Guidance to maneuver units on obstacle responsibilities should be listed in the body of the basic order, not in the engineer annex.

5-63. The engineer staff officer produces the engineer overlay to highlight obstacle information or breaching operations. A gap-crossing operation may require a separate annex as part of the base order.

5-64. The engineer staff officer performs as the staff integrator and advisor to the commander for environmental considerations. An environmental considerations appendix parallels guidance from the joint OPLAN, OPORD, or concept plan. (See ATP 3-34.5 for an example of an environmental appendix.) When dictated by specific command procedures, other staff officers include some environmental considerations in logistics and medical annexes. Unit planning at the brigade level and below normally includes only those elements required by the higher headquarters orders or plans that are not already included in a unit standard operating procedure. If this appendix is not written, appropriate material will be placed in the coordinating instructions of the basic order.

SUSTAINMENT PLANNING CONSIDERATIONS

5-65. Sustainment support for engineers is provided by different organizations based on various factors, such as the echelon of the supported unit and command and support relationships. Although engineers should be familiar with the sustainment organizations described in ADP 4-0, some organizations provide support to engineers more frequently than others.

5-66. The engineer staff officer, engineer unit commander, supported unit logistics officer, and supporting sustainment unit work closely to synchronize sustainment for engineering capabilities. When the supported unit receives a warning order (directly or implied) as part of the MDMP, the engineer staff officer initiates the engineer portion of the logistics estimate process. The engineer staff officer focuses the logistics estimate on the requirements for the upcoming mission and the sustainment of subordinate engineer units that are organic and task-organized in support of the unit. Class I, III, IV, and V supplies and personnel losses are the essential elements in the estimate process. Close integration with the sustainment support unit can simplify and accelerate this process using the automated systems logistics status report to ensure that the sustainment support unit is able to maintain an up-to-date COP picture of the engineer unit sustainment requirements. During continuous operations, the estimate process supporting the decision-making and synchronization process may need to be abbreviated due to time constraints.

5-67. The engineer staff officer uses the running estimate to determine the requirements for unit and mission sustainment and compares the requirements with the reported status of subordinate units to determine the

specific amount of supplies needed to support the operation. These requirements are then coordinated with the supporting sustainment unit or forward support element to ensure that the needed supplies are identified and resourced. The engineer staff officer then translates the estimate into specific plans that are used to determine the supportability of supported unit COAs. After a COA is selected, the specific sustainment input to the supported unit base OPORD and paragraph 4 of the engineer annex are developed and incorporated.

5-68. Engineers must integrate sustainment with engineer plans. Engineer resources compete with other echelon logistics requirements. It is essential that the engineer communicate risk to the commander when making recommendations to prioritize sustainment. Sustainment must not be an afterthought. Engineers must coordinate and synchronize operations with the elements of sustainment. This must occur at all levels of war and throughout the operations process at all echelons. Engineer planners evaluate the sustainment significance of each phase of the operation during the entire planning process. They create a clear and concise concept of support that integrates the commander's intent and concept of operation. This includes analyzing the mission; developing, analyzing, war-gaming, and recommending a COA; and executing the plan. Chapter 7 details specific sustainment considerations for engineer planning. Table 5-6 lists some of the engineer planning considerations.

Table 5-6. Engineer considerations in the military decisionmaking process

MDMP Steps	*Engineer Considerations*
Receipt of the mission	• Receive higher headquarters plans, orders, and construction directives. • Understand the commander's intent and time constraints. • Request geospatial information about the AO. • Establish engineer-related boards, as appropriate.
Mission analysis	• Analyze the available information on existing obstacles or limitations. Evaluate terrain, climate, and threat capabilities to determine the potential impact on M/CM/S. • Develop the essential tasks for M/CM/S. • Identify the available information on routes and key facilities. Evaluate LOC, SPOD, and APOD requirements. • Determine the availability of construction and other engineering materials. • Review the availability of engineering capabilities, to include Army, joint, multinational, HN, and contracted support. • Determine the bed-down requirements for the supported force. Review theater construction standards and base camp master planning documentation. Review unified facilities criteria, as required. • Review the existing geospatial data on potential sites, conduct site reconnaissance (if possible) and environmental baseline surveys (if appropriated), and determine the threat (to include environmental considerations and explosive hazards). • Obtain the necessary geologic, hydrologic, and climatic data. • Determine the level of interagency cooperation required. • Determine the funding sources, as required. • Determine the terrain and mobility restraints, obstacle intelligence, threat engineering capabilities, and critical infrastructure. Recommend the commander's critical information requirements. • Integrate the reconnaissance effort.

Table 5-6. Engineer considerations in the military decisionmaking process (continued)

MDMP Steps	*Engineer Considerations*
COA development	• Identify the priority engineer requirements, including essential tasks for M/CM/S developed during mission analysis. • Integrate engineer support into COA development. • Recommend an appropriate level of protection effort for each COA based on the expected threat. • Produce construction designs that meet the commander's intent. (Use JCMS when the project is of sufficient size and scope.) • Determine alternate construction locations, methods, means, materials, and timelines to give the commander options. • Determine real-property and real estate requirements.
COA analysis	• War-game and refine the engineer plan. • Use the critical path method to determine the length of different COAs and the ability to crash the project.
COA comparison	• Determine the most feasible, acceptable, and suitable methods of completing the engineering effort.
COA approval	• Determine and compare the risks of each engineering COA. • Gain approval of the essential tasks for M/CM/S and construction management, safety, security, logistics, and environmental plans, as required.
Orders production, dissemination, and transition	• Produce construction directives, as required. • Provide input to the appropriate plans and orders. • Ensure that resources are properly allocated. • Coordinate combined arms rehearsals, as appropriate. • Conduct construction prebriefings. • Conduct preinspections and construction meetings. • Synchronize the construction plan with local and adjacent units. • Implement protection construction standards, including requirements for security fencing, lighting, barriers, and guard posts. • Conduct quality assurance and midproject inspections. • Participate in engineer-related boards. • Maintain as-built and red line drawings. • Project turnover activities.

Legend:

AO	area of operations	M/CM/S	mobility, countermobility, and survivability
APOD	aerial port of debarkation		
COA	course of action	MDMP	military decisionmaking process
HN	host nation	SPOD	seaport of debarkation
LOC	line of communication		
JCMS	Joint Construction Management System		

FACILITIES AND CONSTRUCTION PLANNING

5-69. Engineers also participate in or perform a number of other processes that address specific engineer functional requirements or support the integration of engineer activities with the overall operation. Force projection is critical to ensuring that engineer forces are available to execute engineer missions when needed. Engineers plan for the acquisition, construction, management, and disposal of facilities to support the force, and they use project management to complete projects that meet expectations for quality, timeliness, and cost. See NTRP 4-04.2.3/TM 3-34.41/AFPAM 32-1000/MCRP 3-17.7M and NTRP 4-04.2.5/ TM 3-34.42/AFPAM 32-1020/MCRP 3-17.7F for more information on construction estimating and construction project management.

5-70. Engineers must plan for the acquisition, management, and ultimate disposal of uncontaminated land and facilities, to include—

- Operational facilities (base camps, CPs, airfields, ports).
- Training ranges.
- The mitigation of explosive hazards for training ranges.
- Logistics facilities (maintenance facilities, supply points, warehouses, ammunition supply points, waste management areas and facilities, APOD, SPOD) for sustainment.
- Force bed-down facilities (dining halls, billeting facilities, religious support facilities, clinics, hygiene facilities).
- Common-use facilities (roads and facilities for joint RSOI).
- Protection facilities (site selection, proximity to potential threat areas, and sniper screening).
- Environmental baseline surveys and occupational environmental health site assessments.

5-71. The commander determines which facilities are needed to satisfy operational requirements. Facilities are grouped into six broad categories that emphasize the use of existing assets over new construction. To the maximum extent possible, facilities or real estate requirements should be met from these categories in the following priority:

- U.S.-owned, -occupied, or -leased facilities (including captured facilities).
- U.S.-owned facility substitutes that are pre-positioned in-theater.
- Facilities provided at specified times in designated locations through existing HN and multinational support agreements.
- Facilities available from commercial sources.
- U.S.-owned facility substitutes that are available in the United States.
- Newly constructed facilities that are considered a shortfall after an assessment of the availability of existing assets.

EXPEDITIONARY CONSTRUCTION

5-72. The engineer staff should plan the expeditious construction of facility requirements that are considered shortfalls (such as those facilities that cannot be sourced from existing assets). In these circumstances, the appropriate Service, HN, alliance, or coalition should perform construction during peacetime to the extent possible. Operational contract support augments military capabilities. If time constraints prevent new construction from being finished in time to meet mission requirements, the engineer should seek alternative solutions to new construction. Expedient construction (such as rapid construction techniques like prefabricated buildings or clamshell structures) should also be considered, because these methods can be selectively employed with minimum time, cost, and risk.

FUNDING

5-73. Adequate funding must be available to undertake the early engineer reconnaissance and acquisition of facilities to meet requirements, whether by construction or leasing. (See JP 3-34 for construction funding information.) Funding constraints are a planning consideration. The commander articulates funding requirements for the construction and leasing of facilities by considering the missions supported and the amount of funds required. Funding requirements include facility construction, associated contract administration services, and real estate acquisition and disposal services. Facility construction planning must be accomplished routinely and repetitively to ensure that mission-essential facilities are identified before they are needed and, when possible, that on-the-shelf designs are completed to expedite facility construction.

CONSTRUCTION STANDARDS

5-74. The CCDR, in coordination with Service components and the Services, specifies the construction standards for facilities in-theater to optimize the engineer effort expended on any given facility while assuring that the facilities are adequate for health, safety, and mission accomplishment. The bed-down and basing continuum highlights the need for early master planning efforts to help facilitate the transition to more permanent facilities as an operation develops. While the timelines provide a standard framework, the situation may warrant deviations from them. In addition to using these guidelines when establishing initial construction standards, the Joint Facilities Utilization Board should be used to periodically revalidate construction standards based on current operational issues and to provide recommendations to the commander on potential changes. Ultimately, the CCDR determines the exact construction type based on the location, materials available, and other factors. Construction standards are guidelines, and the engineer must consider other planning factors. See ATP 3-34.40 and JP 3-34 for additional discussions of construction standards.

UNIFIED FACILITIES CRITERIA

5-75. Unified facilities criteria provide facility planning, design, construction, operations, and maintenance criteria for DOD components. Individual unified facilities criteria are developed by a single-disciplined working group and published after careful coordination. They are jointly developed and managed by USACE, the NAVFAC, and the Air Force Civil Engineer Center. Although unified facilities criteria are written with long-term standards in mind, planners who are executing under contingency and enduring standards for general engineering tasks may find them compulsory. Topics include pavement design, water supply systems, military airfields, concrete design and repair, plumbing, and electrical systems.

5-76. Unified facilities criteria are living documents and will be periodically reviewed, updated, and made available to users as part of the Services' responsibility for providing technical criteria for military construction. Unified facilities criteria are effective upon issuance and are distributed only in electronic media from the following sources:

- Unified Facilities Criteria Index.
- Unified Facilities Criteria Library.
- Naval Facilities Engineering Criteria and Programs Office.
- Construction Criteria Base Index.

5-77. General engineer planners must consider the construction standards established by CCDRs and ASCCs for the AOR. These constantly evolving guidebooks specifically establish base camp standards that consider regional requirements for troop living conditions and, therefore, have a major impact on projects (base camps, utilities). Because the availability of construction materials may vary greatly in various AORs, standards of construction may differ greatly between them. CCDRs also often establish standards for construction in OPORDs and fragmentary orders that may take precedence over guidebooks. Planners must understand the expected life cycle of a general engineering project to apply these standards. Often the standards will be markedly different, depending on whether the construction is nonpermanent or is intended to be permanent.

PROJECT MANAGEMENT

5-78. Planners use the project management process described in TM 3-34.42 as a tool for coordinating the skill and labor of personnel using equipment and materials to form the desired structure. The project

management process divides the effort into preliminary planning, detailed planning, and project execution. Currently, when engineer planners are focused on general engineering tasks, they often rely on the JCMS to produce the products required by the project management system. These products include the design, activities list, logic network, critical path method or Gantt chart, bill of materials, and other products. Effective products produced during the planning phases also greatly assist during the construction phase. In addition to the JCMS and Army Facilities Components System, the engineer has various other reachback tools and organizations that can exploit resources, capabilities, and expertise that are not organic to the unit that requires them. Examples of such tools and organizations include the USAES, UROC, the Air Force Civil Engineer Support Agency, and the NAVFAC.

5-79. The project management process normally begins at the unit level with the construction directive. This gives the who, what, when, where, and why of a particular project and is similar to an OPORD in its scope and purpose. Critical to the construction directive are plans, specifications, and the items essential for project success. Units may also receive general engineering missions as part of an OPORD, a fragmentary order, a warning order, or verbally. When leaders analyze a construction directive, it is viewed as a fragmentary order. Information required for a thorough mission analysis exists in an OPORD issued for a specific contingency operation.

MAJOR ACTIVITIES DURING OPERATIONS

5-80. Applications of engineer support efforts at EAB must remain integrated within the combined arms framework. Integration enables a synchronized application of combat power, maximizing the effect of the engineering effort. In general, the engineer staff at EAB or of a joint force assists their commander by furnishing engineer advice and recommendations to the commander and other staff members; preparing those portions of plans, estimates, and orders that pertain to engineering; participating on boards and working groups, as necessary; and coordinating and supervising engineer units and other activities within the engineer staff's span of control. The running estimate is a tool that assists the engineer staff in navigating the various processes and activities involved in conducting operations while considering the application of engineer combat power.

CONTINUOUS REFINEMENT

5-81. As more detailed engineer requirements are refined in collaborative planning with subordinate echelons and headquarters, the engineer effort remains synchronized with the combined arms team by integrating across warfighting functions (see table 5-5, page 5-19).

5-82. As engineer requirements are identified and continually refined, the engineer disciplines offer organization into categories of related capabilities and activities (see table 5-7). Assessments of engineer requirements in terms of the engineer disciplines assist in tailoring the engineer force.

Table 5-7. Capabilities and activities organized by engineer disciplines

Combat Engineering	
Capabilities: • Organic engineer elements. • Force pool. • Other. ▪ Joint (Marines). ▪ Multinational. ▪ Host nation.	**Activities:** • Conduct mobility. • Conduct countermobility. • Conduct survivability.
General Engineering	
Capabilities: • Force pool. • USACE. • Other. ▪ Joint (Navy, Air Force). ▪ Multinational. ▪ Host nation. ▪ Interagency. ▪ Contract.	**Activities:** • Restore damaged areas. • Restore essential services. • Construct and maintain sustainment lines of communications. • Provide engineer construction support (including support to combat engineering activities). • Supply mobile electric power. • Provide facilities engineer support. • Construct waste and distribution facilities.
Geospatial Engineering	
Capabilities: • Organic engineer elements. • Force pool. • USACE field force engineering. • Other. ▪ Joint (Navy, Air Force, nongovernmental organizations). ▪ Multinational. ▪ Host nation. ▪ Interagency.	**Activities:** • Conduct geospatial engineering and functions.
Legend: USACE United States Army Corps of Engineers	

COORDINATION AND CONTROL

5-83. A significant consideration for the integration of engineer capabilities is the task organization of engineer forces. Task organization includes allocating available engineer assets to subordinate commanders and establishing their command and support relationships. In some cases, engineer forces may be task-organized to subordinate nonengineer headquarters, such as when a Sapper company is attached to a BCT or when a clearance company placed OPCON to a MEB. In most cases, an engineer brigade or battalion headquarters provides the longer term C2 of tailored engineer forces and may be required at various echelons for the C2 of engineer operations at each level. The analysis of the mission variables, within the construct of the running estimate, helps determine the engineer task organization. ADP 3-0 describes command, support, and other relationships that may be established in the task organization. Table 5-8, page 5-28, summarizes the considerations for the three engineer headquarters elements available from the force pool to provide C2 for engineer capabilities and missions.

Table 5-8. Considerations for the task organization of an engineer headquarters

Theater Engineer Command	
Capabilities: • Can provide C2 for task-organized Army engineer brigades and other engineer units and missions for the joint force, land component, or Army commander. • Can deploy a main CP and two DCPs to provide flexibility and rotational capability. • Can augment CPs with FFE assets from USACE to enhance technical capabilities and joint or multinational assets to extend the span of control. • Can deploy tailored support elements from the DCPs to augment GCC, JFC, and theater army engineer staffs in support of TCP execution and contingency planning.	**Considerations:** • The TEC is the preferred organization designed for the operational command of engineer capabilities at echelons above corps level and will often provide C2 for the JFC if an operational echelon engineer headquarters is required.
Engineer Brigade	
Capabilities: • Can conduct engineer missions and control up to five mission-tailored engineer battalions, including capabilities from all three engineer disciplines. • Can integrate and synchronize engineer capabilities across the supported force. • Can deploy a main CP or tactical action center to provide flexibility and rotational capability. • With augmentation, can serve as a joint engineer headquarters and may be the senior engineer headquarters deployed in a JOA if full TEC deployment is not required. • Can be augmented with FFE assets from USACE to enhance technical capabilities.	**Considerations:** • One or more engineer brigades are required in the division or corps when the number of engineer units or the functional nature of engineer missions calls for a brigade-level C2 capability. • Most operations or contingencies requiring the deployment of the corps headquarters in one of its configurations will also require an engineer brigade headquarters element. • Unlike a BCT or a MEB, the functional engineer brigade is not designed to control terrain. Significant augmentation would be required to accomplish such a mission.
MEB	
Capabilities: • Can C2 forces from multiple branches—especially those that conduct maneuver support operations for the force. • Can employ task-organized forces to enable decisive action in support of Army division, echelon above division, joint, interagency, or multinational headquarters. • Can operate across the spectrum of conflict to support, reinforce, or compliment offensive and defensive large-scale ground combat operations and can support or conduct stability or DSCA operations. • Unlike the engineer brigade, the MEB is staffed and trained to C2 an assigned AO and control terrain. In this regard, it is similar to a BCT; however, it does not have the inherent maneuver capability of a BCT.	**Considerations:** • Each division conducting large-scale ground combat will be supported by at least one MEB. Divisions conducting contingency operations will typically also be supported by a MEB. • The MEB is primarily designed to provide support to the division, but it is capable of being employed to provide support to higher echelon, joint, and multinational organizations, as well. • When given control of an AO, the MEB's ability to integrate and synchronize engineer capabilities outside its AO is degraded.

Table 5-8. Considerations for the task organization of an engineer headquarters (continued)

Engineer Battalion	
Capabilities: • Can conduct engineer missions, controlling any mix of up to five mission-tailored engineer companies. • Except the prime power battalion (which performs a specific technical role), can provide C2 for combat or general engineering missions when they have been task-organized to perform those roles.	**Considerations:** • When two or more engineer modules are task-organized in support of a BCT, a MEB, an engineer brigade, or other unit, an engineer battalion headquarters may be required for the C2 and sustainment of those modules. • Typically found within the engineer brigade, the MEB, or in support of a BCT. • For the conduct of construction or EH clearance missions, the battalion will receive survey and design or EH teams to facilitate those missions.

Legend:

AO	area of operations
BCT	brigade combat team
C2	command and control
CP	command post
DCP	deployable command post
DSCA	defense support of civil authorities
EH	explosive hazard
FFE	field force engineering
GCC	geographic combatant commander
JFC	joint force commander
JOA	joint operations area
MEB	maneuver enhancement brigade
TCP	theater campaign plan
TEC	theater engineer command
USACE	United States Army Corps of Engineers

FUNCTIONAL CONTROLS AND CONTROL MECHANISMS

5-84. Commanders use a mission command approach to exercise C2 over subordinate forces. Staffs provide their greatest support by providing control and by using C2 systems to keep commanders informed. The operator drafts maneuver graphics, boundaries, axes of advance, and fire-support coordination lines to control fires and maneuver—and the engineer employs standards, priorities, engineer work lines, and obstacle-free zones. The engineer staff is responsible for establishing functional control (through the commander) of engineers, including—

- Establishing policies and construction standards.
- Assigning priorities (such as funding, construction, priority of effort, priority of support).
- Delegating authority (to employ family of scatterable mines or other munitions).
- Establishing relationships with USACE district, division, or task forces, with the capability to provide C2 over deployed USACE elements assigned to the GCC.
- Assigning missions and tasks to subordinates.
- Establishing engineer portions of plans and orders, including their components and subordinate plans, such as the following:
  - Unit mission.
  - Task organization.
  - Concept of operations.
  - Project lists.
  - Engineer tasks that are part of Annex L (Information Collection).
- Establishing graphic control measures (including engineer work lines).

5-85. Some of these control measures are directed by the GCC and the JFC; others are established by the ASCC and the JFLCC. The engineer staff is responsible for coordinating and establishing control mechanisms, which may include—

- Performing routine reports and returns.
- Using the staff engineer cells and supporting engineer headquarters organizations to gather and refine information requirements impacting engineers within the AO.
- Establishing and maintaining effective communication with supporting engineer staff cells, engineer units, and multifunctioning CPs.
- Using the running estimate and the continuous link with supporting elements to compute resource and force requirements and recommend priorities and task organization.
- Developing specific missions and conveying them to subordinates through orders and annexes.
- Using supporting unit CPs to assess and report to anticipate change and unforeseen requirements.

RISK ASSESSMENT

5-86. Risk management is an integrating process that occurs during all operations process activities. Risk management is the process of identifying, assessing, and controlling hazards (risks) that arise from operational factors and of balancing that risk with mission benefits. ATP 5-19 describes the risk management process.

Chapter 6
Engineer Echelon Perspectives

Engineer support to operations requires engineers at every echelon to think about their perspectives and the implications they have both horizontally and vertically while supporting operations. Each echelon provides different, intertwined levels of expertise; a breadth of capability; and the capacity to execute missions.

UNITED STATES ARMY CORPS OF ENGINEERS

6-1. USACE supports the theater army headquarters and the ASCC (or JTF in areas where USACE is the location design construction agent); contract construction support comes from divisions, districts, and contingency elements, and technical engineering assistance. These services may include commercial contract construction acquisition and management, project and program management, real estate and environmental services, technical services (such as on-site, qualified assurance and surveillance through technically qualified engineer contracting officer representatives), and access to the full suite of USACE and other agency capabilities through reachback. The theater army engineer collaborates with an assigned TEC and/or USACE LNO for direct access to USACE resources to support engagement strategies and operations. The supporting LNO typically assists the theater army in coordinating with the DOD-designated contract construction agent if that element is not USACE.

6-2. The FFE program for USACE provides cost-reimbursable, technical engineering assistance to the theater army, employing USACE capabilities from the three engineer disciplines (primarily general engineering) to support operations through reachback and forward presence. The USACE deployable FFE teams include the FEST, contingency real estate support team, and environmental support team.

Note. The 249th Engineer Battalion (Prime Power), FEST teams, AGC, and the Engineer Research and Development Center (ERDC) are examples of the unique and specialized capabilities available through USACE to address specific operational requirements. These elements are not considered solely FFE capabilities, but they are available to support FFE.

6-3. The reachback element for FFE supports the deployable teams with an extensive expertise network from USACE and USACE associates in other Services, agencies, industries, and academia. Reachback can deliver specialized data, research, and expertise to forward entities, when needed.

6-4. If the theater army is operating in one of the geographic AORs for USACE, the theater army will also offer contract construction support. To support this effort, USACE can deploy mission-specific teams designed to deliver high-value projects, typically involving extensive construction within an HN. The teams may range from one or more engineer districts with supporting division headquarters elements, an area or resident office, or a unique team specifically designed for the mission.

6-5. A clear strategic vision for the overall HN reconstruction requires an office that integrates all reconstruction efforts in the theater of operations. This entity integrates all reconstruction programs, including those from the DOD, the United States Agency for International Development, the Department of State, coalition partners, humanitarian aid agencies, and the HN. When USACE is the primary DOD contract construction agent, it achieves DOD program integration by using a joint programs integration office located in the theater engineer cell. The joint programs integration office—

- Plans, programs, and oversees all major DOD construction programs.
- Develops strategies for implementing DOD programs related to HN water, energy, and transportation infrastructure.

- Provides program management and technical expertise in the real estate, electrical/fire safety, and environmental elements of DOD programs.
- Creates short-, medium-, and long-term goals for DOD programs and an action plan for attaining these goals in cooperation with senior military personnel in the OE, Department of State, and United States Army Agency for International Development. Successful goals and plans require the complete integration of all stakeholders.

6-6. In the absence of a joint programs integration office, another entity must assume the responsibilities listed above to ensure the integration of all engineer construction efforts and to avoid effort duplication by one or more agencies.

6-7. The USACE is the executive agent for Army and DOD military construction, real estate acquisition, and national infrastructure development through the civil works program. USACE has the primary responsibility to execute Emergency Support Function 3–Public Works and Engineering for the DOD, in support of DSCA. Most USACE assets are part of the institutional force, but selected elements support the operational Army, to include various FFE teams and the 249th Engineer Battalion (Prime Power). With its subordinate divisions, districts, laboratories, and centers, USACE provides a broad range of engineer support to military departments, federal agencies, state governments, and local authorities through cost-reimbursable projects. USACE districts provide design, operational contract support, construction, and operation of hydroelectric power generation plants and river navigation systems. USACE also provides technical assistance and operational contract support deployed worldwide.

6-8. USACE provides capabilities to the force, which includes those of the ERDC laboratories and centers; and to the resources within the divisions, districts, and other sources. ERDC is comprised of a network of laboratories and 43 centers of expertise. The ERDC specialty areas include:

- Coastal and Hydraulics Laboratory.
- Cold Regions Research and Engineering Laboratory.
- Construction Engineering Research Laboratory.
- Environmental Laboratory.
- Geospatial Research Laboratory.
- Geotechnical and Structures Laboratory.
- AGC.
- The United States Army Engineering and Support Center.

6-9. USACE has aligned its divisions with, and assigned LNOs to, combatant commands and selected ASCCs to enable access to USACE resources supporting engagement strategies and wartime operations. USACE supports unified land operations by providing the following major functions:

- Water resource functions support the balance between water resource development and environmental impact.
- Infrastructure functions acquire, build, and sustain critical facilities for military installations, theater support facilities, and public works.
- Environmental functions restore, manage, and enhance local and regional ecosystems.
- Research and development functions work toward the innovation, introduction, and improvement of products and processes in support of the warfighter; installations; and energy, environmental, and water resources.
- Civil disaster response functions respond to and support recovery from local, national, and global disasters.
- Military contingencies provide engineering and contingency support for unified land operations.

6-10. USACE provides technical and contract engineer support, integrating its organic capabilities with those of other Services and other sources of engineer-related reachback support. USACE may also have assets directly supporting separate commands, the TEC, or senior engineer headquarters in-theater. Whether providing engineer planning and design or contract construction support in the AO or outside the contingency area, USACE can use the TeleEngineering Communications Equipment–Deployable (when necessary) to obtain the necessary data, research, and specialized expertise that is not present in-theater or through reachback capabilities. The TeleEngineering Communications Equipment–Deployable is the

communications architecture that facilitates reachback when the existing communications infrastructure does not support it. The TeleEngineering Operations Center is under the proponency of the USACE and is inherent in FFE.

FIELD FORCE ENGINEERING

6-11. USACE aligns its divisions with specific combatant commands. A USACE division integrates USACE capabilities to meet combatant command requirements and to provide C2 over USACE activities in the AO. USACE supports all combatant commands. Table 6-1, depicts USACE division alignments to combatant commands.

Table 6-1. USACE division alignments

USACE Division	*Supported Combatant Command*
North Atlantic Division	United States Africa Command United States European Command
Transatlantic Division	United States Central Command and United States Special Operations Command
Northwestern Division	United States North Command
Pacific Ocean Division	United States Pacific Command
South Atlantic Division	United States South Command

6-12. USACE is the primary organizing agent for FFE and related institutional force support that enables engineer support to the operational Army. ***Field force engineering*** **is the application of Army engineering capabilities from the three engineer disciplines through reachback and forward presence.** FFE is provided by technically specialized personnel and assets deployed or participating through the USACE reachback process or through operational force engineer Soldiers linked to reachback capabilities. The engineer commander maintains flexibility and determines the mix of capabilities (Soldier, USACE Civilian, and contractor) based on the tactical situation, time-phased requirements, capabilities required, available funding, and force caps. The USACE division commander task-organizes division capabilities to meet the varying time-phased requirements. These capabilities rely heavily on reachback through the TeleEngineering Communication Systems. The FFE concept is applicable in joint and multinational operations to provide technical engineer solutions that can be implemented expeditiously and with a small footprint forward. The United States Air Force and United States Navy have similar capabilities—the Air Force uses its Geo-Reach Program, while the Navy has the capability to conduct engineer reconnaissance with reachback to the NAVFAC.

6-13. USACE objectives for FFE are to—

- Leverage its institutional force capabilities (engineering expertise, contract construction, real estate acquisition and disposal, environmental engineering, and waterways management) in operations.
- Maximize the use of reachback to provide technical assistance and enable operational force engineers in support to the CCDR.

6-14. USACE accomplishes these objectives by training, equipping, and maintaining specialized, deployable FFE teams. These deployable USACE organizations provide technical assistance, enable operational force engineers, and access additional technical support through reachback. Another way that USACE supports the operational force is through nondeployable teams that provide dedicated engineer assistance in response to requests for information from deployed teams or engineer Soldiers in the operational area. Focus areas for these teams include infrastructure assessment and base camp development. LNOs are provided to the geographic combatant commands and to select ASCCs (plans and operations) on a full-time basis. These LNOs communicate and integrate the USACE capacity into combatant commands and ASCCs, and they provide USACE headquarters and major subordinate commands situational awareness with a focus toward impending or ongoing USACE operations in support of the combatant commands or ASCCs.

6-15. The FFE teams and the UROC are the primary contacts within USACE that are organized, trained, and equipped to provide technical solutions to engineer and construction-related challenges. FFE teams

deliver technical engineer support to supported units through the engineer staff. FFE teams provide embedded engineer planning and technical engineer support to unified land operations or offer dedicated reachback support to deployed teams and engineer Soldiers in need of technical support. FFE teams typically develop solutions by employing available resources, but the teams have the option to employ reachback to the entire array of expertise within the USACE laboratories or centers of expertise for more complex engineering issues. USACE has expertise that may support the strategic, operational, or tactical level in engineer planning and operations. USACE can leverage reachback to technical subject matter experts in districts, divisions, laboratories, and centers of expertise; other Services; and private industry as part of the USACE role in the institutional force. FFE is a means to access specialized engineering capabilities that can augment joint forces command planning staffs.

Forward-Deployed Field Force Engineering Capabilities

6-16. FFE teams can deploy to meet requirements for engineering assessments and analyses in support. Teams include forward engineer support teams (FESTs), contingency contracting teams, members from contingency real estate support teams, and environmental support teams. USACE LNOs and aligned USACE divisions assist the ASCC and GCC to determine the amount and force tailoring of the USACE FFE enablers and FEST teams. Theater army headquarters normally require a FEST-A, a contingency real estate support team, an environmental support team, and prime power capabilities. Additional enablers (such as contracting, military munitions support services, or other technical engineering capabilities of USACE) may also be required. USACE provides theater-level planners to supplement the engineer staff assigned to the GCC.

Forward Engineer Support Team–Advance

6-17. An FEST-A is a deployable team that provides infrastructure assessment; engineer planning and design; and environmental, geospatial, and other technical engineer support (from theater army to brigade echelon) and augments the staff at those echelons. This team is capable of supporting any echelon configured as a joint force headquarters for limited contingency operations or may be task-organized to a corps, division, or brigade echelon when configured as an intermediate or tactical headquarters. The FEST-A operates as augmentation to the supported force engineer staff or to the supporting engineer headquarters. When supporting a JTF headquarters, the FEST-A may include a contingency real estate support team and an environmental support team. The FEST-A conducts a variety of core essential tasks in support of stability and technical engineering. The active duty FEST-A consists of uniformed military personnel and DA Civilians. Although the United States Army Reserve consists of all military personnel, both teams require sustainment and security support from the gaining or supported unit.

Forward Engineer Support Team–Main

6-18. The FEST-M is a deployable capability that provides minor contract construction administration, environmental, geospatial, and other engineer support (typically to the theater army). The FEST-M is capable of providing technical oversight of other deployed FFE teams. FEST-Ms are not required for initial entry into a theater of operations; therefore, FEST-Ms reside in the United States Army Reserve and National Guard. This team would typically support a JTF or the land component of a JTF. The FEST-M operates as a technical support team to the joint force engineer staff or the engineer headquarters element or may operate as a discrete headquarters element. The FEST-M element also conducts a variety of core essential tasks in support of stability and technical engineering. It requires sustainment and security support from the gaining or supported unit. FEST-Ms require augmentation from contracting; the USACE contingency contracting team is capable of fulfilling this role.

Contingency Real Estate Support Team

6-19. A contingency real estate support team is a deployable element of USACE that is capable of the acquisition of real estate outside the United States for use by U.S. forces. USACE and NAVFAC acquire, manage, and oversee the disposal of real estate on behalf of the U.S. government pursuant to delegated authority under 10 USC 2675.3, and specific delegation from the Office of the Deputy Assistant Secretary of the Army Installations, Housing, and Partnerships. This team can support any echelon, but it is typically tailored to support an Army component headquarters configuration supporting real estate management. The

contingency real estate support team operates as augmentation to the supported force engineer staff or supporting engineer headquarters. The contingency real estate support team is comprised of DOD Civilians and requires sustainment and security support from the supported unit. Contingency real estate support team support is requested by a formal request for forces process or as a reimbursable service through the contingency real estate support team aligned USACE division.

Environmental Support Team

6-20. An environmental support team is comprised of USACE DA Civilian environmental experts. The team advises and conducts environmental assessments, baseline studies, and other environmentally related surveys and studies. The team supports all echelons, but it is typically tailored to support ASCC headquarters for base camp development. The environmental support team normally augments the engineer staff at echelon. The environmental support team conducts environmental management tasks in support of base camps and technical engineering. The team is capable of deploying early to perform environmental baseline assessments, identify environmental hazards, and remain post-deployment to provide remediation support for base or base camp closure. These small teams require sustainment and security support from the supported unit. Requests for support from environmental support teams is processed through the request for forces process. Environmental support teams may be directly paid for as a reimbursable service through the environmental support team aligned to the USACE division.

Contingency Contracting Team

6-21. The USACE contingency contracting team consisting of contracting officers who conduct contracting activities in support of minor contract construction with an FEST-M. The contingency contracting team is a warranted team of the supported company commander. The contingency contracting team plans, coordinates, and implements theater support contracting functions at the corps, JTF headquarters, division, BCT, and sustainment or transportation brigade echelon. The team is capable of developing, soliciting, awarding, managing, and closing out for theater support contracts.

Expansion of USACE Contract Construction Support

6-22. When contract construction exceeds the capability or capacity of the major subordinate commander, USACE may establish a contingency engineer district or other contingency support organizations or augment existing field offices. A USACE district, with its field offices, is normally staffed by DOD Civilians and requires sustainment and security assistance from the supported organization.

THEATER ENGINEER COMMAND

6-23. At the theater army echelon, the engineer staff assists in translating a broad operational approach into a coherent, feasible concept for employing forces. The engineer examines the functional and multifunctional mobilization, deployment, employment, and sustainment requirements of the concept of operations. From the operational perspective, those requirements typically include RSOI, construction, real estate, and other general engineering support through the sustainment and protection warfighting functions. The operational perspective also includes initially shaping the combat and general engineering capabilities most favorable for each subordinate echelon. Geospatial information and terrain analysis provides the foundation on which understanding the physical environment is based.

6-24. As the operational approach develops, the theater engineer collaborates with subordinate echelon engineers to identify and refine requirements for general and combat engineering support linked to the movement and maneuver and protection warfighting functions. The theater engineer must also ensure that adequate geospatial engineering support is provided for intelligence and C2 at each echelon. Communication enables collaboration, which continues throughout the operations process. To facilitate collaboration with engineer unit commanders and other unit engineer staff, each element seeks to—

- Understand the higher commander's intent and planning guidance.
- Analyze the physical environment and have extensive knowledge of the obstacle information, threat capabilities, and terrain and geospatial products available.

- Know the engineer systems and capabilities needed to accomplish identified tasks and the time required to do so.
- Identify risks where engineer capabilities are limited or time is short, and identify methods to mitigate the risks (including leveraging reachback capabilities).
- Consider the depth of the AO and the impact of potentially simultaneous operational elements.
- Include the integration of environmental considerations.
- Plan for the sustainment of engineer operations.
- Ensure that logistics requirements (with special emphasis on engineer resources) are analyzed and accounted for to the end state of the operation so that future operations are facilitated.

6-25. The theater engineer running estimate provides a working compilation of relevant information that is primarily focused on the physical environment while comprehensively accounting for engineer units, capabilities, and other resources. The running estimate is built from initial assessments framed by the operational or mission variables. The running estimate evolves as planning continues. The relevant information contained in the theater engineer running estimate logically connects each identified challenge or opportunity to an operational requirement. The running estimate can be organized by engineer discipline and warfighting function. The running estimate is continuously refined and updated as additional assessments are made, guidance and priorities are established, and feedback is gathered.

6-26. Engineer operations act as one of many key enablers as the theater army commander works to shape the conditions for tasks and objectives to achieve the military end state. To be effective as an enabler, the engineer staff must be integrated in the effort to assist the commander in framing and reframing the problem, formulating the design, and refining the design. Engineer disciplines assist in organizing capabilities, warfighting functions synchronize engineers with other enablers, and the elements of Army design methodology provide a framework for expressing design concepts. The theater engineer staff integrates these efforts through the operations process to identify the specific engineer operational approach for the theater or JOA and to develop the refined operational concept.

6-27. The theater army level typically conducts various operations simultaneously throughout the AOR. In each case, the commander and staff use the operations process activities to conduct the operations. Theater army echelon commanders use Army design methods to help understand and describe the OE, frame the problem, and shape and refine COAs. The resulting concept of operations forms the basis for developing the detailed campaign, OPLAN, or OPORD. During execution, commanders and staffs assess the situation, considering design elements and adjusting current and future operations and plans as the operation unfolds.

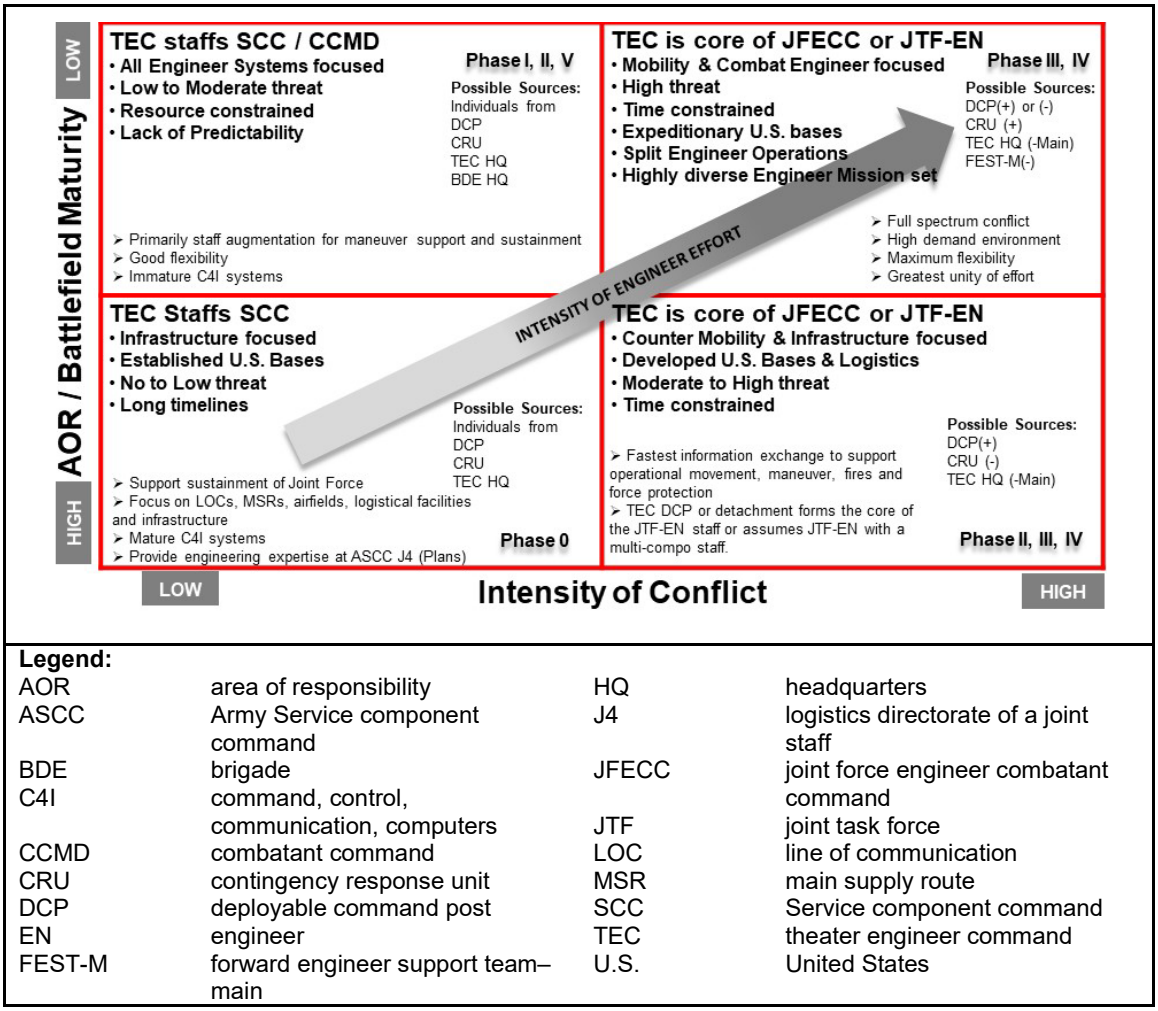
6-28. Engineer operations are typically resource- and time-intensive. The theater army engineer perspective offers an extended planning horizon as an opportunity that is available at the operational level. To seize the opportunity, some initial decision making is necessary even as the concept of operations develops. The commander's visualization provides an initial concept of operations. This planning guidance is a reflection of how the commander envisions the progression of the operation. It provides a broad description of when, where, and how the commander intends to employ combat power within the higher commander's intent. Planning guidance also contains priorities for each warfighting function.

6-29. The theater army engineer seeks to exploit an extended operational planning horizon by prioritizing the need for the commander's decisions and shaping selected aspects of the operation as early as possible (for example, the provision of contingency basing and facilities for aviation capabilities can require extensive design and construction resources). Even if abundant design and construction capabilities are available (which would be a rare circumstance), an extensive amount of time may still be required to complete the effort. In this case, the operational-level engineer seeks to confirm the commander's priority for the project and to obtain the decisions on project location and design. With these initial decisions, the engineer effort can move to preparation and execution while operational planning continues.

6-30. For the theater army engineer staff, the cyclic activities of the operations process are continuous and simultaneous. These activities overlap and recur as circumstances demand. Assessment enables planning, which further enables assessment. In many cases, engineering preparations occur as operational planning is conducted. The execution of selected engineer operations usually precedes operational execution, and operational assessments generate additional engineer requirements. While the engineer staff will be cycling

the selected activities demanded by engineer requirements, they must remain synchronized with their staff counterparts in the broader operations process.

6-31. TECs synchronize engineer effort throughout the theater. Through their persistent engagement with the geographic combatant commands, each TEC is routinely involved in various military engagements with associated theater army headquarters. For other major operations, the theater army engineer collaborates with the TEC commander and staff as planning proceeds. Significant determinations included in the force generation effort are timing and the level required for the deployment of TEC capabilities. For large-scale ground combat, the theater army echelon typically requires the early or phased deployment of the full TEC headquarters. Stability and DSCA vary but may require the deployment of the supporting TEC or its deployable CP. Figure 6-1 shows phased-deployment capabilities to task alignment of the TEC and its deployable CPs.



Legend:

AOR	area of responsibility	HQ	headquarters
ASCC	Army Service component command	J4	logistics directorate of a joint staff
BDE	brigade	JFECC	joint force engineer combatant command
C4I	command, control, communication, computers	JTF	joint task force
CCMD	combatant command	LOC	line of communication
CRU	contingency response unit	MSR	main supply route
DCP	deployable command post	SCC	Service component command
EN	engineer	TEC	theater engineer command
FEST-M	forward engineer support team–main	U.S.	United States

Figure 6-1. TEC deployment model

6-32. The TEC commander serves as the senior in-theater engineer. The TEC is the preferred organization designed for the operational command of engineer capabilities at echelons above corps and often provides C2 for the joint force command if an operational echelon engineer headquarters is required. The TEC is focused on the operational C2 of engineer operations across all engineer disciplines and typically serves as the senior theater or land component engineer headquarters. When directed, the TEC provides C2 for engineers from other Services and multinational organizations and provides technical oversight (quality assurance and surveillance) assistance for contracted construction engineers according to the joint relationships established by the joint force command. The theater army operationally configured as a land

component command benefits from the early or phased deployment of the full TEC headquarters. An engineer brigade may provide adequate engineer OPCON if given a narrower span of control.

6-33. The TEC develops plans, procedures, and programs for engineer support for theater army (including RSOI) requirement determination, operational mobility and countermobility, general engineering, power generation, area damage control, military construction, geospatial engineering, engineering design, construction material, and real property maintenance activities. The TEC commander receives policy guidance from the land component headquarters or theater army, based on the guidance from the GCC. The TEC headquarters element provides C2 for operational echelon engineer operations in the AO and reinforces engineer support to subordinate echelon forces. The TEC may support joint and multinational commands and other elements according to lead Service responsibilities as directed by the supported joint force command. This headquarters maintains a collaborative planning relationship with the theater army to help establish engineer policies for the theater. It also maintains coordination links with other Services and multinational command engineering staffs.

6-34. The engineer brigade is one of several functional brigades available to support theater-level operations. It may be—

- Task-organized under theater level functional commands.
- Organized under the C2 of the TEC.
- Directly subordinate to the theater army.

6-35. The engineer brigade provides a similar but reduced organic capability to the theater army. The engineer brigade provides expertise to the TEC, but with a reduced capability. A significant determinate in tailoring the engineer brigade is the anticipated breadth of OPCON and support functions. The TEC is capable of supporting a broad array of requirements, as is typical when the theater army functions in an operational configuration while continuing its ASCC responsibilities. The brigade provides a more concentrated capability that may be adequate for a smaller-scale configuration with some functional assistance from a subordinate headquarters of ARFOR.

6-36. The TEC can deploy scalable staff specialty capabilities to support the needs of the operational commander. These elements are capable of providing a wide range of technical engineering expertise and support and of coordinating support from USACE, other Service technical laboratories and research centers, and other potential sources of expertise in the civilian community. The elements are enabled by the global reachback capabilities associated with FFE. TEC resources are synchronized with USACE for peacetime engagements and to provide FFE and contract construction capabilities to the operational force (including engineering technical assistance, project planning and design, contract construction, real estate acquisition, infrastructure support, and support to nation-building capacities).

ENGINEER BRIGADE AND MANEUVER ENHANCEMENT BRIGADE

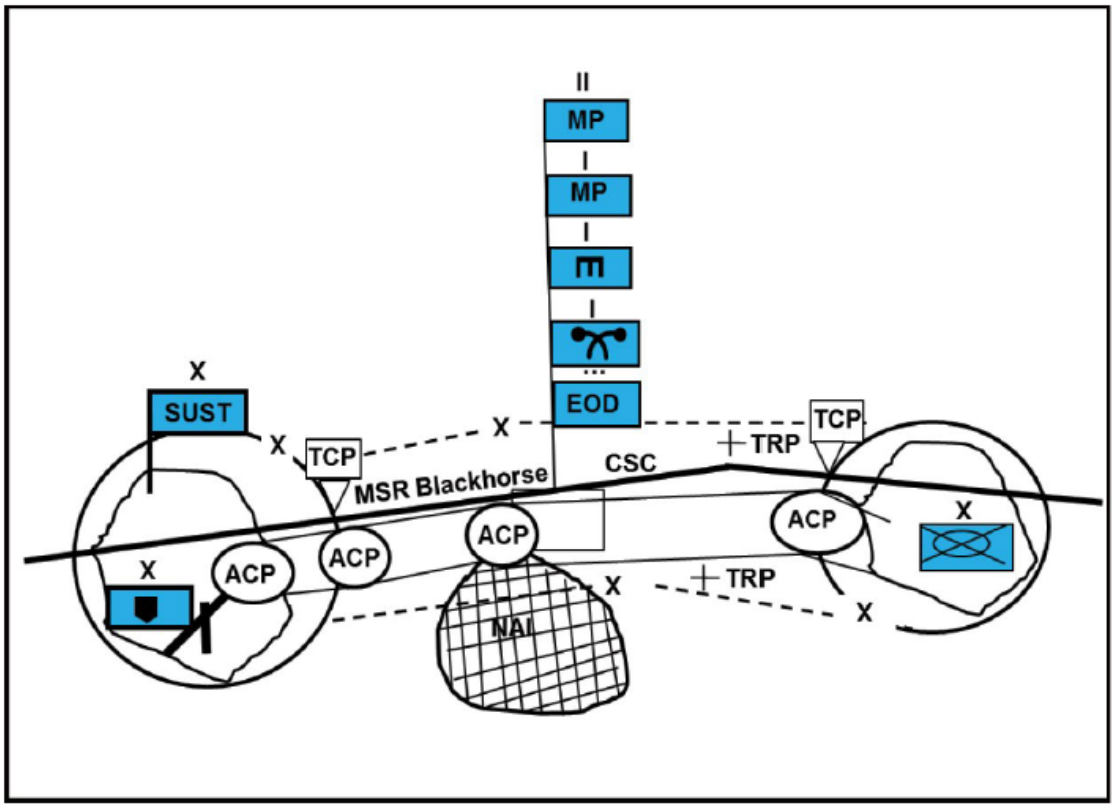
6-37. The division and corps support areas require a force headquarters to oversee a geographical area or to cover a specific function. Engineer brigades have been used to fill this gap in C2 coverage, or a C2 node can be used when more than two units are operating. Although a MEB and an engineer brigade are scalable forces, there are associated tasks that are best executed at the division level. These tasks include movement control, protection, detainee operations, air coordination, tactical combat force augmentation/employment, and the C2 of up to five enabler battalion size elements.

6-38. The execution of complex engineer missions (such as gap crossings, deliberate defenses, and city wide reconstruction) requires engineer brigade headquarters to augment divisions and to functionally aligned corps engineer brigades operating in the corps or theater support areas. Commanders must balance modularity and flexibility with dedicated and assigned/attached engineer headquarters (including technical and tactical expertise) during training and during combat operations to fully support maneuver forces.

6-39. Complex operations (such as division-level wet-gap crossing operations) far exceed the span of control, capability, and capacity of the BEB and the division engineer staff section. To sustain operational tempo between interdependent warfighting formations in a wet-gap crossing, a division requires a brigade-level C2 headquarters with the capacity and technical capability to C2 multiple EAB engineer assets conducting M/CM/S and general engineering across the divisional crossing area. An engineer brigade is the most

expeditious and effective C2 headquarters for the C2 of EAB engineer structure task-organized across the division.

6-40. Supporting collective tasks of an AO include terrain management, information collection, movement control, area security in support or consolidation areas, base security and defense, area damage control, and stability. The MEB is a brigade headquarters capable of providing C2 of a joint security area for a JFLCC. It conducts support area and maneuver support activities for corps and divisions. The MEB is specifically designed as an AO controlling brigade to enable BCTs to focus primarily on combat operations. The MEBs are only in the Reserve Component. If MEB capabilities are required to deploy early in mission cycles, engineer brigades are capable of fulfilling the MEB mission with augmentation of a support control team, communications teams, and intelligence analysts. However, taking on a multifunctional role will risk the functional brigade's capability and capacity to C2 functional engineer missions. Figure 6-2 depicts a way to task organize for C2 over mobility corridors. See ATP 3-90.4 for a full discussion of planning considerations for mobility corridors.



Legend:

ACP	air control point
CSC	convoy support center
EOD	explosive ordnance disposal
MP	military police
MSR	main supply route
NAI	named area of interest
SUST	sustainment
TCP	traffic control point
TRP	target reference point

Figure 6-2. Example command and control of mobility corridors

ENGINEER AND MULTIFUNCTIONAL FORCES

6-41. There are four complementary and interdependent categories of U.S. Army engineer units in the operating force, including USACE-provided technical engineering capabilities. The four categories include organic engineers (and staff elements) and three other categories held in an engineer force pool. The assets in the force pool reside at EAB and exist to augment BCT engineers. The EABs consist of engineer headquarters units, baseline units, and specialized engineer units. See table 6-2.

Table 6-2. Operating-force engineers

Engineer Elements			*Component*		
			Active Army	*ARNG*	*USAR*
Organic engineers		Brigade engineer battalion	X	X	
		Geospatial engineer team	X	X	
Force pool	***Engineer headquarters***	Theater engineer command			X
		Engineer brigade headquarters	X	X	X
		Engineer battalion	X	X	X
	Baseline engineer units	Sapper company	X	X	X
		Mobility augmentation company	X	X	X
		Clearance company	X	X	X
		Engineer support company	X	X	X
		Engineer construction company	X	X	X
		Engineer vertical construction company		X	X
		Multirole bridge company	X	X	X
	Specialized engineer units	Area clearance platoon		X	X
		Asphalt team		X	X
		Concrete section		X	X
		Construction management team	X	X	X
		Diving team	X		
		Engineer detachment (canine)	X		
		Engineer facility detachment		X	X
		Engineer utilities detachment		X	X
		Explosive hazard coordination cell		X	X
		Firefighting	X	X	X
		Forward engineer support team—advanced*	X	X	X
		Forward engineer support team—main*		X	X
		Geospatial planning cell	X		
		Prime power*	X		X
		Quarrying team		X	
		Well drilling		X	

*Assigned to the United States Army Corps of Engineers

Legend:
ARNG Army National Guard
USAR United States Army Reserve

6-42. The units that make up the theater army engineer force (including Army, joint, and multinational force providers) are diverse with technical skills that range from highly specialized to multifunctional and multi-sourcing. Operational-level engineer planners are challenged to comprehensively identify current and future requirements across the range of organizational skill sets. Typically, operational priorities and substantially defined, subordinate requirements are clear and the associated tasks and troop formations are evident. For operational planners, the requirements for supporting less substantially defined tactical needs of subordinate echelons become increasingly ambiguous. To ensure the adequate resourcing of units to meet these needs, planners must consider troop formations and tasks that are evident and that provide for the flexibility to mitigate uncertainty.

6-43. Planners use the engineer discipline and its primary relationship to warfighting functions to organize and ensure that there is an integrated view of operational requirements. At the theater army echelon, a significant focus is placed on general engineering capabilities that must be tailored according to the operational requirements linked to the movement and maneuver, sustainment, and protection warfighting functions. These requirements include—

- **Construction requirements.** Construction requirements typically exceed Army unit capabilities and must be analyzed, with consideration given to joint, multinational, contract, and other capabilities.
- **Specialized requirements.** Specialized requirements may require additional or technical information to effectively associate with tasks and troops. FFE or reachback may be employed to guide the technical assessment needed. Theater army engineer planners may, through their own analysis of the situation, determine the tailored force required by operational priorities and substantial subordinate requirements. They will need subordinate echelon input to more precisely tailor the force required to meet the tactical engineer requirements.

6-44. Theater level engineer planners typically develop a broad, less-defined understanding of the requirements at each lower echelon. Geospatial engineering support, though organic at each echelon down to the BCT, may generate requirements for augmentation at the operational or a selected subordinate echelon. General engineering support requirements linked to the movement and maneuver, sustainment, and protection warfighting functions at each subordinate echelon may be evident and accepted as an operational force responsibility or considered in tailoring the subordinate echelon. Similarly, general engineering support as augmentation to combat engineering capabilities at lower echelons may be considered but will be less clearly defined. Finally, additional combat engineering requirements for each BCT and major tactical element are considered. Augmentation is provided in the form of additional combat and general engineering capabilities, along with the appropriate engineer and multifunctional headquarters elements. For the operational planner, the type and level of augmenting capabilities will likely be ambiguous. To ensure that there is a flexible force adequate for comprehensive operational requirements, planners must employ more than their own broad understanding of those requirements.

6-45. When available for collaborative planning, subordinate echelon headquarters provide invaluable input for their assigned mission requirements and for some operational requirements that may have been overlooked by the higher echelon. Subordinate echelon engineer units and the engineer staff supporting corps, division, and other headquarters develop an understanding through a more concentrated analysis of the situation. The resulting view adds depth to understanding the engineer forces that are required for mission support.

6-46. The tailored engineer force supporting the theater army echelon typically includes joint and multinational engineer formations. Planners task organize Service capabilities with joint, multinational, interagency, and nongovernmental organizations. Operational-level engineer planners consider the joint engineer force capabilities and collaborate with joint force providers to effectively align joint capabilities with the necessary requirements. Consideration will typically include tactical limitations for joint engineer forces. While Navy and Air Force engineer forces include a variety of technical skill sets, they are often limited in ground combat capabilities (for example, certain Air Force engineer units possess highly skilled electrical, plumbing, and other utilities and construction crafts but are limited in their capability to move to and secure a work site). This unit type would be appropriate as a joint resource for requirements within a base but not for requirements throughout a less secure operational area.

OTHER CAPABILITIES

6-47. With augmentation from other Services, the theater army can provide a JTF headquarters for contingencies. Other situations may generate requirements for individual augmentation within the theater army or a subordinate echelon headquarters. Similarly, the situation may require the tailoring of individual augmentees for a provisional headquarters or provisional teams. The GCC supports the theater army with joint individual augmentees, as available, through its standing joint force headquarters. As requirements exceed the GCC capabilities, they are passed to joint force providers. The Army provides individual augmentees through its worldwide individual augmentee system. This augmentation could be uniformed from any service or civilians from across the Department of Defense through the expeditionary civilian workforce program.

6-48. Commanders may use an operational-needs statement to document an urgent need for a material solution to correct a deficiency or to improve a capability that impacts mission accomplishment. The operational-needs statement provides an opportunity for the field commander, outside of the acquisition and combat development and training development communities, to initiate the requirements determination process. A response to the operational-needs statement varies depending on the criticality of the proposed item. Response can range from a headquarters, DA-directed requirement and fielding of a material system to the forwarding of the action to the United States Army Training and Doctrine Command for review and routine action. The theater army engineer staff may become involved in the reviewing and processing of engineer-related statements as part of the theater army echelon administrative control responsibilities. Examples of engineer-related operational needs may include bridging or construction equipment, explosive hazards clearance improvements, and other nonstandard capabilities. See AR 71-9 for more information on processing operational-needs statements.

6-49. Engineers supporting the theater army should understand contingency construction authorities and associated funding to meet construction requirements and activities in support of contingency operations. The USACE LNO at the theater army echelon can advise engineer planners on contract construction and the integration of these assets. Although USACE engineer districts and other contract construction elements are cost-reimbursable, their missions support the campaign plan of the theater army. At the theater level, a joint program integration office is included in the theater engineer cell to ensure the coordination and integration of DOD, interagency, and coalition construction missions throughout the theater.

6-50. Theater army echelon engineer missions are conducted considering the range of military operations occurring throughout the theater. The theater army engineer staff routinely coordinates construction activities that assist the GCC in shaping the security environment in a particular region while maintaining presence within the AO. The engineer staff may also participate in exercise programs within a particular AO as a tool to maintain presence and to foster strong military-to-military cooperation. USACE and other unified action partners are strategically engaged worldwide in activities that promote national security objectives by improving HN infrastructure (such as products of the exercise-related construction program, Humanitarian and Civic Assistance Program, and Support for Others Program). Each theater army USACE LNO, TEC LNO, and joint program integration office assists in coordinating these activities with the senior engineer staff organization.

6-51. The theater army engineer staff coordinates for the engineer support required for limited intervention operations. Support may include tailored engineer forces and the application of a variety of joint and other engineer capabilities. The theater army LNO from the USACE or TEC may assist in integrating USACE and unified action partner activities that support operational objectives. Engineers are critical enablers in foreign humanitarian assistance that is conducted to relieve or reduce the results of natural or man-made disasters. The engineer response may include—

- Erecting temporary shelters and clinics.
- Providing emergency power generation.
- Removing debris.
- Performing temporary construction to reinforce weakened superstructures.
- Reestablishing transportation right-of-ways.
- Constructing protective structures.
- Constructing levees to contain rising floodwaters.

- Creating flood prediction models for mapping disaster effects.
- Fighting fire.

6-52. Peace through large-scale combat operations typically involves the scaled introduction of increasingly larger military construction forces into the operational area. This range of military operations implies a degree of theater echelon engineer support for access, base development, sustainment base establishment, and operational movement requirements. While each theater or JOA is unique from a broad perspective, each follows a pattern from some level of immaturity at the beginning of operations, through development, to established standards and the maintenance of those standards during operations and, finally, to the closure or turnover of bases and other facilities as operations conclude. Lesser-developed theaters or operational areas tend to generate more operational-level engineer effort earlier in the operations process. Table 6-3 shows a general comparison based on the development level.

Table 6-3. Development level-based requirements comparison

Lesser Developed Theater	*Highly Developed Theater*
Greater effort is required to establish SPOD and APOD.	SPOD and APOD may be available but require improvement.
Geospatial data may require generation.	Geospatial data may be available.
Real estate acquisition is less likely.	Real estate may be more available for acquisition.
Environmental conditions may be unknown.	An environmental baseline may be established.
Austere base camps and forward operating bases may be required.	Installations may be available for temporary use.
A road network is likely limited.	A road network is available.
Natural obstacles predominate.	Man-made obstacles predominate.
May be primitive or basic infrastructure.	May be complex or extensive infrastructure.
Legend: APOD aerial port of debarkation SPOD seaport of debarkation	

6-53. While the unifying theme describes the character of the dominant major operation being conducted, ARFOR conduct decisive action within this larger framework. All major operations conducted overseas combine offensive, defensive, and stability operations elements executed simultaneously at multiple echelons. ARFOR provide a mix of land combat power that can be tailored for any combination of offensive, defensive, stability, and DSCA operations as part of an interdependent joint force. At higher echelons, engineer operations consist of more technically focused tasks that simultaneously support offensive, defensive, stability, and DSCA operations. The technical aspects of engineer tasks at higher echelons become increasingly essential to their effective application. For example, from an operational-level perspective, the application of engineering efforts to repair and upgrade a road and its component bridges tends to retain a consistent set of technical tasks. Operational elements have less distinct impact than the technical aspects of the engineering tasks; in fact, most operational-level engineering simultaneously supports all of the operational elements. For example, upgrading a road supports the movement of forces into attack positions, the movement of counterattack forces repositioning in a mobile defense, and the movement of forces supporting civil security. Theater army engineer operations apply technical capabilities to create favorable conditions for any combination of operational elements.

6-54. While the influence of distinct operational elements may be lessened for some technically focused engineering tasks, the overall engineer effort must remain integrated within the combined arms framework. The engineer staff participates in operations process activities to synchronize the orchestration and sustainment of primarily subordinate echelon engineer actions and the application of more technically focused engineer capabilities. Some generalities can be observed while considering the operational elements and higher echelon engineer operations.

6-55. During the offense, a significant portion of the tailored engineer force tends to have supporting relationships with maneuver commanders. For some general engineering capabilities and for most combat engineering capabilities, the tailored engineer force is pushed. Command and support relationships are tailored toward the tactical echelons for close support of combat operations. Movement and maneuver requirements are not well defined at higher echelons and are more dynamic in combat operations. Tailored forces are pushed to subordinate echelons to address these requirements and to add flexibility for those maneuver commanders to react to unforeseen challenges and opportunities.

6-56. In the defense, operational-level engineer planners are typically unable to generate adequate construction capabilities to support all of the subordinate requirements for both movement and maneuver (countermobility) and protection (survivability). Operational-level requirements compete for these same construction capabilities. The operational planner must recommend priorities for these capabilities and then work collaboratively with subordinate elements to assist them in mitigating shortfalls.

6-57. When planning for stability operations, engineers consider the broadest range of potential requirements. The operational-level engineer planner considers all of the theater echelon requirements linked to the movement and maneuver, sustainment, and protection warfighting functions while also considering nonlethal applications supporting the objective end state. Subordinate echelons also require a broad range of general engineering support, or they may be conducting combat operations requiring combat engineering with appropriate augmenting general engineering capabilities. The tailored engineer force is distributed among echelons for operational-level applications and close support of subordinate operations. Stability operations are most likely to occur in close coordination with multinational and interagency elements and among the local population. Construction capabilities will most likely also be required to support infrastructure and reconstruction needs. Construction requirements will likely exceed Army unit capabilities. Operational-level engineers, subordinate echelon engineers, engineer leaders, and engineer staff will be required to coordinate efforts from a range of other capabilities to meet the extensive construction requirements.

6-58. Planning for DSCA tasks is significantly different from offense, defense, or stability operations because of the unique nature of the threat, although the basic tasks may be similar to those of stability. The threat will likely be a natural or man-made disaster, accident, or incident with unpredictable consequences. Additionally, planners must be aware of the number of statutes and regulations that restrict Army interaction with other government agencies and civilians during DSCA. The local and state response normally leads the effort, with a federal response providing support, as required. Interagency response during DSCA is governed by the National Response Framework, which delegates responsibility to various federal agencies for emergency support functions. Each lead agency is responsible for planning within their assigned emergency support functions.

6-59. Army commanders assume a support role to one or more designated agencies. Engineers can expect to be involved in planning for the support of relief operations, with geospatial products and analysis of potential areas to establish life-support areas. Engineers may be called on to provide manpower support or general engineering support from units with unique capabilities, such as water purification, temporary shelter, power generation, and firefighting. Engineer commanders and staffs work with the proponent planners to identify requirements and plan engineer applications. The USACE and other engineering capabilities of the institutional force have prominent roles during DSCA operations:

- Urban search and rescue.
- Route opening and route clearance.
- Temporary and tactical bridging.
- Environmental control and groundwater sampling.
- Decontamination site and holding-pond construction.
- Humanitarian and temporary shelter construction.
- Controlled demolition (in support of mass firefighting operations in urban areas).
- Power generation and distribution.
- Firefighting.
- Debris removal.

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Chapter 7
Sustainment Considerations

Engineer support to operations carries special sustainment challenges which, if not overcome, can seriously inhibit or even stop engineer support. Engineers must anticipate these challenges and work within the sustainment warfighting function to overcome them. Doing so requires that engineers thoroughly understand the sustainment warfighting function, including sustainment organizations, the principles of sustainment, sustainment roles and responsibilities, sustainment functions, and the integration of sustainment into operations, as described in ADP 4-0. This chapter focuses on the sustainment support for engineer capabilities and highlights the sustainment considerations that affect engineer support.

SUSTAINMENT CHALLENGES FOR ENGINEER SUPPORT

7-1. Many sustainment challenges are common to all units, but engineer units face several unique sustainment challenges. Engineers and staffs who employ engineer units/capabilities need to thoroughly understand, anticipate, and work to overcome these challenges.

7-2. Many engineer tasks require the use of engineer equipment that is large and heavy; these heavy items require low-density haul assets if they are to be moved more than short distances. Engineer equipment often exceeds size and weight restrictions, making its movement even more challenging.

7-3. Engineer equipment is also often low-density, which poses challenges to its maintenance and repair. Obtaining engineer-specific Class IX repair parts frequently requires extraordinary coordination. The number of mechanics who are capable of maintaining and repairing engineer equipment may also be limited, increasing the difficulty of keeping engineer equipment operating.

7-4. Engineer equipment also consumes large amounts of fuel (higher than most equipment found in infantry and Stryker BCTs). Refueling is often complicated by the fact that many pieces of engineer equipment cannot easily travel to refueling points. Any time spent travelling between work sites and refueling points can significantly reduce productivity; however, bringing fuel trucks to work sites can be difficult, especially when the sites are widely scattered over large distances in difficult terrain and the risk for the loss of fuel trucks is increased. The availability of fuel trucks for other critical missions is also reduced.

7-5. Construction materials often require long lead times and can be difficult to acquire in the required quantities and specifications. For example, statutory, regulatory, and command policies may dictate the source of construction materials, requiring the maximum use of local procurement.

7-6. All of the previously mentioned challenges are further complicated by the frequent movement of engineers within the AO and by likely changes to task organization and command and support relationships. Limited engineering assets often require that they be repeatedly shifted throughout the AO to meet mission requirements. These movements and changes often have a ripple effect in the sustainment system, which may have difficulty keeping up with multiple changes. This is exacerbated when engineer missions are conducted in austere environments while infrastructure is being established or improved.

7-7. The requirements for engineer capabilities almost always exceed the capacity of available engineer units. This inevitably imposes pressure to delay preventive maintenance, checks, and services to avoid work stoppages, which increases the likelihood and length of future equipment failures and further compounds maintenance difficulties. It also frequently leads to the procurement of locally available construction materials, repair parts, and construction services. This brings its own unique challenges—and the need for financial management and contract management support. Most engineer units do not have dedicated contingency contracting teams, and this support is provided on a general support basis from the supporting operational contract support brigade, joint command (if established), or USACE district.

7-8. Some key differences between contracted and military support include the following:

- Contractor personnel who are authorized to accompany the force are neither combatants nor noncombatants. They are civilians who are authorized to accompany the force in the field.
- Contractors are not in the chain of command. They are managed through their contracts and the contract management system, which should always include a unit contracting officer representative.
- Contractors only perform tasks as specified in contracts by the terms of their contract.

7-9. All of these challenges are predictable, and none of them should surprise engineer leaders or the staffs that support them. Engineers and staffs must anticipate such challenges, work to prevent them, and be prepared to overcome them. Because of the critical impact that sustainment has on engineer missions, engineer commanders and staffs must be thoroughly familiar with sustainment doctrine and organizations, as described in ADP 4-0 and subordinate publications. The importance and unique challenges of contracted support require engineer commanders and staffs to fully understand their role in planning for and managing contracted support, as described in ATP 4-92 and ATP 4-94.

ORGANIZATIONS AND FUNCTIONS

7-10. Sustainment support for engineers is provided by different organizations based on various factors, such as the echelon of the supported unit and command and support relationships. Although engineers should be familiar with all of the sustainment organizations described in ADP 4-0, some organizations provide support to engineers more frequently than others.

PRINCIPLES OF SUSTAINMENT

7-11. As discussed in ADP 4-0, the principles of sustainment (integration, anticipation, responsiveness, simplicity, economy, survivability, continuity, and improvisation) are essential to maintaining combat power, enabling strategic and operational reach, and providing ARFOR with endurance. The sustainment challenges for engineer support (described at the beginning of this chapter) make it essential that engineer leaders and staffs effectively apply these principles. This section describes ways in which engineers apply the principles of sustainment.

7-12. Engineers integrate sustainment with engineer plans. Sustainment must not be an afterthought. Engineers must coordinate and synchronize their operations with the elements of sustainment. This must occur at all levels of war and throughout the operations process at all echelons. Engineer planners evaluate the sustainment significance of each phase of the operation during the entire planning process. They create a clear and concise concept of support that integrates the commander's intent and concept of operation. This includes analyzing the mission; developing, analyzing, wargaming, and recommending a COA; and executing the plan.

7-13. Engineers must visualize future operations and identify the appropriate required support. They must then start the process of acquiring the materiel or placement of support that best sustains the operation. As early as possible, engineers must forecast requirements for Class IV and V supplies (and the transportation and material-handling support needed to move them) and initiate actions to acquire and place them where they will be needed. Engineer staff officers must do this long before specific engineer missions are assigned to specific engineer units. Otherwise, sufficient resources will likely be unavailable when needed. Engineers must also anticipate requirements for financial management and contract management support for the local

procurement of construction materials and services and repair parts. They must anticipate requirements for fuel and for maintenance support and other supplies and services common to all units.

7-14. The planner who anticipates is proactive—not reactive—before, during, and after operations. The ability of the force to seize and maintain the initiative, synchronize activities along the entire depth of the AO, and exploit success depends on the abilities of the commanders, logisticians, and engineers to anticipate requirements. Engineers consider joint, multinational, contract civilian, and interagency assets when planning support for engineer missions. They—

- Use all available resources, especially HN assets.
- Prioritize critical engineer activities based on the concept of operations.
- Anticipate engineer requirements based on wargaming and the rehearsal of concept drills, incorporating the experience and historical knowledge of all participants.
- Do not think linearly or sequentially; they organize and resource for simultaneous and noncontiguous operations.
- Participate in and evaluate the engineer significance of each phase of the operation during the entire command estimate process, to include mission analysis and COA development, analysis and wargaming, recommendation, and execution.

7-15. The engineer staff officer must anticipate likely task organization changes that will affect the flow of sustainment to engineer organizations. Additional missions will be created by the sustainment plan (for example, clearing a landing zone for aerial resupply). These missions and tasks must be anticipated and planned for during the mission analysis.

7-16. Engineers must develop and maintain responsiveness. They must seek to ensure that sufficient resources are identified, accumulated, and maintained to meet rapidly changing requirements. For example, engineers conduct reconnaissance to identify local materials and other resources that could be used to support potential engineer missions. They establish preconfigured loads, pre-position supplies and equipment, and ensure that trained and certified personnel are available to support local purchases of materials and services.

7-17. Operational contract support obtains and provides supplies, services, construction labor, and materiel—often providing a responsive option or enhancement to support the force. General engineers are required to provide subject matter expertise for the supervision of contracted materials and services.

7-18. Engineers use mission-type orders and standardized procedures to contribute to simplicity. Engineer commanders and staffs establish priorities and allocate classes of supply and services to simplify sustainment operations. They use preconfigured loads of specialized classes of supply to simplify transport.

7-19. At some level and to some degree, resources are always limited. When prioritizing and allocating resources, the engineer commander and staff may not be able to provide a robust support package. Priority of effort is established while balancing the mitigation of risk to the operation. Engineer commanders may have to improvise to meet the higher intent and mitigate the risks. Commanders consider economy when prioritizing and allocating resources. Economy reflects the reality of resource shortfalls while recognizing the inevitable friction and uncertainty of military operations.

7-20. Engineers must protect the resources they need to sustain their units and accomplish their mission. In addition to protecting their own units, personnel, and equipment, engineers must also emphasize security and protection for Class IV and V supplies. These supplies are not easily replaced and can be tempting targets for enemy action.

7-21. Engineers contribute to ensuring that sustainment means are survivable by constructing sustainment bases and clearing LOCs. They may also construct ammunition holding areas and provide revetments or other types of hardening for petroleum, oil, and lubricants products.

7-22. The tempo of operations requires a constant vigilance by the logistician and engineer commander to ensure a constant flow of support. Supplies are pushed forward (the unit distribution method) when logistically feasible. Maneuver units rely on lulls in the tempo of an operation to conduct sustainment operations, but engineers might not do the same. Engineers usually do not have this opportunity because many of their missions occur during a lull in operations, and this could deny them the opportunity to use the supply point method. This increases the need for engineers to plan for continuous, routine, and emergency logistics support.

7-23. When faced with unexpected situations or circumstances, engineers must improvise. They must be aware of the resources available in the local area and must regularly train on using improvised methods of accomplishing engineer tasks.

ENGINEER LEADER AND STAFF RESPONSIBILITIES FOR SUSTAINMENT

7-24. The successful sustainment of engineer organizations and capabilities requires active involvement by engineer staffs and commanders at every echelon. In addition to ensuring the sustainment of their units, engineers must work closely with their supported units. This is because the supported unit is responsible for providing the fortification, barrier, and construction materials and the mines and demolitions needed for the tasks they assign to the supporting engineer unit, regardless of the command and support relationship between them. The higher echelon engineer staff officer must retain an interest in the sustainment of subordinate engineer units and capabilities, regardless of their command and support relationships with the units they support. Within a supported unit, the engineer staff officer must work closely with the logistics staff to assist in planning, preparing, executing, and assessing operations that require engineer materials and resources. Within engineer or multifunctional headquarters units, the logistics staff provides sustainment planning for the engineer force under its C2.

7-25. Within engineer units, leaders, and staffs must monitor, report, and request requirements through the correct channels and ensure that sustainment requirements are met when sustainment is brought forward to the engineer unit. The accurate and timely submission of personnel and logistics reports and other necessary information and requests is essential.

ENGINEER STAFF OFFICER

7-26. The engineer staff officer at each echelon is responsible for engineer logistics estimates and plans and monitors engineer-related sustainment support for engineer capabilities operating at that echelon. When an engineer unit or capability is task-organized in support of another unit, the engineer staff officer considers the impact of inherent sustainment responsibilities and recommends the most efficient and effective command or support relationship. The engineer staff officer—

- Writes the engineer annex and associated appendixes to the OPLAN or OPORD to support the commander's intent, including the recommended distribution for any engineer-related, command-regulated classes of supply and special equipment.
- Assists in planning the location(s) of the engineer forward supply point for the delivery of engineer-configured loads of Class IV and V supplies. This site(s) is coordinated with the unit responsible for the terrain and the appropriate S-4 or G-4.
- Assists in planning the location(s) of engineer equipment parks for the pre-positioning of critical equipment sets, such as tactical bridging. This site(s) is coordinated with the unit responsible for the terrain and the appropriate S-4 or G-4.
- Works closely with the sustainment staff to identify available haul assets (including HN) and recommends priorities to sustainment planners.
- Identifies extraordinary medical evacuation requirements or coverage issues for engineer units and coordinates with sustainment planners to ensure that the supporting unit can accomplish these special workloads.
- Identifies critical engineer equipment and engineer mission logistics shortages.

- Provides the appropriate S-4 or G-4 an initial estimate of required Class III supplies in support of construction.
- Provides the appropriate S-4 or G-4 an initial estimate of required Class IV and V supplies for countermobility and survivability efforts.
- Provides the appropriate S-4 or G-4 an initial estimate of required Class IV supplies in support of construction. Monitors and advises implications of statutory, regulatory, and command policies for the procurement of construction materials, as required. The critical issue for the engineer staff officer is timely delivery at required specifications, whatever the source for construction materials.
- Tracks the flow of mission-critical Class IV and V supplies into support areas and forward to the supporting engineer units. Coordinates to provide engineer assistance to accept delivery of construction materials, as required.
- Coordinates route clearing and tracks their status at the main CP.
- Coordinates for EOD support and integration, as necessary.
- Considers the environmental impacts of all decisions.

ENGINEER UNIT COMMANDER

7-27. The unit commander ensures that sustainment personnel maintain the mission capabilities of the unit and its ability to provide combat power. The unit commander provides critical insight during the supported unit's planning process. The unit commander—

- Coordinates for sustainment support requirements external to the engineer unit.
- Anticipates problems, works to avoid delays in planning and transition, and conducts sustainment battle tracking.
- Communicates with subordinate leaders to identify the need for push packages, ensures their arrival, and tracks their expenditure.
- Determines the location of the unit resupply points and monitors the operation.
- Ensures that the unit is executing sustainment operations according to the supported unit's standard operating procedure and operations orders.
- Monitors equipment locations and maintenance status.
- Updates the engineer-specific Class IV and V supply requirements based on a reconnaissance of mission sites.
- Tracks engineer equipment use, maintenance deadlines, and fuel consumption.
- Receives, consolidates, and forwards all logistical, administrative, personnel, and casualty reports to the parent or supported unit.
- Directs and supervises the medical support within the unit, coordinating for additional support, as required.
- Supervises and monitors the evacuation of casualties, detainees, and damaged equipment.
- Orients personnel replacements and assigns personnel to subordinate units.
- Conducts sustainment rehearsals at the unit level.
- Maintains and provides supplies for unit field sanitation activities.
- Integrates explosives ordnance disposal support, as necessary.

SUSTAINMENT PLANNING CONSIDERATIONS

7-28. The engineer staff officer, the engineer unit commander, the supported unit S-4 or G-4, and the supporting sustainment unit work closely to synchronize sustainment for engineer capabilities. When the supported unit receives a warning order as part of the MDMP, the engineer staff officer initiates the engineer portion of the logistics estimate process. The engineer staff officer focuses the logistics estimate on the requirements for the upcoming mission and the sustainment of all subordinate engineer units that are organic and task-organized in support of the unit. Class I, III, IV, and V supplies and personnel losses are the essential elements in the estimate process. Close integration with the sustainment support unit can simplify and accelerate this process through the use of the automated systems logistics status report to ensure that the sustainment support unit is able to maintain an up-to-date COP of the engineer unit sustainment requirements.

During continuous operations, the estimate process supporting the rapid decision-making and synchronization process may need to be abbreviated because of time constraints.

7-29. The engineer staff officer uses the running estimate to determine the requirements for unit and mission sustainment and compares the requirements with the reported status of subordinate units to determine the specific amount of supplies needed to support the operation. These requirements are then coordinated with the supporting sustainment unit or forward support element to ensure that the needed supplies are identified and resourced.

7-30. The engineer staff officer then translates the estimate into specific plans that are used to determine the supportability of supported unit COAs. After a COA is selected, the specific sustainment input to the supported unit base OPORD and paragraph 4 of the engineer annex is developed and incorporated.

7-31. In each of the different types of BCTs, the engineer staff officer (working with the appropriate sustainment planner and executor) tracks essential sustainment tasks involving all engineer units supporting the brigade. Accurate and timely status reporting assists the engineer staff officer in providing the overall engineer status to the brigade commander and allows the engineer staff officer to intercede in critical sustainment problems, when necessary. The engineer staff officer also ensures that the supplies needed by augmenting EAB engineer units to execute missions for the brigade are integrated into the brigade sustainment plans. For the engineer staff officer to properly execute these missions, accurate and timely reporting and close coordination between the engineer staff officer, sustainment planners and providers, task force engineers, and supporting EAB engineers is essential. Supporting EAB engineer units must affect linkup with the existing engineer sustainment to ensure their synchronization of effort.

7-32. Some important considerations for engineer planners include—

- Coordinating for a field maintenance team to support each engineer unit to ensure quick turnaround of maintenance problems.
- Coordinating closely with the logistics staff to assist in the management of required construction materials. The engineer staff helps the logistics staff identify and forecast requirements to ensure that a quality control process is in place for receipt of the materials. The management of Class IV supplies for survivability and countermobility is most efficient when there is a shared interest between maneuver and engineer logisticians.
- Using preconfigured loads of barrier materials.
- Coordinating closely with the theater support command or sustainment command (expeditionary) support operations officer, the ARFOR G-4, the supporting contract support brigade, and the associated logistics civil augmentation program planner to ensure that engineer requirements are properly integrated and captured in the operational contract support plan and/or are specifically addressed in the ESP.

7-33. Engineers must consider the environmental impacts of their actions. They must weigh the implications of holding out for logistical support against possible collateral environmental damage. They must ensure that a proper environmental risk assessment is done before beginning any action. See ATP 3-34.5 or TM 3-34.56 for additional information.

Glossary

The glossary lists acronyms and terms with Army or joint definitions. Where Army and joint definitions differ, (Army) precedes the definition. Terms for which FM 3-34 is the proponent are marked with an asterisk (*). The proponent publication for other terms is listed in parentheses after the definition.

SECTION I – ACRONYMS AND ABBREVIATIONS

ADP	Army doctrine publication
AGC	Army Geospatial Center
AFPAM	Air Force pamphlet
AFTTP	Air Force tactics, techniques, and procedures
AO	area of operations
AOR	area of responsibility
APOD	aerial port of debarkation
AR	Army regulation
ARFOR	Army forces
ASCC	Army service component command
ATP	Army techniques publication
ATTN	attention
BCT	brigade combat team
BEB	brigade engineer battalion
C2	command and control
CBRN	chemical, biological, radiological, and nuclear
CCDR	combatant commander
CGTTP	Coast Guard tactics, techniques, and procedures
CJCSM	Chairman of the Joint Chiefs of Staff manual
COA	course of action
COP	common operational picture
CP	command post
DA	Department of the Army
DOD	Department of Defense
DOTD	Directorate of Training and Doctrine
DSCA	defense support of civil authorities
EA	engagement area
EAB	echelons above brigade
EOCA	explosive ordnance clearance agent
EOD	explosive ordnance disposal
ESP	engineer support plan

FEST	forward engineer support team
FEST-A	forward engineer support team–advance
FEST-M	forward engineer support team–main
FFE	field force engineering
FM	field manual
G-2	assistant chief of staff, intelligence
G-3	assistant chief of staff, operations
G-4	assistant chief of staff, logistics
G-9	assistant chief of staff, civil affairs operations
GCC	geographic combatant commander
GI&S	geospatial information and services
GPC	geospatial planning cell
HN	host nation
IPB	intelligence preparation of the battlefield
J-2	intelligence directorate of a joint staff
J-3	operations directorate of a joint staff
J-4	logistics directorate of a joint staff
J-7	engineering staff section of a joint staff
J-9	civil military operations directorate of a joint staff
JCMS	joint construction management system
JFC	joint force commander
JFLCC	joint force land component command
JOA	joint operations area
JOPES	Joint Operation Planning and Execution System
JP	joint publication
JTF	joint task force
LNO	liaison officer
LOC	line of communication
M/CM/S	mobility, countermobility, and survivability
MCRP	Marine Corps reference publication
MCTP	Marine Corps tactical publication
MCWP	Marine Corps warfighting publication
MDMP	military decisionmaking process
MEB	maneuver enhancement brigade
MSCoE	United States Army Maneuver Support Center of Excellence
NATO	North Atlantic Treaty Organization
NAVFAC	Naval Facilities Engineering Command
NGA	National Geospatial-Intelligence Agency
No.	number
NTRP	Navy tactical reference publication
NTTP	Navy tactics, techniques, and procedures

OE	operational environment
OPCON	operational control
OPLAN	operation plan
OPORD	operation order
RSOI	reception, staging, onward movement, and integration
S-2	battalion or brigade intelligence staff officer
S-3	battalion or brigade operations staff officer
S-4	logistics staff officer
S-9	battalion or brigade civil affairs operations staff officer
SPOD	seaport of debarkation
SSGF	standard and sharable geospatial foundation
STANAG	standardization agreement (NATO)
TC	training circular
TEC	theater engineer command
TGD	theater geospatial database
TM	technical manual
UROC	USACE Reachback Operations Center
U.S.	United States
USACE	United States Army Corps of Engineers
USAES	United States Army Engineer School
USAREUR	United States Army, European Command
USC	United States Code
USINDOPACOM	United States Indo-Pacific Command

SECTION II – TERMS

countermobility operations

Those combined arms activities that use or enhance the effects of natural and man-made obstables to deny enemy freedom of movement and maneuver. (ATP 3-90.8)

***engineer work line**

A coordinated boundary or phase line used to compartmentalize an area of operations to indicate where specific engineer units have primary responsibility for the engineer effort.

***field force engineering**

The application of Army engineering capabilities from the three engineer disciplines through reachback and forward presence.

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18 December 2020

By Order of the Secretary of the Army:

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General, United States Army
Chief of Staff

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