APPENDIX B
ENGINEER ESTIMATE

The engineer estimate is an extension of the command-estimate procedure. It is a logical thought process that is conducted by the engineer staff officer concurrently with the sup ported maneuver force's tactical planning process. The engineer-estimate process—

- Generates early integration of the engineer plan into the combined arms planning process.
- Drives the coordination between the staff engineer, the supported commander, and other staff officers.
- Drives the development of detailed engineer plans, orders, and annexes.

Each step of the engineer-estimate process corresponds to a step of the command-estimate procedure. Like the command estimate, the engineer estimate is continuously refined. Table B-1 shows the relationship between these two estimates. A more detailed discussion of each step of the engineer estimate process is found in the following paragraphs. The command-estimate procedure provides the framework for discussion of the corresponding engineer-estimate actions.

Table B-1. Estimate of the situation and engineer estimate

Estimate of the Situation	Engineer Estimate
Mission	Mission
Facts and Assumptions	lPB/EBA
Mission Analysis	Engineer Mission Analysis
Commander's Guidance	Scheme of Engineer Operations Development
COA Development	Engineer Plan (War-Game and Refine)
COA Analysis	COA Recommendation
Decision	Final Engineer Plan
Actions and Orders	Orders

RECEIVING THE MISSION

The staff engineer quickly focuses on several essential components of the basic order and engineer annex when he receives the mission. These are—

Ž The enemy situation.

Ž The mission paragraph.

- The task organization
- The logistics paragraph.

Ž The engineer annex.

- The topographic operations annex
- The type of operation (offensive or defensive).
- The current intelligence picture.
- The terrain analysis.
- The assets available.

Ž The time available (estimate).

FACTS AND ASSUMPTIONS

Developing and refining facts and assumptions is a continuous process. The maneuver commander relies on the staff to present him with facts and assumptions on which he can base his mission analysis, restated mission and course-of-action development. Facts and assumptions pertain to the enemy as well as the friendly situation. The staff engineer uses the EBA as the framework for developing facts and assumptions.

ENGINEER BATTLEFIELD ASSESSMENT

The EBA consists of three parts (see Table B-2):

Table B-2. Engineer battlefield assessment

- Develops facts and assumptions about--
  - Enemy engineer weaknesses.
  - Critical friendly engineer capabilities and requirements.
- Mutually supports the G2/S2's IPB.

Ž Contains three components:

- Terrain analysis.
- Enemy mission and engineer capability.
- Friendly mission and engineer capability.

Ž Terrain analysis.

Ž Enemy mission and engineer capabilities.

• Friendly mission and engineer capabilities.

TERRAIN ANALYSIS

Terrain analysis is a major component of the IPB. The objective of the terrain analysis is to determine the impact that the terrain (including weather) will have on mission accomplishment. The staff engineer supports the intelligence officer in this process. Normally using the OCOKA framework (see Table B-3), they determine what advantages or disadvantages the terrain and anticipated weather offer to both enemy and friendly forces. This process has direct impact on planning engineer operations. See Table B-4, page B-4, for examples of how the components of OCOKA may impact engineer support.

ENEMY MISSION AND ENGINEER CAPABILITIES

Threat analysis and threat integration are also major components of the IPB. Enemy mission and engineer capabilities are subcomponents of the threat analysis and threat integration process. The staff engineer supports the intelligence officer during the threat evaluation by focusing on the enemy's mission as it relates to enemy engineer capability. When executing this component of the EBA, the staff engineer must first understand the enemy's anticipated mission (attack or defend) and consider how enemy engineers will be doctrinally employed. The staff engineer then develops an estimate of the enemy's engineer capabilities. To do this, he uses the G2/S2's order of battle and knowledge of enemy engineer organizations and other assets (such as combat vehicle self-entrenching capabilities) that may impact engineer operations. The staff engineer must also consider hard intelligence pertaining to recent enemy engineer activities.

Table B-3. EBA terrain analysis

• Analysis of the terrain's impact on the battle using the OCOKA framework
- Observation and fields of fire.
- Cover and concealment.
- Obstacles.
- Key terrain.
- Avenues of approach.
• Advantages/disadvantages the terrain offers the enemy and the friendly force.
Ž Conclusions on the terrain's impact on accomplishing the mission.

Table B-4. OCOKA and sample engineer effects on planning

OCOKA	Examples of Effects on Engineer Support
Observation and Fields of Fire	Offense: Planning obscuration/location of the support force for breach operations. Defense: Obstacle distance from direct-fire systems (might also affect obstacle composition with reduced standoff). Limited fields of fire might limit certain obstacle effects (for example, fix and block).
Cover and Concealment	Offense: Planning obscuration.assault positions for breach operations. Impacts feasibility of conducting a covert breach. Defense: Tying In reinforcing obstacle to existing obstacles might require an increased counter-mobility effort.
Obstacles	Offense: Task organizing special engineer mobility assets (AVLBs and ACES). Plotting enemy countermobility effort, tying into existing obstacles. Defense: Tying In reinforcing obstacle to existing obstacles might require an increased countermobility effort.
Key Terrain	Offense: Targeting indirect-fire suppression and obscuration for breach operations. Defense: Obstacle intents tied to how valuable the key terrain is for retention.
Avenues of Approach	Offense: Capability to conduct in-stride, deliberate, and covert breaching operations. Focusing countermobility effort in a transition to a hasty defense. The need for flank protection. Defense: Focusing specific obstacle effects in a specific location in an avenue of approach. Size of avenue of approach impacts on required countermobility effort.

The staff engineer then uses the G2/S2's situation template and the enemy's capability estimate to plot the enemy's engineer effort and its location. Coordinating with the G2/S2, the staff engineer recommends PIR and the engineer force necessary to augment the reconnaissance effort that will confirm or deny the situation template. Enemy engineer activities must be organic to the total combined arms R&S plan. See Table B-5 for a quick summary on enemy mission and engineer capability analysis. In the defense, the SM engineer plots—

- The enemy's mobility capabilities and location in the enemy's formation.

B-4 Engineer Estimate

Table B-5. EBA enemy mission/engineer capability

Ž Anticipate enemy engineer operations and their impact on the battle.
Ž Consider the enemy's mission and doctrinal employment of engineers in battle.
Ž Estimate enemy engineer capability based on--
- G2/S2's order of battle.
- Threat engineer organizations.
- Manpower/equipment capabilities.
- Recent activities
Ž Plot enemy engineer effort based on--
- G2/S2's situational template.
- Doctrinal engineer employment.

- The enemy's use of scatterable mines.

Ž Enemy engineers that support the reconnaissance effort.

- HVT recommendations (bridging assets, breaching assets, and scatterable mine delivery systems).

Ž The enemy's countermobility and survivability capabilities in a transition to a defense.

In the offense, the staff engineer plots the enemy's—

Ž Tactical and protective obstacle effort.

Ž Use of scatterable mines.

- Survivability and fortification effort.

FRIENDLY MISSION AND ENGINEER CAPABILITIES

The third component of the EBA is to estimate the friendly engineer capability and its impact on mission accomplishment. To perform this function, the staff engineer uses the information he developed in the first step (receive the mission).

Knowing the type of operation, the engineer quickly prioritizes the development of capability estimates. The staff engineer considers engineer forces task-organized to his supported unit as well as the assets that other members of the combined arms team unit have (such as mine plows) to determine the assets that are available. Assets under the control of the higher engineer headquarters and adjacent engineer units should be noted for future reference in the event a lack of assets is identified during course-of-action development. The en-

gineer analyzes the available coverage, currency and adequacy of standard topographic products and terrain-analysis data bases. If shortfalls are noted, he coordinates with the G2 to identify new production requirements for the DMA or the theater topographic engineer battalion.

Having determined the assets available and having already estimated and refined the time available with the G3/S3, the staff engineer uses standard planning factors or known unit work rates to determine the total engineer capability. For example, in the offense, the engineer would focus first on the total numbers of breaching equipment (AVLBs, MICLICs, ACES, engineer platoons, and combat engineer vehicles (CEVs)) and translate that into breach lanes. In the defense, the staff engineer determines the number of minefield, hull- or turret-defilade positions, and tank ditches he could construct with available resources. He uses the results of his capability estimates during the course-of-action development. See Table B-6 for an outline of this analysis.

The engineer combines his analysis of the terrain, enemy capability and friendly capability to form facts and assumptions about—

- Likely enemy engineer effort and the most probable enemy course of action.
- Potential enemy vulnerabilities.
- Critical friendly requirements.
- The impact of the factors above on the mission.

Developing facts and assumptions is a detailed and sometimes lengthy process. The staff engineer must maintain his focus on the information required by the maneuver commander and his battle staff to make decisions. The EBA is a continuous process that is continually refined as the situation becomes clearer. Each time new information is collected or the conditions change, the engineer must evaluate its impact on the mission and refine the facts and assumptions as necessary.

Table B-6. EBA friendly mission/engineer capability

- Evaluate friendly engineer capability and its impact on accomplishing the mission.
- Consider the friendly mission.
- Estimate the engineer assets available based upon task organization of--
  - Maneuver forces.
  - Engineer forces.
  - Higher engineer headquarters.
  - Adjacent engineer units.
- Consider the availability of critical resources.
- Estimate the total engineer capability based on engineer planning factors.

MISSION ANALYSIS

The engineer participates in mission analysis by identifying engineer tasks that are mission critical and have an impact on the overall mission. The staff engineer identifies engineer tasks from the higher unit's entire OPORD, not just the engineer annex. The staff engineer must look in numerous places to fully understand the total scheme of maneuver, commander's intents, and instructions from the higher unit's staff engineer. The staff engineer should concentrate on the following portions of the OPORD as he receives and identifies the engineer mission:

- Mission (paragraph 2).
- Commander's Intent (two levels up) (paragraphs 1b and 3).
- Scheme of Maneuver (paragraph 3).
- Scheme of Engineer Operations (paragraph 3).
- Subunit Instructions (paragraph 3).
- Coordinating Instructions (paragraph 3).
- Service Support (paragraph 4).
- Command and Signal (paragraph 5).
- Engineer Annex.
- Topographic Operations Annex.

Mission analysis has several components, with the staff engineer focusing on engineer capabilities in each of the following components:

- Specified tasks. Specified tasks are derived directly from the WARNORD, OPORD, or commander's intent. Examples are obstacle zones, obstacle belts with intents, the required number of breach lanes, and the type of breach designated by the higher commander.
- Implied tasks. Implied tasks are developed by analyzing the mission in conjunction with the facts and assumptions developed earlier. For example, obstacle handover coordination during a relief-in-place mission, if not specified, is an implied task. A classic example of an implied task is identifying and planning a river-crossing operation to support an attack to seize an objective if a river crossing is necessary to accomplish the mission but is not specified in the higher OPORD.
- Assets available. The staff engineer should have already identified the available engineer assets in the EBA. The engineer should also examine the total force structure of the combined arms team. This will help the engineer as he participates in course-of-action development. For instance, the amount of firepower available may help to determine whether the force should conduct an instride versus a deliberate breach or which float bridging is available to support division river-crossing operations.
- Limitations (constraints and restrictions). Constraints are those specified tasks that limit freedom of action. Designated reserve obstacles, obstacle zones (with intents), and ORAs are examples of constraints the engineer must consider in his mission analysis. Restrictions are limitations placed on the commander that prohibit the command from doing something. Therefore, they impact greatly on the course-of-action development. Obstacle zones and ORAs are excellent examples of restrictions because they limit the area in which tactical obstacles can be placed.

- Risk. A commander might specify a risk he is willing to accept to accomplish the mission. For instance, the priority obstacle effort in a defense may be employed on the most likely enemy avenue of approach while situational obstacles are to be planned on the most dangerous avenue of approach as an economy-of-force measure. The staff engineer must understand how a risk involving an engineer capability will specifically impact on combined arms operations and advise the commander accordingly.

Ž Time analysis. The staff engineer ensures that engineer operations are included in the combined arms time analysis and determines the actual total time available. He then refines his time analysis by developing a basic time-line sketch that includes such items as—

— The supported unit's OPORD.

— The engineer unit OPORD.

— Movement times.

— Line-of-departure or prepare-to-defend times.

— Rehearsals.

— Hours of darkness or limited visibility.

This technique assists the staff engineer in accurately refining the estimate of the amount of time actually available and adjusting the friendly engineer capability accordingly.

Ž Essential tasks. Essential tasks are specified and implied tasks that are critical to mission success are identified as essential tasks. The engineer focuses the development of his plans, staff coordination, and allocation of resources on the essential tasks. The staff engineer does not ignore the other specified and implied tasks, but his planning centers on the essential tasks.

Ž Restated mission. The restated mission follows the same format as any mission statement. The who, what, where, and why are based on the mission analysis.

COMMANDER'S GUIDANCE

The staff engineer needs to receive planning guidance to tailor the schemes of engineer operations that he will develop during course-of-action development. The amount of guidance required is based on the experience of the staff engineer and maneuver commander, the time available, whether habitual relationships between the engineer and maneuver units have been established, and SOPs. Some areas in which the staff engineer might require guidance are—

- Situational obstacle planning.
- Use of digging assets (survivability versus countermobility).

Ž Use of maneuver forces in the obstacle effort.

- Risk acceptance of engineer tasks.
- Interpretations of the higher commander's intent pertaining to engineers.

SCHEME OF ENGINEER OPERATIONS

The next step of the command estimate is developing the maneuver courses of action. Course-of-action development centers on the employment of maneuver forces. However, the engineer assists in the process by considering the impact engineer operations has on maneuver. The staff engineer must participate in order to tailor the scheme of engineer operations for each course of action. The staff engineer develops a scheme of engineer operations for each maneuver course of action. He does not develop complete plans, just a concept. It is developed using the same steps as the maneuver course of action but without the detailed force allocation. If time permits, the engineer may begin working on the details for each plan. The process is as follows (see Table B-7):

- Analyze relative combat power. The staff engineer compares the anticipated enemy engineer capability with the friendly engineer capability needed to defeat it. For example, in the offense, the staff engineer considers the enemy doctrinal norms, hard intelligence, recent activities, and the time the enemy has to prepare, then determines if the friendly engineer capability is sufficient to overcome the enemy capability. Likewise, in the defense, the staff engineer looks at enemy capability and where and when he expects that capability to be employed and determines what will defeat it and what assets are available to ensure success.

- Identify engineer missions and allocate forces. Based upon the maneuver course of action, situation analysis, mission analysis, and commander's intent, the engineer assesses the engineer requirements. This is the most important step in developing a scheme of engineer operations.

- Develop a scheme of engineer operations. The scheme of engineer operations focuses on how the engineer efforts integrate into and support the maneuver course of action. Like the maneuver course of action, the scheme of engineer operations is generic without a specific engineer force allocation or unit designation. It must address all phases of the operation, particularly where engineer priorities must change to support the maneuver.

- Balance assets available against support requirements. The staff engineer reviews his scheme of engineer operations in light of the assets he has available (using his

Table B-7. Scheme of engineer operations development

1. Analyze relative combat power.
2. Ident ify engineer missions and allocate forces/assets.
3. Develop a scheme of engineer operations.
4. Balance requirements with assets available.
5. Integrate into the maneuver course of action.

EBA product). Hasty estimate tools such as belt planning factors, blade-hour estimates, and breach-lane requirements are used to quickly assess whether adequate assets are available to support the plan. All shortfalls are noted and the scheme of engineer operations is refined, if necessary. The plan is refined by shifting assets to the main effort, shifting priorities with the phases of the operation, recommending to the commander to accept risk, or requesting additional assets.

Ž Integrate into the maneuver course of action. The staff engineer prepares a statement describing the scheme of engineer operations. This statement addresses how engineer efforts support the maneuver course of action. He integrates the necessary graphics to illustrate this tentative engineer plan (for example, breach control measures and obstacle graphics and intents).

WAR-GAME AND REFINE ENGINEER PLAN

Staff analysis identifies the best course of action for recommendations to the commander. War-gaming techniques are used to analyze the courses of action. War gaming is a systematic visualization of enemy actions and reactions to each friendly course of action. The staff engineer participates in war gaming to—

Ž Ensure that the scheme of engineer operations supports the maneuver plan and is integrated with the other staff elements.

- Further identify weaknesses in his plan and make adjustments, if necessary.
- Ensure the G2/S2 integrates enemy engineer assets and actions as he plays the enemy force.

There are three techniques for war gaming. See Table B-8.

The next step, after each course of action is independently war-gamed, is to compare the results. The goal of comparing courses of action is to analyze the advantages and disadvantages of a course of action relative to the other plans. Each course of action is compared to the others using specific evaluation criteria. These evaluation criteria may be developed by the staff or maybe directed to the staff by the commander during his planning guidance.

The staff engineer compares courses of action in terms of which scheme of engineer operations best supports accomplishing the mission. His comparison is only part of the total comparison by the staff.

RECOMMEND A COURSE OF ACTION

The objective of the comparison is to make a unified recommendation to the commander on which course of action is best. The engineer may have to give greater consideration to a course of action which he can least support if it looks like it is the best selection from the other staff's perspectives. He must be prepared to inform the maneuver commander where he must accept risk or where he will need additional assets to avoid that risk. The staff engineer must also be prepared to inform the maneuver commander where those assets maybe obtained and what influence the maneuver may have to exert to get them. This is where knowledge of higher and adjacent unit's engineer assets becomes important.

Table B-8. War-gaming techniques

Avenue in Depth This technique concentrates on one avenue of approach from start to finish, It is equally applicable to offensive and defensive operations. It allows the engineer to war-game the analyzed impact of enemy obstacles on the plan of attack and the effects of sequential obstacle belts or groups for the defensive plan.
Belt The belt technique divides the battlefield into areas that run the width of the sector, war-gaming across the front and multiple avenues at once. This is the preferred technique. It allows the engineer to war-game the mutual support between obstacle belts and groups. It is the best method for analyzing mutual support and adjacent engineer effort.
Box This technique focuses solely on critical enemy or friendly events in a designated area (box). The advantage of this method is that it is not time-consuming. It allows the engineer to focus on a particular breach site or engagement area.

Based on the staff's recommendations, the commander makes a decision on which course of action to adopt for final planning. He may select a specific course of action, modify a course of action, or combine part of several courses of action. In any event, the commander decides and issues to the staff additional guidance for developing the plan. This guidance concentrates on synchronizing the fight focusing on bringing the combat multiplier a together.

FINALIZE THE ENGINEER PLAN AND ISSUE THE ORDER

The staff engineer focuses his planning efforts on the scheme of engineer operations for the selected maneuver course of action. The engineer determines the C2 necessary to accomplish the engineer missions (see Chapter 2 for additional information). The scheme of engineer operations is fine-tuned baaed on the wargaming process, the commander's guidance, and situation updates. As the engineer falls in the details of his plan, he refers back to his initial mission analysis to ensure that all missions have been taken into account. The staff engineer ensures that all engineer tasks are assigned to maneuver and engineer units as part of the subunit instructions. Final coordination is made with other staff members to ensure total integration and mutual support.

The staff engineer conveys his written plan through his input in the basic OPORD (scheme of engineer operations, subunit instructions, and coordinating instructions paragraphs) and the engineer annex (see Appendix A). As part of the combined arms staff, the engineer also participates in the OPORD briefing to the assembled group. As with the other primary staff officers, the engineer gets only one chance to brief the command group on the

scheme of engineer operations. This is the first step in a properly executed and well-coordinated engineer plan. The focus of the staff engineer is briefing the subordinate commanders; the maneuver commander and staff should already know the plan. It helps to develop standard briefings as a guide. Time is always critical; repeating information covered by other staff members should be avoided, and only critical items should be covered, to include SOP items. Above all, the staff engineer should be thoroughly familiar with the total plan so that he is comfortable fielding questions.