

CHAPTER 6

Gap Crossing

HISTORY

HISTORICAL PERSPECTIVES

Ever since armies have marched and fought, leaders have faced the problem of crossing gaps. The natural difficulty of this task has persuaded them to use gaps as part of their defensive tactics. These crossings have frequently been defended by opposing forces. Since World War II, 29 significant battles have been fought at gap-crossing sites. Of these attempts, 21 were successful for the attacker. The eight unsuccessful crossings were not at rivers, but at streams ranging in width from 15 to 150 meters.

The armed forces of larger nations plan and train for mobile warfare with emphasis on

mechanized combat forces. This creates a high degree of mobility both in nuclear and conventional warfare. However, most vehicles will still depend on roads for extended marches and must cross gaps, wet or dry, using special equipment or techniques. Gap-crossing equipment capabilities and Army vehicle mobility characteristics are given in appendix B.

Breaching in stride. Although gaps can be overcome by airborne, airmobile or AirLand operations, the ability to sustain combat depends on linkup with combat trains which are vulnerable to natural and constructed

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gaps and which may require assistance in crossing them. Therefore, even undefended, gaps produce delay that must be minimized. The speed of movement depends on the force's ability to breach gaps in stride.

Tactical advantage. The force conducting a gap crossing has several tactical advantages such as time, method, and location. This is particularly true for linear gaps such as lengthy tank ditches, streams, canals, or rivers. The defending force loses the initiative for choosing the time and location of the crossing and must usually hold the obstacle line with minimal forces. The defending force must also maintain reserves ready to move quickly to any threatened crossing site.

Role of attaching force. The attacker plans and executes gap-crossing tasks to exploit the defender's situation. It must surprise the enemy and swiftly pass through the gap before the defenders can mass forces and firepower. The defender generally cannot hold extended gaps in strength, however, crossings at any point maybe opposed. Before deploying gap-crossing assets, the attacker must eliminate enemy direct fire from the far side of the gap and when possible, eliminate observed indirect fires. It must then quickly establish a tactical foothold on the far side to prevent the defender from indirect fire observation. This creates a base from which moving units can defeat counterattacks and then continue movement.

CROSSING EQUIPMENT

Improvements in weapons systems have

affected both gap-crossing techniques and equipment. The development of the armored fighting vehicle has dramatically influenced this process. There has also been a large increase in the size and weight of vehicles and equipment to be crossed. The speed and mobility of motorized vehicles has also increased significantly. As a result, an advancing force will encounter gaps requiring engineer effort more frequently than ever before. Table 6-1 provides a comparison of battlefield movement rates from 1940 to the present.

GAP-CROSSING LESSONS

The significant historical lessons of military gap-crossing operations are still applicable on the AirLand battlefield and focus on the attacker's ability to provide the following:

- Assets to quickly project combat power across the gap.
- Means to accomplish swift crossing of heavier combat equipment and supplies.
- Assets to replace initial bridging, rafting, or ferry equipment with more permanent structures so that the gap is not an obstacle on the line of communications and supply when assault bridging is recovered and returned for use by maneuver elements.

Military gaps. The term military gap is defined as any battlefield terrain feature, wet or dry, that is too wide to be overcome by self-bridging. In this manual, they are called gaps. Self-bridging means the ability of a

TABLE 6-1. BATTLEFIELD MOVEMENT RATES

	MODE	RATE (SUSTAINED)
1940	Infantry (dismounted)	4-5 km/h
1968	Infantry (M113 mounted)	20 km/h
1984	Armored/infantry (M1/M2 mounted)	30-40 km/h

vehicle to cross a gap using only its length, weight, and suspension system. For example, US Army main battle tanks can self-bridge over channels, streams, or ditches up to 2.7 meters (9 feet) wide (figure 6-1). Other tracked vehicles vary in their ability to self-bridge gaps. However, wheeled vehicles, with the exception of multi-axel configuration, do not have this capability. Table B-7 in appendix B lists combat vehicle self-bridging capabilities.

Fording. Fordability of a wet gap means how easily it can be crossed without the use of special equipment. Fordability depends on both the physical characteristics of the gap and the crossing capabilities of the vehicle. Tanks are able to ford water depths up to 1.2 meters (4 feet). Trucks larger than the M151 utility series vehicle can ford water depths up to 0.9 meters (3 feet). Some vehicles can be equipped with devices that enable fording in water as deep as 6 meters (20 feet).

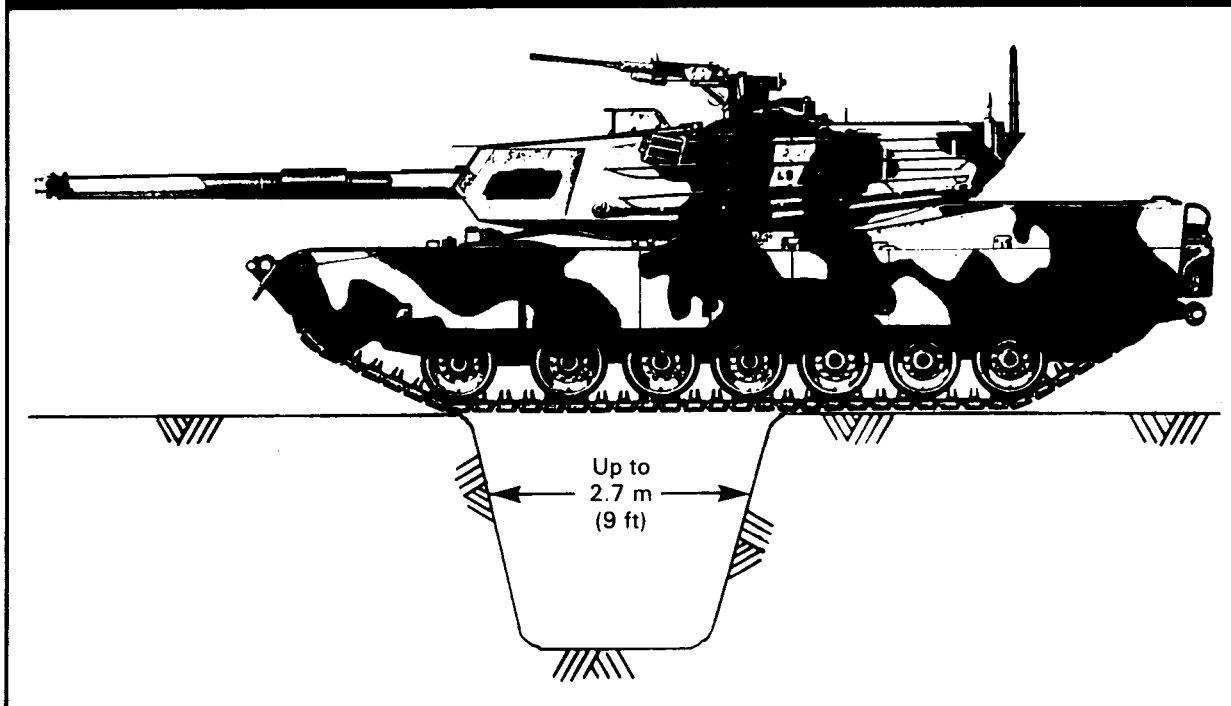
River-crossing operations. Even with

sophisticated equipment, rivers remain major obstacles. A river crossing is one of the most complex combined arms operations. It differs from other gap-crossing activities in the size of the forces deployed. Generally, river crossings are conducted at division level. River-crossing doctrine is discussed in FM 90-13.

MOBILITY SYSTEMS APPROACH

As a mobility task, gap crossing involves those activities which will allow a force to maintain movement over or through gaps. Like other mobility tasks, bypass should be the first option considered. This is often not possible, however, as large linear gaps and reinforcing obstacles lessen the possibility of local bypass. Extensive movement of forces will be required to avoid crossings. Crossing sites must be carefully chosen. For linear gaps, a broad crossing front is best as it reduces congestion and vulnerability of troops to enemy fires. The characteristics of the obstacle and the types of equipment to be

FIGURE 6-1. SELF-BRIDGING CAPABILITY OF TANK



crossed will dictate the necessary equipment and techniques. Light forces, such as infantry, require minimal support in crossing most gaps. However, coordination for aerial resupply or follow-on crossing efforts are critical to the ability to sustain operations. Planners and commanders must determine specific characteristics of the obstacle when attempting to pass mechanized forces or wheeled traffic over dry and wet gaps. Also, the mobility scheme approach to planning and executing activities is critical. Planning, reconnaissance, consolidation, and reconstitution assume added significance to limit movement delay and the separation of forces at crossing sites.

TYPES OF CROSSING

There are two types of offensive gap crossings, hasty and deliberate. Both types imply that the crossing will likely be opposed. The movement of forces across the gap is conducted in a similar manner in both cases. Tactics can be based upon those specified for the breach of obstacles and mined areas.

Hasty crossing. In the hasty crossing, the attacking force uses organic, existing, or expedient crossing means with little or no loss of momentum. It must be anticipated and plans made in advance before the leading elements reach the near shore or bank. Routine procedures, such as positioning hasty crossing equipment well forward in march columns, will assist. Since time is the most important element, the commander and engineer select the quickest method. The following options are listed in order of increased time requirement:

- Drive across (self-bridge or ford).
- Swim amphibious vehicles.
- Employ the armored vehicle launched bridge (AVLB).
- Cut down banks and drive across.
- Use other expedient techniques.
- Raft/ferry force across gap.

- Use float bridging.
- Wait for follow-on bridging or bypass.

Deliberate crossing. A deliberate crossing is executed if a hasty gap crossing is not possible or has failed. A deliberate crossing is a centrally planned and coordinated activity. In most cases before crossing the gap, a build-up of forces and equipment is needed on both the near and far sides. Enemy forces must first be cleared from the near side. Next, a secure foothold must be established on the far side. Integrated with close air support and air defense weapons fire, this foothold lessens the chances of losing vulnerable crossing assets to enemy direct or observed indirect fires.

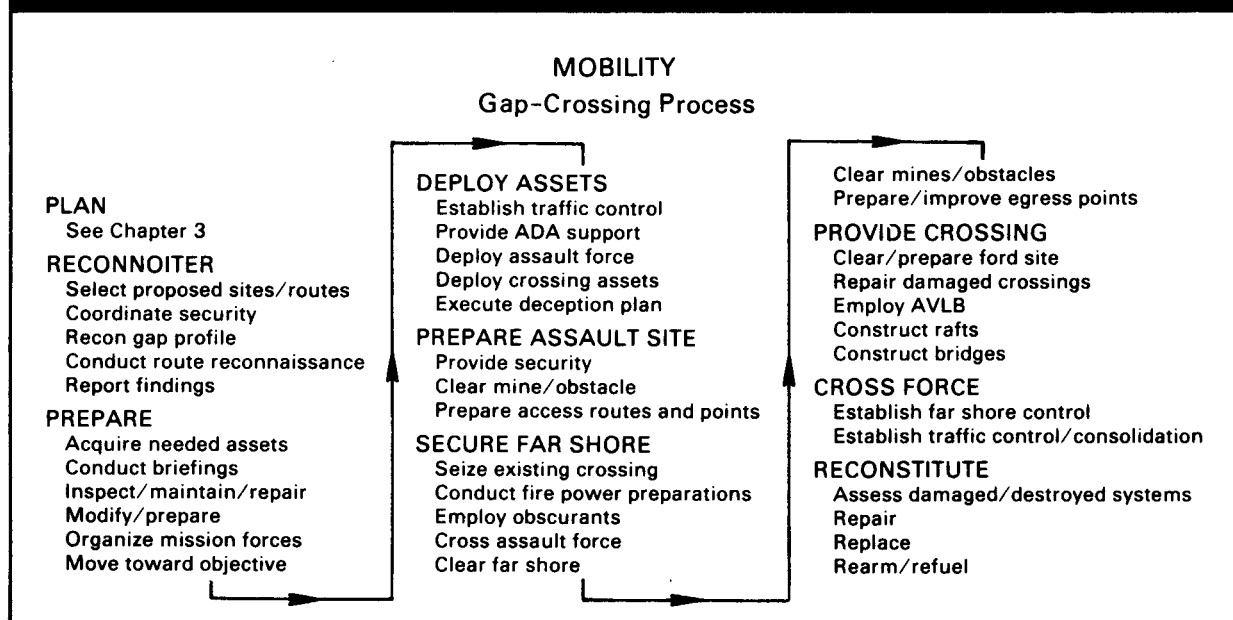
GAP-CROSSING STEPS

The gap-crossing functional area is made up of nine distinct steps (figure 6-2). Within each category, not all of the tasks maybe required. For example, crossing sites with suitable banks and entrance/exit points will not require extensive engineer preparation. The fundamentals of planning are described in chapter 3. The remainder of this chapter offers specific guidance and techniques which apply to the gap-crossing mobility function.

PLANS AND PREPARATIONS

Successful planning and preparation for gap crossing depends on early detection and investigation of gap obstacles. Timely and accurate intelligence data allows the commander to develop methods and tactics for overcoming the two greatest disadvantages of gap crossing, namely limited crossing assets available and the frequency rate at which gaps are encountered.

Organic crossing means. Since small gaps are encountered frequently, each maneuver force must have mobile crossing means of its own and be able to install them quickly. Follow-on bridging, such as the medium girder bridge, will have to be positioned after assault bridges are removed at each of these minor gaps. Also, the rate of encounter for

FIGURE 6-2. POSSIBLE SUBTASKS IN THE GAP-CROSSING PROCESS

wide gaps will require bridge systems capable of spanning these gaps to always be well forward.

Commander's decision. The rate of encountering gaps and scarcity of crossing assets present problems similar to those in other combat situations. The solution to these difficulties must be based on a sound tactical

plan. The engineer or mobility planner must inform the commander of the engineering considerations for successful crossing with the assets and labor available and should state the most satisfactory plan from a technical point of view. The commander must then weigh the factors, risks, and limitations involved and decide on the best course of action.

RECONNAISSANCE AND SITE PREPARATION

DETECTION AND VERIFICATION
Generally, the existence and locations of gaps will be obtained in the planning phase. The staff mobility planner is able to pinpoint existing gaps along the proposed avenues of approach. In most cases, the physical characteristics of the feature, such as width, bank conditions, approaches, and water velocity (if applicable) can be obtained from divisional, corps, or theater Army terrain teams. The reconnaissance effort centers on verifying this data. Intelligence information provides the main source for detecting unknown reinforcing gaps. Such obstacles

include antitank ditches and demolition craters. Tactical reconnaissance parties, such as scouts, or aerial observers, provide early warning of enemy-emplaced gaps. Reinforcing gap obstacles will likely be integrated with mines. Whether the gap is an existing or reinforcing obstacle, reconnaissance is essential to the maneuver commander. The commander must have timely information or verification of the gap, including mobility data on the routes to and from the gap. Thus, the commander is able to select the most tactically sound crossing site(s), routes, and method of deception. This information is

provided by both ground and air reconnaissance means.

CROSSING AREA RECONNAISSANCE

Physical ground reconnaissance of possible crossing areas is preferred. This enables the crossing unit to “see” and plan support requirements and traffic control needs. Keeping in mind that the unit must attack the enemy and physically cross the gap concurrently, the reconnaissance of possible crossing areas focuses on the following features:

- Trafficable routes to the site and routes from the far side exit leading toward the objective.
 - Fighting positions for supporting weapons on the near side of the gap.
 - Fighting positions on the far side once a foothold is established.
 - Covered, concealed, and dispersed assembly areas near the entry bank.
 - Work areas for support forces and the collection of crossing assets.
 - positions on both sides of the gap that could provide enemy observation on the crossing site.
 - Effects of weather on soil trafficability, visibility, the use of smoke, and the current velocity (for wet gaps).
- Location and condition of existing crossing sites.
 - Indication or sighting of reinforcing obstacles (mines, underwater obstacles, or obstacles constructed along the banks).
 - Width, depth, and bottom conditions of dry gaps.
 - Width, depth, bottom conditions, and water velocity of wet gaps.
 - Bank height, slope, and soil stability of both wet and dry gaps.

Engineers use this information to determine specific site-crossing requirements. The entry and exit banks may require grading or other measures to stabilize the soil. The obstacle's depth and width will determine which crossing technique, such as fording, swimming, rafting, bridging, or driving across, is best suited to the needs of the maneuver unit. The water velocity in a wet gap will determine vehicle swimming capabilities and bridge anchorage requirements. The reconnaissance of existing bridges is necessary to enable engineers to plan for their repair or reconstruction along key routes. Figure 6-3 shows the physical characteristics contributing to wet gap-crossing abilities. Figure 6-4 shows the similar type of constraints for dry gaps.

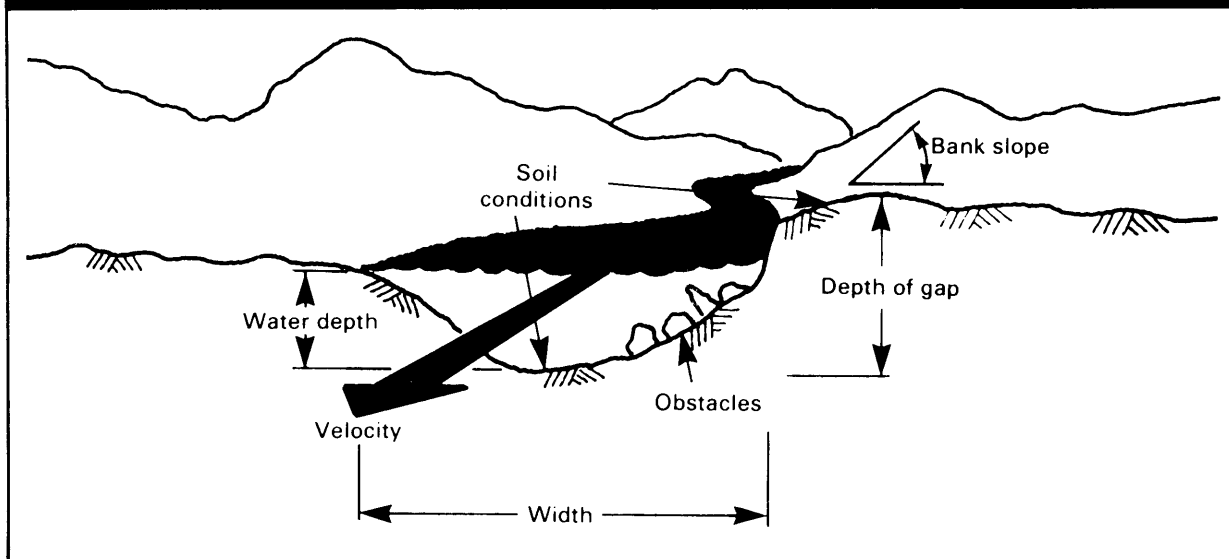
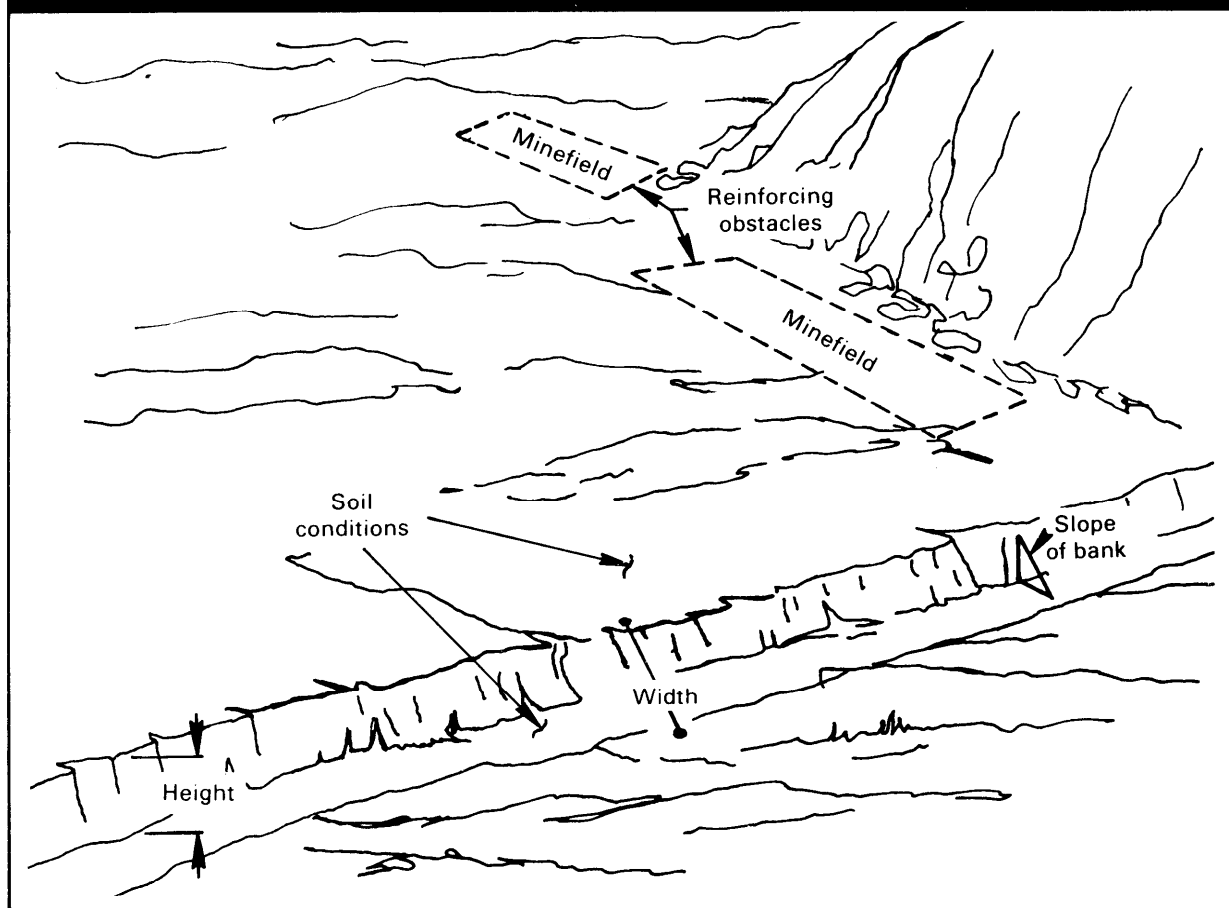
CROSSING SITE SELECTION

GAP PROFILE RECONNAISSANCE

The collection of data on the physical characteristics of the gap at each possible crossing site is a critical task. However, it may not be possible to obtain all of the desired information. The time available, accessibility of the site, and enemy situation may not allow detailed engineer reconnaissance. If possible, the minimum collection of reconnaissance data should include—

- Condition of access/egress points.

The location and nature of crossing sites is determined by the tactical requirements of the unit, as well as the mission and objective beyond the gap. Characteristics of the obstacle and the amount of crossing equipment available will affect the number of crossing sites. If there are no fording sites across a wet gap, vehicles cross by swimming, rafting, or bridging. The routes of access and egress, the slope, stability of the banks, and the depth and velocity of the water for wet gaps all influence the selection of possible crossing points. Reconnaissance elements investigating possible sites must always be alert for

FIGURE 6-3. WET GAP SITE CRITICAL FACTORS**FIGURE 6-4. DRY GAP SITE CRITICAL FACTORS**

signs of enemy mines or booby traps. These include obstacles and mines installed in the bottom of a dry gap or along both shores and underwater for wet crossings. Experience has shown that old crossing sites will be mined or obstructed more often than areas not previously used. A description of how the characteristics of a site influence each technique for crossing is necessary. Crossings can be accomplished either by using existing civilian bridges, swimming vehicles, fording, use of expedient means, or a military raft or bridge.

Civilian bridges. The securing of intact bridges should not be part of a site-crossing plan. If US forces or their allies gain military control, this action should be considered a bonus. Civilian bridges will normally be under enemy control and therefore destroyed by the defender before they are surrendered. Targeting of such bridges for direct or indirect fire is relatively simple as the locations are known by both sides. In many cases, the load classification of civilian bridges is not enough for heavy vehicles such as tanks. If used in defensive or retrograde crossings, civilian bridges should supplement other crossing techniques.

Vehicle swimming. Two factors should be considered in swimming amphibious vehicles through wet gaps—the velocity of the water and condition of the banks. In general, as stream velocity increases, most amphibious vehicles become less maneuverable, take longer to cross a given gap, and have more trouble in exiting. Also, because these vehicles drain rapidly when exiting, initially firm banks tend to deteriorate rapidly from multiple uses of the same exit point. Therefore, numerous exit points should be planned. This is true even when stream velocities are low and the bank's trafficability is good. The existence of mud or surface irregularities further degrades the percent of slope an amphibian can overcome.

Vehicle fording. When selecting a fording site in a wet gap crossing, the depth of the

water is the most significant factor. The ability to ford varying depths depends on the vehicle. The depth of the water in one crossing area may change due to bottom surface mud or irregularities (boulders or pot holes).

Expedient crossing means. When evaluating a potential crossing site, the reconnaissance party should note material or existing features that could be used as expedient crossing devices. These include culvert pipe, lumber or cut timber, or war-damaged equipment. Sections of culvert pipe, for example, laid side by side in the gap, form the basis of a culvert bridge. The culverts are laid parallel to the current in a wet gap. Any available fill material is placed over the culverts, thus dissipating the pressure of vehicles over the surface of the pipes. Disabled or destroyed vehicles pushed into the gap can also become an expedient crossing surface.

Military rafting/bridging. The first criteria in selecting crossing sites is whether crossing without bridging or rafting would cause significant delay. Steep banks, water velocity, and depth of the gap are the critical factors. Steep bank angles are normally enough to prevent the exiting of swimming or fording vehicles. Water velocity determines equipment requirements. When a wet gap is too deep for fording, bridging and rafting equipment should be used. Float bridge equipment is organic at separate brigade, division, and corps levels. FM 90-13 provides additional information on the deployment of these assets to support major combined arms operations.

RECONNAISSANCE REPORTS

Reports of a gap's initial detection or supplemental intelligence data is essential to gap-crossing plans. Swift, accurate reports allow the commander and staff to adjust tactical plans.

Four different report formats are provided in this section. These are the amphibious crossing site report, ford report, ferry site report, and bridge site report. A sample obstacle

report format is given in chapter 5. Much of the detail for these reports can only be provided by qualified engineer personnel. Non-specialist personnel include only the detail they are qualified to collect and report. The discussion of these reports and the reconnaissance include expedient techniques for gathering the required technical data. All of the reports implement Standardization Agreement (STANAG) 2096.

Although these reporting formats were devised for radio transmission, the most secure means of communication, usually written, should be used to lessen the vulnerability of the force and for tactical surprise. Radio transmission should be the last choice. Supplemented with drawings, maps, traces, or overlays, these written reports are forwarded through operational channels and monitored by the staff intelligence, logistics, and engineer sections (if provided). Also, the reports are provided to the terrain analysis detachments in order to update their data base. The originator completes only those parts of the report which apply to the results of the reconnaissance.

Obstacle reports. Most gaps are detectable during the mobility planning sequence. Reinforcing gaps, such as craters created by demolition just prior to encounter, will not be detected early. The obstacle report is used to report initial detection of such gaps. Subsequent reconnaissance, if required, provides additional detail.

Amphibious crossing site reports. The amphibious crossing reconnaissance provides information concerning the difficulty of swimming vehicles across a wet gap. This report requires that the observer make a military judgment appraisal on the combined physical characteristic effects of the gap. A sample amphibious crossing site report is shown in figure 6-5 on page 6-10.

Ford reports. The object of this report is to determine if vehicles can negotiate a wet or dry gap without swimming. Measurements,

These reports, usually written, should be forwarded by the most secure means available.

such as water depth, slope of banks, and stream velocity, are made physically. A sample ford report is shown in figure 6-6.

Determining depth of gaps. Field expedients, such as measured poles or weighted ropes, are usually required. Depth readings are normally taken every 3 meters. Depths and currents must be checked at frequent intervals to warn against changes due to environmental factors such as rain, snowfall, or the opening of dams or locks upstream.

FIGURE 6-5. SAMPLE AMPHIBIOUS CROSSING SITE REPORT

ALFA	Map sheet(s).
BRAVO	Location (grid reference) and date-time group of observation.
CHARLIE	Types of amphibious vehicles considered (wheeled, tracked, and so forth).
DELTA	Classification and frontage, in meters, of complete site, for example, WHITE-400 meters. ● White. A site where vehicles can be expected to make a passage with such ease that few, if any, will require assistance. ● Gray. A site where the majority of vehicles will require assistance to make a passage. ● Black. An impractical site owing to the excessive amount of assistance required.
ECHO	General information to include other limitations, for example, mines, debris, ice flows, ice thickness, enemy observation, enemy fire, and explanation of restrictive factors.

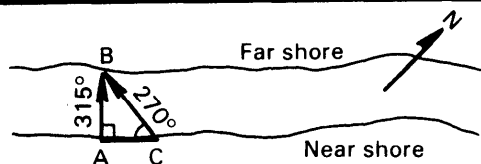
Determining gap width. For wet gaps or gaps with restrictive terrain, a compass can be used to measure the distance from bank to bank. From a point on the near shore and close to the water's edge, the azimuth to a point on the opposite shore is taken and recorded. Another point on line at a right angle to the azimuth selected is established on the near shore from which the azimuth to the same point on the far shore is 45 degrees (800 roils) at variance with the previously recorded azimuth. The distance between the

FIGURE 6-6. SAMPLE FORD REPORT

ALFA	Map sheet.
BRAVO	Date-time group of information collection.
CHARLIE	Location (grid reference or trace).
DELTA	Minimum width.
ECHO	Maximum depth.
FOXTROT	Stream velocity.
GOLF	Type of bottom, for example, SOFT SANDY or FIRM ROCKY.
HOTEL	Maximum slope on banks and bank condition, for example, 9 percent-SLIPPERY CLAY.
INDIA	Trafficability of near and far shore routes (GO, SLOW GO, NO GO).
JULIETT	Rise and fall of water level.
KILO	Concealment/cover.
LIMA	Any other information which could be given, such as essential limiting factors or requirements for support.

two points on the near shore is measured, and this distance is equal to the distance across the stream (figure 6-7).

FIGURE 6-7. MEASURING GAP WIDTH WITH COMPASS



Key:

A is the point on the near shore.

B is the point on the far shore.

AB is the distance to be measured.

Azimuth of line AB is 315°.

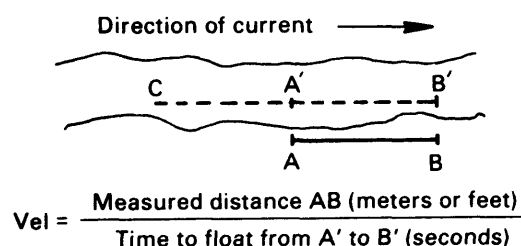
Azimuth of line CB is 270°.

Difference between azimuth AB and azimuth CB = 45°.

Distance along AC equals distance along AB.

Determining stream velocity. Current velocities vary in different parts of a stream. In general, the current is usually slower near the shore and swifter in the main channel. Similarly, the current is slower as the stream widens. To determine the velocity of a stream, measure a distance along the river bank (figure 6-8). Throw a light object which floats into the stream, and record the time the object takes to float the measured distance. This procedure is then repeated several times. The average time of the tests is then used in the formula in the figure to determine stream velocity.

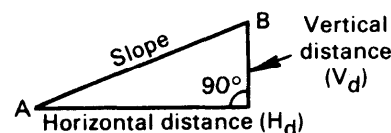
FIGURE 6-8. DETERMINING STREAM VELOCITY



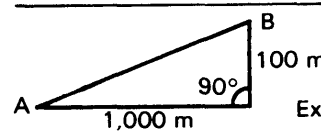
Note: The same method of measurement, feet or meters, is used throughout the process.

Determining slope on banks. The rise or fall of a ground form from a specific point is known as slope. Slope can be expressed as steep or gentle, but these terms are too general for gap-crossing reconnaissance purposes. A more exact slope description is needed to indicate the effect a given slope will have on traffic flow. To meet this requirement, reconnaissance personnel compute and report the percent of slope for bank gradients. Percent of slope is the ratio of the change in elevation (vertical distance) to horizontal ground distance, multiplied by 100 (figure 6-9). Percent of slope is used to describe slopes which rise or fall. If not shown by symbol, arising slope in the direction of travel is preceded by a plus (+) sign, and a falling slope by a minus (-) sign. In computing percent of slope, the vertical distance and the horizontal distance must always be expressed in the same unit of measure.

FIGURE 6-9. DETERMINING SLOPES ON GAP APPROACH BANKS

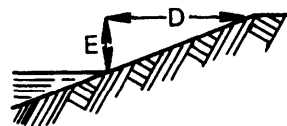


$$\text{Percent of slope from A to B} = \frac{\text{Vertical distance (V}_d\text{)}}{\text{Horizontal distance (H}_d\text{)}} \times 100$$



Example: From A to B

$$\text{Percent of slope} = \frac{V_d}{H_d} \times 100 = \frac{100 \text{ m}}{1,000 \text{ m}} \times 100 = +10\%$$



D = Approach distance
E = Approach elevation

$$\text{Slope in percent of approach} = \frac{E}{D} \times 100$$

This report confirms or denies the possibility of using military rafts.

Ferry site report. The object of reporting ferry or raft site information is to confirm or deny the possibility of using military rafting equipment. A sample ferry site report is shown in figure 6-10.

FIGURE 6-10. FERRY SITE REPORT

ALFA	Map sheet(s).
BRAVO	Date-time group of collection of information.
CHARLIE	Location (grid references or trace).
DELTA	Trafficability of near and far shore routes (GO, SLOW, GO, NO GO).
ECHO	Possibilities for concealment or cover.
FOXTROT	Width of the river.
GOLF	Depth of water along ferry path and at the banks, including tidal information.
HOTEL	Stream velocity.
INDIA	Maximum slope on bank approaches and bank conditions.
JULIETT	Parking areas for road and water transport.
KILO	Any other information which could be given, such as maximum number of rafts for which site is usable, work required in personnel-hours for preparation of approach routes, present water gage reading, if available, and obstructions or restrictions at the site.

Bridge site report. Unlike the bridge report format described in chapter 5, this report describes likely locations for emplacing gap-crossing bridges. It can be used for reporting employment sites for the armored vehicle launched bridge (AVLB) or for bridges capable of spanning large gaps. A sample bridge site report is given in figure 6-11.

SITE PREPARATION

Once a crossing site is selected, the force collects and prepares the soldiers and equipment required to successfully cross the gap. At this stage, the necessary command and control measures are initiated. These include the separation and control of assault forces, crossing means, and support forces. The organization, preparation, and rehearsals necessary for crossing tasks are similar to those for countermine and counterobstacle

activities. These allow flexibility of control. If possible, a plan is initiated to deceive the enemy of crossing intentions. The crossing site selection should minimize discovery by the enemy. Crossings should start at night as a further measure of protection. Smoke generator detachments are employed when available. If possible, the site is secured from enemy air and underwater attack. Air Defense Artillery (ADA) units will be employed to protect the crossing site\ area. Also, alternative plans are available in case the site is destroyed. Once a crossing site has been detected, it will be extremely vulnerable. Arrangements should be made for the quick dispersal of crossing equipment or for alternative means of crossing. When possible, the frequent changing of crossing sites should be planned, rehearsed, and executed in the deployment of forces.

FIGURE 6-11. SAMPLE BRIDGE SITE REPORT

ALFA	Map sheet.	KILO	Height of far bank above water level.
BRAVO	Date-time group of collection of information.	LIMA	Safe bearing pressure of soil.
CHARLIE	Location (grid reference or trace).	MIKE	Description of work required on approaches, near and far banks.
DELTA	Width of gap between near and far bank edge of gap.	NOVEMBER	Possible local areas for concealing bridging equipment.
ECHO	Width at water level.	OSCAR	Potential staging areas.
FOXTROT	Width at bottom of gap.	PAPA	Turnouts for oversize, overweight, or disabled vehicles.
GOLF	Rise and fall of water level and change in wet gap width.	QUEBEC	Trafficability.
HOTEL	Velocity of current.	ROMEO	Road nets.
INDIA	Nature of bottom.	SIERRA	Assembly areas.
JULIETT	Height of near bank above water level.	TANGO	Engineer release point.

PREPARATION OF ASSAULT SITES

The first step in executing a gap crossing is the control of the near bank side of the gap. This includes moving to the selected site and establishing security. Adequate routes are important for the timely movement of the assault force and crossing assets. Combat trails may have to be developed under fire. The CEV and M9 armored combat earth-mover (ACE) should be deployed forward to assist in these tasks. Clearing and upgrading of approaches to crossing sites and the sites

themselves is a priority task for engineers. Once the near side is secured, access and egress points must be prepared. These points, and the banks at crossing sites, will likely be reinforced by obstacles and/or mines. The techniques for breaching these additional restrictions are applied by the force making the initial crossing. They can be assisted by the assault force before their deployment to the far shore. Once these tasks are accomplished, the crossing is begun.

METHODS OF CROSSING

HASTY CROSSINGS

Hasty gap crossings are characterized by several factors, they are—

- Speed, surprise, and a minimum loss of momentum.
- Weak enemy defenses on both banks.
- Minimum **concentration** of forces.
- A quick continuation of the attack.

To maintain momentum and to get maximum combat power across quickly, the maneuver force negotiates the gap on a broad front. Air assets are ideally suited for this mission. Airborne or airmobile forces can be used to enhance surprise and establish forces on the enemy side of the obstacle. They can also speed up crossing tasks by carrying equipment quickly. Airmobile forces can be used to seize crossing sites before the enemy can destroy or damage them.

Dry gap hasty crossing. Antitank ditches and craters are examples of dry gap-crossing obstacles. They are used to block roads and trails at points where the terrain prevents bypassing. To hamper breaching operations, antitank and antipersonnel mines are often placed at the obstacle and covered by indirect and direct fire. Once the mines have been breached and direct fire suppressed as much as possible, the CEV or M9 ACE can be used

to push down the sides of ditches or to fill in craters. The CEV demolition gun or hand-emplaced explosives can be used to cave in the sides of ditches sufficiently to allow passage of traffic. Substantial fill material placed in craters or ditches allows the passage of combat tracked vehicles. The crossing site can be improved and maintained for wheeled traffic use after the far side is secured. The AVLB is particularly suited for spanning streambeds, antitank ditches, craters, canals, partially blown bridges, and similar obstacles. It can be launched or recovered in less than 5 minutes. Normally, the engineer AVLB is attached to a forward engineer element for use in hasty crossings of short gaps. The AVLB should be left in place across the gap only so long as necessary, then replaced with other fixed bridging. If the hasty bridge is not required for follow-on forces, the last tactical element across is responsible for recovering the bridge. Otherwise, the launcher may be directed to move rearward or remain in place to meet up with a replacement bridge.

Wet gap hasty crossing. The divisional engineer battalions provide wet gap-crossing support to the tactical maneuver units. Major wet gap crossings usually require additional support from corps or theater army engineer units. Identifying wet gaps early and deploying the required resources allow hasty crossings of known or anticipated gaps to occur in stride. Bridges are rarely employed

in the assault phase because of their vulnerability to enemy fires and the need to concentrate assets at the crossing site(s). The exception is the AVLB which is used in wet gap hasty crossings. If possible, an assault force is projected across the gap. However, the AVLB requires only the elimination of direct fire and security afforded by support forces, as the vehicle provides small arms and limited NBC protection.

Crossing means. When necessary, the leading force engineer unit constructs mobile assault, float bridges, or expedient bridges. These crossing means will be replaced by other floating or fixed bridging as soon as possible to permit the forward bridge company to retrieve its equipment and continue to support the leading force.

Engineer tasks. Engineer tasks in the wet gap hasty crossing include—

- Breaching or reducing obstacles and/or mines.
- Guiding the assault forces to the crossing site.
- Finding and upgrading ford and swim sites.
- Operating and controlling crossing equipment to include traffic flow.
- Constructing approach roads and exits.

FM 90-13 contains a detailed discussion on the planning and execution of river crossings, including the responsibilities of all elements involved.

DELIBERATE CROSSINGS

The deliberate breach of gaps is used when a hasty gap crossing is not feasible, has failed, or when renewing offensive operations at the gap. It may be forced by a large or complex gap obstacle. Such a gap could prevent effective use of organic or expedient crossing means. A strong enemy defense on one or

both sides of the crossing site may also require a deliberate crossing. Deliberate gap crossings are characterized by—

- A deliberate pause to prepare, acquire additional equipment, and concentrate combat power.
- Clearance of enemy forces from the entry bank.
- Air superiority over the crossing site.
- Air defense protection within the crossing area.
- Detailed planning and centralized control.

Wet gap deliberate crossing. The deliberate gap crossing is divided into three phases. These phases are the assault phase, rafting phase, and the bridging phase. They may occur in sequence or concurrently. In each of these phases, the responsible engineer unit—

- Knows the availability of crossing equipment.
- Recommends crossing sites.
- Plans the use of fords,
- Plans for aiding amphibious vehicles to exit the far bank.

In planning the deliberate gap crossing, the engineer should plan for—

- Rehearsal of the crossing.
- Inspection of amphibious vehicles.
- Location of concealed crossing equipment assembly areas.
- Enforcement of noise and light discipline.
- Control at fords and amphibious crossing sites.

- Establishment of entry and exit bank recovery teams.

Objective. The objective in deliberate gap crossings is to project combat firepower to the exit bank at a rate faster than the enemy can concentrate forces for a counterattack. To do this, the commander may elect to first construct rafts for nonswimming vehicles while swimming vehicles make the crossing. Bridge construction is started when observed indirect fire has been eliminated. If the tactical situation allows elimination of the rafting phase, bridging efforts would begin immediately. This is a suitable option considering the high speed of employment of systems like the ribbon bridge. Factors in evaluating these alternatives include—

- Opposing force capability to fire on crossing sites.
- Types of crossing equipment.
- Crossing sites available (number, location, and quality).
- Characteristics of the obstacle.

Temporary means. Rafting is generally a temporary method of moving firepower to the far bank and should stop once this equipment has crossed. For planning purposes, bridges should be constructed to move the elements of the brigade trains and other follow-on units. If sufficient equipment is available, rafting operations may continue while replacement bridges are under construction. The rafts may later be incorporated into the bridges or removed.

Responsibilities. Plans for movement across a wide wet gap must be detailed and control of traffic must be positive. Initially, exit bank responsibilities will be assumed by divisional units until they can be relieved by nondivisional engineers. Communications planning is critical, continuous, and concurrent with tactical planning. Prior to contact with enemy forces, radio listening silence should be

strictly enforced to deny the enemy knowledge of the crossing. Once friendly intentions are obvious, maximum use of wire communications with provisions for backup wire and messenger communications is essential. Standing operating procedures should include allocation of communications equipment for major wet gap crossings.

Dry gap deliberate crossing. Deliberate dry gap crossings are generally determined by the strength of enemy defenses or the magnitude of the gap. If possible, the use of the M9ACE, CEV, and blade tanks to reduce banks, or the AVLB are preferred. The Bailey bridge, medium girder bridge (MGB), and M4T6 dry span are used for spanning major dry gaps. These assets are labor-intensive and expose personnel to enemy fire during their construction. In all cases, the most important goal is to reduce enemy resistance. Maneuvering assault forces on the far bank is a crucial step of the deliberate crossing. Use of air assault assets is desired but will generally involve assault into the enemy's flanks or rear. This could be time restrictive and is dependent on local air superiority. Other means involve using rope or foot bridges for dismounted crossings. Support force concentration of suppressive fires and obscuring smoke on the enemy also contribute to successful dismounted maneuver.

RETROGRADE CROSSINGS

Obstacles and mines placed behind defending forces by the enemy must be expected in withdrawal operations. The enemy will attempt to isolate units and disrupt withdrawal routes. Gap-crossing sites will be prime targets. Proposed or operational sites will be damaged or destroyed, and actual contact with enemy forces is possible. Success in retrograde crossings depends heavily on the force possessing tactical mobility equal to, or greater than, the opposing force. Withdrawal forces should cross on existing permanent bridges whenever possible. These structures are prepared for rapid destruction as a countermobility task, and provide the best retrograde crossing means. When

needed, crossing equipment that can be recovered rapidly should be used. Tactical bridging, such as the M4T6, should be removed early in the operation. Crossing assets are destroyed in place if the enemy is likely to capture and use them.

THREAT ACTIVITY DURING RETROGRADE

If the enemy becomes aware that a gap crossing is critical to the success of a retrograde operation, it will make every effort to destroy or capture the site. Deception and camouflage play a large part in opposing such efforts. The pursuing force will seek a rapid, deep penetration to cut off a successful retrograde crossing. Threat doctrine directs lead elements of pursuit columns to fix retrograding forces while other forces attempt to encircle. Motorized rifle elements can be expected to mount flanking attacks. Artillery and tactical air elements organic to the Threat attackers will attempt to place continuous fires on retrograding forces.

RETROGRADE CROSSING TASKS

Retrograde gap-crossing tasks do not consist of offensive methods conducted in reverse. One advantage is that both banks of the wet or dry gap will be under friendly control. Detailed area and crossing site information is readily available to the commander. This knowledge, combined with information of enemy strengths, dispositions, and expected tactics, allows the commander to task-organize forces in the most effective manner for defensive operations and retrograde crossings. A strong defense on both banks is important to aid those forces remaining in the entry bank to cross successfully. This defense must secure the crossing site until the bridge is removed or destroyed in place. Detailed planning is necessary to insure the success of this phase. The initial defense force should be small. It consists of elements not involved in the retrograde as well as reserve units, if available. As forces cross the gap, they assume defensive positions. Since forces are not available to defend all points, mobility tasks must provide for rapid lateral

movement to concentrate firepower. Army aviation support can assist in movement and provide economy of force coverage of lightly defended areas. This lateral movement provides favorable ground force ratios at the required time and place.

ENGINEER SUPPORT DURING RETROGRADE CROSSING

The engineer's role in retrograde gap crossings will generally involve all of the mobility-counter-mobility -survivability (M-CM-S) tasks. The major engineer support requirements are the crossing of the retrograding unit, the development of defensive measures on the exit bank, and the creation of obstacles on the entrance (enemy) side.

Crossing support. The techniques and methods for engineer participation do not differ from offensive crossings. Responsibilities still include operation of crossing assets and repair of crossing site points and routes. Command and control of these tasks is required so that a safe, orderly, and efficient withdrawal crossing can be executed.

Exit bank defenses. Defensive positions, including survivability measures, are developed on the exit. These positions are continually improved and expanded to accommodate elements that are crossed. Lateral combat roads and trails are provided in order to allow rapid concentration of combat power along the defense.

Obstacle development. Engineer counter-mobility tasks are performed on both sides of the retrograde crossing site. Obstacles and minefield that impede or channelize the enemy on approaches to the far side entry bank are emplaced to enhance the effectiveness of friendly overmatching fires. Obstacles and mines used on the exit bank side of the gap are designed to create maximum difficulty for pursuit force crossing efforts.

RETROGRADE CROSSING EXECUTION

Operation of the crossing area must provide for the following requirements.

- Rapid flow of traffic across the gap. Emphasis is placed on siting crossing equipment to accommodate varying quantities of friendly forces.
- Assurance that only essential personnel and equipment are operating in the crossing area.
- Coordination of crossing sites to insure overwatch of forces withdrawing under enemy pressure.
- Control of all movement to, across, and exiting from the gap.

- Maximum use of obscurants, close air support, and air defense support.

Crossing assets must be removed or destroyed as soon as the last withdrawing elements have passed and before the advancing enemy can cross. Commanders will provide multiple demolition systems, positive command and control, and guards adequate to insure destruction. When there is great risk or the enemy has tactical advantage, major bridges should be destroyed in advance and tactical or assault systems used in the final withdrawal.

COMMAND AND CONTROL

GAP-CROSSING CONTROL

More than any other mobility task, gap crossing involves the management of combat power, space, time, and terrain. The maneuver commander is responsible for and coordinates all gap-crossing activities which support the operation including the use of artillery, aviation support, and engineer assets. Crossings require that assets be massed and elements separated, temporarily, by the obstacle. Therefore, the details of the command and control organization are disseminated throughout the entire force. The controlling headquarters must be flexible enough to react to any changes in the tactical situation and scheme of crossing.

Management. Space and terrain management around selected crossing sites is necessary for controlling movement and enhancing survivability. Terrain is allocated on both sides of the gap for the various elements to disperse, work, move, and consolidate when required. Traffic and movement control is a responsibility of the command and control headquarters. The entire sequence of assaulting, crossing, consolidating, and then continuing movement is regulated by a tactical timetable. This allows soldiers and equipment to cross in a tactically sound sequence while making efficient use of crossing sites.

Threat considerations. The possible use of

nuclear or chemical weapons against friendly crossing activities impacts on control procedures. In order to prevent them from becoming targets, concentrations of forces on either side of the gap must be minimized. During actual crossing of the assault force or main body, troops and their equipment are passed over the obstacle as swiftly as possible. The controlling headquarters also varies the crossing site location. Operation of a single crossing site over an extended period of time increases the possibility of enemy interdiction.

ORGANIZATION FOR CROSSING

Commanders and staffs should include gap-crossing considerations during the planning and preparation phase of an operation. The resulting task organization and orders will include gap-crossing responsibilities and contingencies. When engineer assets are planned for crossing activities, they should be located forward in the movement column. Whenever possible, task-organized forces conduct rehearsals on actions taken upon encountering gap obstacles. The commander organizes the forces into three elements for gap crossing. These groups are the same regardless of the category or type of gap. The elements follow.

The assault force. The primary mission of this force is to project combat power across

the obstacle once the near side is secured. A foothold on the far side of the gap is established and enemy direct and observed fire eliminated. The assault force then becomes the cornerstone of the unit's consolidation effort on the far side. Normally built around infantry units, it is responsible for repulsing enemy counterattacks during the vulnerable phases of establishing and crossing the main body. Engineers generally assist in the crossing on land and water. Aviation assets move the assault force vertically over the obstacle.

The crossing means. Engineers are responsible, in most cases, for the actual crossing means and equipment. Their initial priority is the preparation of the near side of the gap while the assault force seeks to establish security for far side exits. Once enemy opposition on the far side is reduced, a method of crossing is quickly established. The responsibility for the actual crossing also includes far side exit trafficability.

The support force. The support force includes all units providing overmatching fires, indirect fires, and other combat support assistance (such as air defense artillery and smoke) and those elements waiting to cross the gap. They are essentially the main body of the maneuver force.

TRAFFIC CONTROL MEASURES

There are two control measures applicable to negotiating forces across gaps. They are staging and holding areas. Staging areas are waiting areas for convoys which will cross the obstacle. They are located far enough away from the gap to facilitate rerouting and use of the alternate roads to crossing sites. Areas selected for staging require—

- Cover and concealment.
- Sufficient area for vehicle and equipment dispersion.
- Easy accessibility.

- Sufficient trafficability to prevent delays caused by terrain problems.

Holding areas are designated waiting spaces both near and within crossing areas to handle vehicles should a sudden interruption occur in the movement of traffic across the river. Vehicles move into these areas and disperse rather than stand on roads and restrict the flow of traffic into crossing areas.

COMBAT SERVICE SUPPORT

In a gap-crossing situation, the committed combat forces will be temporarily separated from their full combat service support. In the early stages of assault only, those vehicles essential to the conduct of the operation should be allowed over or through the obstacle. Ammunition and fuel replenishment vehicles are given sufficient priority to insure timely resupply.

Helicopters. Helicopters may provide a useful linkup with combat elements. They are capable of transporting replacement personnel or equipment and supplies during all phases of the crossing. Attack helicopters are ideally suited for providing overmatching fire, while medium and heavy lift helicopters move personnel and equipment. Medical support must include collection arrangements for casualties incurred on both sides of the gap. Forward of the obstacle, medical evacuation against the flow of traffic must be considered. Helicopters are valuable in this role.

Recovery equipment. Recovery equipment must be included in the traffic control plan to insure that all routes, particularly crossing sites, are kept open. Recovery resources should be provided at both sides of the crossing sites to insure that these remain operational. Because of difficulties of recovering heavy equipment, recovery and repair support must be given special consideration.

TACTICAL AIR CONSIDERATIONS

Gap-crossing requires close interaction with the on-going tactical air operations. Friendly forces must be protected from enemy attack

at crossing sites. The destruction or harassment of crossing activities by enemy aircraft will slow the momentum of the crossing. Air reconnaissance and counterair aviation lessen the chance for crossing failure. Air reconnaissance missions should be integrated into gap-crossing planning and deployment of assets. Such intelligence gathering can provide the nature of the

enemy's gap defense posture. Local air superiority may be available only for limited periods of time depending on the quantity of counterair aircraft available. Therefore, assault and breaching tasks are closely coordinated with the air commander. Also, close air support missions can assist the assault force in securing an area on the far side of an obstacle.