FM 3-34

ENGINEER OPERATIONS



DECEMBER 2025

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This publication supersedes FM 3-34, dated 18 December 2020.

HEADQUARTERS, DEPARTMENT OF THE ARMY

Foreword

The operational environment of the 21st century is characterized by rapid technological advancements, shifting global power dynamics, and the potential that the United States will become embroiled in a conflict involving large-scale combat operations. The Army is rapidly evolving in response to these complexities of modern warfare. One such evolution was the introduction of a new operating concept, Multidomain Operations, and the Army strategic contexts.

Brought to life with the October 2022 publishing of the revision to FM 3-0, Operations, this new operating concept is built around the understanding that future armed conflicts will require the employment of joint capabilities across all domains spanning space and time to achieve decisive outcomes. Multidomain Operations is how the Army will contribute to the joint fight.

Nested within the competition continuum are the Army strategic contexts. These new contexts detail the role the Army plays across the competition continuum as the United States employs the elements of national power.

This revision of FM 3-34, Engineer Operations, provides the foundational doctrine that outlines how the Engineer Regiment contributes to Army operations throughout the strategic contexts in support of national objectives. The expertise and capabilities of Army engineers are more crucial than ever. Observations from conflicts across the globe, including the wars in Ukraine and Gaza, have only served to emphasize the critical and essential role that engineers will play. We must stand ready, with well-trained and properly manned and equipped units, to respond when and where needed.

To that end, the Regiment is transforming. New force design updates are being incorporated that align engineer units with divisions. Experimentation is taking place to discover new, more efficient techniques, to accomplish our engineering tasks. And concepts are being developed and tested that will make our formations more survivable and more lethal.

From breaching obstacles and crossing gaps, to building infrastructure and providing a detailed understanding of the terrain, engineers are more pivotal than ever. Success will be dependent upon the effective employment of engineer capabilities across the range of military operations.

The challenges our Nation faces are myriad. We will stand ready.

ESSAYONS!



STEPHEN J. KOLOUCH
COLONEL, EN
COMMANDANT

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ENGINEER OPERATIONS

Contents

Page

Preface ..... **v**
Introduction ..... **vii**
CHAPTER 1 ..... **1**
THE ARMY ENGINEER **1**
The Role of the Army Engineer 1
Engineer Disciplines 1
Foundations of Engineer Operations 3
Lines of Engineer Support 3
Operational Environment 11
Engineer Activities Spanning the Levels of Warfare 15
Challenges 18
CHAPTER 2 ..... **21**
ENGINEER SUPPORT TO OPERATIONS **21**
Section I – Army Operations **21**
Engineer Support Across the Range of Military Operations 21
Considerations for Engineer Support to Operations 22
Section II — Considerations at Echelon **23**
Theater Army 23
Corps 25
Division 26
Brigade Combat Team 28
Section III — Considerations Across the Army Strategic Contexts **29**
Engineer Support During Competition Below Armed Conflict 29
Engineer Support During Crisis 31
Engineer Support During Armed Conflict and Large-Scale Combat Operations 31
Consolidation of Gains 48
Managing Transitions 49

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Special Considerations 49
Section IV — Joint, Interagency, Intergovernmental, and Multinational Considerations 49
Joint Considerations 50
Interagency and Intergovernmental Considerations 51
Multinational Considerations 51
Host-Nation Considerations 52
Nongovernmental Organizations 53
Integrating Capabilities 53
CHAPTER 3 55
ENGINEER SUPPORT TO THE WARFIGHTING FUNCTIONS 55
Overview 55
Enabling Combat Power 61
CHAPTER 4 63
ARMY ENGINEER FORCES 63
Engineer Organizations and Capabilities 63
Operating-Force Engineers 63
Army Geospatial Enterprise 77
Reachback Support 77
Engineer Force Tailoring 77
Echelon Force Tailoring 78
CHAPTER 5 81
ENGINEER ORGANIZATION PERSPECTIVES 81
United States Army Corps of Engineers 81
Field Force Engineering 85
Reachback Engineering Capabilities 87
Theater Engineer Command 89
Engineer Brigade 92
Engineer and Multifunctional Forces 92
Other Capabilities 93
CHAPTER 6 97
PLANNING 97
Section I — Planning 97
Engineer Support to the Planning Process 97
Staff Integration 100
Section II — The Planning Process 106
Staff Processes 106
Facilities and Construction Planning 117
Project Management 119

Major Activities During Operations 119
Continuous Refinement 120
Coordination and Control 120
CHAPTER 7 125
SUSTAINMENT CONSIDERATIONS 125
Principles of Sustainment 125
Organizations and Functions 126
Engineer Leader and Staff Responsibilities for Sustainment 127
Sustainment Challenges for Engineer Support 129
APPENDIX A 131
DEFENSE SUPPORT OF CIVIL AUTHORITIES 131
Glossary 135
References 139
Index 143

Figures

Introductory figure 1. Lines of engineer support vii
Introductory figure 2. Logic chart viii
Figure 1-1. Domains and dimensions of an operational environment 11
Figure 1-2. Levels of warfare 15
Figure 2-1. Theater-level engineer operational design 25
Figure 2-2. Corps engineer operational design 26
Figure 2-3. Division engineer operational design 28
Figure 3-1. Engineer application of combat power 56
Figure 4-1. Combat Engineer Company–Armored 70
Figure 4-2. Combat Engineer Company–Stryker 71
Figure 4-3. Combat Engineer Company–Infantry 72
Figure 4-4. Combat Engineer Company–Airborne 73
Figure 4-5. Brigade engineer battalion 74
Figure 4-6. Engineer Companies A and B 76
Figure 5-1. Notional TEC deployment model 91
Figure 6-1. Notional joint engineer staff 102

Tables

Table 2-1. Notional engineer support to defensive operations 34
Table 2-2. Notional engineer support to offensive operations 39
Table 2-3. Engineer considerations in the offense 41
Table 2-4. Notional engineer support to stability operations 46
Table 4-1. Operating-force engineers 64
Table 5-1. USACE division alignments 83
Table 5-2. Huntsville Engineering and Support Center Programs and Centers of Expertise 83
Table 5-3. USACE centers of expertise 88
Table 5-4. Development level-based requirements comparison 95
Table 6-1. Army command relationships 98

Table 6-2. Army support relationships 99
Table 6-3. Military decision-making process and engineer staff running estimates 109
Table 6-4. Types of operations 111
Table 6-5. Planning integrated across warfighting functions 113
Table 6-6. Engineer considerations in the military decision-making process 116
Table 6-7. Capabilities and activities organized by engineer disciplines 120
Table 6-8. Considerations for the task organization of an engineer headquarters 121
Table A-1. Notional engineer support to DSCA operations 132

Preface

FM 3-34 is the Army doctrinal publication that contains the foundational doctrinal guidance for U.S. Army engineers. This manual is the integrating publication that nests engineer doctrine with Army capstone/keystone 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. Subordinate engineer doctrinal publications are based on the foundations established in this manual and are aligned with their respective joint and Army publications. 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 curricula.

To comprehend the doctrine contained in this manual, readers should first understand the fundamentals of operations and the Army's operational concept, multidomain operations, as described in FM 3-0. Readers of this manual should also understand the Army profession and moral principles described in ADP 1, the fundamentals of the operations process found in ADP 5-0, the principles of mission command as described in ADP 6-0, and the protection principles discussed in ADP 3-37. Readers should also be familiar with ADP 1-01, ADP 3-07, ADP 3-28, and ADP 3-90.

The principal audience for FM 3-34 is the commanders and staff elements at all echelons and the engineer personnel who are tasked with planning, directing, and executing engineer missions. 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* 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 United States Army Engineer School. The preparing agency is the Doctrine Division, Fielded Force Integration Directorate (FFID), Maneuver Support Center of Excellence (MSCoE). Send comments and recommendations on DA Form 2028 (Recommended Changes to Publications and Blank Forms) to Commander, MSCoE, ATZT-CDC FM 3-34, 14000 MSCoE Loop, Suite 246, Fort Leonard Wood, Missouri 65473-8929; by e-mail to usarmy.leonardwood.mscoe.mbx.engdoc@army.mil; or submit an electronic DA Form 2028.

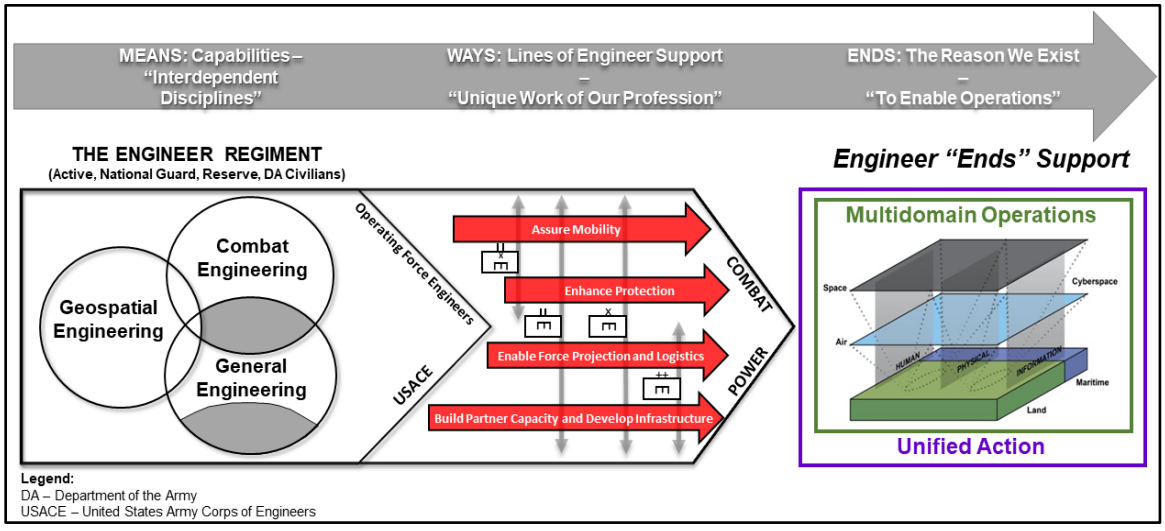
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Introduction

The Army Engineer Regiment has a mixture of capabilities that spans the active and reserve components to the United States Army Corps of Engineers (USACE) and Civilian corps. The regiment contains three basic categories of operating force engineers: engineer brigades and battalions assigned to divisions, brigade combat team (BCT) organic brigade engineer battalions (BEBs), and force pool. The force pool exists to augment the divisional units and the organic BCT engineers. They reside at echelons above division and provide complementary engineer capability and capacity. Force pool engineer units and capabilities are available from Forces Command or from elements assigned to the Headquarters, Chief of Engineers.

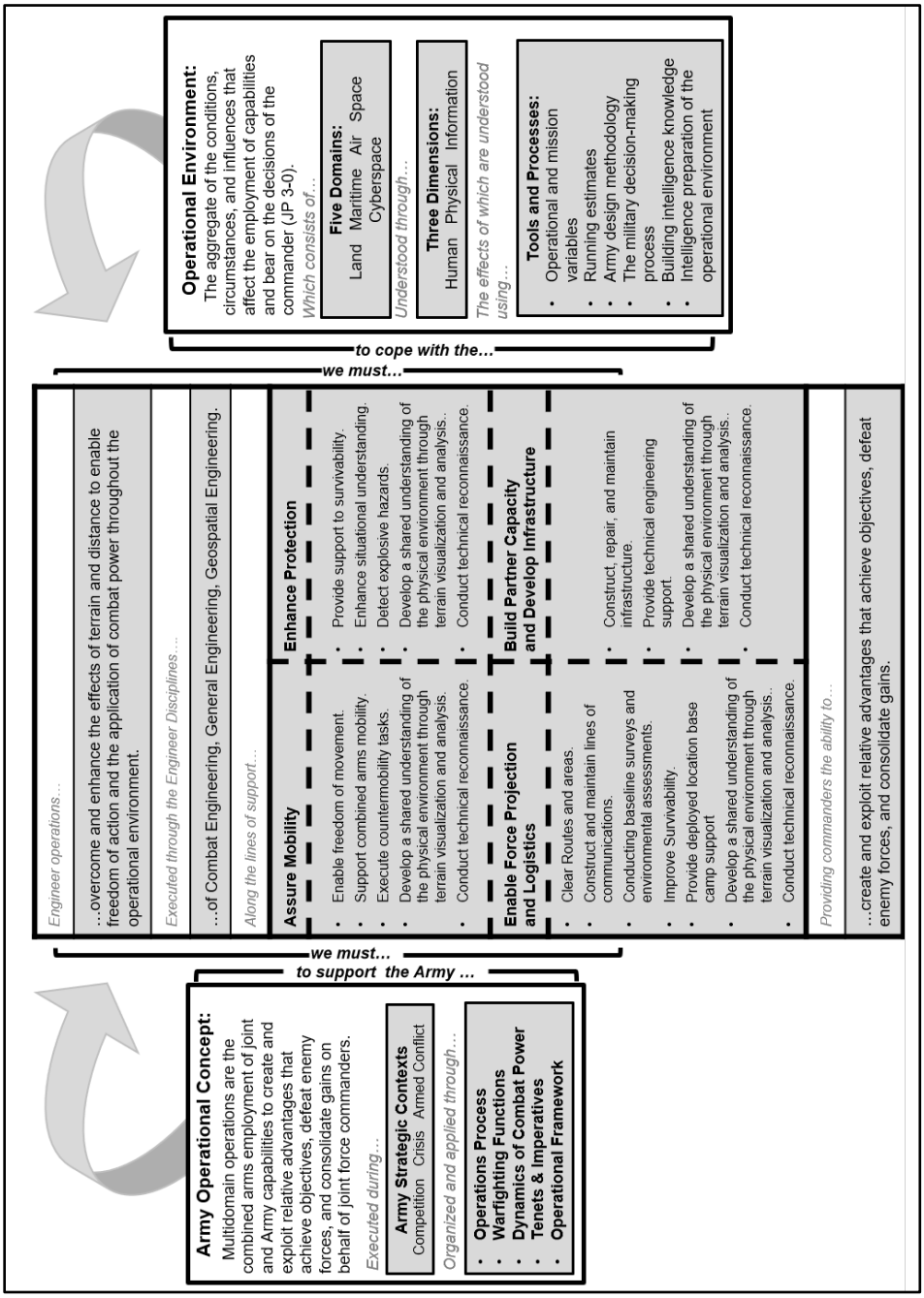
FM 3-34 establishes the engineer framework, provides the intellectual underpinnings, and refines the purpose and major activities of the Army Engineer Regiment. These are commonly referred to as the lines of engineer support (see introductory figure 1). The lines of engineer support describe how engineers combine the skills and organizations of the three interrelated engineer disciplines to provide support to commanders to assure mobility, enhance protection, enable force projection and logistics, build partner capacity, and develop infrastructure among populations and nations.

In introductory figure 1, while the geospatial engineering discipline is essential to both, combat and general engineering tasks commonly overlap because of the support they provide to Army missions and end states. General engineering is inseparably linked to USACE civil works, so the lower section of general engineering is greyed to acknowledge that overlap. The Army engineer disciplines consist of capabilities that enable the lines of engineer support—the disciplines are the means with which the regiment applies its capabilities to achieve the ends. The ways are how the capabilities that are inherent in engineer formations and organizations are used to apply combat power and enable freedom of action. In turn, freedom of action provides commanders the ability to create and exploit relative advantages. To enable the application of combat power and ensure freedom of action, the units spanning the three disciplines found in the operating force and USACE conduct multiple engineer tasks along each line of engineer support.



Introductory figure 1. Lines of engineer support

The engineer regiment exists to enable operations by providing freedom of action for Army and joint forces. This manual provides the foundation for how to think about exploiting the capabilities of the engineer regiment in support of Army operations and the joint force. 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, analyze, and exploit the terrain that facilitates the lines of support. 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 2 for a logical representation of the Regiment's contribution to Army operations.



Introductory figure 2. Logic chart

The engineer foundations provided in this doctrinal publication support the decisions and actions of engineer commanders. Doctrine is not intended to be a substitute for disciplined initiative. 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 operational environment (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.

This revised version of FM 3-34 includes the following changes:

- Updates and aligns with FM 3-0, *Operations* (2022).
- Introduces and describes engineer operations throughout the Army strategic contexts.
- Aligns Maneuver Enhancement Brigade (MEB) discussion with FM 3-81.
- Updates engineer visualization and understanding of the OE.
- Enhances the discussion of engineer support to Army operations.
- Describes engineer support throughout the operational framework.
- Provides additional considerations for planning engineer operations.
- Updates unit organizational charts and provides a detailed discussion on engineer capabilities by formation.
- Introduces new force design updates.
- Increases the discussion of environmental responsibilities.
- Emphasizes engineer utility in enabling and extending the operational reach of the corps and division through the engineer disciplines.

This FM is divided into seven chapters and one appendix:

- **Chapter 1** describes how the Engineer Regiment enables Army operations by executing engineer operations through the disciplines along the lines of support and provides a conceptual view of the OE and associated challenges that U.S. Army Forces face from an engineer perspective.
- **Chapter 2** provides information on the engineer mission support to Army operations.
- **Chapter 3** provides an overview of how engineers integrate and synchronize capabilities to enable the warfighting functions to generate combat power and apply it against enemy forces.
- **Chapter 4** describes the architecture of engineer forces and the capabilities available to the combatant commander (CCDR).
- **Chapter 5** discusses engineer organizational perspectives.
- **Chapter 6** identifies planning responsibilities, engineer integration, and processes for engineer units and planners. It further describes command and support relationships and additional sustainment considerations that uniquely affect planning for engineer operations.
- **Chapter 7** discusses sustainment considerations.
- **Appendix A** discusses defense support to civil authorities planning, tasks, and considerations.

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Chapter 1
The Army Engineer

Army engineers use a variety of engineer capabilities to support operations. Commanders employ engineers to assure mobility, enhance protection, enable force projection and logistics, build partner capacity, and develop infrastructure. This chapter describes the engineer mission through the disciplines, the lines of engineer support, and their supporting tasks. It also provides a conceptual view of the OE engineer activities spanning the levels of warfare and the associated challenges U.S. Army Forces face from an engineer perspective.

THE ROLE OF THE ARMY ENGINEER

1-1. Army engineers are manned, equipped, and trained to operate in all operational scenarios or categories, starting with the most lethal conditions first—large-scale combat against a peer threat. While there are no absolute rules for warfare, Army doctrine emphasizes tenets and imperatives for operations. An operation's prospects for success are improved with the incorporation of these tenants and imperatives. Army engineers are indispensable assets available to commanders in their quest to meet those tenets and imperatives. Army engineers enable the freedom to move and orient more rapidly than the threat, assist in convergence across domains to create opportunities, preserve and protect combat power to enhance endurance, and provide depth to persevere over time and space from the homeland to an objective. For further discussion on the tenets and imperatives, see FM 3-0.

1-2. Ground forces conduct operations on, in, above, or below the terrain in the land domain. The terrain affects them, and they often affect the terrain. Engineer operations are unique because, regardless of the intended purpose, they are directly aimed at affecting the terrain or at improving the understanding of it. As a result, terrain is central to the three engineer disciplines.

Note. In this context, terrain includes natural and man-made features.

1-3. Engineer capabilities contribute to the Army's operational concept—multidomain operations. *Multidomain operations* are the combined arms employment of joint and Army capabilities to create and exploit relative advantages that achieve objectives, defeat enemy forces, and consolidate gains on behalf of the joint force commanders (JFCs) (FM 3-0). All operations are considered multidomain operations. Engineers support operations by overcoming and enhancing the effects of terrain in the OE. Through the three disciplines and the four lines of support, engineers enable freedom of action and the application of combat power to create and exploit relative advantages.

ENGINEER DISCIPLINES

1-4. The engineer disciplines are areas of expertise within engineer units and headquarters. Each discipline mutually supports the other disciplines. The disciplines are composed of personnel and equipment that provide unique technical knowledge, services, and capabilities that make engineers a valued member of the Army profession. Through these disciplines, engineer units provide commanders a range of tailorable capabilities that focuses on the mission.

1-5. 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 equipped with small arms and a limited number of crew-served weapons that enable them to engage in close combat when combined with fire and movement (primarily intended to be in a self-defense role). Regardless of the discipline, all engineers must be prepared to conduct missions in close combat.

COMBAT ENGINEERING

1-6. *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 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. Combat engineers limit the ability of the enemy to generate tempo and mass forces by reinforcing the natural restrictions of the physical environment. These limitations increase enemy reaction time and degrade their will to fight.

1-7. Combat engineer tasks primarily support mobility, countermobility, and survivability (M/CM/S) requirements. However, they can conduct general engineering tasks related to horizontal and vertical construction when augmented with the appropriate tools, equipment, and training. Examples of general engineering tasks include improving culverts and fords or repairing command posts (CPs).

GENERAL ENGINEERING

1-8. *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 primarily focuses on providing construction support. It is the most diverse of the three engineer disciplines. General engineering occurs across the strategic contexts and throughout the area of operations (AO), at all levels of warfare, and during every type of military operation. It may include the employment of all engineer military occupational specialties. Engineer units with a general engineering mission are trained and prepared to integrate the engineer disciplines in support of the maneuver commander. See ATP 3-34.40.

1-9. General engineering primarily focuses on construction support. Tasks most frequently performed under general engineering include—

- Restoring damaged areas.
- Constructing and maintaining lines of communication.
- Establishing base camps.
- Assessing, repairing, and restoring infrastructure.
- Fulfilling environmental responsibilities, including surveys, reports, and assessments.
- Providing infrastructure support for managing hazardous materials and waste.
- Providing master facility and design support.
- Developing and maintaining facilities.
- Providing electrical power generation and distribution.
- Acquisitioning and disposing of real estate.

1-10. In addition, general engineering is one of the Army logistics elements. General engineer units execute tasks that establish and maintain the infrastructure required to conduct and sustain military operations.

GEOSPATIAL ENGINEERING

1-11. *Geospatial engineering* is the engineering capabilities and activities that contribute to a clear understanding of the physical environment by providing geospatial information and services (GI&S) to commanders and staffs (JP 3-34). Geospatial engineers provide services to enable informed running estimates and decision making. Geospatial engineering fundamentally supports engineering operations, all warfighting functions through terrain analysis, and visualization of the physical environment and its effects on military operations. This support is accomplished through the Army Geospatial Enterprise (AGE) utilizing the geospatial engineer's four primary functions: generate, manage, analyze, and disseminate (GMAD). The AGE allows geospatial data to be collected, stored, conflated, analyzed, and disseminated across echelons, networks, and network security domains. These functions are cyclic and organizationally supported through the Theater Geospatial Database (TGD), Army Service component command (ASCC) geospatial planning cells (GPC), Army Geospatial Center (AGC), and various other organizational

components. This geospatial data comprises the standard and shareable geospatial foundation (SSGF) and functional geospatial data and information (GD&I). See paragraph 1-87 for a description of GMAD and SSGF, and paragraph 4-53 for a description of AGE. For additional information, see AR 525-95, ATP 3-34.80, JP 3-34, and TC 3-34.80.

1-12. Geospatial engineers provide the following support from the ASCC to the BCT levels:

- Terrain analysis, management, and other geospatial decision aids that support the operations process.
- Terrain visualization (such as 3-D terrain mapping and fly-through representation).
- Nonstandard, tailored map products (such as cross-country mobility, view shed, zone of entry, and hydrology).
- SSGF data (such as controlled imagery, feature data, maps/charts, and elevation data, including the generation, management, analysis, and dissemination of the data) for the common operational picture (COP) that establishes the common map/common terrain for unit planning and operations.
- Maintenance, updates, and management of the TGD.

FOUNDATIONS OF ENGINEER OPERATIONS

1-13. Engineer operations overcome and enhance the effects of terrain and distance to provide freedom of action and the application of combat power throughout the OE. Executed through the disciplines and along the lines of support, engineer operations provide commanders the ability to create and exploit relative advantages.

1-14. The Army engineer provides freedom of action for supported forces. Engineer operations affect various terrain—bridges (including gaps), roads, trails, airfields, fighting positions, protective positions, deception, and a wide variety of other structures and facilities (such as base camps, aerial ports, seaports, utilities, and buildings). Engineers affect these by clearing, reducing, emplacing, building, repairing, maintaining, camouflaging, protecting, conserving, or modifying them in some way through tasks (such as obstacle clearance, obstacle reduction, infrastructure and environmental reconnaissance, and geospatial engineering).

1-15. Regardless of the category, engineer operations 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 task is the same, but with different purposes. In addition to the different purposes an engineer task can have at different times, engineer support often involves simultaneous tasks with different purposes that support different warfighting functions.

LINES OF ENGINEER SUPPORT

1-16. The ability to anticipate and analyze problems and understand the OE is fundamental to engineer support to operations. Engineer planners then select and apply the right engineer discipline and unit type to perform the required individual and collective tasks. It may be necessary to think in combinations of disciplines, integrating and synchronizing tasks across the warfighting functions. Finally, engineer planners establish the necessary command and support relationships. The lines of engineer support are the framework for how engineers think in combinations of disciplines; these lines provide the connection between capabilities and tasks.

1-17. Commanders use lines of engineer support to synchronize engineer operations 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 operations and capabilities grouped by purpose for specific operations. Lines of engineer support assist commanders and staffs to understand engineer capabilities that are organic within the engineer disciplines and to align 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 unified action, achieves the lines of engineer support.

1-18. Regardless of where a task falls within the combined arms 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.

1-19. 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 vitally important and integral GI&S data, standard and nonstandard geospatial products, mission-tailored data, geospatial decision aids, and terrain visualization products that enable commanders and staffs to visualize and understand the OE across all lines of engineer support.

ASSURE MOBILITY

1-20. The assure mobility line of engineer support orchestrates the combat, general, and geospatial engineering capabilities in combination to allow a unit 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 support the movement and maneuver warfighting function, including support to special operations forces. Although normally associated with organic combat engineers, general engineers may also be task-organized to support this line of engineer support. This line of engineer support does not include engineer tasks supporting the nontactical movement of personnel and material normally intended to enable logistics.

1-21. 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.

Support to Mobility

1-22. *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 3-36). 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.

1-23. 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. 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 ports of debarkation. These tasks are often considered combat engineering tasks; however, general engineer units can perform them when conditions allow.

1-24. 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, when needed, under conditions of close support to maneuver forces that are in close combat.

1-25. Engineer contributions to the planning of mobility occur at all levels of warfare and throughout armed conflict. The execution of engineer tasks in support of mobility usually occurs at the operational and tactical levels of warfare, but it often has strategic-level implications. At the tactical level of warfare, combat engineer units are frequently required, especially in offensive and defensive operations. At the

operational level, general engineer units typically perform most engineer tasks. During the conduct of offensive and defensive operations, engineer tasks are focused on the mobility of friendly forces. In stability and defense support of civil authorities (DSCA), engineer tasks are often focused on the mobility of the first responders and the population.

1-26. 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 a line of communications (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).

1-27. Mobility tasks are typically identified as essential tasks and may require integration into the synchronization matrix to account for the assets and time required to implement them. For information on planning considerations for M/CM/S, see chapter 6.

Support to Countermobility

1-28. Engineer support to countermobility includes the following engineer tasks:

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

1-29. *Countermobility* is a set of combined arms activities that use or enhance the effects of natural and man-made obstacles to prevent the enemy freedom of movement and maneuver (ATP 3-90.8). The primary purposes of countermobility are to shape enemy movement and maneuver and to prevent the enemy from gaining the position of advantage. Subsequently, countermobility supports the execution of offensive and defensive tasks.

1-30. Countermobility tasks typically involve engineers and include 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 also plans for the clearing of obstacles at the cessation of hostilities and for minimizing obstacle effects on noncombatants and the environment.

1-31. The engineer tasks that support countermobility operations include those that construct, emplace, or detonate obstacles and those that track, repair, and protect obstacles. 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 conditions allow.

1-32. The effects of natural and man-made obstacles are considered during planning at the theater strategic down to the tactical level of warfare. At the tactical level of warfare, 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 or tactical deception. 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. For information on countermobility, see ATP 3-90.8.

1-33. 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.

1-34. As of 1 January 2010, U.S. Army Forces are no longer authorized to employ persistent and undetectable land mines (land mines that are not self-destructing or self-deactivating). The United States employs self-destructing and self-deactivating mines (scatterable mines) to provide countermobility for the force. In addition, 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.

Note. The United States acknowledges the importance of protecting noncombatants while enabling legitimate operational requirements. See the current U.S. land mine policy for additional employment guidance for scatterable mines, including authorizations for the use of antipersonnel and antivehicle mines.

Other Tasks Associated with Assure Mobility

1-35. Geospatial engineering provides the necessary geospatial information and products to help combat and general engineers visualize the OE 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). 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 analyzing the meaning of activities, which significantly contributes 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. It is imperative that geospatial engineers 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 assist with engagement area (EA) development.
- 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 (such as roads, airfields, railroads, bridges, tunnels, and ferries) capable of facilitating the transportation of people, goods, vehicles, and equipment.

1-36. The engineer diving detachment provides equipment and personnel to conduct underwater operations. The unique skills of the diver provide critical support to commanders during river-crossing operations by conducting near-shore 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. For more information on military diving, see ATP 3-34.84 and TM 3-34.84.

1-37. Combat engineer units form engineer reconnaissance teams that can operate independently, but they normally support BCTs, 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 to update the unit COP and to include in the TGD. For more information on engineer reconnaissance tasks, see ATP 3-34.81. For more information regarding the TGD, see ATP 3-34.80.

1-38. Explosive ordnance clearance agent (EOCA) personnel are combat engineers with additional training to perform limited disposal of authorized explosive ordnance identified in the EOCA guide or supplemental EOCA ordnance list in support of mobility. Engineers may assist explosive ordnance disposal (EOD) assets in EOD operations, as directed by the theater. For more information on EOD operations, see ATP 4-32.2.

ENHANCE PROTECTION

1-39. 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 (such as area clearance). It also includes survivability and other protection tasks performed or supported by engineers. For more information, see ADP 3-37 and ATP 3-37.34.

Support to Survivability

1-40. *Survivability* is a quality or capability of military forces which permits them to avoid or withstand hostile actions or environmental conditions while retaining the ability to fulfill their primary mission (ATP 3-37.34).

1-41. Engineer support to survivability consists of the following areas:

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

1-42. 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 and is an element of combat power. Engineers employ capabilities from all three engineer disciplines to support survivability operations. Engineer support to survivability operations is most often aligned with the enhance protection line of engineer support.

1-43. Although units conduct survivability operations within their own 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.

1-44. Engineer tasks that support survivability operations occur predominately at the operational and tactical levels of warfare. At the tactical level of warfare, 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 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 transition to tasks that provide protection of the population or civilian assets. For additional information, see ATP 3-37.34.

1-45. 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 dig 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 tactical 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.

1-46. Engineer tasks support survivability in chemical, biological, radiological, or nuclear (CBRN) environments. Protective positions and hardened facilities support protection against nuclear blast effects and improve shielding. Engineers support contamination control at decontamination sites and by scraping roadways and other surfaces to mitigate contamination. For more information on operations in CBRN environments, see ATP 3-11.32.

Other Tasks That Enhance Protection

1-47. Engineers also enhance protection through the execution of countering explosive hazards tasks. (For more information on countering explosive hazards, see ATP 3-34.20.) 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. Where the tactical situation permits, area clearance is accomplished by a USACE-contracted capability.

Note. Area clearance and demining are not synonymous. Section 401, Title 10, United States Code (USC), Chapter 20 (10 USC 401 Chapter 20) explicitly restricts members of the armed forces from demining unless it has the concurrent purpose of supporting a U.S. military operation. See the International Mine Action Standards website for more information on demining and the mine action standards.

1-48. EOCA personnel not only play a vital role in the assure mobility line of engineer support, but they are also equally vital for the enhance protection line of engineer support. They advise the on-scene commander on recommended personnel and equipment protective measures and isolate blast and fragmentation danger areas within the AO. EOCA personnel may assist EOD personnel in disposing of explosive hazards.

1-49. Engineer mobility and countermobility tasks typically support the assure mobility line of engineer support, but those tasks 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).

1-50. 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.

1-51. Firefighting teams are limited assets that provide fire prevention and fire protection services. Some key protection tasks provided to commanders include fire prevention inspections and investigations, fire suppression, search and rescue, and hazardous material response. In addition, these teams provide medical response and assistance to victims and offer technical oversight of nonfirefighting personnel when supporting firefighting operations.

1-52. Engineers with environmental training and knowledge can be embedded at the tactical level to conduct environmental baseline surveys, analyze site conditions, identify resources and hazards, and make recommendations to enhance protection. These personnel are trained to identify, prevent, and mitigate potential hazards to the environment, personnel, and mission. Potential hazards should be identified early, before force projection and site occupation. For more information on environmental considerations, see ATP 3-34.5.

ENABLE FORCE PROJECTION AND LOGISTICS

1-53. Engineers combine capabilities from across the three engineer disciplines to enable force projection and logistics. These capabilities are applied to enhance theater strategic through tactical movements. Executed primarily through the general engineering discipline, tasks in this line of support—

- Free combat engineers to support maneuver forces.
- Establish and maintain the infrastructure necessary to support follow-on forces.
- Sustain military operations during and after hostile action.
- Provide recommendations for the site selection of facilities, joint fires, and protection.

Tasks Enabling Force Projection and Logistics

1-54. The engineer-focused tasks are typically performed by engineer units or commercial contract construction management assets, such as USACE, for specialized and reachback support. They can be performed by a combination of joint engineer units, civilian contractors, host nation (HN) forces or multinational engineers. They may also require various types of technical and tactical reconnaissance and assessments be performed prior to or in the early phases of a mission, including gathering information for countermobility, site selection, master planning, support to disaster preparedness planning response, and support to consequence management. For more information on engineer reconnaissance, see ATP 3-34.81.

1-55. Geospatial engineers provide geospatial products to enable terrain visualization and situational understanding to support operations across all warfighting functions and the competition continuum. This provides early-entry forces with terrain information and analysis on landing sites, movement corridors, avenues of approach (AAs), and follow-on objectives. In addition, it provides follow-on forces information on potential locations of bases and base camps for initial operations.

1-56. Combat engineers 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 clear the hazards that are within capability and scope to ensure freedom of movement along a LOC or within an aerial port of debarkation (APOD) or a seaport of debarkation (SPOD).

1-57. Engineer personnel augment sustainment units to support joint logistics over-the-shore (JLOTS) to assist planning efforts. Engineer personnel prepare access routes to and from the beach when port facilities are unavailable, damaged, or denied. They also prepare landing sites and staging areas.

Other Tasks That Enable Force Projection and Logistics

1-58. These tasks are primarily general engineering tasks that are not normally performed under conditions of support to maneuver forces that are in close combat. For more information, see ATP 3-34.40. 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.
- Generating and distributing electrical power.
- Managing utilities and waste.
- Acquiring, managing, remediating, and disposing of real estate.
- Firefighting.
- Conducting battle damage repair.
- Completing environmental surveys and reports.
- Integrating environmental considerations and requirements.
- Improving fighting and protective positions and hardening facilities.
- 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

1-59. Engineers combine capabilities from across the three disciplines to support the build partner capacity and develop 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 competition below armed conflict, crisis, transitions that support stability operations, and missions that enable civil authority. It is often a series of technical tasks (such as building roads and water treatment facilities) that fall under different general engineering units (electricity, road and rail transportation, water supply and sanitation, water treatment and sewage).

Tasks That Support Building Partner Capacity and Develop Infrastructure

1-60. 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.

1-61. The different purposes of build partner capacity and develop infrastructure to enable force projection and logistics significantly change the way 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. In addition, 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.

1-62. The engineer role in capacity building is included in the build partner capacity and develop infrastructure line of engineer support. (For additional information on building partner capacity, see FM 3-07.) 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.

1-63. While engineers at all echelons build partner capacity requirements, USACE field force engineering (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

1-64. 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 as well as conduct geospatial data exchanges for interoperability. 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.

1-65. Engineers in all 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.

OPERATIONAL ENVIRONMENT

1-66. Within the broader strategic environment, Army forces conduct operations in unique and complex OEs. An *operational environment* is the aggregate of the conditions, circumstances, and influences that affect the employment of capabilities and bear on the decisions of the commander (JP 3-0). The understanding of the OE has evolved. For Army forces, an OE includes portions of the land, maritime, air, space, and cyberspace domains understood through three dimensions (human, physical, and information). The land, maritime, air, and space domains are defined by their physical characteristics. Cyberspace, a man-made network of networks, connects the other domains (see figure 1-1). While Army engineer operations are conducted in the land domain, these operations can enable forces operating in the other domains because almost all capabilities, no matter where employed, are ultimately based on, or controlled from, land. For additional information on the domains and dimensions of an OE, see FM 3-0.

1-67. The OE model aids in accounting for the totality of factors, specific circumstances, and conditions that impact the conduct of operations. This understanding enables leaders to better identify problems, anticipate potential outcomes, and understand the results of various friendly or threat actions and the effects these actions have on achieving military objectives.

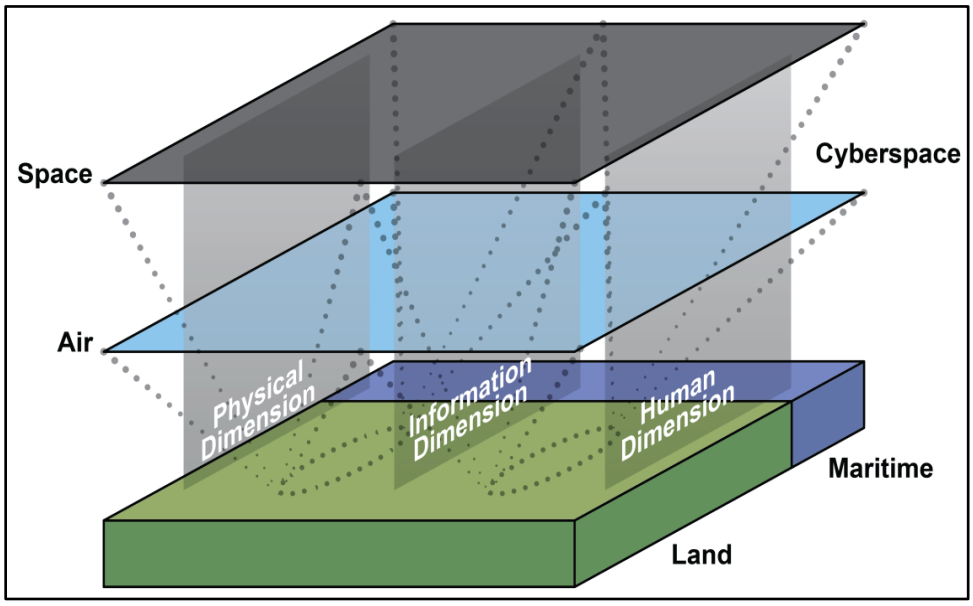


Figure 1-1. Domains and dimensions of an operational environment

1-68. The term *threat* is any combination of actors, entities, or forces that have the capability and intent to harm United States forces, United States national interests, or the homeland (ADP 3-0). Threats include nation-states, organizations, people, groups, or conditions that can damage or destroy life, vital resources, or institutions. The various actors in an AO can qualify as a threat, an enemy, an adversary, a neutral, or friendly actor(s). A peer threat is an adversary or enemy with the capabilities and capacity to oppose

U.S. forces across multiple domains worldwide or in a specific region where it enjoys a position of relative advantage. Peer threats possess roughly equal combat power to U.S. forces in geographical proximity to a conflict area. Engineers describe a threat in terms of their capabilities and functions. In addition, they develop methods to discern and identify threat patterns of behavior to aid commanders and staffs in clearly visualizing and understanding the threat as it relates or is applied to the OE. For more information on threats, see ADP 3-37 and ATP 3-34.22.

1-69. An OE for any specific operation involves not only isolated conditions of interacting variables that exist within a specific AO, but also interconnected influences from the global or regional perspective (for example, political, social [crime, terrorist], and economic) that impact conditions and operations. These interconnected influences impact operations throughout the strategic framework (strategic support area, joint security area, extended deep area, and assigned operational area). Maneuver commanders rely on the three engineer disciplines to add breadth and depth to the overall understanding of the OE. Each environment presents its own challenges to planning and executing engineer tasks and may require engineers to employ specialized knowledge, skills, techniques, and equipment. To be successful in the conduct of military operations, engineers should thoroughly understand and appreciate the changing nature of an OE.

1-70. Army doctrine describes an OE in terms of the eight constantly interacting operational variables: political, military, economic, social, information, infrastructure, physical environment, and time (PMESII-PT). 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 a shared common understanding from an engineer perspective. The mission variables are mission, enemy, terrain and weather, troops and support available, time available, and civil considerations, each of which have informational considerations (METT-TC [I]). Commanders and staffs use operational and mission variables as tools to refine their understanding of the OE. For more information on operational and mission variables as it relates to engineer operations, see chapter 4 of this book. For more information on operational and mission variables, see FM 5-0.

1-71. Engineers analyze the OE using operational and mission variables to identify potential challenges and opportunities within the operation, both before and during mission execution, to add to the shared common understanding. 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

1-72. The OE is described using the operational variables of PMESII-PT. 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 of 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 effects 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 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 infrastructures

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. Impacts to the local economy from use of local materials and resources are considered, including use of natural resources, alternative energy production, tourism, and recreation areas. Opportunities in the form of potential resource protection, or in the form of new or improved production facilities, might be added.
- **Social.** The social variable describes the cultural, historic, religious, ethnic makeup, and social cleavages of an OE. The engineer view might add challenges associated with specific cultural, historic, or religious buildings or installations; the impact of language barriers or availability of laborers; and qualified local engineer resources. Opportunities to protect or reinforce cultural, historic, or religious resources may be a consideration. For more information about identifying and protecting resources, see ATP 3-34.5.
- **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 considers 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, including power considerations.
- **Infrastructure.** Infrastructure comprises the basic facilities, services, and installations needed for a community or society to function. 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. For more information, see ATP 3-34.40 and ATP 3-34.81.
- **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 freedom of action. The engineer view might add challenges associated with natural and man-made obstacles, or opportunities in the form of existing routes, installations, and resources. Enemy engineer manipulation of the physical environment (dam demolition for flooding, deliberate toxic incidents in industrial areas) and how those actions can impact friendly operations is also a consideration. The engineer view supports a broad understanding of the physical environment through geospatial engineering. Insights into environmental considerations are also a concern. For more information on geospatial engineering, see ATP 3-34.80. For more information on environmental considerations, see ATP 3-34.5.
- **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. CCDRs establish base camp strategies that are tailored to the joint operational area based on an assessment of the situation, unique characteristics of the region, and anticipated duration.

MISSION VARIABLES

1-73. Mission variables are fundamental in analyzing the situation and developing a course of action (COA) for a given operation. Mission variables describe characteristics of an AO, focusing on how they might affect a mission. METT-TC (I) represents the mission variables leaders use to analyze and understand a situation in relationship to the unit's mission. The first six variables are not new. The

increased use of information (both military and civilian) to generate cognitive effects requires leaders to continuously assess the informational impacts on operations.

1-74. The following are examples of the engineer perspective for each of the mission variables:

- **Mission.** Leaders analyze a mission in terms of specified tasks, implied tasks, and the commander's intent (two echelons higher) to determine essential tasks. Engineers conduct the same analysis (with added focus on engineer requirements) to determine essential tasks and engineer priorities. The early identification of 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 threaten friendly operations. This includes an analysis of enemy disposition, enemy engineering capabilities, obstacle intelligence, engineer reconnaissance, and explosive hazard reporting within the AO or area of interest (AOI) that could impact the mission.
- **Terrain and weather.** As the terrain visualization experts, geospatial engineers analyze terrain 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 and geospatial decision aids to help commanders and staffs visualize the OE and understand the impacts of terrain on operations. The effects of weather coupled with terrain considerations define the total engineering operating environment. Air Force Staff Weather Office 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 numbers, types, capabilities, and conditions of engineer troops and the support available from unified action partners.
- **Time available.** Engineers must understand the time required to plan engineer operations and the importance of collaborative and parallel planning to prepare and execute tasks. Engineers understand 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, those influences 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 identifies challenges, including environmental stewardship, financial and economic feasibility, social and cultural impacts, and the implications associated with specific deficiencies in the basic infrastructure and opportunities for improving and developing it.
- **Informational considerations.** *Informational considerations* are those aspects of the human, information, and physical dimensions that affect how humans and automated systems derive meaning from, use, act upon, and are impacted by information (FM 3-0). Informational considerations are expressed as a parenthetical variable (I) in that they are not an independent variable, but an important consideration combined with each mission variable that leaders should pay particular attention to when understanding a situation. Information considerations include relevant friendly, threat, and neutral (both military and civilian) individuals, organizations, and systems that are capable of generating cognitive effects and influencing behavior.

Note. For more information about analyzing the OE through PMESII-PT and METT-TC(I), see ATP 2-01.3. For more information on civil considerations, see FM 3-57.

1-75. Engineers contribute to understanding of the OE through analyzing operational and mission variables and their interaction with the three dimensions. Engineers continuously change the physical environment to accomplish military requirements or to set the conditions for future operations. In addition, they train with joint and other unified action partners to continuously develop multinational interoperability and readiness for large-scale combat operations. In doing so, engineer organizations continually network and engage with

Army, joint, multinational, other unified action partners, and local populaces to complete projects, training, and missions. Interaction and a proactive approach improve interoperability with joint and multinational forces while enhancing the Army's influence and enabling information collection.

ENGINEER ACTIVITIES SPANNING THE LEVELS OF WARFARE

1-76. The *levels of warfare* are a framework for defining and clarifying the relationship among national objectives, the operational approach, and tactical tasks (ADP 1-01). While the various methods of warfare are ultimately expressed in concrete military action, the four levels of warfare—national strategic, theater strategic, operational, and tactical—link tactical actions to the achievement of national objectives, as shown in figure 1-2.

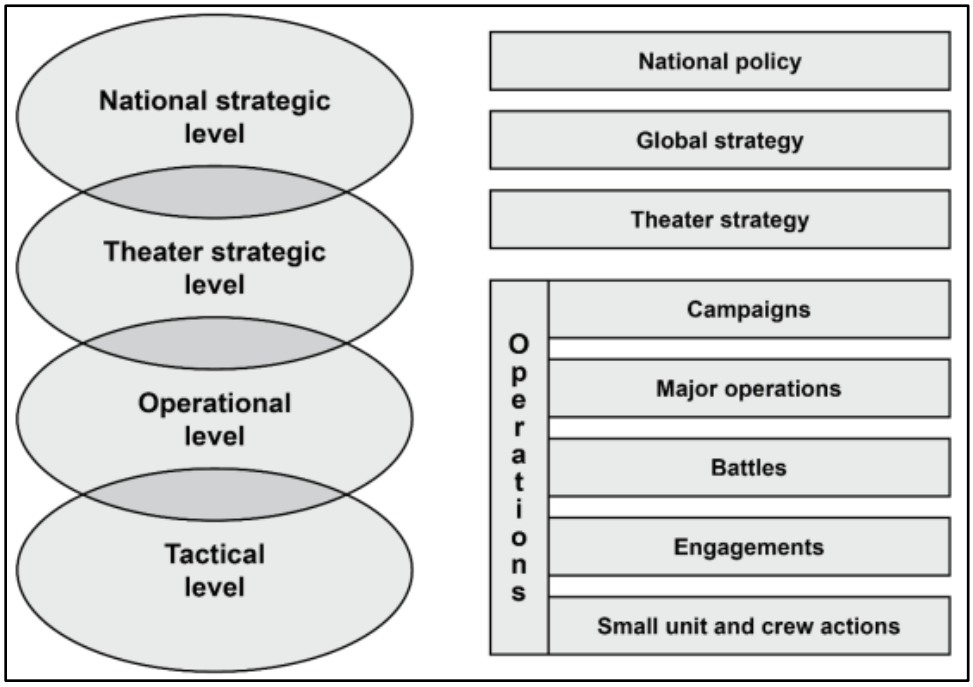


Figure 1-2. Levels of warfare

1-77. The levels of warfare distinguish four broad overlapping activities—providing national direction and creating national strategy (national strategic), conducting continuous theater campaigning (theater strategic); planning and conducting campaigns and major operations (operational); and planning and executing operations, battles, engagements, and actions (tactical). No fixed limits or boundaries exist between these levels; they help commanders visualize a logical arrangement of operations, allocate resources, and assign tasks to the appropriate commands. The challenges of planning, preparing, executing, and continuously assessing operations within diverse theaters are many and varied. Engineer commanders and staffs must remain involved in the operations process at all levels of warfare. Engineer leaders identify challenges and opportunities that equip the staff with relevant information to form a more comprehensive understanding that leads to the most effective use of engineer assets and capabilities in mission execution. Engineer staff members ensure that they are integral to the planning process at all levels.

NATIONAL STRATEGIC

1-78. The *national strategic level of warfare* is the level of warfare at which the United States government formulates policy goals and ways to achieve them by synchronizing action across government and unified action partners and employing the instruments of national power (FM 3-0). The instruments of national power are all the means available to the government in its pursuit of national objectives—diplomatic, informational, military, and economic (DIME). The national strategic level of warfare focuses on developing global strategy and providing global strategic direction. Strategic direction provides context, tasks, and purpose for the employment of the instruments of national power.

THEATER STRATEGIC

1-79. The *theater strategic level of warfare* is the level of warfare at which combatant commanders synchronize with unified action partners and employ all elements of national power to fulfill policy aims within the assigned theater in support of the national strategy (FM 3-0). Engineer planners determine the means, ways, and ends as part of a joint force to enable U.S. Army Forces to achieve objectives, defeat enemy forces, and consolidate gains. Activities include planning the right engineer force, with the right mixture of capabilities and policies in place, to mobilize, deploy, employ, sustain, and redeploy forces. Engineer activities at the theater strategic level seek ways to set conditions during competition and crisis for success in the event of armed conflict. Engineers conduct force planning, develop engineer policy, and support campaigns and operations. These activities are primarily focused on the means and capabilities to generate, deploy, employ, sustain, and recover forces.

1-80. Infrastructure development is a critical aspect of enabling and sustaining force deployments, and it places a heavy demand on engineer requirements. Engineers at the theater strategic level advise on terrain and infrastructure. Considerations include—

- GI&S.
- TGD management.
- SPOD.
- APOD.
- Force generation.
- Engineer support priorities.
- Lines of communication.
- Air base and airfield operations.
- The theater basing strategy.
- Joint targeting.
- Foreign humanitarian assistance.
- Environmental considerations.
- Engineer interoperability.
- Input for the rules of engagement.
- Rules for the use of force.
- Support to protection.
- Explosive hazards mitigation and explosive remnants of war.

1-81. Environmental considerations apply at all levels of command and across the full range of military operations. They can have strategic, tactical, and operational implications and affect mission success and end states if they are not incorporated throughout planning and operations and are not recognized early in the process. The failure to recognize important environmental aspects puts forces at significant risk, which adversely affects readiness, local community relations, insurgent activities, and diplomatic relations.

1-82. Commanders include environmental risk assessments in conjunction with the operational variables and determine the amount of effort to direct at the range of environmental media, resources, and programs that may affect the planning and execution of military operations. Commanders integrate environmental guidance into operation plans (OPLANs) and operation orders (OPORDs), and engineers recommend appropriate COAs to the commander and are tasked to oversee those efforts. They constantly strive to prevent adverse impacts to the mission by avoiding damage to the environment, harm to people, competition for and mismanagement of resources, and issues based on economics, culture, religion, and historical and natural resources. For example, environmental considerations may include avoiding cultural sites, developing guidance for targeting industrial infrastructure, interpreting laws and treaties that pertain to environmental conditions, identifying natural resources that are important to the local economy and reconstruction, and determining the level to which the military conducts environmental remediation or restoration. Throughout the life-cycle phases of contingency locations, Environmental Baseline Survey Checklists and Reports, Environmental Conditions Reports, inspection reports, and Environmental Site Closure Surveys and Reports are completed to record environmental conditions and assess environmental risks. For more information about environmental regulations and considerations, see AR 200-1, ATP 3-34.5, environmental conditions forms, and HN-specific environmental regulations.

OPERATIONAL

1-83. The *operational level of warfare* is the level of warfare in which campaigns and operations are planned, conducted, and sustained to achieve operational objectives to support achievement of strategic objectives (JP 3-0). Engineer activities at the operational level focus on the impact of geography and force projection infrastructure on the CCDR operational design. Operational-level decisions may include selecting (or not selecting) potential targets, developing guidance on establishing supply routes and hubs, developing guidance for base camp site selection, developing guidance on integrated waste management programs and identifying required resources, determining when these resources must be moved into the theater, and planning for hazmat transport. (For more information, see ATP 3-34.5.) Engineer planners determine the basic (yet broad) mobilization, deployment, employment, and sustainment requirements of the CCDR concept of operations. Engineer planners also review and decide how to specifically apply environmental policy and general procedures. Engineer planners secure funding within authorities and plan for the procurement of Class IV supplies and services. Operational planning merges the OPLAN or OPORD of the joint force, specific engineer missions assigned, and available engineer forces to achieve success. Combatant command (CCMD) 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.

1-84. Many of the engineer activities conducted for theater strategic operations are also performed at the operational level. Engineers conduct operational area and environmental reconnaissance missions and work with intelligence staff to analyze the threat and terrain. 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. For more information on base camps, see ATP 3-37.10. 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 assigned to the operational Army (such as forward engineer support teams, multirole bridge companies, engineer construction companies, prime power teams, and additional engineer brigades).

1-85. 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, including 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. Conventional force engineers across the three disciplines can provide 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 AOI. Engineers should be familiar with fiscal policy, and they can translate special operations requirements in terms that the supporting conventional forces can understand and execute.

TACTICAL

1-86. The *tactical level of warfare* is the level of warfare at which forces plan and execute battles and engagements to achieve military objectives (JP 3-0). Engineer planners determine the best methods to task-organize forces at the lowest level to support the maneuver of combat forces to achieve their objectives at the least cost. Engineer activities at the tactical level focus on supporting 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.

1-87. 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. 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 commanders 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, consideration of threat capabilities is essential.

1-88. Geospatial engineers conduct four primary functions using GI&S—generate, manage, analyze, and disseminate—to provide unique graphical representations and terrain analysis that enable commanders to visualize the AO. In addition, geospatial engineers provide SSGF, which serves as the geospatial background for the unit COP on all command and control (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. For more information, see ATP 3-34.80 and ATP 3-34.81.

1-89. Engineer support to special operation forces at this level of warfare has been allocated to provide engineer expertise across the engineer disciplines. Engineer units at this echelon must be prepared to provide an engineer liaison officer (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 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 type of operation, but they do execute these missions with an emphasis on speed and resource ingenuity.

CHALLENGES

1-90. OEs present unique challenges that engineers should be prepared to overcome during competition below armed conflict, crisis, and armed conflict (see FM 3-0 for more information about competition, crisis, and armed conflict). Adversaries use a combination of military and nonmilitary capabilities in all domains, requiring commanders and staffs to continually assess engineer priorities and employment of engineer capabilities within their assigned AO from the homeland to the close area of the operational framework.

1-91. Enemy capabilities enable them to conduct operations within the homeland, against power-projection capabilities, in the support areas, and into the deep maneuver and fires areas of the AO. The enemy will contest all deployments, challenge the tempo of movement, and restrict the build-up of combat power. Their disruptive effects may occur at unit home stations and ports of embarkation, while in transit to the theater, and upon arrival at ports of debarkation. Army forces may not have the capability nor the authority to preempt these attacks. Engineer planners should be aware of the effects created from impacts to force projection in time and space to engineer capabilities requested from national guard and reserve units. These effects can also cause unavailability of some entities as they work to support DSCA operations.

1-92. Commanders must also be aware of personnel within their own force who have authorized access to Department of Defense (DOD) facilities, systems, equipment, information, or infrastructure and who may want to maliciously cause damage, disrupt operations, commit espionage, or support a criminal, extremist group, insider threat or terrorist organization. Army forces should account for being under constant observation. Adversaries rely on surveillance and reconnaissance capabilities from national and local levels to collect information on U.S. military headquarters, communications systems, critical infrastructure, and power projection facilities in the homeland.

1-93. They will employ nonlethal capabilities to reduce friendly force tempo, deny essential services, and understand and influence populations and officials, altering friendly decision making. Adversaries also create, or leverage conditions intended to fracture partnerships, stress the will of friendly actors, and flip friendly force advantages in multiple areas to the side of the adversary. Adversaries have the capability to contest friendly forces in the space and cyberspace domains and degrade communications systems. Engineer units should maintain analog and manual reporting skills and should be prepared to use alternate means of communications and in some cases be prepared to continue to make decisions and act in the absence of orders.

1-94. Setting the conditions for forward operations is critical to managing challenges within the OE and imposed by adversaries. Base camp defense and protection of key terrain is vital as forward-stationed forces may be required to defend critical terrain with other coalition forces or be prepared to fight while relatively isolated in the early stages of an enemy attack. Engineers set conditions in theater through improving ports of debarkation and LOCs as well as establishing, maintaining, and defending bases to enable commanders to generate, project, and sustain combat power from reception, staging, onward movement and integration (RSOI) at ports of debarkation to the operational support area. In some cases, theater engineer staff acquire real estate or develop real estate agreements in anticipation of future operations to support first deployers, while developing base defense plans as forces move into theater. Securing and protecting staging bases, infrastructure, and theater assembly areas will be essential to the force's ability to compete and win.

1-95. Environmental conditions can present unique challenges that need to be addressed to protect personnel and the mission. For example, challenging site characteristics can include inadequate drainage, contaminated soil, poor water or air quality, erosion, or flooding. Storage containers or sites may contain hazardous materials with over-stacked containers, lack of segregation or labeling, or leaking tanks. Wastes may be dumped, improperly treated, or infested with pests or disease vectors. There may be resources that require protection, such as cultural resources or water sources. To address these challenges, commanders should integrate environmental guidance into OPLANs and OPORDs, and commanders should integrate environmental considerations into training, unit activities and daily operations, intelligence preparation of the operational environment (IPOE) and risk management, and planning and execution processes. These actions are essential for finding the balance between the operational framework and the environmental ethic in which subordinate commands conduct operations.

1-96. Limited contingency and large-scale combat operations in urban terrain are especially complex and resource-intensive. A thorough knowledge of the terrain assists in mitigating complications and risk in an urban OE. Engineer planners assess the restrictions on engineer capabilities imposed by the rules of engagement and the presence of noncombatants. Not all engineer systems can be used in an urban environment or restrictive terrain, such as a subterranean condition, with the emphasis on limiting collateral damage. ATP 3-21.51 describes subterranean environments in three major categories: tunnels or natural cavities and caves, urban subsurface systems, and underground facilities. Each presents its own challenges to U.S. Army Forces during limited contingency operations or large-scale combat operations. However, urban settings also provide opportunities for additional resources and services that are not always available in other environments. Geospatial engineering provides a shared understanding and visualization of the OE and evaluates urban features to determine the effects on potential operations.

1-97. Maritime environments present additional and unique challenges based on the nature of the OE. Engineer support to the maritime environment is challenged by the potential for austere noncontiguous land masses, contested logistics, and the extension to the lines of communications which may limit available resources and flexibility during the onset of hostilities. Planners must be closely linked to operational planning and anticipate support requirements to ensure commanders maintain freedom of action when operating in a maritime environment. Setting the proper conditions with a maritime environment becomes crucial with these factors in mind. Considerations affecting engineer operations in a maritime environment include the types of terrain, coastline configurations, suitability of routes of communication, availability of airfields, extent of existing infrastructure, use of existing infrastructure by the landing force, climate, weather, and available engineer resources. Decisions affecting engineers include mobility around the landward segments of littoral areas, which require improvements of noncontiguous areas between domains. Engineer operations within a maritime environment may be challenged from the potential for austere noncontiguous land masses, contested logistics, and the extension to the lines of communication, which limits available resources and flexibility during the onset of hostilities or locations that have very little material to use.

1-98. Engineer units face the proliferation of unmanned aircraft systems (UASs) as adversaries attempt to take advantage of relatively inexpensive, flexible, and expendable systems while exploiting inherent difficulties with attribution and its implications for deterrence. Commanders at all levels face the challenge of countering air threats and adversarial reconnaissance within their OEs.

1-99. UASs come in a variety of sizes and capabilities. Some larger UASs can be as lethal as cruise missiles and can launch from a wide array of locations. Smaller UASs can not only launch virtually undetected but, with their low radar and sound profiles, are also difficult to detect as they maneuver within the OE, making them an increasingly preferred method to carry out tactical-level strikes.

1-100. Small UASs pose a particular threat to engineer units. From both a fires and a reconnaissance perspective, suppression and obscuration—fundamental to a successful breach or gap crossing—become increasingly difficult to achieve when small UASs are present in the OE. During defense, if small UASs are not identified and destroyed, friendly survivability operations can be observed, allowing for the targeting of assets and the pinpointing of battle positions.

1-101. For these reasons and more, it is imperative that commanders account for enemy capabilities and likely reconnaissance objectives as they develop a counter-small, UAS plan. Commanders and leaders implement techniques and procedures for countering enemy small, UASs based on their organic capabilities, attached capabilities, and mission variables. Commanders must ensure Soldiers are appropriately trained and equipped and that they understand counter-small, UAS operations (see ATP 3-01.81).

Chapter 2

Engineer Support to Operations

This chapter discusses how engineer capabilities support Army operations at every echelon and throughout the competition continuum. Engineer operations that focus on general and geospatial capabilities during competition below armed conflict and crisis enable the theater army to set and maintain conditions for Army forces in, or flowing into, theater, while managing its daily operational engineer requirements. During armed conflict, engineers from all three disciplines provide simultaneous and synchronized support to deep, close, and rear operations. Engineers enable transitions and consolidation of gains between competition, crisis, and armed conflict by achieving objectives that support setting conditions for assuring mobility, enhancing protection, enabling force projection and logistics, building partner capacity, and developing—infrastructure.

SECTION I – ARMY OPERATIONS

2-1. The primary mission of the Army is to organize, train, and equip its forces to conduct prompt and sustained land combat to defeat enemy ground forces and seize, occupy, and defend land areas. Army forces contribute to and operate as part of the joint force through the use of multidomain operations. Army forces shape OEs, counter aggression on land during crises, prevail during large-scale combat, and consolidate gains (strategic roles).

2-2. Commanders and staff plan and execute operations using the operational framework. The *operational framework* is a cognitive tool used to assist commanders and staffs in clearly visualizing and describing the application of combat power in time, space, purpose, and resources in the concept of operations (ADP 1-01). The operational framework describes an operational approach, supports decision making, and assesses risk. It enables leaders and planners to visualize the OE and operations at echelon. There are three models commonly used to build an operational framework:

- Assigned areas (AO, zone, and sector).
- Deep, close, and rear operations.
- Main effort, supporting effort, and reserve.

2-3. Engineers execute missions as part of an integrated combined arms effort in support of operations during competition below armed conflict, crisis, and armed conflict throughout the operational framework. It is essential that engineer commanders and staffs understand friendly and enemy capabilities and the potential impacts to engineer operations.

ENGINEER SUPPORT ACROSS THE RANGE OF MILITARY OPERATIONS

2-4. The Army supports the joint force in accomplishing its strategic roles by providing forces for joint campaigns that enable integrated deterrence of adversaries outside of conflict or the defeat of enemies during conflict. U.S. Army Forces achieve objectives by conducting operations.

2-5. Joint doctrine describes the strategic environment in terms of a competition continuum with three broad categories of strategic relationships: cooperation, competition below armed conflict, and armed conflict. Although CCMDs and theater armies campaign across the competition continuum, Army tactical formations typically conduct operations within a context that is dominated by one strategic relationship at a time. Therefore, Army doctrine describes strategic situations through three contexts in which U.S. Army Forces conduct operations: competition below armed conflict, crisis, and armed conflict.

2-6. Known as the Army strategic contexts, they generally correspond to the joint competition continuum and the requirements of joint campaigns. Because cooperation is generally conducted with an ally or

partner to counter an adversary or enemy, Army doctrine considers it part of competition below armed conflict, which is generally called competition. Army doctrine adds crisis to account for the unique challenges facing ground forces that often characterize the transition between competition and armed conflict.

2-7. The Army strategic contexts span the range of military operations, from military engagement and security cooperation to large-scale ground combat. Levels of violence and national interest increase the closer crisis gets to armed conflict. For more information on the Army strategic contexts, see FM 3-0.

2-8. While violence varies across the range of military operations, the magnitude of requirements for engineers may remain consistently high from competition below armed conflict through armed conflict. This demand results in the application of the engineer disciplines to provide a menu of actions available to support military operations.

2-9. Engineer requirements that support competition may include geospatial engineering tasks that provide a clear understanding of the physical environment. During a crisis, large numbers of forces may be required for military engagement, security cooperations, or deterrence activities. These forces require infrastructure, facilities, LOCs, and bases or base camps to support sustainment. Even in areas with well-developed infrastructure, significant engineer effort is required to survey, plan, design, construct, acquire, operate, maintain, or repair necessary facilities to support operations in theater. The effort to provide positive and timely assistance during disaster and humanitarian relief usually includes significant engineering challenges—yet there may be opportunities to capitalize.

2-10. Engineer activities during armed conflict 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. Armed conflict also involves significant challenges associated with sustaining the operation.

2-11. During transitions between competition below armed conflict and crisis, engineers are often required to improve stability through projects that develop infrastructure and create or improve the technological capacity of HNs. Other agencies might also require specialized engineer support. USACE uses the Foreign Military Sales program to support intergovernmental relations and to enhance capacity through construction. Engineers involved in irregular 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.

CONSIDERATIONS FOR ENGINEER SUPPORT TO OPERATIONS

2-12. Engineering capabilities are a significant force multiplier during armed conflict, contributing to operations by facilitating the freedom of action necessary to meet mission objectives. Support to operations considerations require engineer commanders and leaders to be cognizant that Army engineers may be requested to achieve requirements in support of unified action or multinational partners when joint or multinational capabilities are no longer available. *Unified action* is the synchronization, coordination, or integration of the activities of governmental and nongovernmental entities with military operations to achieve unity of effort (JP 1, Volume 1). This may require engineer operations to support in other domains that have traditionally been supported by other forces, such as in the landward segment of littorals in maritime.

2-13. During competition and crisis, engineers support efforts for setting conditions for future operations and for building partner capacity and interoperability. This assures mobility and enhances protection for the joint force to enable force projection and logistics. During armed conflict, joint forces require simultaneous combinations of offensive, defensive, stability, and DSCA operations. Higher-echelon engineer activities are intrinsically simultaneous. They support combinations of operational components, at every echelon, influencing each level of warfare and the entire range of military operations. Engineer activities modify, maintain, provide understanding of, and protect the physical environment. These activities enable the mobility of friendly forces and alter the mobility of threats. This enhances survivability; enables the sustainment of friendly forces; contributes to understanding the physical environment; and provides support to noncombatants, other nations, and civilian authorities and agencies. Engineer activities may be so widespread and inclusive that they may be viewed as a stand-alone objective, but they are not. Engineer

applications are effective within the context of the supported objective. Military engineer support focuses on the objectives of the supported force. To identify and maintain that focus for the widespread application of engineering capabilities, engineer support is integrated within the combined arms operation.

2-14. Assigned engineering capabilities in the division provide close support to the maneuver of those forces. Based on a mission variable analysis, the division task-organizes with additional engineering capabilities to meet mission requirements. For the offense and defense, engineer augmentation may consist of combat engineering capabilities and an engineer brigade or supplementary battalion headquarters to provide the necessary C2 for the mix of engineer units and capabilities augmenting the division. Other more technically specialized engineering capabilities support division requirements related to the movement and maneuver, protection, and sustainment warfighting functions. Corps and theater army echelons may employ these same capabilities 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.

2-15. During combat operations, engineer units normally have command and support relationships aligned to maneuver commanders. For more information, see ADP 6-0. Engineer commanders advise maneuver commanders on which appropriate command or support relationship best enables 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 always begins with predicting threat intent through a thorough understanding of the threat, engineer capabilities, and effect of the terrain on operations. Geospatial data, products, and analysis 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. For information on engineer reconnaissance, see ATP 3-34.81. A greater degree of planning is required for a penetration from the breach to the ultimate control of the objective.

SECTION II — CONSIDERATIONS AT ECHELON

THEATER ARMY

2-16. 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 combat, but they also occur during competition below armed conflict and crisis. The theater army has the following primary tasks that occur across the competition continuum and the joint operations construct:

- Providing Title 10 United States Code (10 USC) exercising C2 over Army forces in theater.
- Providing Army support to other Services.
- Conducting theater security cooperation.
- Assessing and developing infrastructure.
- Developing concept plans and OPLANs.
- Maintaining threat orders of battle.
- Providing indications and warnings of changes in an OE.

2-17. The theater Army sets and maintains the theater and supports the operational area through securing and protecting ports, lines of communication, critical facilities, and the flow of forces and materials. It also coordinates support with national technical capabilities to enable protection. The theater Army facilitates the linkage to interagency and host-nation support to protect critical capabilities and capacities to expedite operations. The theater Army coordinates with national-level assets assuring access to critical, all-domain technical capabilities to protect the force and operations.

2-18. The theater army engineer provides focus on the relationship of the physical environment and infrastructure for the development of 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

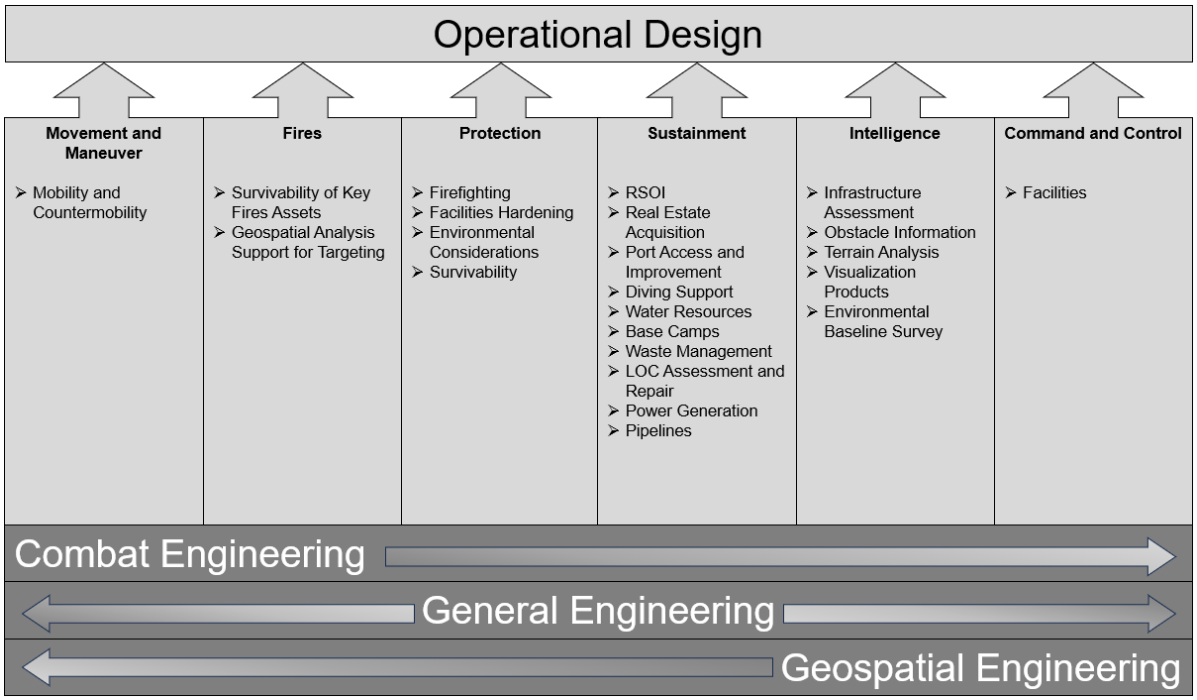
expressed through the framework of Army design methodology, as described in ADP 5-0 and FM 5-0. Unified action partners are considered for those tasks which Service engineers do not have the capability or capacity to perform.

2-19. Between the levels of warfare and theater echelons of command, the horizons for planning, preparation, and execution vastly differ. 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 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 combat and the various administrative and support functions required throughout the theater.

2-20. The theater army 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, environmental protection and management, real estate, and other general engineering support through the sustainment and protection warfighting functions. The operational perspective also includes initially aligning combat and general engineering capabilities to provide the most favorable outcomes for each subordinate echelon. Geospatial information and terrain visualization and analysis provide the foundation on which understanding the physical environment is based. Figure 2-1 shows an example of how the warfighting functions, engineer tasks, and engineer disciplines are used to organize and integrate theater echelon engineer requirements. For information on how the disciplines support the warfighting functions, see chapter 3.

2-21. 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 the basing life cycle. It ranges from considering the acquisition—and later the disposal—of real estate, real property, materials, construction labor, base setup, and decommissioning to 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) supplies. 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). These tasks and resource requirements become more critical and challenging in a maritime environment.

2-22. Another vital asset to the theater is engineer support through USACE. An example of this support is 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 DOD agencies in Kwajalein Atoll (in the Republic of the Marshall Islands). In support of the United States Indo-Pacific Command strategy, it designs and constructs facilities for all U.S. forces in Korea and Japan.



Legend:

LOC	line of communications
RSOI	reception, staging, onward movement, and integration

Figure 2-1. Theater-level engineer operational design

2-23. Infrastructure survey teams use infrastructure assessments to prioritize the categories and parts of the infrastructure that require reexamination during the infrastructure survey. The Forward Engineer Support Team–Advanced (FEST-A) provide infrastructure assessment. (See Chapter 5 for more information on the FEST-A.) 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

2-24. The corps headquarters is very versatile and can be 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 JFC, the corps serves as an operational-level headquarters conducting land operations as the Service component. The corps normally has an expeditionary sustainment command, a military police brigade, a medical brigade, a corps signal brigade, a MEB, an expeditionary military intelligence brigade, a field artillery brigade, and an engineer brigade headquarters. 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. The corps is the echelon best positioned and resourced to achieve convergence with Army and joint capabilities (see FM 3-94 and ATP 3-92).

2-25. With significant joint augmentation, the corps can function as a joint task force (JTF) or coalition force land component command for small-scale contingencies. When a corps is a JTF or coalition force

land component command, the contingency CP of a theater engineer command (TEC) 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 then concentrates on the substance and shape of required tactical actions by the division and lower echelons. It achieves this by shaping the OE and setting conditions for tactical actions through its protection capabilities and enabling operations.

2-26. The corps engineer advises the commander and staff on engineering and the use of engineering assets. The corps engineer coordinates engineer tasks related to combat, general, and geospatial engineering, facilitating the functions that enable the four lines of engineer support. The engineer staff provides base camp development and construction planning and geospatial products and services. They also assess environmental considerations and develop recommendations on joint fires and survivability for the forces employed. They coordinate and task organize the engineer capabilities available to meet requirements. The corps engineer staff set the conditions for successful operational at the tactical level by anticipating requirements and ensuring that capabilities are available to accomplish engineer support requirements. Figure 2-2 shows an example of tasks which the corps echelon engineer uses to build a foundation of operational requirements, while detailing tactical-level requirements for a contingency.

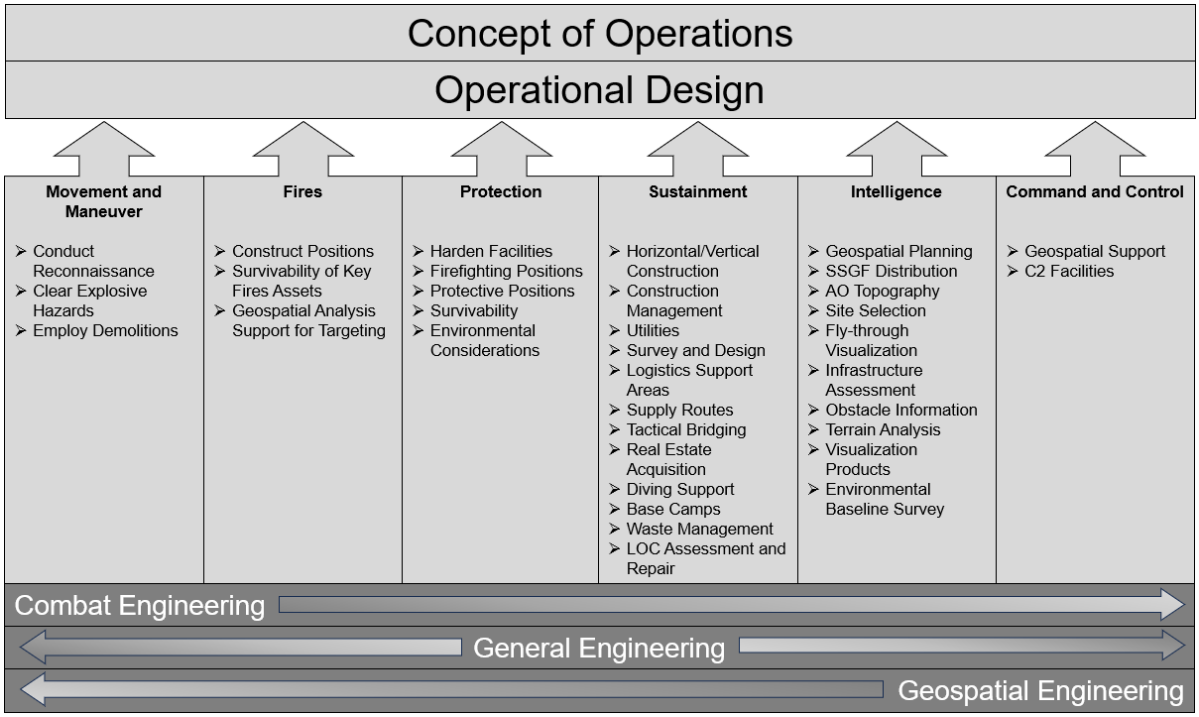


Figure 2-2. Corps engineer operational design

DIVISION

2-27. The division is the Army's principle tactical warfighting headquarters. Its primary role is to serve as a tactical headquarters exercising C2 of BCTs and supporting brigades in large-scale combat operations. Depending on the mission variables, it commands up to five BCTs and a mix of functional brigades. The division combines offensive, defensive, or stability operations in an AO assigned by its higher

headquarters, normally a corps. The division task-organizes its subordinate forces according to the mission variables to accomplish its assigned mission. The division is typically the lowest tactical level that employs capabilities from multiple domains to achieve convergence during large-scale combat operations.

2-28. During smaller-scale contingencies, the division headquarters, with staff augmentation, may serve as a joint force land component headquarters. Without augmentation, it may serve as an Army forces headquarters. With extensive augmentation, it may serve as a JTF. When serving as the Army forces headquarters, coalition force land component command, 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). See FM 3-94 and ATP 3-91 for more information about Army divisions.

2-29. Joint manning documents determine other Service officer and noncommissioned officer augmentation that the division staff requires to perform duties as a JTF headquarters. When serving as a JTF headquarters, the division headquarters organizes and operates in accordance with joint doctrine. When conducting operations, the division synchronizes and integrates warfighting functions primarily from the tactical-level perspective. See JP 3-33 for more information on the JTF.

2-30. 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 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 level 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 are to 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 2-3, page 28, 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.

2-31. Operational level 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 that is described in the operational framework. The division echelon engineer perspective similarly includes a solid operational foundation from which to focus on the detailed tactical level requirements (see figure 2-3).

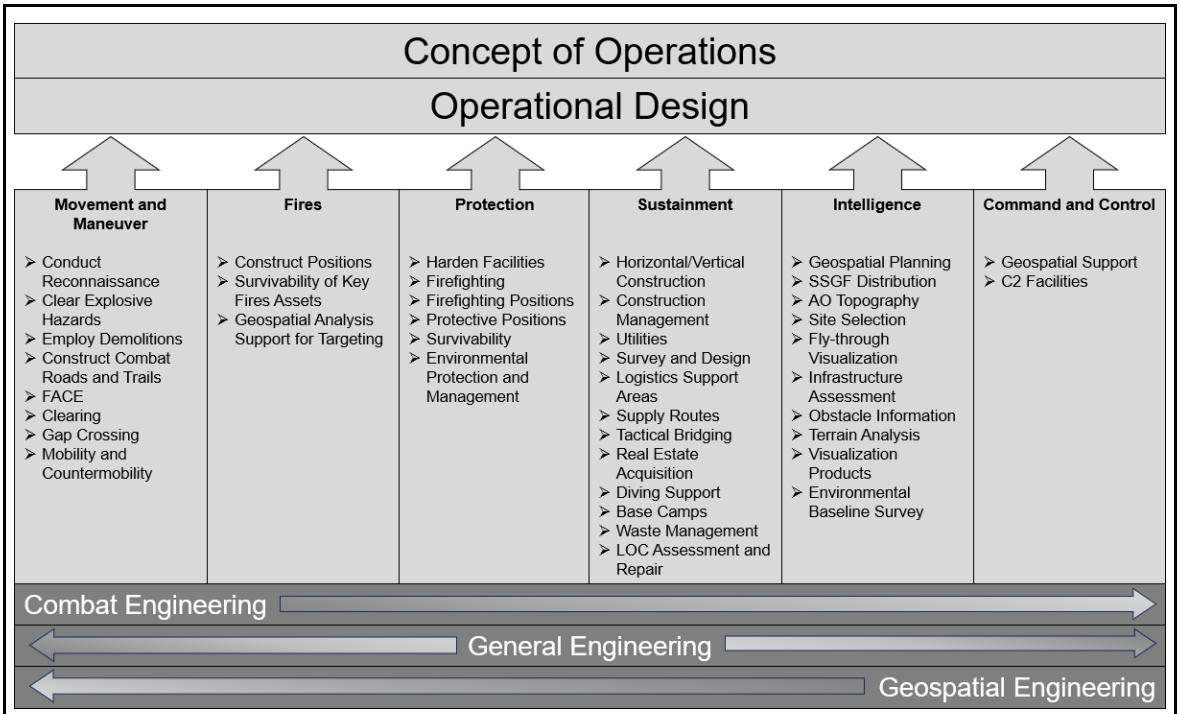


Figure 2-3. Division engineer operational design

2-32. 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 how Army operations set conditions for armed conflict. 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.

2-33. 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 as well as natural, cultural, and historic resources within a region present significant security and countermobility challenges.

BRIGADE COMBAT TEAM

2-34. The BCT is the Army's primary combined arms, close-combat maneuver force and the principal ground maneuver unit of a division or a JTF. There are three types of BCT: the infantry BCT, the armored BCT, and the Stryker BCT. The different BCTs perform in complementary or supportive missions with each other. Depending on the tactical situation, these three types of organizations are augmented with additional Army and joint capabilities to help them accomplish their missions. The role of the BCT is to conduct close operations to destroy enemy forces and to seize and retain terrain, resources, and population centers (see FM 3-96).

2-35. Divisionally aligned engineer battalions may be task organized to the BCT. The engineer battalion provides a baseline of combat capability to the BCT. Specialized units from echelons above division (EAD) augment that capability. The engineer battalion provides engineer planning and execution capabilities and has the capacity to maintain C2 of task organized engineer organizations. The BCT headquarters has geospatial engineers that work within the intelligence section.

2-36. The BEB's baseline of combat capability to the BCT can also be augmented with specialized units from EAD. The BEB provides engineer planning and execution capabilities and has the capacity to maintain C2 of task organized engineer organizations as well as organic engineer, military intelligence, and signal capabilities.

2-37. Brigade and below engineer support to operations during competition and crisis typically includes the state partnership program, infrastructure repair, restoration to reconstruct, and the establishment of services that support the population. Home station training enhances engineer battalion personnel skills in areas that are normally instructed as USACE-provided specialized training. This includes training on reconnaissance tools, tele-engineering communications equipment, and the Joint Construction Management System (JCMS) to facilitate tasks conducted during competition and crisis by enhancing standardized construction practices.

SECTION III — CONSIDERATIONS ACROSS THE ARMY STRATEGIC CONTEXTS

ENGINEER SUPPORT DURING COMPETITION BELOW ARMED CONFLICT

2-38. Competition below armed conflict occurs over extended periods of time and exists when tension is developed due to an adversary's national interests being incompatible with U.S. interests. Competition below armed conflict is characterized by a willingness of those adversaries to pursue those interests short of open armed conflict.

2-39. Operations during competition are intended to deter malign adversary action, set conditions for armed conflict on favorable terms when deterrence fails, and shape an OE with mission partners in ways that support U.S. strategic interests and policy aims. Army operations during competition below armed conflict bring together all of the activities necessary to prepare for armed conflict (set the theater, build allied and partner capabilities and capacity, improve joint and multinational interoperability, protect forward-stationed forces, prepare to transition and execute OPLANs, and train and develop leaders for operations in specific theaters) and participating in programs such as military engagement, security cooperation, deterrence, and humanitarian assistance, intended to promote regional stability and prepare for future operations. Activities that occur during competition are directly tied to authorities provided in various titles of the United States Code and approved programs. See FM 3-0 for more information on Army activities to prepare for armed conflict. Army engineer forces support these activities and programs through the three disciplines, to a greater degree general and geospatial engineering, and along the lines of engineer support during competition. Engineer operations during competition are continuous and include a variety of missions, tasks, and actions that are intended to assure allies, build partner capacity and capability, and enhance the OE, while achieving Army and joint activities.

2-40. The primary Army organization overseeing Army activities during competition is the theater army. Army engineer organizations that support the theater army in setting conditions are the TEC and USACE. During competition, the TEC can assist with determining and building needed infrastructure. Where possible, they can build up the capabilities of allied and partner nations to withstand an initial assault by a threat. The USACE may provide technical engineer support, including engineer reconnaissance, design and planning of projects (including roads, airfields, buildings, and waste and wastewater treatment), executing contract construction, real estate acquisition and disposal, and environmental surveys.

SET THE THEATER

2-41. Setting a theater is meant to establish favorable conditions for the rapid execution of military operations and the support requirements for a specific OPLAN during crisis or conflict. Engineer

operations that support setting the theater includes such activities as infrastructure improvement, bases, and base camp planning and development to create depth for force projection and enabling protection of forward stationed forces. Infrastructure improvements to APODs or SPODs assist in mitigating the effects of threat activities through hardening critical nodes for survivability and creating flexible options for force projection. See ATP 3-37.10 for more information on base and base camp planning, and ATP 3-37.34 for more information of survivability operations. Surveys identify potential assembly areas, LOC infrastructure capacity, or potential gap crossing sites based on such factors as size of Army formations, dispersion, and equipment types. In some cases, real estate services are required. In addition, engineer operations may include environmental services to set and monitor conditions or requirements as the OE changes.

MILITARY ENGAGEMENT

2-42. *Military engagement* is the contact and interaction between individuals or elements of the Armed Forces of the United States and those of another nation's armed forces, or foreign and domestic civilian authorities or agencies, to build trust and confidence, share information, coordinate mutual activities, and maintain influence (JP 3-0). Military engagements are often focused on understanding, engaging, influencing, changing, or countering human perceptions. From an engineering perspective, this is executed through engineering partnerships that improve LOCs, APOD/SPOD, support to the local population (within authorities), and providing 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 dimension is dynamic. Therefore, operations during competition should be ongoing, consistently maintain positive engagements, and be flexible enough to adjust to changing political conditions.

SECURITY COOPERATION

2-43. *Security cooperation* is all Department of Defense interactions with foreign security establishments to build relationships that promote specific United States security interests, develop allied and partner military and security capabilities for self-defense and multinational operations, and provide United States forces with peacetime and contingency access to allies and partners (JP 3-20). Engineer operations support security cooperation efforts during competition by providing input to the theater security cooperation plan, training and skills development of HN personnel, security force assistance support, and construction projects focused on humanitarian and civic assistance programs. For information on security cooperation, see FM 3-22. For engineer support to security cooperation programs, see JP 3-34.

DETERRENCE

2-44. Deterrence, for Army forces, demands that they plan, train, and exercise to conduct operations continuously and ensure integration with joint forces. Activities through military engagement, security cooperation, and security force assistance support also provides opportunities to train with partners. Engineer forces participate in combined training and exercises as well as other activities with joint and multinational forces to demonstrate readiness, capability, interoperability, and the will to engage a threat if necessary.

HUMANITARIAN ASSISTANCE

2-45. While foreign humanitarian assistance is led by the United States Agency for International Development, they can and often do request U.S. Army engineers to play a significant role. Engineer operations to support humanitarian efforts include clearing debris, constructing temporary facilities, providing emergency power and distribution, and restoring public facilities as well as other operations. For more information on humanitarian engineer operations, see JP 3-34. These operations help HNs to restore stability while building and strengthening relationships with multinational partners and the local populations.

CONSOLIDATE GAINS AND TRANSITION

2-46. Engineers consolidate gains continuously through competition related activities and programs that help ensure stability and reduce the potential for man-made crisis or armed conflict throughout a region while preparing for transitions to these contexts in the event that they occur. Consolidation of gains during competition can be activities such as infrastructure improvements that enable force projection and logistics while building partner capacity or force protection measures for forward stationed forces. Forward

stationed forces may be required to defend key terrain and infrastructure to allow for receiving deploying forces or as part of a mobile or area defense in support of the JFC. Engineer capabilities can support these activities through hardening facilities, conducting reconnaissance of all lines of communication, identifying potential assembly areas—or in some instances establishing survivability positions—to preserve combat power when enemy preparatory fires commence with little or no warning.

2-47. Engineer efforts are critical during the transitions between the strategic contexts and supporting consolidation of gains efforts. Therefore, it is imperative that the senior engineer commander or the engineer staff officer at each echelon assist in developing the supported commander's OPLAN or OPORD. Engineer planners synchronize, integrate, and organize engineer capabilities and resources throughout operations to protect U.S. interests and build partner capacity and partnerships while setting the conditions for transitions and the consolidation of gains.

ENGINEER SUPPORT DURING CRISIS

2-48. Competition can transition to crisis because of an adversary nonlethal action, indicators of actions, or from a natural or human disaster. This may require a rapid response by forces to deter further actions or support recovery efforts. A crisis can be anticipated or occur with no warning and may have an unpredictable duration making crisis response operations highly volatile and uncertain. Furthermore, crisis, as a state or context, is relative to the actors involved. While partners or U.S. Army Forces may perceive themselves in a state of crisis, adversaries may perceive themselves in a different state or context. The transition to crisis has the potential to be chaotic and presents leaders with unforeseen challenges that require rapid changes to plans and operations. This requires leaders and forces to be flexible and ready for what is required, while avoiding accidental escalation of the situation. For more information on operations during crises, see FM 3-0.

2-49. Operations during crises are intended to deter an adversary and de-escalate the situation in order to return to competition or demonstrate a readiness and willingness to engage in armed conflict. Army forces support operations by maintaining freedom of action, presenting a credible threat to an adversary, and providing effective options to the JFC, which enables the joint force to gain positions of relative advantage prior to future combat operations. In a crisis, commanders generally focus on actions that protect friendly forces, assets, and partners. These actions may have significant engineering requirements.

2-50. Engineer operations in crisis continue those activities initiated during competition below armed conflict with increased emphasis to enable the projection and protection of forces. This could entail increased needs for real estate and basing, opening ports of debarkation, establishing lines of communications, hardening of facilities, and identifying AAs or battle positions. The integration of engineer reconnaissance—to include environmental and geospatial analyses—can provide critical intelligence to support mobility assessments or to determine staging areas.

2-51. A key challenge in supporting responses during crisis is how to quickly ensure the right mix of engineer forces. With approximately three-fourths of Army engineer units in the reserve component, the order of deployment for force packages requires significant consideration. Planners need to account for the time it takes to mobilize reserve component forces. Some specialized engineer capabilities, such as the engineer diving detachment, may be required to support underwater surveys or repair for port opening operations. Engineer forces may be required to rapidly mobilize and prepare for deployment in support of a crisis response.

2-52. During and after crisis response, Army forces consolidate gains to deny adversary forces the means to extend the crisis or create a similar crisis in the future. Consolidate gains activities include populace and resources control, security cooperation, law and order reestablishment, humanitarian assistance, and critical infrastructure protection and restoration. Engineer forces should be prepared to support transitions back to competition or a transition to armed conflict.

ENGINEER SUPPORT DURING ARMED CONFLICT AND LARGE-SCALE COMBAT OPERATIONS

2-53. Armed conflict encompasses the conditions of a strategic relationship in which opponents use lethal force as the primary means for achieving objectives and imposing their will on others. Armed conflict can

be a combination of conventional and irregular warfare. The characteristics of armed conflict vary based on the actors and other factors that are involved.

2-54. Large-scale combat operations are extensive joint combat operations in terms of scope and size of the forces that are committed, which have actions that can overlap with actions initiated during competition and crisis. Large-scale combat operations are executed in high levels of complexity, lethality, ambiguity, and tempo. Army readiness is centrally focused on preparing for large-scale combat operations to defeat enemy armed forces while establishing control over land and populations.

2-55. During large-scale combat operations, Army forces conduct offensive, defensive, and stability operations to defeat enemy forces. Divisions and corps are the formations central to the conduct of large-scale combat operations, as they are organized, trained, and equipped for the deep, rear, and close operations that enable subordinate success during close combat.

2-56. Engineer support during large-scale combat operations is complex, requiring an in-depth understanding of the OE, the commander's intent, the concept of operations, and the capabilities and limitations of engineer forces. Engineer support in large-scale combat occurs throughout the depth of the AO. During offensive and defensive operations, engineers provide simultaneous and synchronized support to close and rear operations. Engineer forces in large-scale combat, as part of a combined arms approach, are enablers that help set conditions for mutual support or for imposing multiple dilemmas on the enemy to provide freedom of movement and endurance for friendly forces while degrading that of the enemy. Engineer reconnaissance can identify areas where friendly forces may require engineer effort in support of mobility or countermobility operations. Engineer forces can be requested, and task organized to emplace obstacles, dig in survivability positions, repair roads to enable logistics, create detention areas, bridge gaps, breach obstacles, identify environmental hazards, or repair ports. Geospatial information systems provide a means to conduct terrain analysis and identify locations where friendly forces can stop or delay enemy action or identify potential hazards derived from battle damage assessments to dams or other critical infrastructure.

2-57. Engineer missions that support offensive and defensive operations can also accomplish consolidation of gains, while setting the conditions for transitions to post-conflict competition and stability operations. Engineers deliberately plan and prepare for a shift in vital engineer resources to support the consolidation of gains or the transitions between phases that capitalize on operational success. Planning and preparation is crucial to allow enough time to gain the resources necessary and complete the significant coordination with unified action partners that is required.

DEFENSIVE OPERATIONS

2-58. A *defensive operation* is an operation to defeat an enemy attack, gain time, and develop conditions favorable for offensive or stability operations (ADP 3-0). Defense plans should not be designed to simply resist enemy attacks. 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.

2-59. The defending force arrives first on the battlefield and, with the help of engineers, shapes the battlefield to its advantage. However, the enemy chooses the time and location of an attack. Emplacing defenses is time intensive, so it is imperative that defending forces have a sense of urgency to complete plans, coordinations, rehearsals, and information collection. Based on the higher commander's intent, maneuver commanders, along with their staffs and subordinate units, 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 enemy over selected, prepared terrain.

2-60. Disruption, flexibility, maneuver, mass and concentration, depth, preparation, and security characterize successful defensive operations. 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 preparing the defense largely depends 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 may anticipate the limitations of allocated capabilities and prioritize efforts and resources to mitigate limitations.

2-61. 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 during defensive operations; however, to some degree, the three disciplines apply simultaneously. Table 2-1, page 34, shows a notional application of engineering capabilities supporting the defense and the preponderance of the weight of activities performed.

2-62. 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. Defense activities 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. 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, such as upgrades to, and repair of, routes.

Note. During the defense, countermobility efforts compete with survivability resources and assets. This makes it critical that maneuver commanders provide clear guidance on resources and priorities of effort.

2-63. 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) in order to nominate those capabilities for targeting, ensuring timely destruction.

2-64. 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 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. For further discussion of barriers, see JP 3-15. Other general engineer activities applied to enable the sustainment warfighting function may also be critical for preparing and conducting the defense. Enabling mobility throughout the depth of the AO will remain an engineer mission in anticipation of transitions from the defense to the offense. It also assists with the forward movement of forces.

Table 2-1. Notional engineer support to defensive operations

Engineer Support		
General Engineering Discipline	***Combat Engineering Discipline***	***Geospatial Engineering Discipline***
• Harden Facilities • Provide Horizontal Construction • Support Countermobility/Survivability • Mitigate hazards • Protect water supplies • Environmental considerations	• Construct Field Fortifications • Construct Fighting Positions • Construct Combat Roads • Conduct FACE • Construct Obstacles • Employ Demolitions • Place Mines or Munitions • Conduct Reconnaissance • Fight as Engineers • Fight as Infantry	• Generate/Collect Geospatial Data • Manage Map Data • Analyze Terrain • Provide Detailed Terrain Analysis of EAs • Advise Commander on Terrain Considerations • Answer Terrain Related Questions • Manage SSGF for Unit COP • Disseminate Hard and Soft Terrain Related Products • Provide Digital Services
Legend: COP common operational picture EA engagement area FACE forward aviation combat engineering SSGF standard and shareable geospatial foundation		

Basics of the Defense

2-65. While the defending force does not stop improving its defensive preparations until it retrogrades or begins to engage enemy forces, the commander determines where to concentrate defensive efforts and where to accept risks. The three types of defense are—

- Area.
- Mobile.
- Retrograde.

2-66. 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. Each type of defensive operation has significantly different concepts and are required to be dealt with differently during planning and execution (see FM 3-90).

Support to Defensive Operations Planning

2-67. 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, rear, and close operations. Therefore, planning for the defense is inextricably linked to offensive operations and, for planning purposes, planners conducting the military decision-making process (MDMP) should consider the transition from the offense to the defense and then back to follow-on offensive operations. Engineers work directly with tactical maneuver units during the seven steps of EA development. EA development (see ATP 3-90.8) consists of the following:

- Identify likely enemy AAs.
- Identify the most likely enemy COA.

- Determine where to kill the enemy.
- *Position subordinate forces and weapons systems.
- *Plan and integrate obstacles.
- *Plan and integrate fires.
- Rehearse the execution of operations within the EA.

Note. The steps marked by an asterisk (*) should be conducted simultaneously.

2-68. 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, and 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 and exploit the advantages that it makes. 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.

Support to Mobile Defense

2-69. A *mobile defense* is a type of defensive operation that concentrates on the destruction or defeat of the enemy through a decisive attack by a striking force (ADP 3-90). 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. The mobile defense trades space and time to achieve a decisive advantage against the enemy. The defeat mechanism is a large, mobile reserve that requires combat power and mobility that are equal to or greater than that of the targeted force. For more information on the mobile defense, see FM 3-90.

2-70. 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 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.

2-71. The division engineer should 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 supports 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.

2-72. Survivability effort is also tailored to a force-oriented defense that trades space and time to create an enemy weakness to exploit by counterattack. To create the conditions for counterattack, brigades 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 should be blunted to allow counterattack.

2-73. The defeat mechanism of the mobile defense is the counterattack by a large, mobile reserve with combat power and mobility that are superior to that of 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 should 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 weighs the trade-offs between dedicating engineer forces to the counterattack and meeting the obstacle and survivability requirements of the main battle area.

Support to Area Defense

2-74. An *area defense* is a type of defensive operation that concentrates on denying enemy forces access to designated terrain for a specific time rather than destroying the enemy outright (ADP 3-90). 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. 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 decisively defeat the enemy.

2-75. In an area defense, the focus of engineer effort is on providing the maneuver commander with the ability to retain terrain while enabling maneuver units to concentrate fires from static positions. The variations of an area defense include defense of a linear obstacle, perimeter defense, and reverse slope defense. Engineers help identify key 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 advises 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 balances these engineer resource requirements. Planning for scatterable mines enables commanders to accept less risk by not allowing the enemy to cross terrain-shaping obstacles.

2-76. The division engineer should understand the implication of the area defense on mobility and survivability requirements and engineer operations. Likewise, the scheme of engineer operations orients on retaining 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 retaining terrain.

2-77. Survivability efforts should enable brigades to concentrate fire power from fixed positions. The division engineer should 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.

2-78. A key component to enabling a complete defeat mechanism is the integration of defensive positions and small, decentralized, mobile reserves. The division engineer ensures that the tactical obstacle effort of adjacent brigades is coordinated and mutually supporting and achieves an interlocking defense. In addition, it is critical that the division engineer ensures that the engineer task organization provides the brigades dedicated mobility support of their respective mobile reserves.

Support to Retrograde

2-79. A *retrograde* is a type of defensive operation that involves organized movement away from the enemy (ADP 3-90). The three types of retrograde operations are delays, withdrawals, and retirements. Retrogrades are transitional operations that—

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

2-80. 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 is 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.
- Protection of the force is key because they are particularly vulnerable to enemy actions during retrograde operations. Consequently, a retrograde is normally conducted under conditions of limited visibility. Engineers support units that remain in contact and extend the time available to the commander by hindering enemy mobility through obstacles, fires, and terrain optimization.

Support to Engagement Area Development

2-81. An *engagement area* is an area where the commander masses effects to contain and destroy an enemy force (FM 3-90). Terrain shaping affects the enemy's ability to move and maneuver to gain positions of advantage. Terrain shaping enables friendly forces to engage the enemy at a desired place and time. The employment of obstacles should be linked with the maneuver commander's intent on how and where to deploy the bulk of the unit's combat power and conduct 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 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 munitions, scatterable mines, demolition obstacles (such as road craters), constructed obstacles, and field expedient obstacles.

2-82. 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 should walk the terrain in conjunction with the supported maneuver unit to ensure that fires cover the EA (see ATP 3-90.8).

Engineer Support to the Theater Army

2-83. 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 should remain integrated within a combined arms framework. The theater echelon engineer staff (from either 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.

2-84. During large-scale combat operations, a significant portion of the tailored engineer force tends to have command relationships with maneuver commanders. Further task organization to the tactical level for close support of combat operations is common. This is true for most combat engineering capabilities and some general engineering capabilities. Movement and maneuver requirements are not well defined at higher echelons and are more dynamic in combat operations. Tailored forces are task organized to subordinate echelons to address these requirements and add flexibility for maneuver commanders to react to unforeseen challenges and opportunities.

2-85. For defensive operations, operational level engineer planners are typically unable 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.

2-86. 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

2-87. 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, and rear operations.

2-88. 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.

2-89. 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.

2-90. In support areas, engineers support protection efforts according to the commander's priorities. This could include increasing the survivability of protection assets, key infrastructure, and C2 nodes by hardening structures and creating protective barriers and the strengthening of base and base camp defenses. Engineers also maintain LOCs and facilities. For forward CPs, survivability relies more heavily on dispersion and displacement while using the minimum functions to avoid detection and enemy indirect fire effects.

Engineer Support to the Division

2-91. A significant consideration for the division echelon is ensuring that subordinate BCTs conducting defense operations are provided adequate additional combat and general engineering capabilities to meet the requirements. The division echelon balances 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.

2-92. Divisions in the defense generally take one of two traditional patterns: mobile defense and area defense. The focus-and-defeat mechanism is the fundamental difference between these patterns. 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. It is essential that the division engineer understands the area and the mobile defense and their implications on engineer functions and unit operations.

Brigade Combat Team Support

2-93. 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 should 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 engineer effort into brigade defensive operations plans. While the process remains the same, each step is tailored to the needs of defensive operations planning. For more information on BCT echelon engineer defense planning, see ATP 3-34.22 and ATP 3-90.8.

OFFENSIVE OPERATIONS

2-94. Engineer support to the offense includes the simultaneous application of combat, general, and geospatial engineering disciplines through the synchronization of warfighting functions and throughout the depth of the AO. Combat engineering in support of maneuver forces is the primary focus of engineers involved in conducting offensive operations; however, the three disciplines simultaneously apply their

capabilities to some degree. The primary focus supports movement and maneuver. Table 2-2 shows a notional application of engineering capabilities supporting offensive operations.

Table 2-2. Notional engineer support to offensive operations

Engineer Support		
General Engineering Discipline	***Combat Engineering Discipline***	***Geospatial Engineering Discipline***
• Provide Port Construction • Provide Horizontal Construction • Provide Quarry Aggregate • Produce Asphalt • Produce Concrete • Provide Underwater Construction • Perform Firefighting • Support Mobility • Support Survivability • Support for Environmental Considerations	• Breach Obstacles • Employ Demolitions • Clear Explosive Hazards • Construct Field Fortifications • Construct Assault Bridging • Construct Combat Roads • Conduct FACE • Conduct Reconnaissance • Fight as Engineers • Fight as Infantry	• Generate/Collect Geospatial Data • Manage Map Data • Analyze Terrain • Provide Detailed Terrain Analysis of Assembly Areas and Objectives • Advise Commander on Terrain Considerations • Answer Terrain Related Questions • Manage SSGF for Unit COP • Disseminate Hard and Soft Terrain Related Products • Provide Digital Services
Legend: COP common operational picture FACE forward aviation combat engineering SSGF standard and shareable geospatial foundation		

2-95. 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 focused to support the collection of relevant obstacle and mobility information. If route clearance is anticipated, clearance teams are task organized and focused on combined arms rehearsals. The engineer staff officer should also be prepared to organize area clearance to allow friendly sustainment and other terrain intensive assets to echelon forward to maintain momentum in the attack. Combat engineer preparations are aligned and integrated with their supported maneuver force preparations.

2-96. 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 regular refueling, dedicated maintenance personnel, and supplemental maintenance tools. It also requires dedicated haul assets and more time for movement. Preparation activities for significant construction may include tasks such as a more technical engineer reconnaissance to enable adequate project planning and design, or the provision of construction materials. Specialized engineer assets may also be necessary to accomplish certain missions. When general engineer activities occur independently in an AO, it is important that they are fully coordinated with the maneuver commander assigned to that AO. Such general engineer support is primarily applied to enable sustainment, but it may also be critical to preparing for an offensive operation, including support to operational mobility.

2-97. 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 sites may be required in the offense and defense, although more so in the defense. CPs require improved survivability to lessen vulnerability and avoid detection. 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.

2-98. 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 breaching tenets of intelligence, breaching fundamentals, breaching 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 that 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

2-99. An *offensive operation* is an operation to defeat or destroy enemy forces and gain control of terrain, resources, and population centers (ADP 3-0). 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. Successful offensive operations are characterized by audacity, concentration, surprise, and tempo. 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.

Support to Offensive Operations Planning

2-100. Engineers support offensive operations by enabling movement and maneuver. The engineer brigade or 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. They recommend sustainable command and support relationships for elements augmenting the BCT, which allows the gaining commander the maximum flexibility to employ assets.

2-101. Engineer support to the offense considers tasks when task-organizing additional engineers. The primary offensive operations are—

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

Table 2-3 provides a summary of engineer considerations for each type of offensive operation. See FM 3-90 for more information on Army offensive operations and ATP 3-90.4 for more information on combined arms mobility.

2-102. The types of offensive operations and the forms of maneuver describe relationships between friendly forces and the enemy. Planning always begins with understanding the commander's desired end state. Analyzing and understanding the threat, threat engineer capabilities, and how the terrain will affect friendly actions are the best methods of determining the enemy's intent. FM 6-0 provides a common foundation and reference for planning. Engineer planning has a propensity 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 under their supported units.

Table 2-3. Engineer considerations in the offense

Offensive Operations	*Engineer Consideration*
Movement To Contact	• The priority for combat engineer support is typically mobility, although it may rapidly shift to countermobility in anticipation of an enemy counterattack. • The task organization of engineers needs to balance allocating 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.
Attack	• 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 breaching 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 isolating and fixing enemy forces and protecting 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 and keeping movement routes open to facilitate the maneuver of ground forces; in addition, they emplace situational obstacles to protect the flanks.
Pursuit	• 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	

2-103. *Mobility tasks* are combined arms activities that mitigates the effects of obstacles to enable freedom of movement and maneuver (ATP 3-90.4). Freedom of mobility is the key to successful military operations. A high degree of tactical mobility and dispersion is essential to counter contemporary highly accurate and lethal weapons.

2-104. Engineers shape the terrain. Terrain shaping begins with a thorough visualization of the enemy and the 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 a properly conducted reconnaissance assisted the ground commander.

Bloody River

The Allied Landings in Italy in September 1943 was 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. Anchored on Monte Cassino, the Gustav Line was a system of sophisticated interlocking defenses 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 it formed a natural moat, protecting Monte Cassino. Rapido is an Italian word meaning fast or rapid—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 riverbank. 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 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 crossing 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 riverbank 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 naturally 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.

2-105. ATP 3-90.4 describes the following primary mobility tasks:

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

Engineer Reconnaissance

2-106. Reconnaissance is vital for verifying 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. It is critical that the maneuver unit integrates engineer reconnaissance into the reconnaissance plan. Because engineer reconnaissance teams are ad hoc formations for engineers, commanders need to 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.

2-107. 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 AOs.

2-108. Engineer support to the offense occurs throughout the AO. Engineers provide continuous and coordinated support to the close and rear operations areas. Engineers recommend obstacles, such as scatterable minefields, that shape the friendly scheme of maneuver. Geospatial engineers provide GD&I, terrain visualization products, and geospatial decision aids to support 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.

Conduct Breaching

2-109. 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 Clearing (Route and Area)

2-110. To *clear* is a tactical mission task in which a unit eliminates all enemy forces within an assigned area (FM 3-90). Route and area clearances are conducted to eliminate enemy obstacle effects or residual obstacles that affect the operational area or route. Based on the mission requirements, commanders may order route and area clearance to facilitate mobility within an AO.

Conduct a Gap Crossing

2-111. A *gap crossing* is the projection of combat power across a linear obstacle (wet or dry gap) (ATP 3-90.4). Gap crossings are akin to breaching in that they are executed as synchronized combined arms activities intended to enable maneuver forces to get from one side of an obstacle to the other. 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).

2-112. A successful gap crossing is characterized by applying gap-crossing fundamentals. These fundamentals are applied when a gap is encountered in the operational area. The fundamentals are—

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

Construct and Maintain Combat Roads and Trails

2-113. 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

2-114. Forward aviation combat engineering describes the engineering capabilities that are employed for the hasty construction or repair of aviation facilities (landing strips, landing zones, and 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.

Support to Conduct Traffic Management and Enforcement

2-115. 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.

Engineer Support to the Theater Army

2-116. 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.

2-117. 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.

Engineer Support to the Corps

2-118. The corps has specific fundamental planning and resourcing responsibilities. The corps engineer and their staff are responsible for developing detailed schemes of engineer support and for providing the extensive engineer forces and assets required for missions. EAD combat 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.
- Maintain and improve key routes designated by the corps assistant chief of staff, operations (G-3).

2-119. Corps-assigned bridging capabilities provide assault float bridging and follow-on LOC bridging. General engineering tasks are executed to maintain LOCs.

2-120. 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.

Engineer Support to the Division

2-121. 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. For more information on division operations, see ATP 3-91.

2-122. The ability to prevail in ground combat is a decisive factor in breaking an enemy's will to continue a conflict. Offensive operations are the primary means for gaining and maintaining the initiative. The offense aims at defeating or destroying an enemy force. 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.

2-123. Surprise includes the tempo and intensity in executing the attack plan and in employing unexpected factors (such as selecting a suboptimal 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.

2-124. Concentration requires careful prior coordination within the combined arms team and with other unified action 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.

2-125. 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 Support

2-126. 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 timely, relevant, accurate, and predictive 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 encountered obstacles. Commanders at echelon configure engineer capabilities to emplace obstacles rapidly once on the objective to protect attacking forces from enemy counterattacks.

2-127. The commander carefully considers the most effective command and support relationship for engineers in support of maneuver elements. In the offense, engineers should be positioned well forward within maneuver formations to maximize responsiveness. A habitual relationship between engineer and supported maneuver units enhances effectiveness and efficiency. It is essential that engineers 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.

Stability Operations

2-128. A *stability operation* is an operation conducted outside the United States in coordination with other instruments of national power to establish or maintain a secure environment and provide essential governmental services, emergency infrastructure reconstruction, and humanitarian relief (ADP 3-0). 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.

2-129. Engineer support to stability operations includes the simultaneous application of combat, general, and geospatial engineering capabilities through the synchronization of 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 during stability; however, to some degree, the three disciplines are applied simultaneously. Table 2-4 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.

Table 2-4. Notional engineer support to stability operations

Engineer Support		
General Engineering Discipline	***Combat Engineering Discipline***	***Geospatial Engineering Discipline***
• Harden Facilities • Provide Horizontal Construction • Provide Vertical Construction • Provide LOC Construction • Provide LOC Repair/Maintenance • Develop Infrastructure • Protect Environment • Manage Waste • Provide Well Drilling • Provide Quarry Aggregate • Provide Asphalt • Provide Concrete • Provide Power • Provide Utilities • Provide Survey and Design • Manage Construction • Perform Firefighting	• Conduct Reconnaissance • Construct Positions • Construct Combat Roads • Provide Forward Aviation Combat Engineering • Employ Demolitions • Clear Explosive Hazards	• Generate/Collect Geospatial Data • Manage Map Data • Analyze Terrain • Incorporate Human Terrain into Terrain Analysis • Advise Commander on Terrain Considerations • Answer Terrain Related Questions • Manage SSGF for Unit COP • Disseminate Hard and Soft Terrain Related Products • Provide Digital Services
Legend: COP common operational picture LOC line of communications		SSGF standard and shareable geospatial foundation

2-130. 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. Army 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; the exception is that engineer stability tasks are conducted overseas (see Appendix A).

2-131. 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 conduct GMAD operations and 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.

2-132. A large portion of the engineer capabilities and specialized expertise that are sought are technical in nature and reside in the institutional force. They are only available through reachback or a forward USACE contingency element. Stability operations tend to be of a long duration compared to other types of operations. The general engineering level of effort is very high at the onset, and it gradually decreases as the theater matures. Preparation activities include the identification of significant infrastructure and base development construction projects and nominating 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, and Navy global contingency construction contract).

2-133. Engineer support may be critical to civil affairs operations, enabling the relationship of military forces with the civil component of the OE, including inter-governmental agencies, nongovernmental organizations, interagency, indigenous populations and institutions, and the private sector. Similarly, engineering capabilities may be applied to provide specific construction and other technical support that is integrated with 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.

2-134. 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 GI&S data enabling geospatial products and requirements for new terrain visualization products.
- Requirements for specialized engineer support (prime power, well drilling, quarry, and 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

2-135. During stability operations the construction tasks performed by Soldiers while working among noncombatants and local populations are emphasized. In planning to conduct stability operations, engineers consider the requirements necessary to support the primary stability tasks. Engineers are typically critical enablers and may lead in the restoration of essential services. The planner (with input on civil considerations from the assistant chief of staff, civil affairs operations/battalion or brigade civil affairs operations staff officer) determines the capabilities needed to establish or restore basic services for the provision of water, emergency shelter, and sanitation (sewage and garbage disposal), as required. Terrain products continue to have a great deal of importance; however, 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.

CONSOLIDATION OF GAINS

2-136. *Consolidate gains* are the activities to make enduring any temporary operational success and to set the conditions for a sustainable strategic 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. Consolidation of 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 Army forces and integrating or reinforcing the efforts of all unified action partners, provide the JFC the significant capability to support the consolidation of gains.

2-137. Consolidate gains is not a synonym for stability, counterinsurgency, 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.

2-138. When consolidating gains, maneuver forces adjust their AO to mass effects and to ensure that C2 covers critical areas in the area of responsibility (AOR). Engineers should deliberately plan and prepare for a shift in vital engineer resources to support the consolidation of gains which capitalize on operational success. Expect engineers and other supporting enablers (such as military police, EOD, medical, and civil affairs) to execute tasks that support a shift in focus to stability or security operations. Engineer capabilities may be employed to request repair utilities, clear debris, improve infrastructure, or construct temporary facilities.

2-139. 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 combat but are essential to support the consolidation of gains and stability of the region.

2-140. Engineer tasks that support the consolidation of gains are similar to tasks executed during competition and crisis 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 trails; replace tactical bridging with long-term LOC bridging.
- Increase contracts for CLASS IV construction/barrier materials, construction equipment, or construction labor.

- Assess and document environmental conditions.
- Construct base camps and infrastructure as forces and logistics are relocated within the AO.

MANAGING TRANSITIONS

2-141. Transitions can occur for many reasons and between different operations such as phases of an operation or strategic contexts. Transitions can be chaotic, rapid, and have increased risks due to frictions caused by enemy action, degraded communications, and the OE. However, they can be caused by unforeseen circumstances and be unplanned. Transitions can be resource and time intensive. Missions that consolidate gains help to facilitate transitions. Commanders need to anticipate transitions and deliberately plan to conduct transitions to preserve combat power and set conditions while capitalizing on opportunities as they present.

2-142. Army forces conclude armed conflict by establishing conditions that are favorable to the U.S. on the ground. Transition to stability operations or back to competition occurs when aggressions from armed conflict ebb. During transition, multinational forces, or relationships with regional leaders, can aid U.S. forces with understanding the OE and connecting with the local population.

SPECIAL CONSIDERATIONS

2-143. 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 specific, unique operation, or as one of a larger series of operations during a joint campaign. Larger operations in urban environments require joint resources. ATP 3-06 provides a framework (understand, shape, engage, consolidate, and transition) for urban operations.

2-144. Geospatial engineers can partner with local authorities to share GD&I. Geospatial engineers assist with the generation, management, analysis, and dissemination of GD&I, enabling the commander to understand the physical environment. Geospatial engineers continue to support the unit COP by providing SSGF operation. For a further discussion of geospatial intelligence (GEOINT) cells, see ATP 2-22.7.

2-145. It is imperative that engineers be familiar with the history of the AO, terrain, and conflict. The knowledge of threat, partner, and HN doctrine, engineer methods, and engineer functions is critical. Engineers should consider threat patterns of obstacle employment—do they infer doctrinal use? 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 should know and understand these markings.

2-146. In addition, engineers should consult with local authorities to learn about important natural, cultural, and historic resources, as well as sensitive populations. This information helps engineers to advise on environmental considerations and to serve as technical experts in protecting the environment and recognizing how environmental impacts and hazards can affect the mission.

SECTION IV — JOINT, INTERAGENCY, INTERGOVERNMENTAL, AND MULTINATIONAL CONSIDERATIONS

2-147. During Army operations, engineer forces operate as part of a joint force and within a multinational and interagency environment across the range of military operations. The following operations are grouped into three areas that compose the range of military operations (for more information, see JP 3-0):

- Military engagement, security cooperation, and deterrence operations.
- Crises response and limited contingency operations.
- Large-scale combat operations.

2-148. Engineer organizations from other services or multinational forces may not be interoperable and may conduct engineering activities differently, but there are similarities that can facilitate the alignment of

capabilities and missions. To achieve unity of effort, engineer commanders synchronize efforts with U.S. and foreign government agencies, multinational forces, nongovernmental organizations, other unified action partners, and contractors.

JOINT CONSIDERATIONS

2-149. Army engineers operating in a joint environment need to understand joint command and support authorities and relationships (described in JP 1, Volume 2), which are similar, but not identical to, Army command and support relationships. They should 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. For more information, see JP 3-15.

SUPPORT TO SPECIAL OPERATIONS FORCES

2-150. 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 indigenous populations 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 CYBERSPACE OPERATIONS AND ELECTROMAGNETIC WARFARE

2-151. Cyberspace operations are continuous and unimpeded by geography. The cyberspace domain leverages the electromagnetic spectrum through wireless systems. Wireless systems are enablers of modern telecommunications, computer networks, and weapon systems. Engineers enable cyberspace operations and are users of cyber enabled 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 electromagnetic disruptions from adversary systems.

SPACE-BASED DEPENDENCIES

2-152. Engineers rely on space-based capabilities and systems to be successful in combat, general, and geospatial engineering. Army space operations officers, within the space support element, at corps and division headquarters manage the planning and coordination of space support with national, Service, joint, theater, and commercial resources. The space support element at the corps and division levels 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. Army 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 in theater.
- Provide updates of the solar environment and its impact to terrestrial and space-based segments of friendly communication systems.
- Monitor terrestrial AOI 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 AND INTERGOVERNMENTAL CONSIDERATIONS

2-153. 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

2-154. The 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. For more information on multinational operations, see FM 3-16. 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.

2-155. 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 LNO support (linguist support, communications equipment, and transportation) is critical to this process.

2-156. 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 information and 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 CCMDs engineer staff and headquarters.
- Providing NATO multinational C2 with the NATO OPORD format and the NATO decision-making 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

2-157. 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 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.

2-158. The product of these analyses is the engineer support plan (ESP). For more information on the ESP, see paragraph 6-28. The goal is to reach HN support agreements in peacetime to provide maximum facilities in theater. Advanced planning and the commitment of resources by HNs reduce the early lift requirements needed to support 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 (HN funded).
- Manpower.
- Equipment.
- Materials.
- Services.
- Waste disposal.

HOST-NATION SUPPORT AGREEMENTS

2-159. 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.

PRE-POSITIONING EQUIPMENT

2-160. 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.

2-161. During a conflict, the HN may provide local contractors to repair or construct facilities. Construction materials (such as cement, asphalt, aggregate, lumber, and 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

2-162. Relationships with international and domestic nongovernmental organizations should 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 need to be coordinated. It is critical that an effective engineer liaison be established and maintained with the force headquarters civil-military operations center.

2-163. 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.

INTEGRATING CAPABILITIES

2-164. All operations follow a cycle of planning, preparation, execution, and continuous assessment. The operations process is the context within which engineer capabilities integrate into combined arms maneuver. For more discussion on enabler integration and command and support relationships, see chapter 6.

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Chapter 3

Engineer Support to the Warfighting Functions

This chapter provides an overview of how integrating and synchronizing engineer capabilities enables the warfighting functions to generate and apply combat power. The successful application of combat power requires leaders to understand the enemy and friendly capabilities. Engineer leaders should know the OE and threat methods to understand the enemy situation. They should also know how engineer capabilities support Army operations through the warfighting functions to enable the Army to generate more effective land power.

OVERVIEW

3-1. A *warfighting function* is a group of tasks and systems united by a common purpose that commanders use to accomplish missions and training objectives (ADP 3-0). For more information on warfighting functions, see ADP 3-0. The six warfighting functions are—

- C2.
- Movement and maneuver.
- Intelligence.
- Fires.
- Sustainment.
- Protection.

3-2. Engineer support contributes significant combat power (lethal and nonlethal) to Army operations and unified action. To effectively support the combined arms team, engineering capabilities are organized by the engineer disciplines and synchronized in their application through the warfighting functions.

3-3. 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 3-1, page 56, depicts these primary support relationships. For example:

- Survivability support may provide linkages to the fires and protection warfighting functions.
- Combat engineering is primarily aligned 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 function.

3-4. Geospatial engineering is primarily aligned with the C2 warfighting function, but it also serves as a direct liaison with the intelligence warfighting function and has a secondary functional relationship to the remaining warfighting functions. Geospatial engineering simultaneously and cyclically supports all warfighting functions across the Joint competition continuum and the Army strategic contexts.

3-5. *Combined arms* is the synchronized and simultaneous application of arms to achieve an effect greater than if each element 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.

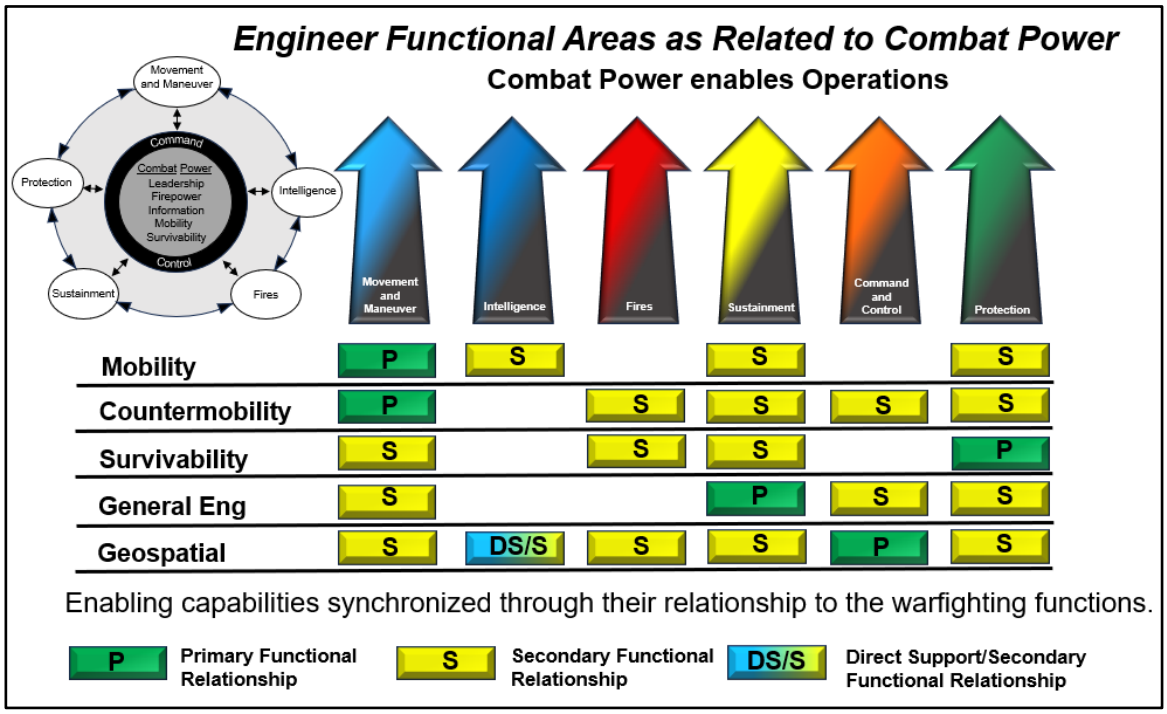


Figure 3-1. Engineer application of combat power

COMMAND AND CONTROL WARFIGHTING FUNCTION

3-6. The *command and control warfighting function* is the related tasks and a system that enable commanders to exercise authority and direction to accomplish missions (ADP 3-0). It is unique in that it integrates the activities of the other warfighting functions.

3-7. Engineer units 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.

3-8. There are typically not enough engineering capabilities available to accomplish the desired engineer tasks. Careful prioritization is a necessity. Even more challenging is that once they are in the AO, force-tailored engineer units need to be able to rapidly transition among elements of operations.

3-9. Because the available force-tailored engineer units are designed for specific tasks, engineering capabilities need to be dynamically shifted within the AO to match the requirements with the capabilities of engineer units. Transitions occur at the theater strategic, operational, and tactical levels. Flexibility in the task organization permits the shifting of engineering capabilities.

3-10. 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 AO 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. For more information on general engineering operations, see ATP 3-34.40.

3-11. Whether a subordinate or supporting unit, it is imperative that engineer unit commanders understand and exercise the mission command approach to C2. For more information about C2, see ADP 6-0. Divisionally aligned and 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 need to integrate within the receiving headquarters. The engineer headquarters provides control of ongoing engineer operations, including 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.

3-12. 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 point 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 operations throughout the competition continuum.

MOVEMENT AND MANEUVER WARFIGHTING FUNCTION

3-13. The *movement and maneuver warfighting function* is the related tasks and systems that move and employ forces to achieve a position of relative advantage with respect to the enemy (ADP 3-0). Engineers support the movement and maneuver warfighting function by performing tasks across the three disciplines. Tasks are associated with geospatial engineering, engineer reconnaissance, and M/CM/S. 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. BCT organic and divisionally aligned engineer units shape the battlefield to support early-entry operations with mobility and countermobility tasks, which enable initial, and the further expansion of, lodgments to enable force projection.

Performing as Combat Engineers

3-14. 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 are 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 forces. 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).

3-15. Some general engineer units may be assigned tasks in support of maneuver forces when additional combat engineers are not available. These missions place the units much closer to the front line of troops than is typical for the unit type. If these units are not augmented with maneuver support for security, they will be required to self-secure. Self-securing pulls personnel away from the primary activity, which extends the time on site for task completion. In addition, general engineers are not equipped with the same weapon types as combat engineers which increases the risk to personnel and equipment.

Fighting as Engineers

3-16. Fighting as engineers is inherent to the primary mission of engineer units. Combat engineers operate at the forefront, fighting alongside maneuver units as part of a combined arms team. When supporting operations, engineers should 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 through the tasks of 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 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, and camouflage and concealment).

Fighting as Infantry

3-17. 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. The commander of a combat engineer unit has the authority to reorganize them as infantry, unless otherwise reserved. The commander needs to carefully weigh the gain in infantry strength against the loss of engineer support.

3-18. 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.

3-19. 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

3-20. 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). 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 WARFIGHTING FUNCTION

3-21. The *intelligence warfighting function* is the related tasks and systems that facilitate understanding the enemy, terrain, weather, 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 IPOE supporting the assistant chief of staff, intelligence (G-2)/battalion or brigade intelligence staff officer and G-3/battalion or brigade operations staff officer 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 GEOINT. During IPOE, engineer staffs and planners provide a predictive and deductive analysis of enemy engineering capabilities to intelligence, provide civil infrastructure considerations for the operational variables (PMESII-PT), and support the information collection plan through engineer reconnaissance. See chapter 5 for further support to IPOE.

3-22. 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, key industrial sites, cultural heritage sites, 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.

3-23. Engineer reconnaissance provides data and information that contribute to answering the commander's critical information requirements and are necessary in the lines of engineer support. For more information on engineer reconnaissance, see ATP 3-34.81. To accomplish the four lines of engineer support, engineers designate the specialized assets available to collect the information needed to answer those requirements. Reconnaissance is inherent in the three disciplines; however, the information collected may be different and either 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.

3-24. Reconnaissance in support of M/CM/S is primarily conducted 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 division's freedom of maneuver and survivability of friendly forces and facilities. This requires engineer company commanders to form and train ad hoc teams for tactical reconnaissance tasks that collect technical information and perform a limited analysis of the information gathered.

3-25. Engineers complete Environmental Baseline Surveys to record and analyze detailed environmental conditions. These surveys provide valuable information about the OE, including hazardous materials, spills and contamination, disease vectors and pests, poor drainage conditions and erosion, natural resources, and cultural and historic resources. The information collected assists commanders in determining the feasibility of areas for use based on environmental conditions. For more information, see ATP 3-34.5.

3-26. Geospatial engineering teams apply all aspects of the Army Geospatial Enterprise (AGE) to improve the situational understanding of terrain. *GI&S* is the collection, information extraction, storage, dissemination, and exploitation of geodetic, geomagnetic, imagery (both commercial and national source), gravimetric, aeronautical, topographic, hydrographic, littoral, cultural, and toponymic data accurately referenced to a precise location on the Earth's surface (see CJCSI 3110.08G). The 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.
- Warfighting functions and multidomain operations through the following:
  - Terrain visualization.
  - Navigation.
  - Mission planning.
  - Mission rehearsal.
  - Modeling.
  - Simulation.
  - Targeting.

FIRES WARFIGHTING FUNCTION

3-27. The *fires warfighting function* is the related tasks and systems that create and converge effects in all domains against the threat to enable operations across the range of military operations (ADP 3-0). Engineering capabilities significantly contribute to this warfighting function when they are used to facilitate targeting. Geospatial engineers may provide templated observer and firing points based on line of sight and 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.

3-28. Integrating engineer effects, missions, and capabilities into combined arms operations at division and above includes integrating the respective target or mission into the targeting process. This enables the selection and prioritization of engineer targets into the Army targeting process or the joint targeting cycle as appropriate. Engineer leaders on staffs should understand preplanned situational obstacle integration and how to shift terrain shaping obstacle systems during dynamic targeting. For more information on engineer tasks in the targeting process, see ATP 3-60.1.

3-29. Engineer staff planners also influence the protection of infrastructure from friendly targeting for potential future use. The damage, reduction, or elimination of enemy critical infrastructure (such as airfields, roads, bridges, intersections, and yards) may result in a need for significant engineer effort to return the sites and facilities to an acceptable standard for friendly use in follow-on operations.

SUSTAINMENT WARFIGHTING FUNCTION

3-30. The *sustainment warfighting function* is the related tasks and systems that provide support and services to enable freedom of action, extend operational reach, and prolong endurance (ADP 3-0). The sustainment warfighting function consists of four elements: logistics, financial management, personnel services, and health service support. Each element should be integrated and synchronized across all warfighting functions to ensure the appropriate level of support. 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 and repairing lines of communications.

3-31. 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 the protection warfighting function.

3-32. 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 longer 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). For more information, see ATP 4-10.1 and JP 3-34.

3-33. Operational contract support obtains and provides supplies, services, and construction labor and material—often providing a responsive option or enhancement to support the force. General engineers provide subject matter expertise for the oversight of contracted services and materials use. For more information, see ATP 4-10, ATP 4-92, and ATP 4-93.

PROTECTION WARFIGHTING FUNCTION

3-34. The *protection warfighting function* is the related tasks, systems, and methods that prevent or mitigate detection, threat effects, and hazards to preserve the force, deny the enemy freedom of action, and enable commanders to apply combat power (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. For more information on survivability operations, see ATP 3-37.34. Combat engineers typically provide basic hardening and field fortification support, while general engineer support focuses on long-term survivability efforts. General engineer support is also applied through the protection warfighting function to control pollution and hazardous materials and to harden facilities. Survivability operations include the following engineer tasks:

- Protecting against enemy action 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 vehicle, information system, equipment, and material protective positions.
  - Hardening of structures and installing overhead cover, pre-detonation screens, and shielding barriers.
  - 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.
  - Employing protective equipment, such as vehicle crash barriers, entry control points, and security fences.
  - Conducting environmental baseline surveys to identify and protect against environmental conditions.
- Identifying, preventing, and mitigating potential hazards to the environment, personnel, and mission. For more information on environmental considerations, see ATP 3-34.5.
- Conducting actions to control CBRN contamination (see ATP 3-11.33).
- Conducting firefighting (see TM 3-34.30).

ENABLING COMBAT POWER

3-35. Multidomain operations require the continuous generation and application of combat power, often for protracted periods. *Combat power* is the total means of destructive and disruptive force that a military unit/formation can apply against an enemy at a given time (JP 3-0). It is the ability to fight. The complementary and reinforcing effects that result from synchronized operations yield a powerful blow that overwhelms enemy forces and creates friendly momentum. Army forces deliver that blow through a combination of five dynamics (see FM 3-0). The dynamics of combat power are—

- **Leadership.** Leadership is the most essential dynamic of combat power. *Leadership* is the activity of influencing people by providing purpose, direction, and motivation to accomplish the mission and improve the organization (ADP 6-22).
- **Firepower.** Firepower is the primary source of lethality, and it is essential to defeating an enemy force's ability and will to fight.

- **Information.** Information contributes to the disruption and destruction of enemy forces. It is central to the application and amplification of combat power. It enables decision making and influences enemy perceptions, decision making, and behavior. Information, like leadership, provides a qualitative advantage to friendly combat power when it can be acted upon more quickly and effectively than the enemy.
- **Mobility.** *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 3-36).
- **Survivability.** Survivability represents the degree to which a formation is hard to kill. It is relative to a unit's capabilities and the type of enemy effects it needs to withstand, its ability to avoid detection, and how well it can deceive enemy forces. Survivability is also a function of how a formation conducts itself during operations.

3-36. All warfighting functions contribute to the generation and application of combat power. Well sustained units able to move and maneuver bring combat power to bear against the opponent. Joint and Army indirect fires complement and reinforce organic firepower in maneuver units. Survivability is a function of protection tasks, the protection inherent to Army platforms, and schemes of maneuver that focus friendly strengths against enemy weaknesses. Intelligence determines how and where to best apply combat power against enemy weaknesses. C2 enables leadership, the most important qualitative aspect of combat power.

3-37. Engineer operations contribute significant combat power—lethal and nonlethal—to all Army operations. Based on an analysis of the mission variables, corps, divisions, and BCTs are task organized with required engineer capabilities to meet mission requirements. For offensive and defensive operations, the engineer task organization may consist of an engineer platoon, company, battalion, or brigade headquarters to provide the necessary C2 for engineer units and capabilities augmenting at the corps, division, or BCT echelon. Other, more technically specialized engineer capabilities provide general support requirements for mobility, countermobility, survivability, general engineering, or geospatial engineering support.

3-38. Lethal force is at the heart of offensive and defensive actions, and its application is critical to success in these operations. However, the use of nonlethal actions is becoming increasingly important. Today's threats operate from populated areas; they are wary of U.S. combat capabilities and welcome the potential collateral damage to noncombatants when combat erupts. The adversary may effectively use information propaganda to dramatize any harm inflicted on noncombatants by friendly forces. There is an inherent, complementary relationship between the use of lethal force and the application of military nonlethal effects, actions, and capabilities to achieve results through less coercive means.

3-39. Stability operations generally require a shift in focus for the engineer disciplines. Building partner capacity and developing infrastructure become the primary line of support. As stated previously, 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.

3-40. Although each situation requires a different mix of force responses, when used together, lethal and nonlethal actions complement each other and create new dilemmas for the opponent. The result of nonlethal actions in situations for which the use of lethal force is counterproductive—or when its use might result in unintended consequences and/or noncombatant casualties—denies the enemy this propaganda tool.

3-41. Every unit, regardless of type, integrates and synchronizes capabilities to enable the generation of combat power, and contributes to the operation. A variety of engineer capabilities and unit types contribute combat power. Tasks within the engineer disciplines support various warfighting functions to assist in generating combat power. The engineer disciplines and lines of support collectively enable all of the warfighting functions, and each engineer discipline is applied within one or more of the warfighting functions.

Chapter 4

Army Engineer Forces

The Engineer Regiment is a diverse force that consists of Regular Army, Army National Guard, and United States Army Reserve engineer organizations; USACE; DOD Civilians; and affiliated contractors and agencies in the civilian community. The regiment has a disparate range of capabilities that, when integrated and synchronized, provide the required engineer expertise and skills needed to support the combined arms team.

ENGINEER ORGANIZATIONS AND CAPABILITIES

4-1. The Army organizes engineer Soldiers and equipment into a variety of organizations, each with capabilities and capacities to meet requirements and achieve objectives. 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 CCDRs and unified action partners. The engineer's active Army organizations include USACE and Army military engineer units within the CCMDs and Army commands. Approximately three-fourths of Army engineer units are in the reserve components. The United States Army Reserve provides two 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.

4-2. The United States Army Engineer School provides specialized training at the individual and unit levels. This training includes the Joint Engineer Operations Course, Combat Engineer Heavy Track Course, Engineer Explosive Ordnance Clearance Agent Course (with assistance from the Ordnance branch), Mine Detection Dog Course, Crane Course, and Sapper Leader Course. The Engineer Regiment 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 and integrates doctrine, organization, training, material, leadership and education, personnel, facilities, and policy (DOTMLPF-P) solutions to counter explosive hazards. The Directorate of Environmental Protection and Management integrates environmental considerations throughout the DOTMLPF-P domains to identify, prevent, and mitigate potential threats to the environment and potential environmental threats to personnel and the mission.

OPERATING-FORCE ENGINEERS

4-3. Engineers in the operating force operate at the theater 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—in conjunction with USACE—operate as integral members of the combined arms team during competition, crisis, and armed conflict to provide a full range of engineering capabilities. This section provides an overview of engineers in the operational force.

4-4. There are five complementary and interdependent categories of U.S. Army engineer units in the operating force, including USACE-provided technical engineering capabilities. The five categories include three categories held in an engineer force pool, divisionally-aligned engineer units (brigades, battalions, and companies), and BCT organic engineers. The assets in the force pool reside at EAD and exist to augment divisional and BCT organic engineers. The EADs consist of force pool units which are organized by engineer headquarters units, baseline units, and specialized engineer units. See table 4-1, page 64.

Table 4-1. Operating-force engineers

Engineer Elements			*Component*		
			Active Army	*ARNG*	*USAR*
Divisionally Aligned Engineer Units		Engineer Brigades	X		
		Engineer Battalions	X		
		Combat Engineer Companies	X		
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	Combat Engineer Company	X	X	X
		Sapper Company		X	
		Mobility Augmentation Company		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
		Forward Engineer Support Team—Main*		X	X
		Geospatial Planning Cell	X		
		Prime Power*	X		X
		Quarrying Team		X	
		Well Drilling		X	

*Aligned with the United States Army Corps of Engineers

Legend:
ARNG Army National Guard
USAR United States Army Reserve

ECHELONS ABOVE DIVISION

4-5. Engineer headquarters C2 subordinate elements. Each EAD headquarters has a staff that assists the commander to C2 engineer organizations and other task organized units, supporting multifunctional missions (such as combined arms breaching and combined arms gap crossing). The headquarters in this category are TECs, engineer brigades, and engineer battalions.

4-6. 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 EAD engineer headquarters. When supporting a division or a corps, baseline engineer units may be task organized to an engineer brigade or battalion or a MEB. When supporting echelons above corps, the baseline engineer units are normally attached to, or are under the operational control (OPCON) of, a functional engineer brigade, TEC, or MEB.

4-7. 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 level to the strategic level, but they also provide selected support at the tactical level.

Engineer Headquarters

4-8. 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 division or 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 multifunctional headquarters for the employment of engineering capabilities. For more information on the MEB, see FM 3-81.

Note. A multifunctional headquarters is designed to provide C2 for forces from multiple branches. They are task organized with the requisite capabilities for a specific mission set.

4-9. Priority theater and field armies may receive a TEC. The TEC is designed to have C2 of assigned or task-organized engineer brigades, other engineer units, and contracted construction engineers within the supported theater army AOR. When directed, the TEC serves as the core for the creation of a joint forces engineer component command. The TEC focuses on theater echelon-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, while 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 CP and two contingency CPs.
- Prioritizes theater distribution of construction material, bridging parts/sets, and engineer equipment throughout the ASCC AOR.

4-10. 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.

4-11. Typically, an engineer brigade is aligned to a corps or division. Alignments may change based on the priorities of main and supporting efforts, and by the phase of the operation. 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 task organized engineer and non-engineer units performing missions in support of a deliberate gap (river) crossing.
- Provides C2 for task organized joint and multinational engineer forces assigned to a land component.
- Plans, supervises, and coordinates for engineer support to combat operations, construction, facility rehabilitation, task organization, resource management, river crossings, barrier placements, countermines, and counter obstacles.
- Provides one contingency CP with engineer staff expertise in technical planning, design, quality assurance and control, geospatial engineering capabilities, 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.

4-12. The engineer battalion provides organic C2 for one headquarters and headquarters company and for 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 (such as airborne, air assault, survey, and design). The battalion may be focused on a single mission (such as route clearance, security, construction, cache inspection, or 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 operation, the engineer battalion provides the supported unit the option to be designated as the crossing-site command.

Baseline Engineer Units

4-13. Baseline engineer units include combat and general engineer units. The baseline engineer units are the primary company size 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 EAD.

4-14. Baseline combat engineer units support combined arms operations at the tactical level. The baseline combat engineer units are the combat engineer company (CEC) and the sapper company. They are designed to provide support to maneuver forces. Engineers have the capability to fight as engineers or, if required, as infantry. When two or more combat engineer units are task organized to a BCT, a MEB, or another organization, an engineer battalion headquarters is typically included to provide the necessary C2, logistics, and staff supervision. 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 divisionally aligned companies or organic engineering capabilities in BCTs (or to deployed baseline sapper companies) when required by the mission.

4-15. 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, and airfields).

Specialized Engineer Units

4-16. 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.

4-17. Construction support includes the following capabilities:

- Asphalt detachment.
- Concrete section.
- Construction management team.
- Engineer facility detachment.
- Engineer utilities detachment.
- FEST-A.
- Forward engineer support team–main (FEST-M).
- Quarry platoon.
- Well-drilling teams.

4-18. Infrastructure support includes the following unit capabilities:

- Engineer prime power units 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, including HN fixed plants.
- Engineer facility detachments support theater opening and closing, base camp development, construction management, contract technical oversight, base camp operations (including waste management functions), and master planning.
- Firefighting teams provide base and base camp fire protection and search and rescue.

Note. For more information on infrastructure and construction support, see ATP 3-34.40. For more information on waste management for deployed forces, see TM 3-34.56.

4-19. 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).

4-20. Explosive hazards support includes tracking, detection, neutralization, and proofing. It provides the commander specialized capabilities and integrates the tasks conducted to counter the explosive hazards threat. These capabilities include the linkage to Army 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.

4-21. The GPC engineer detachment is the theater geospatial engineering asset designed specifically to GMAD the TGD to support operations within a CCMD AOR. They provide 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 (GCCs).

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 GI&S, producing spatially accurate products and geospatial decision aids for commands and commanders, intelligence, measurements, mapping, visualization, and modeling (see ATP 3-34.80).

Other Capabilities

4-22. Technical engineer reconnaissance, including route classifications and assessments and surveys of bridges, engineer resources, infrastructure, environmental conditions, and airfields, 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 IPOE. For a detailed discussion on the range of engineer reconnaissance capabilities, see ATP 3-34.81. For detailed information about environmental reconnaissance and how the DD Form 2993 (Environmental Baseline Survey [EBS] Checklist) is used to verify and record technical information about environmental conditions, see ATP 3-34.5.

DIVISIONALLY ALIGNED ENGINEER UNITS

4-23. Divisionally aligned engineer units are formations that have been assigned to divisions to support the Army's transition to the division as the primary tactical echelon. The previous discussion on engineer headquarters at EAD applies equally to these units. The primary distinction is that these units have preemptively been aligned with the division to meet its baseline engineer requirements.

4-24. There is intentional flexibility in the construct intended to provide division commanders the latitude to apply additional command and support relationships as required. These units are at the disposal of the division commander for further task organization to meet the requirements of the division's mission. The construct and capabilities of these engineer units vary depending on the construct and mission of the division to which they have been aligned.

4-25. The command and support relationships for the units will differ based upon the division's mission set and the needs of the division commander. In addition, those relationships may change as the division's mission changes. It is therefore incumbent upon engineer leaders to remain adaptable and have an intimate understanding of the various command and support relationships that could exist. For more information on command and support relationships, see chapter 5 of this book and FM 5-0.

Engineer Brigades

4-26. Divisionally aligned engineer brigades provide C2 for all assigned and task-organized engineer teams, companies, and battalions. When directed, they may also provide C2 for engineers from other Services and multinational forces. Its mission focus is on engineer support across the three engineer disciplines. In limited contingencies it may serve as the Theater Engineer Command for a Theater Army, land component headquarters, or a JTF.

4-27. The divisionally aligned engineer brigade can provide for the planning, integration, and employment of engineer capabilities in support of the division. In addition, it can provide supervision of contract construction, labor, and indigenous personnel as well as the planning and supervision for terrain analysis and geospatial operations.

4-28. When assigned to a division, the engineer brigade commander is the senior engineer in the division. They advise the division commander on the integration and synchronization of engineer assets across the three disciplines.

Engineer Battalions

4-29. There are three types of divisionally aligned engineer battalions: engineer battalion, engineer battalion (wheel), and engineer battalion (airborne). The composition of each type is the same; however, their capabilities differ based on the type of division to which they are aligned. They are composed of an

organic headquarters and headquarters company and an organic field service company. The divisionally aligned engineer battalion may have up to five engineer companies assigned or task organized to them. The divisionally aligned engineer battalion provides for the C2, planning, integration, and direction for mission tailored engineer companies and augmentation engineer units from the three engineer disciplines not organic to corps and division.

4-30. In the absence of an engineer brigade headquarters or another brigade level organization commanded by an engineer, and there are two or more engineer battalions, the supported command determines who advises the commander. They advise the commander on the integration and synchronization of engineer assets across the three disciplines.

4-31. When task organized under a BCT, the engineer battalion commander is the senior engineer in the brigade. They advise the maneuver commander on how best to employ combat, general, and geospatial engineering capabilities to conduct combined arms integration in support of operations.

Combat Engineer Companies

4-32. The combat engineer company is the primary source of engineer support for the division to which it is aligned. It may remain under the C2 of the engineer battalion it is assigned to, or it may be task organized to another organization.

4-33. Combat engineer companies support combined arms operations at the tactical level and are designed to provide M/CM/S support to maneuver forces. They are tailored to meet the baseline engineer requirements of the division.

4-34. There are four types of divisionally aligned combat engineer companies:

- Combat engineer company–armor (CEC–A).
- Combat engineer company–Stryker (CEC–S).
- Combat engineer company–infantry (CEC–I).
- Combat engineer company–airborne (CEC–ABN).

Descriptions of the four types of CECs and their accompanying line charts follow below.

Combat Engineer Company–Armored

4-35. The CEC–A provides for the planning, supervision, and execution of M/CM/S combat engineering tasks in support of an engineer battalion or supported units. When task organized, CEC–A provides C2 for up to five platoons with assault, obstacle, route clearance, area clearance, bridging, or general construction capability and operates as an engineer team or part of a combined arms team.

4-36. The CEC–A comprises a headquarter section, two combat engineer platoons, and an assault and obstacle platoon. The combat engineer platoons each consist of a headquarters section and three combat engineer squads. A countermobility squad, headquarters section, two construction sections, bridging section, and a breach section compose the assault and obstacle platoon. The CEC–A is manned and equipped to support the armored division to which it is aligned. The company organization for the CEC–A is depicted in figure 4-1, page 70.

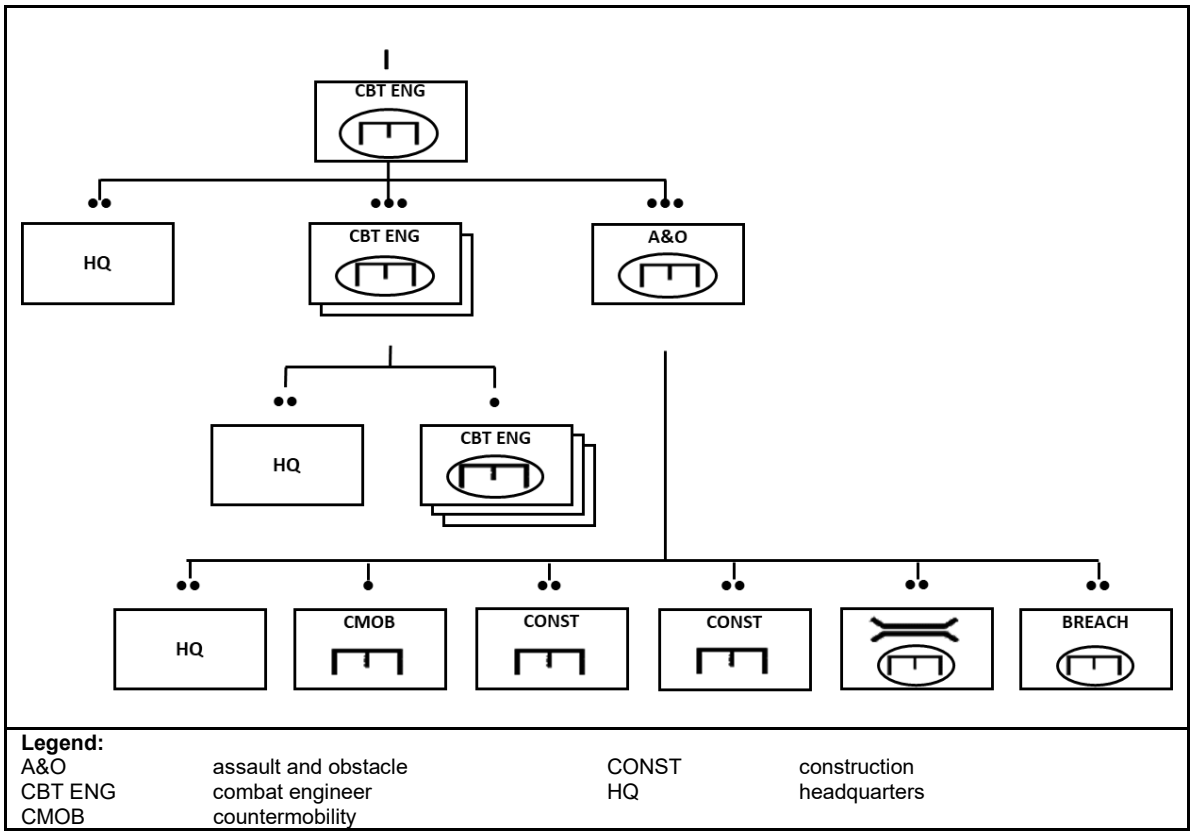
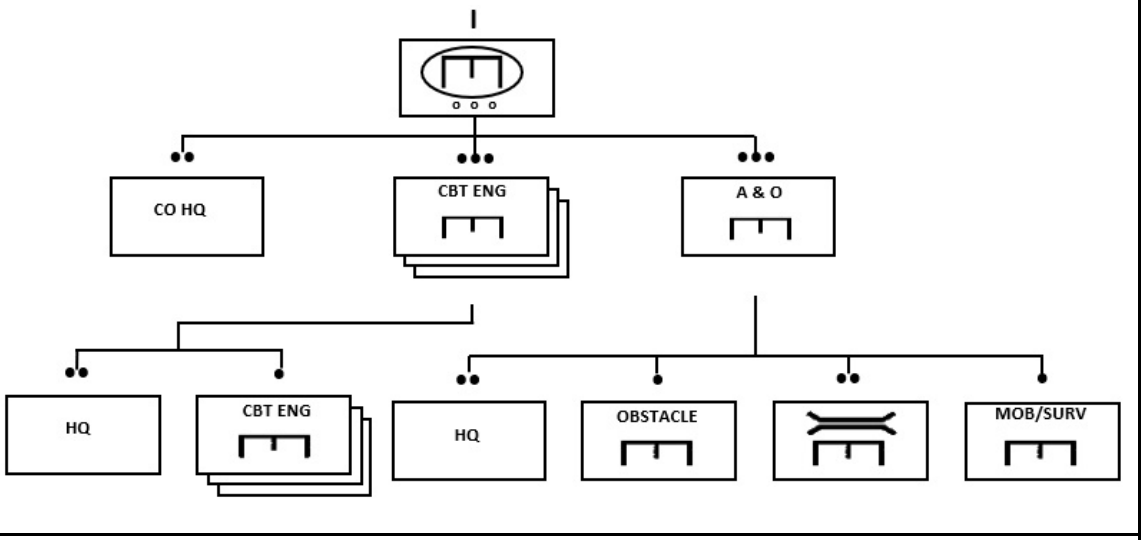


Figure 4-1. Combat Engineer Company–Armored

Combat Engineer Company–Stryker

4-37. The CEC-S provides for the planning, supervision, and execution of M/CM/S combat engineering tasks in support of an engineer battalion (wheel) and supported units. When tasked organized, CEC-S provides C2 for up to five platoons with assault, obstacle, route clearance, area clearance, bridging, or general construction capability and operates as an engineer team or part of a combined arms team.

4-38. The CEC-S comprises a headquarter section, three combat engineer platoons, and an assault and obstacle platoon. The combat engineer platoons each consist of a headquarters section and three combat engineer squads. An obstacle squad, mobility and survivability squad, headquarters section, and bridging section compose the assault and obstacle platoon. The CEC-S is manned and equipped to support the infantry division to which it is aligned. The company organization for the CEC-S is depicted in figure 4-2.



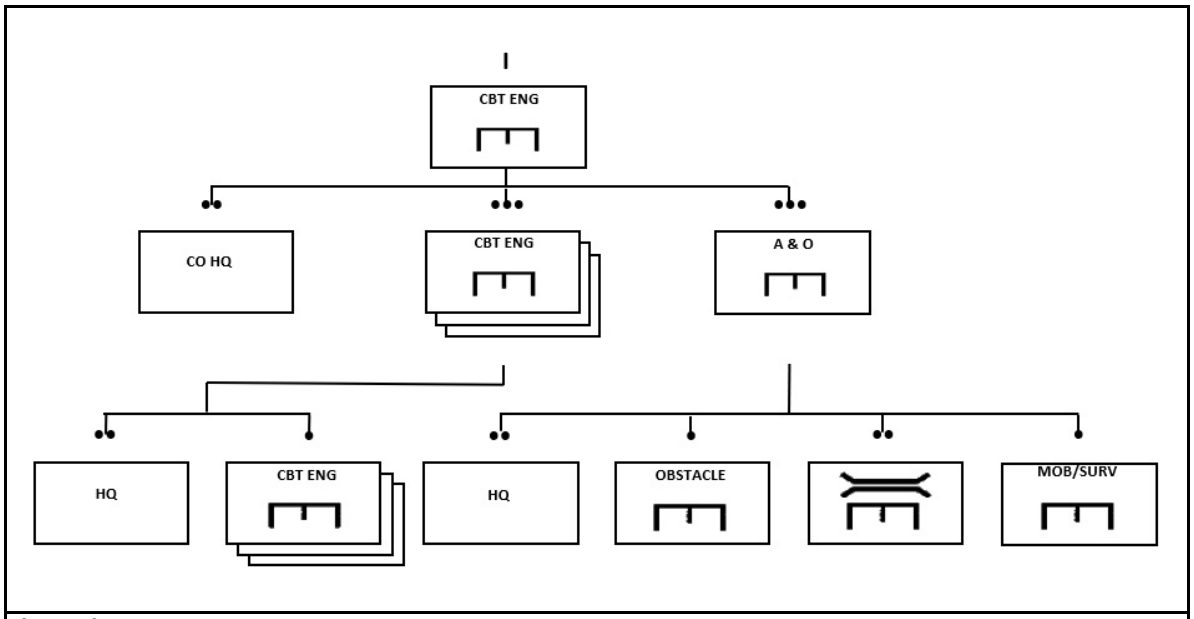
Legend:			
A&O	assault and obstacle	HQ	headquarters
CBT ENG	combat engineer	MOB/SURV	mobility and survivability
CO HQ	company headquarters		

Figure 4-2. Combat Engineer Company–Stryker

Combat Engineer Company–Infantry

4-39. The CEC-I provides for the planning, supervision, and execution of M/CM/S combat engineering tasks in support of an engineer battalion (wheel). When tasked organized, provides C2 for up to five platoons with assault, obstacle, route clearance, area clearance, bridging, or general construction capability and operates as an engineer team or part of a combined arms team.

4-40. The CEC-I comprises a headquarter section, three combat engineer platoons, and an assault and obstacle platoon. The combat engineer platoons each consist of a headquarters section and three combat engineer squads. An obstacle squad, mobility and survivability squad, headquarters section, and a bridging section compose the assault and obstacle platoon. The CEC-I is manned and equipped to support the infantry division to which it is aligned. The company organization for the CEC-I is depicted in figure 4-3, page 72.



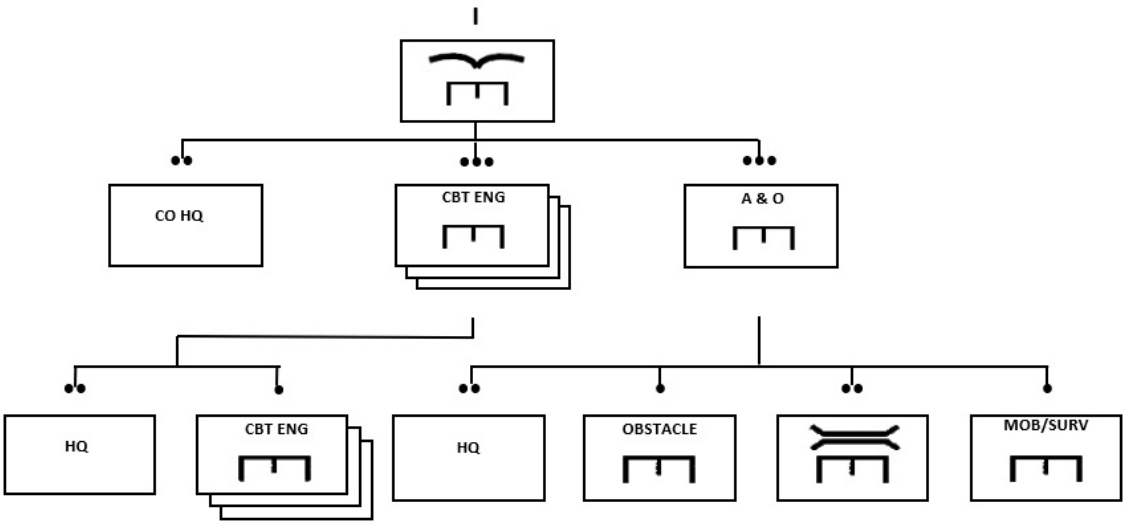
Legend:			
A&O	assault and obstacle	HQ	headquarters
CBT ENG	combat engineer	MOB/SURV	mobility and survivability
CO HQ	company headquarters		

Figure 4-3. Combat Engineer Company–Infantry

Combat Engineer Company–Airborne

4-41. The CEC–ABN provides for the planning, supervision, and execution of M/CM/S combat engineering tasks in support of an engineer battalion (ABN). When tasked organized, provides C2 for up to five platoons with assault, obstacle, route clearance, area clearance, bridging, or general construction capability and operates as an engineer team or part of a combined arms team.

4-42. The CEC–ABN comprises a headquarter section, three combat engineer platoons, and an assault and obstacle platoon. The combat engineer platoons each consist of a headquarters section and three combat engineer squads. An obstacle squad, mobility and survivability squad, headquarters section, and a bridging section compose the assault and obstacle platoon. The CEC–ABN is manned and equipped to support the airborne infantry division to which it is aligned. The company organization for the CEC–ABN is depicted in figure 4-4.



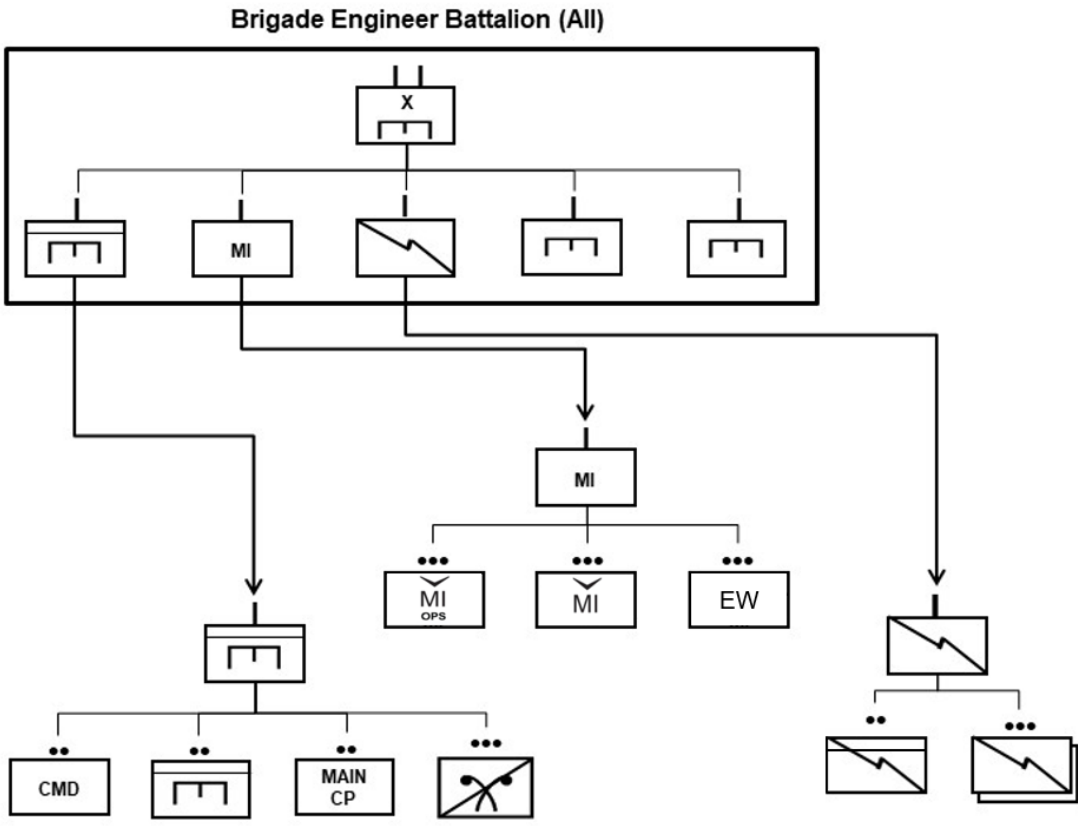
Legend:			
A&O	assault and obstacle	HQ	headquarters
CBT ENG	combat engineer	MOB/SURV	mobility and survivability
CO HQ	company headquarters		

Figure 4-4. Combat Engineer Company–Airborne

ORGANIC—BRIGADE ENGINEER BATTALION

4-43. In the instance that there is an organic BEB, the BEB commander is the brigade engineer in the BCT. They advise the maneuver commander on how best to employ combat, general, and geospatial engineering capabilities in support of large-scale combat operations. The brigade engineer integrates engineers into the brigade planning process and coordinates engineer activities in the brigade area. The BEB provides organic engineer planning and execution capabilities to the BCT. The BEB is typically responsible for all engineer units assigned or attached to the brigade or for those working in the brigade AO.

4-44. The BEB has the capacity to maintain C2 of task organized engineer organizations, assigned signal and military intelligence companies, and a 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. For the structure of the BEBs, see figure 4-5, page 74.



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	MI	military intelligence
CMD	command	OPS	operations
CP	command post		

Figure 4-5. Brigade engineer battalion

4-45. The BEB is responsible for the administrative, logistical, training, and protection support of subordinate units. The BEB has a typical functional staff; however, the staff is predominantly engineers.

4-46. The BEB also includes a CBRN reconnaissance platoon. The CBRN reconnaissance platoon provides reconnaissance and surveillance of CBRN hazards to protect the force during armed conflict and is responsible for providing technical advice to the BEB. They may be detached to other units within the brigade to provide early warning during deep operations or provide CBRN route reconnaissance and site assessment support to the BEB. The CBRN reconnaissance platoon receives administrative and sustainment support from the BEB. For more information on the employment of CBRN reconnaissance platoons, see FM 3-11.

4-47. The BCT commander directs command and support relationships within the BCT. These relationships dictate whether the BEB will logistically support or coordinate support with the BCT for task-organized units. Unless the BCT directs otherwise, the BEB retains a command or support relationship with organic and task-organized units. Organic companies and companies that are 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 task-organized 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.

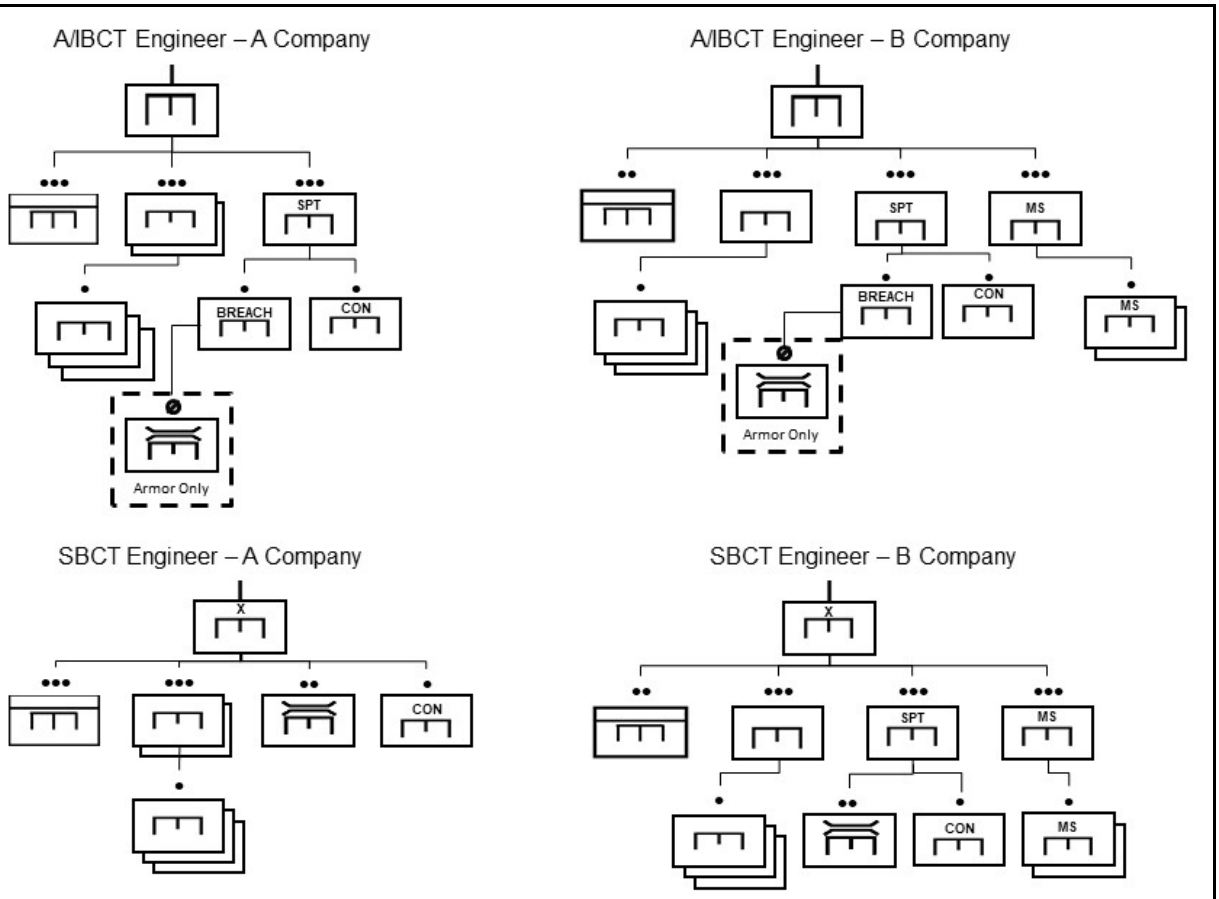
4-48. Two engineer companies provide the BCT the minimum capability to support the offense and defense (breach and cross obstacles, assist in the assault of fortified positions, emplace obstacles to protect friendly forces, construct or enhance survivability positions, conduct route reconnaissance and information collection, and identify and neutralize explosive hazards). 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 crossing, earthmoving, and route-clearing capabilities.

Company A

4-49. Engineer Company A is organized like the armored and infantry BCTs, but their equipment differs. 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 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 4-6, page 76.

Company B

4-50. Engineer Company B is slightly different in the armored, infantry, and Stryker BCTs. Engineer Company B has one combat engineer platoon, a route clearance platoon and one engineer support platoon. The route clearance platoon provides the detection and neutralization of explosive hazards and reduces obstacles along routes that enable force projection and logistics. This 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 EAD engineers if the capability and capacity are required.



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

Figure 4-6. Engineer Companies A and B

Brigade Combat Team Geospatial Engineering Staff

4-51. 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 GEOINT team. Geospatial engineering teams support functional and multifunctional brigades, including aviation, engineer, sustainment, division artillery, military intelligence, fires, maneuver enhancement and security force assistance. GEOINT teams support BCTs, divisions, and corps under guidance and direction from the G-2. Geospatial engineers within a geospatial engineering team or GEOINT cell provide geospatial support to the assigned echelon and lower.

Security Force Assistance Brigade—Brigade Engineer Battalion

4-52. 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 HN or coalition partners. 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.

ARMY GEOSPATIAL ENTERPRISE

4-53. The AGE is central to the MDMP due to its ability to enable the visualization of a wide variety of data into the context of place and time. It is a cross-cutting capability, applying to all warfighting functions, in all phases of operations, across both the Operating Force and the Generating Force. As a component of the Army Enterprise Architecture and the National System for Geospatial-Intelligence (NSG), the AGE is designed to enable Army operations and unified mission command, as well as provide shared situational awareness between U.S. and coalition elements, through standardized geospatial information collection, management, analysis, visualization, and dissemination.

4-54. The SSGF is a standardized set of GD&I providing a common foundation for visualizing and analyzing spatial aspects of an AOI to enable C2, planning, and military operation execution. SSGF contains a common set of the best available geospatial data within J/G/S3 directed AOI boundaries providing the geospatial foundation for all COE enabling technologies. The SSGF forms the foundation on which units build their COP. As the foundation of the COP, the SSGF is relevant to all phases of operations and influences all systems, platforms, and processes that use, produce, store, manage, or disseminate geospatial data and/or information shared within and between the warfighting functions. Use of the SSGF supports mission command by putting current operations, planning efforts, and running estimates in the context of space and time on a common digital map shared and seen by all. The evolving specified GD&I formats that make up the SSGF continuously enhance the understanding and performance of the services and information provided. It also ensures compatibility with all COE systems for each capability set. An SSGF currently consists of four basic types of geospatial data: georeferenced imagery, elevation matrices (raster), geospatial features (vector), and military standard maps. Capabilities for three dimensional and vector mapping are being developed for future inclusion.

4-55. The AGE delivers the SSGF as a foundation for warfighting functions to display operational graphics on the COP in each computing environment. Data overlaid on the geospatial foundation includes GD&I; analysis products and decision aides; operational and planning graphics from all WFF and special staff; current operations data; demographic, cultural, economic, industrial and infrastructure data; and staff running estimate information that ties to a specific location. Because it is the basis of the COP, the SSGF is relevant to all phases of operations and includes personnel, units, systems, platforms, and processes that use, produce, store, manage, or disseminate geospatial data and/or information that can be shared within and between the six WFF. Use of the SSGF puts current operations, planning efforts, and running estimates in the context of space and time, which supports mission command.

REACHBACK SUPPORT

4-56. The UROC is the reachback management team which provides solutions for technical engineering requests—including environmental related requests—for information from deployed U.S. forces. The UROC serves as one door to USACE and provides access to Labs from the Engineer Research and Development Center (ERDC), USACE Base Development Teams, and USACE Centers of Expertise to address technical engineering RFIs. The UROC provides access to completed requests for information through the Reachback Engineer Data Integration portal. For more information on UROC, see chapter 5.

ENGINEER FORCE TAILORING

4-57. The organization of forces within the Army is dynamic. Requirements for forces are seldom identical to pre-deployment plans. Therefore, the theater army commander recommends the appropriate mix of forces and the deployment sequence for forces to meet the GCC requirements. This is called force tailoring—the process of determining the right mix of forces and the sequence of their deployment in support of a JFC—and may include elements from the operational Army and the institutional force. For more information on force tailoring, see JP 3-35.

4-58. Tailoring the engineer force requires a different mindset—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 Army operations. Careful prioritization needs to occur for the limited engineer resources typical in the OE. To accomplish the identified tasks in the desired timeframes, commanders consider augmentation requirements and recognize which mission requirements can be supported through reachback and geospatial products instead of by 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 are allocated from the engineer force pool.

4-59. Engineer force packages need to 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 should 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 need reinforcement 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. Engineer planners need to tailor the engineer force through all phases of the operation to minimize stresses on the time-phased force and deployment data (TPFDD), maintain flexibility for re-task organizing across BCT and Division lines, and mitigate the risk of creating an imbalance of engineer capability at the time of need.

4-60. 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; however, they are task organized under an engineer battalion headquarters that will provide C2 in theater.

4-61. 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 should 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 CCMD JTF level and normally place legal restrictions on the uses of 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.

ECHELON FORCE TAILORING

4-62. With input from appropriate corps and division headquarters, engineer planners at the joint and theater army levels collaborate with their supporting TEC planners to select engineer forces based on an analysis of the mission variables and recommend a deployment sequence. The 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 rely on subordinate echelons to assist in defining tactical-level requirements. Engineer planners should also consider and leverage the variety of other engineer capabilities that may be available to meet or mitigate requirements.

4-63. EAD engineer planners consider a variety of other engineer capabilities to meet operational-level and, in some cases, tactical-level requirements. A designated DOD contract construction agent (normally, the USACE and/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 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 several requirements for which the most effective engineer capability only exists in USACE or other institutional force engineer organizations.

4-64. Theater army engineer planners need to understand some requirements more fully than others. The theater army echelon should 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 need to know the requirements for upgrading selected SPODs and APODs with enough clarity to include tentative designs, plans, and estimates. Similarly, a selected ground line of communications 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.

4-65. Theater army engineer force planners do not disregard tactical-level requirements. They should 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 that refine the gap-crossing design.

4-66. Prioritization occurs in applying the tailored engineer forces most effectively against actual requirements. EAD engineer staff and planners recommend priorities to the commander based on the continuous assessment maintained through the running estimate. EAD 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 conduct task organization. It is the process in which they organize and reorganize groups of tailored engineer units for specific missions by allocating available assets to subordinate commanders and establishing their command and support relationships. Meeting the evolving engineer requirements throughout an operation depends directly on the ability to efficiently task-organize the tailored engineer force and integrate it within the gaining or supported force.

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Chapter 5
Engineer Organization Perspectives

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

UNITED STATES ARMY CORPS OF ENGINEERS

5-1. USACE provides technical engineering reconnaissance, planning and design, construction services, execution of contract construction, acquisition of real estate for use by U.S. forces, and environmental services in support of the theater army headquarters and the ASCC. USACE provides these services through regionally aligned USACE divisions and districts which provide support in a specific GCC AOR. The regionally aligned district has support agreements in place with the ASCC and other service component commands to facilitate the provision of general engineering and contract construction support on a reimbursable basis. If the workload outgrows the capacity of the regionally aligned district, USACE has contingency districts available on requirements-only tables of distribution and allowances, which it can assign to the GCC AOR and staff to execute the contingency workload. 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. Specific information on the responsibilities of DOD construction agents is contained in Department of Defense Directive 4270.5, *Military Construction*.

5-2. USACE is the executive agent for Army and DOD military construction and real estate acquisition, and provides sustainment, restoration, and modernization support on Army and DOD installations. USACE is responsible for planning and executing the civil works program. This includes maintaining the navigable waterways of the nation, operating over 800 dams—many of which provide hydroelectric power—and protecting critical infrastructure and people through the operation of flood control projects and infrastructure. USACE has a robust environmental program capable of providing environmental support to protect U.S. Soldiers and the people of the Nation while simultaneously maintaining ecosystems or conducting remediation activities to clean up environmental hazards, including munitions of explosive concern. USACE leverages its core competencies to provide a broad range of engineering support to military departments, federal agencies, state government and local authorities on a reimbursable basis through subordinate divisions, districts, centers, and laboratories. In addition, 249th Engineer Battalion (Prime Power), a direct reporting unit to HQ USACE, provides electrical power generation and distribution support to contingency bases worldwide. While most USACE assets are part of the generating force, the 249th Engineer Battalion (Prime Power) and FFE teams are part of the operational Army.

5-3. USACE is available to support operations during each of the strategic contexts and all phases of military operations. Its assets are particularly useful during crisis and onset of armed conflict in executing set-the-theater engineering tasks designed to receive and enable onward movement of deploying U.S. forces. USACE assets are capable of conducting reconnaissance of SPODs and APODs, roads and bridges, and conducting site assessments for the staging of U.S. forces. In addition, the Secretary of the Army delegates authority for USACE real estate personnel to acquire real estate for U.S. forces. Real estate acquisition experts deploy early in an operation and acquire real estate for use by U.S. forces. Status of forces agreements, and HN agreements generally dictate how land and facilities are acquired. U.S. forces acquire rent-free facilities in accordance with HN agreements. Real estate SMEs often work, hand in hand, with USACE environmental and ecological SMEs who conduct environmental baseline surveys on terrain that U.S. forces occupy. USACE geospatial information systems specialists often work with water resource engineering to provide flood plain analysis to deployed U.S. forces to prevent the establishment of staging areas and basecamps in flood plains and to enhance maneuver planning. The 249th Engineer Battalion

often deploys during stability operations when electrical power generation and distribution at a semi-permanent level is required and the use of tactical generators is not practical, or when utility power is not available or is unstable. Typically, this power is provided on an as-needed basis to support operations, as directed by the theater Army or JTF commander. Finally, USACE is prepared to establish a task force for safety actions for fire and electricity (TF SAFE) to ensure electrical safety in facilities occupied by U.S. forces.

5-4. USACE assets are suited to support CCMDs and ASCCs across the competition continuum, but its capabilities are increasingly employed in competition below armed conflict in order to achieve theater strategic effects for the supported command. USACE districts support capacity building of HN military forces through the execution of foreign military sales construction projects which provide facilities for HN militaries and their equipment. USACE supports theater security cooperation and assistance projects funded by the CCMDs ranging from humanitarian assistance to building partner capacity projects. USACE provides SME support in managing waterways for HNs and for nations struggling with water scarcity or water management issues. Other security assistance support includes the execution of technical and project support to the interagency, which are generated at U.S. embassies abroad or via the interagency at the GCCs. Science and technology research and development support is provided to organizations and countries via cooperative research and development agreements. Finally, USACE leverages its core competency in disaster response domestically to build the capacity of foreign countries to be able to conduct emergency operations within their country through emergency management and resilience program activities across the globe.

5-5. USACE provides support to stability operations and, during transitions, to enable civil authority through integration into ESPs at the GCC and ASCC to execute construction programs that provide facilities for the HN military and its equipment and to repair HN infrastructure. USACE is capable of providing senior SME support to HN ministries, like the Ministry of Water Resources, to build the capability and capacity of the ministry. In addition, USACE is prepared to leverage the core competency of its Ordnance and Explosives Directorate to provide the capability to clear munitions and unexploded ordnance from HN land.

5-6. USACE aligns its divisions with specific GCCs and the Special Operations Command. The division is responsible for C2, regional relationships, program management, and quality assurance for USACE activities in the AOR. USACE has LNOs and/or military planners embedded in the J4s or as part of the theater engineer staff of the respective GCCs/ASCCs to facilitate planning and integration into CCMD plans and operations. As required, the division establishes liaison at key nodes, especially the ASCC, to facilitate support for an emerging contingency. USACE districts execute construction projects, operate projects, and deliver services as assigned by their division, or assigned based on specific authorities and/or laws. Districts focus on delivering quality projects by working in collaboration with partners and stakeholders. Districts generally have established support agreements with service component commands and other stakeholders for which they provide reimbursable services in a CCMD AOR. Regionally aligned USACE divisions and districts serve as one door to the corps for the supported commands and provide access to USACE centers, laboratories, and centers of expertise. Division and district alignment is shown in table 5-1.

5-7. ERDC is the premier research and development center for USACE. ERDC labs discover, develop, and deliver innovative solutions to the nation's toughest challenges in military engineering, installations and OEs, civil works, geospatial research and engineering, and engineered resilient systems. Capabilities ERDC provides the warfighter include, but are not limited to, flood plain analysis to facilitate the siting of basecamps, dam break analysis, tunnel detection capability, expeditionary techniques to harden facilities to improve force protection, and expeditionary techniques to cross gaps to facilitate mobility. ERDC labs include the following:

- Coastal and Hydraulics Laboratory.
- Cold Regions Research and Engineering Laboratory.
- Construction and Engineering Research Laboratory.
- Environmental Laboratory.
- Information Technology Laboratory.

- Geospatial Research Laboratory.
- Geotechnical and Structures Laboratory.

Table 5-1. USACE division alignments

Supported Combatant Command/Sub-Unified Command	*USACE Division*	*Executing District*
U.S. AFRICOM	North Atlantic Division (NAD)	European District
U.S. CENTCOM	Transatlantic Division (TAD)	Middle East District
U.S. EUCOM	North Atlantic Division (NAD)	European District
U.S. INDOPACOM	Pacific Ocean Division (POD)	Honolulu District/Alaska District
U.S. SOCOM	Transatlantic Division (TAD)	
U.S. SOUTHCOM	South Atlantic Division (SAD)	Mobile District
U.S. NORTHCOM	Northwestern Division (NWD)	
U.S. ALASKA COMMAND	Pacific Ocean Division (POD)	Alaska District
U.S. Forces Japan (USFJ)	Pacific Ocean Division (POD)	Japan District
U.S. Forces Korea (USFK)	Pacific Ocean Division (POD)	Far East District

5-8. The Engineering and Support Center, Huntsville manages projects falling into five portfolios: medical, facilities and base operations, energy, operational technology, and environmental. Services provided by the engineer and support centers (see table 5-2) include, but are not limited to, conduct of electrical safety inspections to ensure the safety of U.S. forces operating in a contingency environment, HN unexploded ordnance cleanup, and expedient designs for medical facilities.

Table 5-2. Huntsville Engineering and Support Center Programs and Centers of Expertise

Major Programs/Product Lines	*Mandatory Centers of Expertise*	*Technical Centers of Expertise*
Ballistic Missile Defense Chemical Demilitarization Ordnance and Explosives Medical Installation Support	Military Munitions Ranges and Training Land Electronic Security Systems Utility Monitoring Systems Medical Ballistic Missile Defense Facilities Explosive Safety Control Systems Cybersecurity	Facilities System Safety Heating, Ventilation, and Air-Conditioning (HVAC) Installation Support Operation and Maintenance Engineering Enhancement (OMEE) for Medical Facilities Energy Savings Performance Contracting
Legend: DD Department of Defense HVAC Heating, Ventilation, and Air-Conditioning OMEE Operation and Maintenance Engineering Enhancement		

5-9. The AGC collects, analyzes, manages, and delivers geospatial data and products; provides acquisition support; and develops innovative solutions to solve the toughest geospatial challenges. The primary AGC geospatial mission support functions are data collection, data analysis, visualization, dissemination, content management, standards, system integration, and governance.

- **System engineering.** AGC leads the development and integration of the Army Geospatial Enterprise; lends GEOINT expertise to develop and field tools for location data gathering; and provides geospatial products, data, and training for an array of military and civil operations.
- **Terrain.** AGC provides design, development, and deployment of systems for terrain reasoning and management and terrain data collections, analysis, distribution of 2D and 3D terrain visualization products and content to enable decision making at all echelons.
- **Imagery.** AGC employs technologies for the collection, processing, integration, use, storage, and distribution of aerial imagery, light detection and ranging (LIDAR), bathymetry, and other geo-enabled phenomenology derived from multiple sources for use in classified and unclassified environments.

- **Acquisition support.** AGC provides specialized subject matter expertise to enable the acquisition and fielding of geospatial services and support to Army Programs of Record.
- **Acquisition program lifecycle management.** AGC provides full lifecycle acquisition management support. This includes design and development, planning and budget execution, and support to maintenance and sustainment for multiple military programs of record that provide data collection, analysis, reconnaissance, survey design, and construction management capabilities to the United States Army Engineer Regiment and joint engineer elements.
- **High resolution 3-dimensional (HR3D) data.** AGC's HR3D, color, unclassified geospatial data (imagery, LIDAR, and bathymetry) can be shared among interagency and international partners for both military and civilian applications. HR3D is the basis for developing a multi-purpose spatial data infrastructure that can aid countries in their infrastructure development objectives, internal security posturing, and preparedness for humanitarian assistance and disaster response scenarios using HR3D digital twins for planning, collaboration, and execution. HR3D products—
  - Enable the COP for resource allocation and strategic decisions.
  - Improve situational awareness, terrain understanding, and visualization of the environment.
  - Enable accuracy and precision of the terrain for posturing, training, construction, and terrain modification(s).
  - Reduce casualties and collateral damage.
  - Enable precise digital twin.
  - Support all decision systems.
  - Support infrastructure development/real estate management.
  - Improve climate assessment.
  - Decrease site selection and terrain modification/engineering.

5-10. The Institute for Water Resources (IWR) provides forward-looking analysis and research in developing planning methodologies to aid the Civil Works program.

- IWR provides—
  - Analysis of emerging water resources trends and issues.
  - State-of-the-art planning and hydrologic engineering methods, models, and training.
  - National data management of results-oriented program and project information across civil works business lines.
- IWR core mission areas include—
  - Data management for dams and levees.
  - Safety technical competency and training for dams and levees.
  - Headquarters technical support for dam and levee safety activities.
  - Policy development for dams and levee operations.
  - Program management for safety program activities.
  - Quality management for safety program activities.
  - Risk management and risk assessment for USACE dams and levees.
- IWR has seven subordinate organizations, including the Risk Management Center. The Risk Management Center is a center of expertise that manages and assesses risks for dam and levee systems across USACE; supports dam and levee safety activities throughout USACE; and develops policies, methods, tools, and systems to enhance those activities. It offers services to support dam safety; levee safety; and the Modeling, Mapping, and Consequence Production Center. For example, subject matter experts from the Management Center provided technical oversight of the grouting mission of the Mosul Dam to prevent its collapse.

5-11. The 249th Engineer Battalion (Prime Power) provides commercial level power to military units and federal relief organizations during military contingency and civil disaster response operations. The battalion offers a variety of services including electrical power requirement assessment, power production, transformer inspection and test analysis, maintenance and repair of power plants, substations, and government owned or managed transmission and distribution systems, circuit breaker and relay maintenance, infrared surveys, expanding or deconstructing power systems, providing base closure support, and medium voltage electrical contractor oversight. The battalion's platoons are capable of installing, operating, and maintaining complete medium voltage electrical power generation and distribution systems worldwide (see ATP 3-34.45).

FIELD FORCE ENGINEERING

5-12. ***Field force engineering*** **is the application of Army engineering capabilities from the three engineer disciplines through reachback and forward presence.** USACE is the primary organizing agent for FFE and related generating force support that enables engineer support to the operational Army. USACE manages the readiness of technically specialized teams and personnel to deploy and embed in operational force engineer staffs or engineer commands, upon request. Just as importantly, USACE sustains a robust reachback network consisting of reachback teams, centers, labs, and centers of expertise capable of answering technical engineering requests from forward deployed U.S. forces. The engineer commander or the theater engineer at ASCC or JTC level 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 these requirements. These capabilities rely heavily on reachback and satellite-based TeleEngineering communication resources when in-theater networks are damaged or unavailable.

5-13. 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. Deployable FFE capabilities reside in the U.S. Army Reserve and National Guard as well as Joint engineers. USACE's FFE training program is applicable to, and enhances the readiness of, FFE teams in the United States Army Reserve and National Guard as well as NAVFAC's contingency engineer response teams. In addition, equipment developed for USACE deployable teams is relevant and required for United States Army Reserve and National Guard capabilities and is provided, upon request, by USACE for training and deployment when resources are available. USACE's FFE program management team is an integrator for readiness requirements for FFE and other general engineering capabilities outside of USACE. The HQ USACE FFE project management team is closely aligned with NAVFAC's Expeditionary Directorate–Contingency Engineering Division Director. NAVFAC personnel deploy, at times, on USACE deployable teams.

5-14. USACE embeds LNOs in the GCCs and Special Operations Command to integrate USACE capabilities into CCMD plans during deliberate and crisis action planning. USACE LNOs are also well aware of the capabilities of the USAR TECs and coordinate with the TECs to integrate their capabilities into GCC plans and operations. In the event of an emerging operation, USACE embeds additional LNOs at the ASCC and other key nodes to facilitate USACE integration. The LNO supports the development of requests for forces and requests for assistance for USACE capabilities. For an emerging operation where the requirements are not well known, USACE recommends a FEST–A, a theater level real estate planner, an environmental planner, a 249th EN BN prime power planner, and a planner from the Engineering and Support Center, Huntsville, capable of planning TF Safe and unexploded ordnance removal support.

FORWARD-DEPLOYED FIELD FORCE ENGINEERING CAPABILITIES

5-15. FFE teams deploy to meet requirements for engineering assessments and analyses in support of operations. Teams include FESTs, contingency real estate support teams (CREST), environmental support teams (ENVST), and a USACE augmentation cell. USACE can also establish a contingency district if emerging contingency exceeds the capacity of the aligned USACE district. 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.

Forward Engineer Support Team–Advance

5-16. The FEST–A provides persistent, embedded capability to conduct infrastructure assessment; engineer planning and design; and environmental, geospatial, and other technical engineer support (from theater army to division echelon) for the engineer staffs at those echelons. This team is capable of supporting any echelon configured as a joint force headquarters for contingency operations or may be task organized to a corps or division 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 contingency real estate, environmental and prime power planners. A USACE FEST–A consists of uniformed military personnel and Department of the

Army (DA) Civilians. The engineering disciplines of the civilian members are civil, mechanical, structural, environmental, and electrical engineers as well as a geospatial information systems specialist. USAR FEST–As consists of all military personnel. Both teams require sustainment and security support from the gaining or supported unit. FEST-A support is requested by a formal request for forces process.

Forward Engineer Support Team–Main

5-17. The FEST–M is a deployable capability that provides oversight of general engineering activities for a theater army or JTF, including technical engineering reconnaissance, environmental considerations, planning and design, geospatial, and construction services and contract construction below the MILCON threshold. The FEST–M is capable of providing technical oversight of other deployed FFE teams. 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. The FEST-M requires augmentation from contracting or use the local contracting command for execution of construction projects below the MILCON threshold. The FEST–M resides in the United States Army Reserve and National Guard and is requested by a formal request for forces process.

Contingency Real Estate Support Team

5-18. 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 chapter 159, 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 CREST is comprised of DOD Civilians and requires sustainment and security support from the supported unit. CREST support is requested by a formal request for forces process or as a reimbursable service through the aligned USACE district.

Environmental Support Team

5-19. The ENVST completes environmental studies, surveys, and reports; provides technical support, advice, and recommendations; and integrates environmental considerations based on the mission. They have the knowledge and expertise to provide a comprehensive, whole system approach to integrating environmental considerations into site planning, sustainment, and closure. As a result, they protect the people (personnel and local citizens), environment, and mission. The ENVST supports all echelons, but it is typically tailored to support ASCC headquarters for base camp development, closure, and repurposing. An ENVST is comprised of USACE DA Civilian environmental experts and normally augments the engineer staff at echelon. The ENVST conducts environmental management tasks in support of base camps and technical engineering. The team can deploy early during crisis and can remain post-deployment to provide remediation support for base or base camp closure. The team works with the contingency real estate support team to determine the suitability of HN facilities for use by U.S. forces. They can collaborate efforts with operational public health on environmental issues, establish pollution prevention programs, and implement hazardous substances management programs. These small teams require sustainment and security support from the supported unit. A request for support from an ENVST is processed through the request for forces process and the team may be directly paid for as a reimbursable service through the applicable USACE division.

Contingency Engineer District

5-20. Should the requirements of an emerging contingency exceed the capacity of the aligned USACE district, USACE may establish a contingency district to execute the USACE mission. To create a contingency district, USACE takes existing district tables of distribution and allowance structure to build

an organization that can deploy to execute the USACE mission in a GCC AOR. It is a requirements-only organizational structure which can be staffed with funding from the contingency construction program.

USACE Augmentation Cell

5-21. USACE also sustains existing tables of distribution and allowance structure for a headquarters and staff augmentation cell in order to augment the staff of a TEC or engineer brigade. It is a requirements-only organizational structure which can be staffed with funding from a contingency construction program. The augmentation cell synchronizes construction effects and customer requirements at the theater level, provides oversight of USACE construction programs, and provides USACE major subordinate command-level oversight of forward-deployed contingency engineer districts and other USACE assets. The augmentation cell roles and responsibilities include—

- Augmenting theater engineer staff with technical engineering expertise not resident within the staff.
- Participating in the development of infrastructure construction requirements and providing command guidance to deployed USACE districts.
- Engaging with the HN government and the U.S. government interagency to synchronize construction effects.
- Supporting construction decisions for work acceptance.
- Receiving information from districts, synthesizing information into construction effects, and providing programmatic oversight of construction programs.
- Communicating construction effects and jointly developing an infrastructure plan that nests with the civil-military strategy as part of the theater campaign plan.
- Ensuring the implementation of USACE business processes throughout the theater.

REACHBACK ENGINEERING CAPABILITIES

5-22. USACE reachback engineering capabilities include—

- UROC.
- Basecamp development teams.
- Centers of expertise.
- JCMS.

USACE REACHBACK OPERATIONS CENTER

5-23. UROC provides one door to USACE for technical engineering requests for information to support contingencies across the full operational and natural disaster spectrum. UROC leverages the capabilities of ERDC labs, and USACE centers of expertise to provide comprehensive answers to technical requests for information. ERDC also manages ten district-based base development teams capable of producing base camp master plans and facility designs or answering other technical requests for information. Manages the USACE reachback engineer data integration (REDi) system, a COP database, with a robust user interface and fully integrated mapping tools for receiving, managing, and archiving technical engineering requests for information, project details, and site assessment related data (such as infrastructure and environmental conditions). One of the primary objectives of REDi is to consolidate and integrate data from multiple authoritative databases and to expose that data in a manner that makes it easily accessible and relevant for situational awareness, planning, and decision making. Provides the TeleEngineering communications equipment, expeditionary environmental tool kits, reconnaissance and infrastructure assessment tools, software, and training for FFE and other deployed engineer elements.

BASECAMP DEVELOPMENT TEAMS

5-24. Basecamp development teams provide installation-level master planning, engineering design analysis, and facilities design expertise for intermediate staging bases, base camps, forward operating bases, and dislocated civilian camps. It uses the JCMS software as its military contingency design tool to turn around designs in a 24- to 36-hour period. Basecamp development teams consist of a mixture of architect/master planners, computer-aided design and drafting technicians; and geotechnical, civil, electrical, environmental, mechanical, structural, and cost engineers.

CENTERS OF EXPERTISE

5-25. USACE centers of expertise are designated USACE organizations (District, Laboratory, or Center) that have demonstrated capability and expertise in a specialized area. Centers of expertise improve capabilities and management, eliminate redundancy, optimize the use of specialized expertise and resources, enhance corps-wide consistency, facilitate technology transfer, help maintain institutional knowledge in key areas, and improve service to customers, including rapid response to emergencies. See table 5-3.

Table 5-3. USACE centers of expertise

Centers of Expertise		
Aircraft Hangar Fire Protection	Engineering Management Systems	National Ecosystem Planning Center of Expertise
Army Geospatial Center	Environmental and Munitions	Paint Technology Center
Automated Performance Monitoring of Dams	Fuel Facilities (Petroleum, Oils, and Lubricants)	Photogrammetric Mapping
CAD/BIM Technology Center	Heating, Ventilating and Air Conditioning Control Systems	Planning Centers of Expertise
CEEIS Processing Centers	Heating, Ventilating and Air Conditioning	Protective Design Center
Centers of Standardization	Historic Structures and Buildings	Range and Training Land Program
Cold Regions	Homeowners Assistance Program	Rapid Response HTRW Center
Collaboration and Public Participation Center	Hydroelectric Design Center	Readiness Support Center
Concrete Technology Center Roller Compacted Concrete	Hydrologic Engineering Center	Real Estate Systems National Center
Construction Equipment/Cost Index Database	Industrial Control Systems Cybersecurity Technical Center of Expertise	Sign Standards Program
Corrosion Control & Cathodic Protection	Inland Navigation Design Center Installation Support Center of Expertise	Supercomputing Resource Center
Cost Engineering for Civil Works	Installation Support	Survey Engineering and Mapping Center
Critical Infrastructure Cybersecurity	Institute for Water Resources	Transportation Systems Center
Curation/Management Archaeological Collections	Interior Design and Space Planning	Tribal Nations Technical Center of Expertise
Dam Safety Modification Mandatory Center of Expertise	Joint Airborne Lidar Bathymetry Center	Utility Monitoring & Control System
Defense National Relocation Program	Marine Design Center	Water Resources Remote Sensing/GIS Technology Center
Electronic Security Center	Medical Facilities	

Legend:

BIM	building information modeling
CAD	computer-aided design
CEEIS	Corps of Engineers Enterprise Infrastructure Services
GIS	geospatial information systems
HTRW	hazardous, toxic, and radioactive waste

JOINT CONSTRUCTION MANAGEMENT SYSTEM

5-26. The JCMS provides a suite of tools that allows engineers to plan contingency locations from design through construction. It allows Soldiers to identify potential sites for contingency basing, adapt standardized designs for basecamps, and develop tailored construction plans, bills of material, cost, labor, and equipment estimates to meet exact mission criteria. The JCMS is available as a desktop application for limited-communication environments and as an online-accessible network repository. The JCMS includes over 900 unified facility criteria compliant standardized designs. The standard designs consist of initial and temporary-level construction designs from site preparation and defensive positions to logistics bases. The most current database designs are available online at JCMS or through the REDi system.

THEATER ENGINEER COMMAND

5-27. 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, environmental considerations, construction, real estate, and other general engineering support tasks 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 operating environment is based.

5-28. 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 also ensures 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, environmental concerns and hazards, and terrain and geospatial products available.
- Know the engineer systems, capabilities, and capacities needed to accomplish identified tasks and the time required for each mission.
- 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 frameworks.
- Integrate environmental considerations and mitigate environmental impacts.
- Plan for the sustainment of engineer operations.
- Ensure that logistics requirements (with special emphasis on engineer unique resources) are analyzed and accounted for to the end state of the operation so that future operations are facilitated.

5-29. 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 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.

5-30. 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 needs to 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.

5-31. 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 the Army design methodology to help understand and frame the OE, frame the problem, develop an operational approach, and reframe (as required). 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.

5-32. Engineer operations are typically resource- and time-intensive. The extended planning horizon available at the operational level offers an opportunity for the theater army engineer to identify required capabilities early. However, to seize the opportunity, some initial decision making is necessary even while the concept of operations is being developed. The commander's visualization will provide an initial concept of operations. This planning guidance reflects 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, thereby providing the theater army engineer the information required to make determinations on what engineer capabilities will be required.

5-33. 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 is rarely the case), 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, design, and construction standard. With these initial decisions, the engineer effort can move to preparation and execution while operational planning continues. For contingency construction standards, see JP 3-34 and ATP 3-37.10.

5-34. 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 remain synchronized with their staff counterparts in the broader operations process.

5-35. TECs synchronize engineer efforts throughout the theater. Through their persistent engagement with the GCC, 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 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 contingency CP. Figure 5-1 shows the alignment of the tasks and roles of the TEC and its contingency CPs across the competition continuum.

5-36. The TEC commander serves as the senior engineer in theater. 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 level engineer headquarters is required. The TEC focuses 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.

Competition Continuum	Strategic Use of Force	TEC Role	TEC Responsibilities	
Cooperation	Assure	TEC Supports Combatant Command	• Mobilization planning • Plans support to Theater Opening • Contributes to OPLAN Engineer Annex • Conducts exercises • Gap crossing analysis	• Supports and writes policy guidance • Focused on US bases • Planning geospatial engineering, terrain analysis, and survey • Reachback capability - Technical Engineering
Adversarial Competition Below Armed Conflict	Deter	TEC Advises JOA Engineer Operations	• CCP deploys forward • TEC Main BPT deploy forward • Mobilize TEC Main to theater	• Support TSC in setting conditions for theater opening • Coordinate with senior contract construction agents • Establish geospatial engineering in theater
	Compel	TEC Synchronizes JOA Engineer Effort	• CCP Forward • TEC Main OPCON to Land Component HQ • Coordinate engineer lines of effort • Follow-on operations planning	• BPT assume command and control of engineer forces • Identify/contract resources • Expeditionary construction • TEC Main assumes coordination of land based engineer effort
Armed Conflict/War	Force	TEC Synchronizes JOA Engineer Effort	• CCP Forward • TEC Main OPCON to Land Component HQ • Coordinate engineer lines of effort	• Assume command and control of assigned engineer forces • Follow-on operations planning
Cooperation	Assure	TEC Supports Host Nation Operations	• Assists restoration of essential services • Support infrastructure development • TEC Main dedeploys engineer forces	• BPT assume command and control of engineer forces • Finalizes plan to turn over to HN • CCP redeploys to CONUS

Legend:

BPT	be prepared to	JOA	joint operations area
CCP	contingency command post	OPCON	operational control
CONUS	continental United States	OPLAN	operations plan
HN	host nation	TEC	theater engineer command
HQ	headquarters	TSC	theater sustainment command

Figure 5-1. Notional TEC deployment model

5-37. The TEC develops plans, procedures, and programs for engineer support for theater army (including RSOI) requirement determination, operational mobility and countermobility, general engineering, electrical power generation and distribution, area damage control, military construction, geospatial engineering, engineering design, construction material, environmental and waste management, 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 level 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.

5-38. 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.

5-39. 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 can support 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 Army forces.

5-40. The TEC can deploy scalable staff specialty capabilities to support the needs of the operational commander. These elements can provide 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, environmental expertise, and support to nation-building capacities).

ENGINEER BRIGADE

5-41. 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. When directed, it may also provide C2 for engineers from other Services and multinational forces. Although an engineer brigade is scalable, there are associated tasks that are best executed at the division level. These tasks include movement control, protection, detention operations, air coordination, and tactical combat force augmentation/employment.

5-42. The execution of complex engineer missions (such as wet-gap crossings, deliberate defenses, and city-wide reconstruction) requires engineer brigade headquarters to augment divisions and functionally aligned corps engineer brigades operating in the corps or theater support areas. Commanders balance modularity and flexibility with dedicated and task organized engineer headquarters (including technical and tactical expertise) during training and during combat operations to fully support maneuver forces.

5-43. Complex operations (such as division-level wet-gap crossing operations) far exceed the span of control, capability, and capacity of the divisionally aligned engineer battalion or the BEB and the division engineer staff section. To sustain operational tempo between interdependent warfighting formations in a wet-gap crossing, a division requires an engineer brigade-level C2 headquarters with the capacity and technical capability to C2 multiple EAD 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 EAD engineer structure task organized across the division.

5-44. Supporting collective tasks of an AO include terrain management, information collection, movement control, area security in support areas, base security and defense, area damage control, and stability. Typically the role of a MEB, engineer brigades can fulfill this mission set early in a deployment cycle if augmented with a support control team, communications teams, fires cell, and intelligence analysts. However, taking on a multifunctional role will risk the functional brigade’s capability and capacity to C2 functional engineer missions.

ENGINEER AND MULTIFUNCTIONAL FORCES

5-45. 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 consider troop formations and tasks that are evident and that provide for the flexibility to mitigate uncertainty.

5-46. Planners use the engineer disciplines and their primary relationships 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 are 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 need to 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.

5-47. 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 are 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 should employ more than their own broad understanding of those requirements.

5-48. 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.

5-49. 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. Considerations 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

5-50. With augmentation from other Services, the theater army can provide a JTF headquarters for contingencies. Other situations may generate requirements for individual augmentation for the in-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 DOD through the expeditionary civilian workforce program.

5-51. 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. For more information on processing operational-needs statements, see AR 71-9.

5-52. 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 Army engineer cell to ensure the coordination and integration of DOD, interagency, and coalition construction missions throughout the theater.

5-53. 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.

5-54. The theater army engineer staff coordinates for the engineer support required for limited contingencies. 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 electrical power generation and distribution.
- Removing debris.
- Performing temporary construction to reinforce weakened superstructures.
- Reestablishing transportation rights-of-way.
- Constructing protective structures.
- Constructing levees to contain rising floodwaters.
- Creating flood prediction models for mapping disaster effects.
- Mitigating compromised or damaged environmental resources or threats to environmental resources.
- Fighting fire.

5-55. Operations from military engagement and security cooperation through large-scale combat typically involve 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. As operations transition between operational categories there is a change from a level of immaturity at the beginning, to the development of established standards and the maintenance of those standards during operations and, finally, to the closure or turnover of bases and other facilities. Lesser-developed theaters or operational areas tend to generate more operational-level engineer effort earlier in the operations process. Table 5-4 shows a general comparison based on the development level.

Table 5-4. 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.
Infrastructure may be primitive or basic.	Infrastructure may be complex or extensive.
Legend: APOD aerial port of debarkation SPOD seaport of debarkation	

5-56. All major operations conducted overseas combine offensive, defensive, and stability operations elements executed simultaneously at multiple echelons. Army forces provide a mix of land combat power that can be tailored for any combination of offensive, defensive, and stability 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 frameworks have less distinct impact than the technical aspects of the engineering tasks; in fact, most operational-level engineering simultaneously supports all the operational frameworks. 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 frameworks.

5-57. While the influence of distinct operational frameworks may be lessened for some technically focused engineering tasks, the overall engineer effort needs to 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 framework and higher echelon engineer operations.

5-58. During the offense, a significant portion of the tailored engineer force tends to have supported 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 level for close support of combat operations. Movement and maneuver requirements are not well defined at higher echelons and are more fluid 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.

5-59. In the defense, operational-level engineer planners are typically unable to generate adequate construction capabilities to support all the subordinate requirements for both movement and maneuver (countermobility) and protection (survivability). Operational-level requirements compete for these same construction capabilities. The operational planner recommends priorities for these capabilities and then works collaboratively with subordinate elements to assist them in mitigating shortfalls.

5-60. When planning for stability operations, engineers consider the broadest range of potential requirements. The operational-level engineer planner considers all 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 may require a broad range

of general engineering support, or they may be conducting combat operations requiring combat engineering with appropriate general engineering capability augmentation. 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.

5-61. Planning for DSCA tasks is significantly different from offense, defense, or stability operations because of the unique nature of the threat. The threat will likely be a natural or man-made disaster, accident, or incident with unpredictable consequences. It is necessary for planners to be aware of the number of statutes and regulations that restrict Army interaction with other government agencies and civilians. Local and state responders normally lead the effort, with a federal response in a support role. Interagency response during DSCA is governed by the National Response Framework.

5-62. The National Response Framework is a guide to how the nation responds to all types of disasters and emergencies. It includes 15 Emergency Support Functions that describe federal coordinating structures that group resources and capabilities into functional areas most frequently needed in a national response. USACE is the lead agency for Emergency Support Function #3, Public Works and Engineering. The lead agency is responsible for planning within their assigned emergency support functions. For more information about the national response framework, see FEMA.

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Chapter 6
Planning

This chapter discusses how engineer planners contribute to combined arms operations through active integration into MDMP. Engineer planners should understand the joint planning processes when supporting joint operations, while utilizing other problem-solving activities that address specific engineer requirements. 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.

SECTION I — PLANNING

6-1. Commanders integrate the input from subordinate commanders and unified action partners into their planning processes. It is essential that engineer leaders understand, and are 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, environmental personnel, and other engineer staff planners integrate directly within the planning staff at each echelon.

ENGINEER SUPPORT TO THE PLANNING PROCESS

6-2. Engineer operations are complex and resource (time, manpower, equipment, material) intensive. They also require proactive and extensive coordination. In addition, 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 need to be directed and synchronized during planning activities of the operations process, requiring the critical reasoning skills and problem-solving techniques inherent in Army planning. 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.

6-3. 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 allocating 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, and stability operations when the 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.

6-4. The tenets of operations are desirable attributes that should be built into all plans and operations, and they are directly related to how the Army's operational concept should be employed. Commanders use the tenets of operations to inform and assess COAs throughout the operations process. The degree to which an operation exhibits the tenets provides insight into the probability for success. The tenets of operations are—

- Agility.
- Convergence.
- Endurance.
- Depth.

6-5. 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. After the breach, a supporting engineer unit may revert from OPCON task organization back 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.

6-6. Table 6-1 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.

Table 6-1. Army command relationships

If relationship is—	Then the inherent responsibilities are: Have command relationship with—	May be task-organized by—	Unless modified, ADCON responsibility goes through—	Are assigned position or AO by—	Provide liaison to—	Establish/ maintain communications with—	Have priorities established by—	Authorities CDR can impose on gaining unit further command or support relationship of—
Organic	Organic HQ	Organic HQ	Organic HQ	Organic HQ	N/A	N/A	Organic HQ	Attached; OPCON; TACON; GS; GSR; R; DS
Assigned	Gaining HQ	Gaining HQ	Gaining HQ	Gaining HQ	N/A	N/A	Gaining HQ	Attached; OPCON; TACON; GS; GSR; R; DS
Attached	Gaining HQ	Gaining HQ	Gaining HQ	Gaining HQ	As required by gaining HQ	Unit to which attached	Gaining HQ	Attached; OPCON; TACON; GS; GSR; R; DS
OPCON	Gaining HQ	Parent unit and gaining unit; gaining unit may pass OPCON to lower HQ	Parent HQ	Gaining HQ	As required by gaining HQ	As required by gaining HQ and parent HQ	Gaining HQ	OPCON; TACON; GS; GSR; R; DS
TACON	Gaining HQ	Parent HQ	Parent HQ	Gaining HQ	As required by gaining HQ	As required by gaining unit and parent HQ	Gaining HQ	TACON; GS GSR; R; DS

Legend:

ADCON	administrative control	GSR	general support–reinforcing
AO	area of operations	HQ	headquarters
ASCC	Army Service component command	N/A	not applicable
CDR	commander	OPCON	operational control
DS	direct support	R	reinforcing
GS	general support	TACON	tactical control

6-7. Table 6-2 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 6-2. Army support relationships

If relationship is—	Then the inherent responsibilities are: Have command relationship with—	May be task-organized by—	Receives sustainment from—	Are assigned position or an area of operations by—	Provide liaison to—	Establish/ maintain communications with—	Have priorities established by—	Authorities a CDR can impose on gaining unit further command or support relationship by—
Direct support	Parent HQ	Parent HQ	Parent HQ	Supported HQ	Supported HQ	Parent HQ; supported HQ	Supported HQ	See note.
Reinforcing	Parent HQ	Parent HQ	Parent HQ	Reinforced HQ	Reinforced HQ	Parent HQ; reinforced HQ	Reinforced HQ; then parent HQ	Not applicable
General support–reinforcing	Parent HQ	Parent HQ	Parent HQ	Parent HQ	Reinforced HQ and as required by parent HQ	Reinforced HQ and as required by parent HQ	Parent HQ; then reinforced HQ	Not applicable
General support	Parent HQ	Parent HQ	Parent HQ	Parent HQ	As required by parent HQ	As required by parent HQ	Parent HQ	Not applicable
Note. 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.								
Legend: CDR commander HQ headquarters								

6-8. Engineers conduct planning at the national strategic, theater strategic, operational, and tactical levels. It is important to understand planning within the context of the levels of warfare. 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 warfare. 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.

6-9. 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 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 supports 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.

6-10. In planning at every level, the engineer planner should consider several of the following:

- **Speed.** Engineer tasks are resource-intensive in terms of time, materials, manpower, and equipment. Practices that support speed include using 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 should have authority that is consistent with responsibilities.
- **Establishment of priorities.** Priorities and resource allocation needs to 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

6-11. 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 C2 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.

6-12. 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

6-13. 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

6-14. Within Army forces, 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 CCMD level. At the corps and division levels, the majority of the workload is required to support database management, mission planning, and the IPOE. Below the division level, geospatial engineering is increasingly focused on current operations and updating the SSGF for the COP.

6-15. The corps and division teams (and the GEOINT 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. The geospatial engineer team requires access to the classified tactical network to update and disseminate SSGF. The geospatial engineer team that is organic to the corps and division collects and provides updated geospatial data and products in support of corps and division operations. For more information about GEOINT, see ATP 2-22.7.

6-16. A GPC is assigned to each Army command and Special Dissemination Command to provide geospatial operational planning; the generation, management, analysis, and preparation of maps, geospatial updates, and geospatial 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 network access (up to and including classified tactical local area network) to update and disseminate GD&I and products. GPCs are responsible for managing the TGD.

6-17. 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.

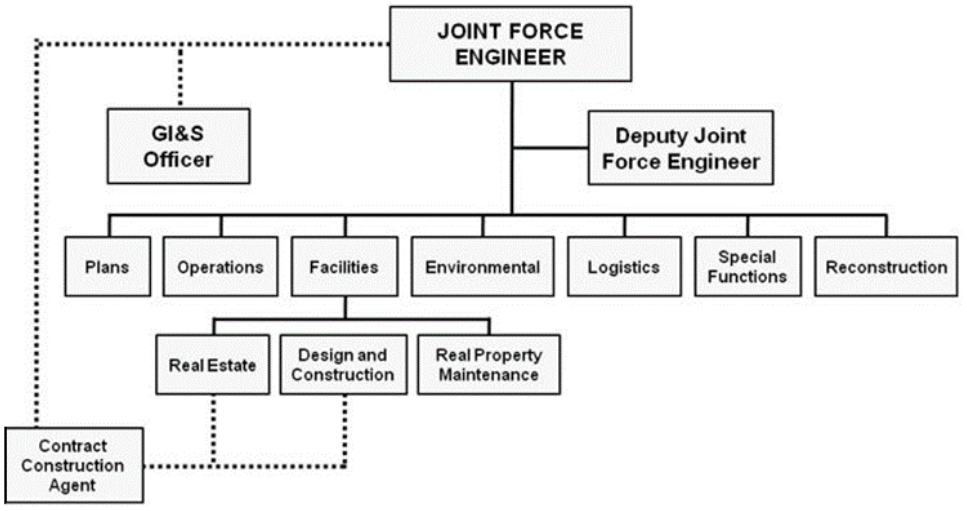
6-18. The NGA produces digital terrain and feature data, which is available to users via the Web or directly from the NGA. The Defense Logistics Agency distributes maps. The geospatial engineer can request imagery, which can be used for spatial and temporal reasoning or multispectral analysis products that are customized to meet 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

6-19. 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 the following:

- **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.

6-20. A CCMD engineer staff assists the 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 6-1, page 102.



Legend:

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

Figure 6-1. Notional joint engineer staff

6-21. 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.
- Surveying sites, researching site aspects and histories, and advising on site selections.
- 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 material 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.

6-22. 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, including 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, including 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.

6-23. Engineer forces, units, and individual augmentees are 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

6-24. 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, EAD engineer planners will also frequently take information from and use the ESP. For information on order formats, see FM 5-0.

6-25. 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). 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. The format for joint plans and orders is in CJCSM 3122.05 and JP 5-0.

6-26. 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.

6-27. The Army OPORD format should 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, sustainment, and signal.

Engineer Support Plan

6-28. Joint interdependence requires higher headquarters to understand joint planning doctrine. Army force headquarters should 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 need to 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. The ESP does not provide a format guide for either OPORDs or OPLANs, but it does broadly follow an order outline. The format for the ESP is described in CJCSM 3122.05.

Sustainment Support for the Engineer Unit

6-29. Support planning and execution needs to 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, health service support, human resources support, financial management support, legal support, religious support, and band support. For units augmenting the division engineers and all other units operating at EAD, integration into an area and/or theater support structure is required. For information on sustainment support, see FM 4-0.

6-30. Engineers operating above the BCT level work closely with, and receive sustainment support from, the sustainment brigade. The sustainment brigade normally has a general support relationship with supported units. 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.

6-31. 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 should 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. Engineer Units are dependent upon the Forward Support Company for fuel, and supplemental transportation of Class IV and Class V supplies as well as support for limited field maintenance. For the Engineer Battalion, sustainment will be provided by a mobilized Sustainment Brigade when it arrives in theater. The Combat Sustainment Support Battalion (CSSB) supports EAD units, multifunctional brigades (MEBs, field artillery brigades, and CABs), and functional support brigades (military police, signal, and engineer brigades) on an area basis.

COMMAND AND CONTROL OF ENGINEER FORCES

6-32. 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. Situations where the supported unit does have an assigned engineer staff at EAD 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.

6-33. During extended periods of communication breakdown, C2 becomes more difficult as shared understanding of a situation deteriorates over time. To maintain C2 with degraded communication, personnel should be trained and proficient in—

- Employing all available C2 systems.
- Operating dispersed CPs.
- Maintaining an other-than-digital COP.
- Managing information with analog processes.
- Monitoring communications channels and crosstalk across echelons.
- Maintaining manual running staff estimates.
- Conducting CP battle drills.

WORKING GROUPS, BOARDS, AND CELLS

6-34. 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. For more information on working groups, boards, and cells, see FM 6-0.

6-35. Commanders and staff engineers manage their personnel to ensure that critical meetings, working groups, boards, and cells have the right engineer representation. Senior engineers should 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 feed into other decision-making boards (such as the Protection Working Group, Joint Facility Utilization Board, or the Joint Targeting and Coordination Board) to drive future actions, funding, approvals, or engineer effects in the AO.

6-36. The geospatial engineering units available to the commander may become part of the command's GEOINT cell. The GEOINT cell is comprised of the people and capabilities that constitute the GEOINT support, including imagery and geospatial assets. The cell ensures that GEOINT 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 GEOINT officer; they may work for their parent unit but coordinate efforts across staff directorates.

SECTION II — THE PLANNING PROCESS

6-37. 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

6-38. Although they are not fully developed planning methodologies, engineers use several 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

6-39. 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. FM 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 advises 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.

6-40. The engineer staff officer 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. The engineer staff officer at each echelon is also 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 specific information and intelligence requirements.
- 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 medical evacuation requirements or coverage issues for engineer units and coordinates with medical planners to ensure that the supporting unit can provide engineer specific evacuation.
- 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 and monitors and advises on (as required) the implications of statutory, regulatory, and command policies for the procurement of construction materials.

Note. A critical issue for the engineer staff officer is the timely delivery of the required specified supplies, regardless of the source of the 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.

6-41. The staff assigned to the BCT and above includes engineers in various sections and cells. One of these engineers, typically the senior engineer officer on staff, is designated as the engineer staff officer. 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.

6-42. Usually the role of the engineer unit commander, some situations may warrant that the engineer staff officer also be designated as the advisor to the maneuver unit commander. In this instance, in addition to their responsibilities as the engineer staff officer, they would advise the commander on the integration and synchronization of engineer assets across the three disciplines.

6-43. In other instances, it may be the engineer unit commander (and their staff) that fills both roles. This is a special circumstance that must be carefully considered as executing the duties of the engineer staff officer for the supported unit may interfere with the commander's responsibilities for C2 of their subordinate units.

6-44. It may even be desirable to assign overlapping roles to both the engineer unit commander and the engineer staff officer by splitting their focus across the engineer disciplines. For example, the engineer unit commander would focus on combat engineering in the close fight, whereas the engineer staff officer would focus on general engineering in the rear area and geospatial engineering.

6-45. Ultimately, it is the supported unit commander's decision on whom to assign which role to. The decision should be made early and be clearly communicated.

6-46. Regardless of the designated roles and responsibilities, a relationship will exist between the supported unit's engineers on staff and the engineer unit commander. These relationships should be defined early and responsibilities for each role codified in standard operating procedures. They must work together to ensure the seamless integration and synchronization of engineer capabilities for the supported unit.

6-47. Considerations for determining the designation of the engineer staff officer and the engineer advisor include the following:

- What staff assets are available to support the engineer staff officer 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 officer vs. 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, work 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 officer 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 maintain close coordination with the supporting engineer unit commander and staff to ensure a synchronization of effort.

6-48. At the task force and company levels the considerations are different. Task forces may have a designated engineer planner, but the engineer is not typically organic at these echelons. When the supported unit does not have a designated engineer, the senior engineer leader of the supporting unit will typically fill that role in addition to their responsibilities as the engineer unit leader. Commonly referred to as the task force engineer, the roles and responsibilities are similar to those of both the advisor and engineer staff officer. (For more information on the task force engineer see ATP 3-34.22.)

6-49. 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.

6-50. Additionally, 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.

6-51. 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 should 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 retains 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 works 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.

6-52. Within engineer units, leaders and staffs 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.

6-53. Engineer commanders and the engineer staff officer 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.

6-54. To facilitate effective parallel planning at the engineer unit level, engineer unit commanders and staff planners need to—

- 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 frameworks, including 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.

ENGINEER STAFF RUNNING ESTIMATE

6-55. 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's 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.

6-56. 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. In addition, the allocation of engineer assets and resources assists in determining the command and support relationships that will be used. Table 6-3 shows the relationship between the MDMP and the engineer staff running estimate.

Table 6-3. Military decision-making process and engineer staff running estimates

Military Decision-making Process	*Engineer Staff Running Estimate*
Mission analysis. • Analyze the higher headquarters plan or order. • Perform the initial IPOE. • 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 IPOE 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.

Table 6-3. Military decision-making process and engineer staff running estimates (continued)

Military Decision-making Process	*Engineer Staff Running Estimate*
COA development.	**Develop the scheme of engineer operations.** • Assess 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. For additional information on the scheme of engineer operations and scheme of engineer support, see FM 6-0.
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	IPOE	intelligence preparation of the operational environment
COA	course of action	M/CM/S	mobility, countermobility, and survivability
EEFI	essential elements of friendly information		

INTELLIGENCE PREPARATION OF THE OPERATIONAL ENVIRONMENT

6-57. IPOE is an integrating process critical to the success of planning. *IPOE* is a systematic process of analyzing the mission variables of enemy, terrain, weather, and civil considerations in an AOI to determine their effect on operations (FM 2-0). To be effective, IPOE needs to—

- Define the commander's AOI 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 effects 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 IPOE 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 complex analysis involves the commander and the entire staff working together to determine these effects.

6-58. IPOE 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 needs to understand the brigade intelligence staff officer threat capabilities statement and situation template to analyze enemy engineer capabilities. Engineer reconnaissance may be required to support IPOE, and the engineer staff should 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. Geospatial engineers play an integral role in the IPOE process by providing necessary SSGF to layer and template intelligence considerations for spatial and temporal analysis (see ATP 2-01.3).

6-59. The four steps of IPOE include the following:

- **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. The entire staff determines the effects of friendly and threat force actions on the population.
- **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.

6-60. 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.

6-61. 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 types of operations (see table 6-4).

Table 6-4. Types of operations

Defense	
Operation: • Mobile defense. • Area defense. • Retrograde.	**Considerations:** • Planning begins with the use of terrain products to visualize how best to shape the terrain, including 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 6-4. Types of Operations (continued)

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.
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, cultural, and environmental 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 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 dictate a command and support relationship.

PLANNING INTEGRATION ACROSS WARFIGHTING FUNCTIONS

6-62. 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.

6-63. Informed by their analysis of the OE, operational-level engineer planners assist in defining an AO, estimating the 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.

6-64. The MDMP serves as the primary tool for Army operational planning. Along with their staff counterparts, operational level 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 6-5.

Table 6-5. 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.	• Identify requirements for geospatial information and 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. • Provision of financial management services.	• 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 systems. • Identify potential sources of construction equipment and construction materials.

Table 6-5. Planning integrated across warfighting functions (continued)

Warfighting Function	*Engineer Planning*
Sustainment (continued):	• 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. • Integrate environmental considerations and requirements. • Determine waste management operations and requirements.
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. • Conduct electromagnetic protection. • Conduct area security. • Conduct operations security. • Conduct cybersecurity and defense.	• 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 hazards and impacts. • Conduct EH threat assessment and support. • Plan for support to CBRN defense to include supporting decontamination sites and survivability.

Legend:

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

PLANS AND ORDERS

6-65. 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.

6-66. 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 should review other sections. Engineers ensure the integration of geospatial support and environmental considerations 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. In addition, 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.

6-67. 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.

6-68. 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.

6-69. The engineer staff officer is the primary staff integrator and advisor to the commander for environmental considerations. In plans and orders, environmental considerations are included in coordinating instructions and as standalone annexes or appendices based on the level of command and scope of the operation. (See ATP 3-34.5 for an example of an environmental appendix.) In addition, environmental aspects and concerns should be addressed by every staff officer, as applicable, and included in their respective annexes and appendices. 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.

SUSTAINMENT PLANNING

6-70. 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 need to coordinate and synchronize operations with the elements of sustainment. This occurs at all levels of warfare 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. Table 6-6 lists some of the engineer planning considerations.

Table 6-6. Engineer considerations in the military decision-making 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, including 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 (including 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. • Analyze site data, and highlight potential hazards to health, safety, and the mission, as well as environmental resources and species of concern.
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.

Table 6-6. Engineer considerations in the military decision-making process (continued)

MDMP Steps	*Engineer Considerations*
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 mid-project inspections. • Participate in engineer-related boards. • Maintain as-built and redline drawings. • Project turnover activities.

Legend:

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

FACILITIES AND CONSTRUCTION PLANNING

6-71. 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. For more information on construction estimating and construction project management, see TM 3-34.41 and TM 3-34.42.

6-72. Engineers plan for the acquisition, management, and ultimate disposal of uncontaminated land and facilities, including—

- Operational facilities (base camps, CPs, airfields, and 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, and hygiene facilities).
- Common-use facilities (roads and facilities for joint RSOI).
- Protection facilities (site selection, proximity to potential threat areas, and sniper screening).
- Environmental surveys and reports, and occupational environmental health site assessments.

6-73. 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

6-74. 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

6-75. Adequate funding needs to be available to undertake the early engineer reconnaissance and acquisition of facilities to meet requirements, whether by construction or leasing. For construction funding information, see JP 3-34. 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 should 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

6-76. 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 needs to consider other planning factors. For additional discussions of construction standards, see ATP 3-34.40 and JP 3-34.

UNIFIED FACILITIES CRITERIA

6-77. 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.

6-78. Unified facilities criteria are living documents that are 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.

6-79. General engineer planners 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 and utilities). Because the availability of construction materials may vary greatly in various AORs, standards of construction may greatly differ between them. CCDRs also often establish standards for construction in OPORDs and fragmentary orders that may take precedence over guidebooks. Planners should 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

6-80. 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 United States Army Engineer School, UROC, the Air Force Civil Engineer Support Agency, and the NAVFAC.

6-81. 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

6-82. Applications of engineer support efforts at EAD should 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 EAD 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

6-83. 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 6-5, page 113).

6-84. As engineer requirements are identified and continually refined, the engineer disciplines offer organization into categories of related capabilities and activities (see table 6-7, page 120). Assessments of engineer requirements, in terms of the engineer disciplines, assist in tailoring the engineer force.

Table 6-7. Capabilities and activities organized by engineer disciplines

Combat Engineering	
Capabilities: • Organic engineer elements. • Force pool. • Other. ▪ Joint (Marines). ▪ Multinational. ▪ HN.	**Activities**: • Conduct mobility. • Conduct countermobility. • Conduct survivability.
General Engineering	
Capabilities: • Force pool. • USACE. • Other. ▪ Joint (Navy, Air Force). ▪ Multinational. ▪ HN. ▪ 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. • Adherence to environmental requirements, standards, and agreements. • Construct waste and distribution facilities.
Geospatial Engineering	
Capabilities: • Organic engineer elements. • Force pool. • USACE field force engineering. • Other. ▪ Joint (Navy, Air Force, and nongovernmental organizations). ▪ Multinational. ▪ HN. ▪ Interagency.	**Activities**: • Conduct geospatial engineering and functions (generate, manage, analyze, and disseminate).
Legend: HN host nation USACE United States Army Corps of Engineers	

COORDINATION AND CONTROL

6-85. 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 non-engineer 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. Table 6-8 summarizes the considerations for the three engineer headquarters elements available from the force pool to provide C2 for engineer capabilities and missions.

Table 6-8. 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 CCPs 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 CCPs 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 often provides C2 for the JFC if an operational level 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.

Table 6-8. 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. • 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 units 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. • Engineer battalions are typically found within the engineer brigade, the MEB, or in support of a BCT.

Legend:

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

FUNCTIONAL CONTROL AND CONTROL MECHANISMS

6-86. 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, and 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).

6-87. Some of these control measures are directed by the GCC and the JFC; others are established by the ASCC and the joint force land component commander. 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

6-88. 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 those risks with mission benefits. ATP 5-19 describes the risk management process.

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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 need to 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.

PRINCIPLES OF SUSTAINMENT

7-1. 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 Army forces with endurance. The sustainment challenges for engineer support make it essential that engineer leaders and staffs effectively apply these principles. This section describes ways in which engineers apply the principles of sustainment.

7-2. Engineers integrate sustainment with engineer plans. It is crucial that sustainment is not an afterthought. Engineers need to coordinate and synchronize their operations with the elements of sustainment. This occurs at all levels of warfare 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.

7-3. Engineers need to visualize future operations and identify the appropriate required support. They should then start the process of acquiring the material or placement of support that best sustains the operation. As early as possible, engineers 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 do this long before specific engineer missions are assigned to specific engineer units. Otherwise, sufficient resources will likely be unavailable when needed. Engineers also anticipate requirements for financial management and contract management support for the local procurement of construction materials and services and repair parts. They should anticipate requirements for fuel and for maintenance support and other supplies and services common to all units.

7-4. 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.

7-5. The engineer staff officer needs to 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 should be anticipated and planned for during mission analysis.

7-6. Engineers should develop and maintain responsiveness. They 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.

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

7-8. For simplicity, engineers use mission-type orders and standardized procedures. 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.

7-9. 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.

7-10. Engineers need to safeguard the resources they need to sustain their units and accomplish their mission. In addition to protecting their own units, personnel, and equipment, engineers should also emphasize security and protection for Class IV and Class V supplies. Consider employing camouflage and concealment as well as overhead cover. Engineer resources are not easily resupplied and may present a tempting target for enemy action.

7-11. 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. Materials and products require proper transportation, handling, storage, and disposal. Military operations generate large quantities of wastes, and engineers need to develop guidance and oversee integrated waste management programs. For example, wastewater, medical waste, hazardous waste, and solid waste require constant management and proper disposal.

7-12. 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.

7-13. When faced with unexpected situations or circumstances, it is essential that engineers improvise. They should be aware of the resources available in the local area and should regularly train on using improvised methods of accomplishing engineer tasks.

ORGANIZATIONS AND FUNCTIONS

7-14. 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 the sustainment organizations described in ADP 4-0, some organizations provide support to engineers more frequently than others.

ENGINEER LEADER AND STAFF RESPONSIBILITIES FOR SUSTAINMENT

7-15. 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 should 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 should 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 works 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.

7-16. Within engineer units, leaders and staffs 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

7-17. 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 Class 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 medical evacuation requirements or coverage issues for engineer units and coordinates with medical planners to ensure that the supporting unit can provide engineer specific evacuation.
- 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 countermobility and survivability efforts.
- Provides the appropriate S-4 or G-4 an initial estimate of required Class IV supplies in support of construction and monitors and advises implications of statutory, regulatory, and command policies for the procurement of construction materials (as required).

Note. A critical issue for the engineer staff officer is timely delivery of the required specified supplies, whatever the source of the construction materials.

- Tracks the flow of mission-critical Class IV and Class 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 and area clearance operations and tracks their status at the main CP in conjunction with the explosive hazard coordination cell.
- Coordinates for EOD support and integration, as necessary.
- Advises the commander on environmental policies and site surveys, assists in integrating environmental considerations into the MDMP, and analyzes the environmental impacts of all proposed COAs, projects, and decisions.

ENGINEER UNIT COMMANDER

7-18. 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.
- Oversees development of unit environmental programs and ensures legal compliance with the appropriate federal, state, HN, and local laws, regulation, and environmental requirements.
- Monitors equipment locations and maintenance status.
- Updates the engineer-specific Class IV and Class 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 organic health service support personnel 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

7-19. 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, II, III, IV, V, and IX 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 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.

7-20. 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.

7-21. 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.

7-22. Engineer staff officers should seek to leverage applicable tools and software, when possible, in the maintenance of running estimates. In addition to time savings these tools enable more accuracy in estimates and in predictive and prescriptive analysis.

7-23. 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 EAD 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 EAD engineers is essential. Supporting EAD engineer units need to affect linkup with the existing engineer sustainment to ensure their synchronization of effort.

7-24. 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 Army forces 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.

7-25. Engineers consider the environmental aspects of sustainment planning. They are responsible for completing environmental risk assessments and integrating environmental considerations into each step of the MDMP. Engineers need to ensure that environmental conditions are surveyed and recorded, as required, throughout the life cycle of an occupied site; environmental policies are followed and impacts are mitigated; and waste storage, collection, and disposal are properly managed. For information about environmental considerations, see ATP 3-34.5. For information about waste management for deployed forces, see TM 3-34.56/MCRP 3-40B.7.

SUSTAINMENT CHALLENGES FOR ENGINEER SUPPORT

7-26. 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.

7-27. 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.

7-28. 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 capable of maintaining and repairing engineer equipment may also be limited, increasing the difficulty of keeping engineer equipment operational.

7-29. Engineer equipment also consumes large amounts of fuel (higher than most equipment found in infantry 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.

7-30. 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.

7-31. All 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.

7-32. 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.

7-33. 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.

7-34. Waste management can also be a significant challenge. The equipment, funding, and space requirements for effective waste management programs should be planned and included in the contracting services and construction timelines to ensure that they are in place when needed. Local or HN municipal waste services may not be available or usable, placing the burden for waste management on the deployed force. Units should be prepared to bear the entire burden for waste disposal, especially during the initial phases of an operation when sustainment infrastructure has not been established. Also, units should be prepared for population surges. They monitor waste management systems to anticipate if design capacities will be exceeded, and they need to meet the challenges of managing additional waste requirements.

7-35. All these challenges are predictable, and none of them should surprise engineer leaders or the staffs that support them. Engineers and staffs should 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 need to 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.

Appendix A
Defense Support of Civil Authorities

A-1. DSCA includes operations that address the consequences of natural or man-made disasters, accidents, and incidents within the United States and its territories. Army forces 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 (see 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.

A-2. 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 Army forces providing C2, protection, and sustainment to government agencies until they can function normally. Table A-1, page 130, shows a notional application of engineering capabilities supporting DSCA. The institutional force elements, including USACE, play a critical and substantial role in DSCA.

A-3. 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. 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 reconnaissance and technical advice.
- Constructing waste treatment and disposal facilities.
- Providing base and base camp construction
- Providing electrical power generation and distribution.
- Conducting infrastructure reconnaissance, technical assistance, and damage assessments.
- Conducting emergency demolitions.
- Conducting debris- or route-clearing operations.

A-4. 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 Army forces 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 Army forces 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.

Table A-1. Notional engineer support to DSCA operations

Engineer Support		
General Engineering Discipline	***Combat Engineering Discipline***	***Geospatial Engineering Discipline***
• Provide Horizontal Construction • Provide Vertical Construction • Provide LOC Construction • Provide LOC Repair/Maintenance • Conduct Infrastructure Reconnaissance • Provide Electrical Power Generation and Distribution • Provide Utilities • Provide Sanitation Services • Provide Survey and Design • Manage Construction • Provide Engineer Advice • Perform Firefighting	• Conduct Reconnaissance • Construct Assault Bridging • Construct Combat Roads • Provide FACE	• Generate/Collect Geospatial Data • Manage Map Data • Analyze Terrain • Partner with Local Authorities to Share Geospatial Data/Information • Advise Commander on Terrain Considerations • Answer Terrain Related Questions • Manage SSGF for Unit COP • Disseminate Hard and Soft Terrain Related Products • Provide Digital Services
Legend: COP common operational picture FACE forward aviation combat engineering LOC line of communication SSGF standard and shareable geospatial foundation		

A-5. 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, sanitation services, and electrical power generation and distribution.
- 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.

A-6. DSCA may require an immediate response. USACE maintains a constant 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.

A-7. Engineer units tasked to perform urban search and rescue (rescuer) and, urban search and rescue (extraction), during DSCA, are qualified 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

A-8. 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 need to 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. For additional information about DSCA and the National Response Framework emergency support functions, see ADP 3-28.

Note. Environmental management and compliance is tasked under domestic government agencies, such as the United States Environmental Protection Agency or Fish and Wildlife Service.

A-9. 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, electrical power generation and distribution, and firefighting). Engineer commanders and staff work with the planners to identify requirements and plan engineer applications.

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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

AA	avenue of approach
ADP	Army doctrine publication
AGC	Army Geospatial Center
AFPAM	Air Force pamphlet
AO	area of operations
AOI	area of interest
AOR	area of responsibility
APOD	aerial port of debarkation
AR	Army regulation
ASCC	Army service component command
ATP	Army techniques publication
BCT	brigade combat team
BEB	brigade engineer battalion
C2	command and control
CBRN	chemical, biological, radiological, and nuclear
CCDR	combatant commander
CCMD	combatant command
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
DD	Department of Defense
DOD	Department of Defense
DSCA	defense support of civil authorities
EA	engagement area
EAD	echelons above division
ENVST	environmental support team
EOCA	explosive ordnance clearance agent
EOD	explosive ordnance disposal

ESP	engineer support plan
ERDC	Engineer Research and Development Center
FEST-A	forward engineer support team–advance
FEST-M	forward engineer support team–main
FFE	field force engineering
FM	field manual
GCC	geographic combatant command
GD&I	geospatial data and information
GEOINT	geospatial intelligence
GI&S	geospatial information and services
GPC	geospatial planning cell
HN	host nation
HR3D	High Resolution 3-Dimensional
IPOE	intelligence preparation of the operational environment
JCMS	joint construction management system
JFC	joint force commander
JOA	joint operations area
JP	joint publication
LNO	liaison officer
M/CM/S	mobility, countermobility, and survivability
MCRP	Marine Corps reference publication
MCTP	Marine Corps tactical publication
MCWP	Marine Corps warfighting publication
MDMP	military decision-making process
MEB	maneuver enhancement brigade
MSCOE	United States Army Maneuver Support Center of Excellence
NATO	North Atlantic Treaty Organization
NAVFAC	Naval Facilities Engineering Command
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
SPOD	seaport of debarkation
SSGF	standard and shareable geospatial foundation
STANAG	standardization agreement (NATO)
TC	training circular
TEC	theater engineer command
TGD	theater geospatial database

TM	technical manual
UAS	unmanned aircraft system
UROC	USACE Reachback Operations Center
U.S.	United States
USACE	United States Army Corps of Engineers
USC	United States Code

SECTION II – TERMS

countermobility

Is a set of combined arms activities that use or enhance the effects of natural and man-made obstacles to prevent the 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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Index

Entries are by paragraph number.

A–B

assured mobility. 1-15, 1-21, 3-12, 6-38

C–D

close combat. 1-5, 1-19, 3-12–3-13, 3-15, 3-18

combat engineer company. 4-14, 4-32, 4-34, 4-35, 4-36, 4-37, 4-38, 4-39, 4-40, 4-41, 4-42,

combat engineer units. 1-23, 1-24, 1-25, 1-37, 1-44, 2-95, 2-118, 3-13, 4-14

combat engineering. 1-5, 1-6, 1-8, 1-19, 1-23, 1-26, 1-31, 1-44, 1-87, 2-14, 2-61, 2-84, 2-91, 2-94, 2-96, 2-100, 2-113, 2-114, 2-154, 3-3, 3-15, 3-19, 4-12, 4-14, 4-35, 4-37, 4-39, 4-41, 4-48, 5-28, 5-47, 5-58, 5-60, A-5

combat engineers. 1-6, 1-20, 1-24, 1-32, 1-38, 1-53, 1-56, 2-62, 2-63, 2-95, 3-12, 3-14, 3-15, 3-16, 3-23, 3-26, 3-33, 4-59

combined arms. 2-3

command and control warfighting function. 3-5
definition. 3-5

E

engineer disciplines. 1-4, 1-8, 1-17, 1-19, 1-39, 1-42, 1-53,

engineer operations. 1-2, 1-13–1-15, 1-17, 1-66,

engineer reconnaissance teams. 1-37, 2-106, 3-23

engineer work line. 3-9, 6-79
definition. 3-9

F

field force engineering. 5-12, 5-15

fires warfighting function. 3-26
definition. 3-26

force projection. 1-53 – 1-58

G–H

general engineer. 1-20, 2-64, 2-131, 3-19, 3-30, 3-33, 7-7

general engineer unit.1-10, 1-23, 3-13,3-14, 4-13, 4-15, 6-72

general engineering.1-8 – 1-10,1-58, 1-60, 2-62, 3-19, 3-3, 3-33, 4-6, 4-12, 4-66, 5-47, A-2

geospatial engineering. 1-5, 1-11 – 1-15, 1-35, 1-96, 2-9, 2-14, 2-106, 2-152, 3-3, 3-20, 3-25, 4-21, 4-43, 4-51, 5-47, 6-14, 6-36,

geospatial intelligence. 2-144, 3-20, 4-51, 5-9, 6-15,6-36

geospatial information and services. 1-11,1-80, 1-88, 2-134, 3-25, 6-19,
definition. 3-25

I

intelligence warfighting function. 3-3, 3-20
definition. 3-20

J–L

levels of war. 1-76, 1-77, 2-19, 6-8, 6-63

lines of engineer support. 1-16 – 1-19. 1-33, 3-22,

M–N

mission command. 3-10, 4-54, 6-79,

movement and maneuver warfighting function. 1-20,1-26, 2-91, 2-131, 3-12, 3-30, A-5
definition. 3-12

O

obstacles. 1-23,1-28 –1-39, 1-58, 1-72, 1-73, 2-56, 2-63, 2-67, 2-70 – 2-82, 2-98, 2-103, 2-106 – 2-110,

operational environment. 1-66 –1-75, 6-51, 6-52

P–R

protection. 1-33

protection warfighting function. 3-33, 1-42, 1-87, 2-64, 3-3, 5-27, 5-28,5-47, 5-60, 6-19
definition. 3-33

S–T

survivability operations. 1-39, 1-42 – 1-44, 1-100, 2-93, 3-15, 3-33,

sustainment warfighting function. 1-87, 2-14, 2-64, 3-3, 3-19, 3-29
definition. 3-29

U–Z

unified action. 1-17, 1-72, 3-2,
definition. 2-12

unified action partner. 1-74, 1-75, 1-78, 1-79, 2-12, 2-18, 2-23, 2-32, 2-57, 2-85, 2-124, 2-135, 2-136, 2-148, 4-1, 4-63, 5-53, 5-54, 6-1,

unmanned aircraft systems. 1-98 – 1-101

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FM 3-34

16 December 2025

By Order of the Secretary of the Army:

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