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Field Manual 90-13
Fleet Marine Force Manual 7-26

*FM 90-13
FMFM 7-26

Headquarters
Department of the Army
Commandant, US Marine Corps
Washington, DC, 30 September 1992

RIVER CROSSING OPERATIONS

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*This publication supersedes FM 90-13, 1 November 1978, and TC 90-13-1, 13 September 1985.

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Preface

PURPOSE

This manual describes how divisions and brigades conduct river crossings. It shows the relationship to corps operations, where appropriate, and includes details for lower echelons to support the brigades. It provides doctrine, tactics, techniques, and procedures in one reference to accomplish this special operation.

SCOPE AND APPLICABILITY

River crossings throughout recorded history have been important, frequently critical military operations. Commanders located the end of enemy lines, crossed a river a short distance away, and attacked the enemy flank to achieve surprise. Napoleon's crossing of the Po River in 1796 is a famous example. The wide-frontage warfare of this century, however, has seldom allowed a large-scale outflanking maneuver at a river. Campaign success has more often depended on an army seizing and holding crossings against direct opposition.

Corps assigns missions and provides the necessary support and equipment. Divisions normally assign bridgehead objectives and control movement across the river. Brigades are the bridgehead forces, which execute the crossings either independently or as elements of a larger force.

River crossing skills and knowledge are highly perishable. As with many other tactical operations, they require constant practice in planning and execution. There are relatively few opportunities to train with the frequency needed to keep a high degree of proficiency in this tough operation. For that reason, this manual includes considerable detail on techniques and procedures.

A river crossing is a special operation in that it requires specific procedures for success because the water obstacle prevents ground maneuver in the usual way. It demands more detailed planning and technical support than normal tactical operations. It also features specific control measures to move the force across a water obstacle. This obstacle may be a river, a lake, or a canal. Unlike other obstacle types, the water obstacle remains effective during and after the crossing operation. See *Field Manual (FM) 90-13-1* for other counterobstacle operations.

IMPLEMENTATION PLAN

As in the past, the United States (US) Army conducts river crossings within the context of its basic doctrine. This manual applies the current AirLand Battle doctrine described in *FM 100-5* to river crossings. It incorporates recent developments in command and control for command post facilities and military decision making. It also aligns US doctrine more closely with ongoing standardization efforts in the North Atlantic Treaty Organization (NATO). In particular, it implements the water crossing doctrine of *International Standardization Agreement (STANAG) 2395.*

USER INFORMATION

The proponent of this publication is the US Army Engineer School. Send comments and recommendations on Department of the Army (DA) Form 2028 (Recommended Changes to Publications and Blank Forms) directly to Commandant, US Army Engineer School, ATTN: ATSE-TDM, Fort Leonard Wood, MO 65473-6650.

Unless this publication states otherwise, masculine nouns and pronouns do not refer exclusively to men. The terms "enemy" and "threat" are used interchangeably in this manual.

Chapter 1
Concepts

GENERAL

The purpose of any river crossing is to project combat power across a water obstacle in order to accomplish a mission. A river crossing is a special operation. It requires specific procedures for success, because the water obstacle prevents normal ground maneuver. It also requires unique technical support and more detailed planning and control measures than normal tactical operations. The nature and size of the obstacle, the threat situation, and the available crossing assets limit the commander's options.

The challenge is to minimize the river's impact on the commander's tactics. The force is vulnerable while crossing, as it must break its movement formations, concentrate at crossing points, re-form on the far shore, and reduce its movement rate to the speed of the crossing means. The commander cannot effectively fight his force while it is split by a river. He must reduce this vulnerability by decreasing his force's exposure time. The best method is to cross the river in stride as a continuation of the tactical operation, whether in the offense or retrograde. Only as a last resort should the force pause to build up combat power or crossing means before crossing. This chapter introduces river crossing operations by discussing the characteristics of this special and difficult task.

AIRLAND BATTLE CONTEXT

AirLand Battle doctrine requires offensive action, high levels of mobility, and audacity. All of these are difficult to achieve when the force is hampered by a river. River crossing operations, within the context of AirLand Battle doctrine, as they will in future AirLand Operations, restore the mobility needed for battlefield success.

Successful river crossings require the application of the four tenets of AirLand Battle doctrine. Carefully selecting the point of attack and seizing the initiative enables a force to make a successful crossing while denying the threat time to recover from the initial surprise. A force cannot conduct a successful crossing without first seizing the initiative. A force must be well prepared to have the necessary agility to react faster to changes than the threat, as the crossing proceeds amid confusion, loss of crossing means, casualties, and errors. A force with necessary agility can conduct a hasty crossing upon arriving at a river without significant loss of momentum, cross in-stride, and develop an attack into an exploitation. Crossing requires depth in area on both shores of the river, in crossing resources, and in time to mass forces on the far shore. This depth must be developed by attacking to seize necessary terrain, by isolating the crossing area with air attack and fires, and by efficiently using all available crossing means if the crossing is to succeed. Forces must carefully synchronize all actions to ensure that the crossing produces adequate combat power at all critical places and maximum combat power at the decisive point and time. This synchronization requires careful calculation during planning and attention during execution.

River crossings take place within the context of close, deep, and rear operations. The focus of the close fight in the offense is the attack across the river and the subsequent securing of the bridgehead. In the retrograde, it is the movement across and subsequent defense along the river. Deep operations conducted by divisions and corps isolate crossing areas from threat reinforcement. Rear operations in an offensive crossing maintain the momentum, by ensuring the unimpeded movement of forces behind the initial assault, and sustain the force in the bridgehead. Initial preparations for a retrograde crossing are primarily rear operations.

CROSSING CATEGORIES

Corps assigns missions and provides the necessary support and equipment. Rarely will a river crossing be a specified task within that mission. More often, a division river crossing will bean implied task. Divisions normally assign bridgehead objectives and control movement across the river. Brigades assault across the river and secure the bridgehead as an element of a larger force.

Both division and corps headquarters anticipate and plan for river crossings in advance. All river crossings require detailed planning at these echelons. The planning requirements and technical support are similar, whether the crossing is hasty, deliberate, or retrograde.

Hasty

A hasty river crossing is a continuation of the attack across the river with no intentional pause at the water to prepare, so there is no loss of momentum. This is possible when threat resistance is weak and the river is

not a severe obstacle; therefore, a brigade does not need to make extensive plans but can rapidly and audaciously force a crossing.

A hasty river crossing is preferable to a deliberate crossing. It features decentralized control at the brigade level. The brigade may use organic, existing, or any available crossing means, but additional support from division or corps is often necessary.

A well-practiced standing operating procedure (SOP) compresses planning and preparation time. A concise order, clearly articulating the commander's intent, allows exploitation wherever subordinate units successfully force a crossing. When possible, advance elements seize crossing sites intact and ahead of the main body.

Against negligible or light threat resistance on both banks, the force does not have to clear all threat forces from the river to conduct a hasty crossing. It capitalizes on the threat's confusion and inability to effectively oppose the crossing.

The force crosses the river at multiple points across a broad front. It makes the crossing as soon as its elements reach the river. As the bulk of the force crosses the river, minimum forces remain to secure the crossing sites.

Deliberate

Corps and divisions conduct a deliberate river crossing when a hasty crossing is not feasible, when one has failed, or when they are renewing offensive operations along a river. A deliberate river crossing is an attack across the river after a halt to make the detailed preparations necessary to ensure success. It features centralized division planning and control, thorough preparations, and the massing of forces and crossing equipment. Time is available for extensive reconnaissance, full-scale rehearsals, development of alternate traffic routes, and logistics stockpiling.

River crossing fundamentals are the same for hasty and deliberate crossings, but their use varies. For example, traffic control is a key fundamental. The commander maintains it in a hasty crossing by using the unit SOP and a fragmentary order. In a deliberate crossing, he uses a traffic control organization that implements a detailed movement plan.

Retrograde

A retrograde crossing is a movement to the rear across a water obstacle while in contact with the threat. It establishes the defense on the exit bank or continues the retrograde to defensive positions beyond the water obstacle. A retrograde river crossing also features centralized planning and control because of limitations on existing bridges. It has the same amount of detailed planning as for a deliberate offensive crossing. Significantly, failure of the retrograde on the entry bank can cause the loss of the entire force.

CROSSING FUNDAMENTALS

Certain fundamentals are characteristic of all river crossings. They describe important attributes of crossing operations that must be included in crossing plans. Failure to consider these fundamentals can seriously risk the success of the crossing.

Surprise

The range and lethality of modern weapons allow even a small force to defeat a larger one exposed in an unfavorable position. A river provides this possibility by channeling a force through a small number of crossing sites, splitting its combat power on separate banks, and exposing units on the water. Surprise minimizes these disadvantages; forces that fail to achieve surprise may also fail in the crossing attempt.

A deception plan is a key element of surprise. It reinforces the threat's predisposition to believe that the force will take a particular course of action. The threat usually expects a crossing. A deception plan that employs reconnaissance, site preparations, force buildup, and preparatory fires at a time or location other than the intended crossing area may delay an effective threat response to the true crossing.

The usual operations security (OPSEC) measures are also important. Commanders enforce camouflage, noise, thermal, electromagnetic, and light discipline. Force deployment avoids predictable patterns. In particular, commanders closely control movement and concealment of river crossing equipment and other obvious river crossing preparations. Despite modern intelligence-gathering technology, the skillful use of night, smoke, fog, and bad weather is still effective.

Extensive Preparation

Comprehensive intelligence of threat defenses and crossing-area terrain must be developed early, since planning depends on an accurate and complete intelligence picture.

Supporting units, which include engineer battalions, bridge companies, smoke-generation platoons, and military police (MP) companies, link up early. They immediately begin crossing preparations and are available to train the lead units during rehearsals.

Commanders plan and initiate deceptive operations early to mask the actual preparation. These operations should conceal both the time and location of the crossing, so they begin before and continue throughout the preparation period.

Work necessary to improve routes to handle the crossing operation's traffic volume should occur early enough not to interfere with other uses of the routes. This requires a detailed plan carefully synchronized with the deception plan.

Rehearsals are essential to clarify roles and procedures, train personnel, inspect equipment, develop teamwork, and ensure unity of effort.

Flexible Plan

Even successful crossings seldom go according to plan. A flexible plan enables the river crossing operation to adapt rapidly to changes in the situation during execution. It allows the force to salvage the loss of a crossing site or to exploit a sudden opportunity. A flexible plan for a river crossing is the result of deliberate design, not chance. Such a plan features –

- Multiple approach routes from assembly areas to crossing sites.
- Lateral routes to switch units between crossing sites.
- Secondary crossing sites and staging areas to activate if threat action closes the primaries.
- Stocks of crossing equipment held in reserve to replace losses or open alternate sites.
- Preplanned engagement areas to block enemy counterattacks.

Traffic Control

The river is a significant obstacle that slows and stops units, thus impeding their ability to maneuver. They may be restricted to moving in column formations along a few routes that funnel together at the crossing sites. Control is essential for units to cross at the locations and in the sequence desired. Control achieves maximum crossing efficiency and prevents the formation of targets susceptible to destruction by artillery or air strikes. In addition, effective traffic control contributes to the flexibility of the plan by enabling commanders to change the sequence, timing, or site of crossing units. The traffic-control organization can switch units over different routes or hold them in assembly areas as directed by the tactical commander.

Organization

Commanders use the same command posts (CPs) for river crossings as they do for other operations. These CPs, however, take on additional functions in river crossings. For this reason, commanders specify which CPs and staff positions have specific river crossing planning and control duties. This may require a temporary collocation of headquarters cells (or individual augmentation) and an increase in communications means.

The commander organizes support forces consisting of engineer, MP, chemical, and other elements. This organization reports to his controlling headquarters. Since this is a temporary grouping, procedures established by the control headquarters must be clear, simple, and rehearsed by all elements to ensure responsive support of the plan and unity of command.

Terrain management is an integral part of the crossing operation. The controlling headquarters assigns different areas for support forces to work in and for forces to concentrate in before crossing. Otherwise, they interfere with each other and become lucrative targets for conventional, chemical, and nuclear fires.

Speed

A river crossing is a race between the crossing units and the threat to mass combat power on the far shore. The longer the force takes to cross, the less likely it will succeed, as the threat will defeat in detail the elements split by the river. Speed is of the utmost importance to crossing success. The commander must allow no interference with the flow of vehicles and units once the crossing has started.

Chapter 2
Terrain and Threat

GENERAL

Estimate of the Situation

Commanders and staffs develop estimates of the situation, described in *FM 101-5,* during the decision-making process. This chapter discusses terrain and threat aspects applicable to estimates for river crossing operations. Much of it has direct application to the intelligence preparation of the battlefield (IPB), covered in *FM 34-130.*

Tactical Requirements

Terrain characteristics strongly influence technical support for crossing operations, but tactical requirements drive crossing-area selection. River conditions must allow employment of available crossing means and the tactics required for the operation.

The far-shore terrain must support mission accomplishment; otherwise, crossing the river there serves little purpose. Crossing sites must also support rapid movement of units to the far shore, or the threat can win the force buildup race. Commanders balance tactical use of the far-shore terrain against technical crossing requirements at the river to determine suitable crossing locations.

Near-shore terrain must support initial assault sites, raft and bridge sites, and the assembly and staging areas used by the force. Routes to and from the river must support the quantity and weight of traffic necessary for the operation and for sustainment of the force in subsequent operations.

The threat disposition of forces limits options for the commander. Because the river physically splits his force, he should execute his crossing operation where the threat is most vulnerable or least able to react. This gives the commander time to mass his force on the far shore before the threat can concentrate against it.

TERRAIN

Characteristics

Rivers form unique obstacles. They are linear and extensive and normally cannot be bypassed. Meandering bends in rivers provide far-shore defenders with opportunities for flanking fires and observation. The combined-arms team, as normally configured for combat, needs special preparation and equipment to carry it across river obstacles. After an attacking force crosses the river, the river remains an obstacle for all following forces.

A formation cannot cross a river wherever desired, as it can with most field obstacles. Likely crossing sites can be few and equally obvious to both attacker and defender.

The river provides excellent observation and fields of fire to both attacker and defender. It exposes the force on the water and makes it vulnerable while entering and leaving the water. It is also an aerial avenue of approach, allowing threat aircraft low-level access to crossing operations.

Tactical employment of the force on the far shore depends on the crossing plan. Force buildup on the far shore is a race between defender and attacker. The river can be an obstacle behind the initial force across the river, allowing the threat to pin and defeat it in detail while preventing rapid reinforcement.

Military Aspects

As with other operations, terrain analysis for a river crossing considers the normal military aspects of terrain, which are observation, cover and concealment, obstacles, key terrain, and avenues of approach (OCOKA). However, many details are peculiar to river crossings. These details include the specific technical characteristics of the river as an obstacle.

River Current

The current is the primary consideration. It imposes limits on all floating equipment, whether rubber assault boats, swimming armored vehicles, rafts, or bridges. Current velocity determines how much the floating equipment can carry or if it can operate at all. Current affects the distance that floating equipment will drift downstream. Therefore, commanders must either select an offset starting point upstream to reach a desired point on the far shore or take additional time to fight the current. High current velocities make control of a heavy raft difficult and require more time and higher skill from boat operators and raft commanders for landings.

Current causes water pressure against floating bridges. Bridge companies use boats or an anchorage system to resist this pressure. The higher the current, the more extensive the anchorage or boat system must be. Current also provides velocity to floating objects, which can damage or swamp floating equipment.

Current can be measured easily (by timing a floating stick, for example) but is normally not constant across the width of the river. Generally, it is faster in the center than along the shore. It is also faster on the outside of a curve than on the inside.

Water Measurements

Water depth influences all phases of river crossing. If it is shallow enough, fording is possible. If the force uses assault boats, the water must not become shallow in the assault area, or the force will have to wade and carry their equipment. Shallow water also causes difficulty for swimming vehicles, as the rapidly moving tracks can dig into a shallow bottom and ground the vehicle. The water must be deep enough to float bridge boats and loaded rafts on their crossing centerlines and deep enough in launch areas to launch boats and bridge bays. Water depth is not constant across a river; it is generally deeper in the center. Either a bottom reconnaissance with divers or sounding from a reconnaissance boat is necessary to verify depth.

River width is a critical dimension for bridges (where it determines how much equipment is necessary) and for rafts. The distance a raft must travel determines its round-trip crossing time, which in turn determines the force buildup rate on the far shore.

Water Changes

Swell is the wave motion found in large bodies of water and near the mouths of rivers. It is caused by normal wave action in a larger body, from tidal action, or from wind forces across the water. It is a serious consideration for swimming armored vehicles and is less important for assault boats, heavy rafts, and bridges. Hydrographic data and local residents are sources of information. Direct observation has limited use, as swell changes over time with changing tide and weather conditions.

Tidal variation can cause significant problems. Water depth and current change with the tide and may allow operations only during certain times. Tidal variation is not the same every day, as it depends on lunar and solar positions and on the river velocity. Planners need tide tables to determine the actual variation, but they are not always available for rivers. Another tidal phenomenon found in some estuaries is the tidal bore, a dangerous wave that surges up the river as the tide enters. It seriously affects water operations.

Rivers may be subject to freshets or sudden floods due to heavy rain or thawing upstream. This will cause bank overflow, higher currents, deeper water, and significant floating debris. If the threat possesses upstream flood-control structures or dams, they can cause these conditions also.

Obstructions

All rivers contain sand or mud banks. They are characteristic of low-current areas along the shore and on the inside of river curves, but they can be anywhere. Since they cause problems for swimming vehicles, assault boats, outboard engines, bridge boats, and rafts, troops must find them through underwater reconnaissance or sounding.

Rocks damage propellers, floats, ground rafts, boats, and floating bridges. They cause swimming armored vehicles to swamp if the vehicle body or a track rides up on them high enough to cant the vehicle and allow water into a hatch or engine intake. They can also cause a fording vehicle to throw a track. Rocks are found by underwater reconnaissance or sounding.

Natural underwater obstructions and floating debris can range from sunken shipping to wreckage and snags. The current in large waterways can carry significant floating debris, which can seriously damage boats and floating equipment. Floating debris can be observed, generally after flooding or rapidly rising waters. Underwater reconnaissance or bottom-charting sonar are the only ways to locate underwater obstructions.

Man-made underwater obstacles can be steel or concrete tetrahedrons or dragons' teeth, wood piles, or mines. The threat places them to deny a crossing area and designs them to block or destroy boats and rafts. Underwater reconnaissance or bottom-charting sonar can locate these obstacles.

Vegetation in the water can snag or choke propellers and ducted impellers on outboard motors and bridge boats. Normally, floating vegetation is not a significant problem. Thick vegetation beds that can cause equipment problems are found in shallow water and normally along the shore. As thick vegetation must extend to within 1 to 2 feet of the surface to hinder equipment, it can normally be seen from the surface.

The Friendly Shore

Concealment is critical to the initial assault across the river. The assaulting unit must have concealed access to the river. It must also have concealed attack positions close to the river in which to prepare assault boats. The overmatching direct-fire unit prepares concealed positions along the friendly shore, taking full advantage of vegetation and surface contours. Salients formed by river meanders limit the number of threat positions that can see or fire on friendly operations.

Dominant terrain formed by hill masses or river bluffs provides direct-fire overwatch positions. If the dominating terrain is along the shore, it also covers attack positions, assembly areas, and staging areas. Air defense sites need terrain that dominates aerial

avenues of approach, one of which is along the river itself.

Approaches to the river must support every stage of the crossing. Critical elements include the following:

- Initial dismounted avenues allow silent and concealed movement of assault battalions to the river.
- Attack positions are very close to the water along the dismounted avenue.
- Avenues from the attack positions to the water have gradual slopes and limited vegetation to allow the assaulting unit to carry inflated assault boats.
- Bank conditions are favorable. Dismounted forces must be able to carry assault boats to the water, and engineer troops must be able to construct and operate rafts with little bank preparation.
- Road nets feed the crossing sites and support movement of construction equipment between sites. These road nets must be well constructed to carry large amounts of heavy vehicle traffic.
- Potential staging areas can support large numbers of tracked and wheeled vehicles without continual maintenance.

The Threat Shore

River meanders form salients and reentrant angles along the shore. A salient on the threat shore is a desirable crossing area for two reasons. It allows friendly fires from a wide stretch of the near shore to concentrate against a small area on the far shore and limits the length of threat shore that must be cleared of direct fire and observation. Additionally, salients on the threat shore generally mean that the friendly shore banks are steeper and the water is deeper, while the threat shore tends to have shallow water and less challenging banks. See *Figure 2-1.*

Dominant terrain is undesirable on the threat shore. Any terrain that permits direct or observed-indirect fires onto crossing sites is key terrain. Friendly forces must control it before beginning the raft or bridge phases.

Natural obstacles must be minimal between the river and the bridgehead objectives. River valleys often have parallel canals, railroad embankments, flood-control structures, swamps, and ridges that can impede more than the river itself. Obstacles perpendicular to the river can help isolate the bridgehead.

Exits from the river must be reasonably good without preparation. Initially, the bank should allow the assaulting unit to land and dismount from the assault boats. This requires shallow banks with limited vegetation, The assaulting unit also requires concealed dismounted avenues up from the river large enough to move assaulting battalions. Bank conditions must allow vehicles to debark from rafts and move up from the river. If banks require earthwork, at least one unimproved crossing site must allow landing earthmoving equipment. The most important far-shore requirement is a road net to carry high volumes of heavy vehicle traffic.

THREAT

Leaders who understand threat tactics can defeat the threat at the river for a successful crossing. Many potential enemies use Soviet doctrine, making Soviet tactics the most likely ones US forces must overcome during a crossing. Therefore, this discussion describes a Soviet-style defense and attack at rivers as the most likely threat. See *FM 1OO-2-1* for details on Soviet defense, *FM 100-2-2* for Soviet river crossings, and *FM 100-2-3* for Soviet equipment capability.

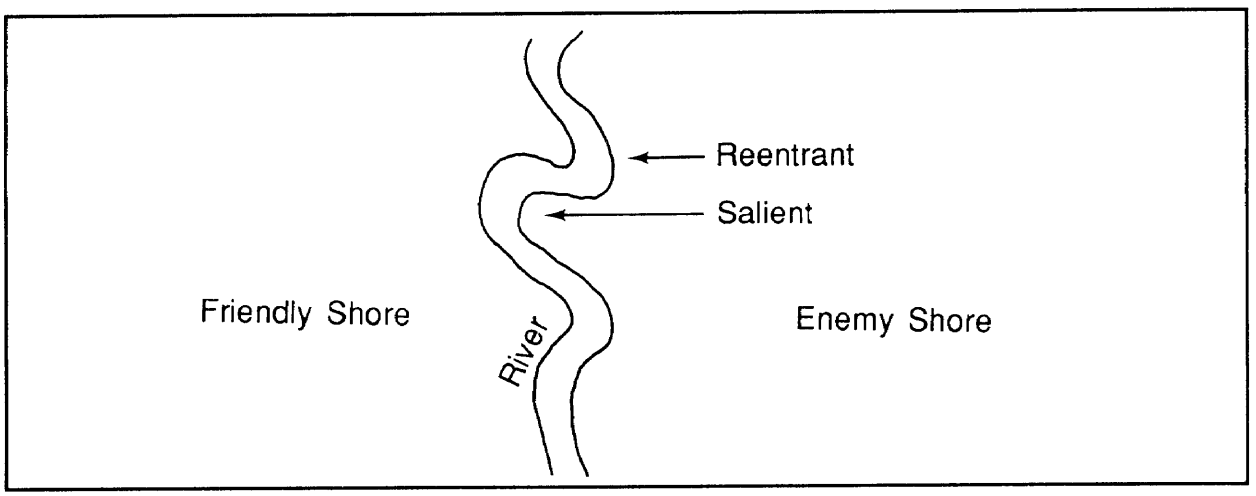


Figure 2-1. Salient and reentrant on enemy shore

Threat River Defense

The threat considers a water obstacle to be a natural barrier, enabling a strong defense on a wide front with small forces. It prefers to defend on the bank of the river that is under its complete control. It can, however, defend forward or to the rear of the river. Its choice depends on the terrain, forces available to it and their strengths, and whether its forces are in or out of contact. The threat considers the defensive characteristics of the terrain. It weighs the severity of the obstacle, the effect of lost crossing sites, and the possibility of severed supply lines,

The threat may defend forward when the terrain is favorable, when it has sufficient reserve combat power, or when it plans to resume the offense immediately. When defending forward, it intends to defeat the crossing force before it reaches the river. The threat will place its defensive forces as far forward of the river as possible.

First-echelon regiments of a division in the main defensive belt forward of the river establish initial defensive positions 10 to 15 kilometers from the river. Second-echelon regiments occupy positions within a few kilometers of the river. These positions are astride major avenues of approach to block attacking forces so that a counterattack can destroy them.

When defending along the river, the threat places most of its forces as close to the exit bank as defensible terrain permits. Their mission is to protect the crossing sites and defeat the force attempting to cross while it is divided by the river. The arrangement of defensive belts is similar to the defense forward of the river, except that the distance between first- and second-echelon regiments may be less. This increases the volume of fires on crossing sites and concentrates more force to defeat lead elements on the exit bank.

Threat engineers destroy existing bridges and mine known crossing sites. They keep only a few sites open for withdrawal of the predominantly amphibious security force. Engineers also emplace obstacles along approach and exit routes, including the river banks. As time and assets permit, they add obstacles such as floating mines and underwater obstructions to further disrupt crossing efforts.

First-echelon defensive forces maneuver to bring maximum defensive fire on the threat. These forces engage the threat with all possible organic and support weapons at crossing sites and while it is crossing. Their mission is to defeat the threat before it can establish a bridgehead.

Second-echelon battalions, astride major egress routes from the river, block assault elements so counterattacking forces can engage and destroy battalion or smaller assault elements. Second-echelon regiments occupy positions 4 to 5 kilometers behind the first echelon. They provide depth to the defense. The threat launches local counterattacks into this area.

The threat undertakes a defense to the rear of the river when time or terrain precludes a defense forward of the river or on the exit bank. In this situation, security elements deploy on the exit bank to harass and disrupt the attacker's assaulting and supporting units. These security elements delay the attacker to provide time to establish the main defense.

A significant threat capability against a river crossing is artillery. It is not sufficient to eliminate only threat observation of the river before building bridges, as the concentration of artillery fires can deny an entire bridge or raft centerline without the necessity for observed fires. Counterbattery fire must be planned to neutralize enemy artillery attacks on the crossing area.

Threat Offensive River Crossing

The threat's offensive river crossing capability has a significant effect on retrograde crossings by US forces. Threat doctrine espouses direct and parallel pursuit. The threat's ability to force a crossing on a flank and cut off friendly elements before they can complete the retrograde crossing is a major concern.

The threat is well prepared to cross water obstacles. On the average, it anticipates that a formation on the offense will cross one water obstacle of average width (100 to 250 meters) and several narrower ones each day. It considers the crossing of water obstacles to be a complex combat mission but regards this as a normal part of a day's advance.

The threat has two assault crossing methods. The first one is an assault crossing from the line of march. This it does on the move, having prepared its subunits for the crossing before they approach the water obstacle. The other method is the prepared assault crossing, where main forces deploy at the water obstacle and cross after making additional preparations. The threat considers the success of a crossing in both cases to be determined by –

- Careful preparation,
- Reconnaissance of opposing forces and the water obstacle.
- Surprise.
- Air cover.
- Destruction of opposing forces by fire.
- Timely advance of crossing resources.
- Personnel and equipment control at the crossings.
- Strict compliance with safety measures.

Development of the offense creates the conditions for an assault crossing from the line of march. Therefore, threat doctrine calls for relentless pursuit to prevent the opponent from disengaging, to seize available crossing sites quickly, and to cross the river on the heels of withdrawing forces. Forward detachments and advance guards have a large role in this. A forward detachment reaches the water obstacle as quickly as possible, bypassing strongpoints and capturing existing bridges or river sections suitable for an assault crossing. It crosses the water, seizes a line on the opposite bank, and holds until the main force arrives.

The threat achieves protection from its opponent along routes to the river by using concealing terrain and creating vertical screens out of vegetation and metallic camouflage nets. Once the crossing begins, it uses smoke and thermal decoys to defeat precision-guided munitions.

Threat tactical doctrine recognizes that time has a decisive significance for success in an assault crossing from the march. The threat anticipates that it should take a forward detachment (battalion) 1 to 1 1/2 hours, a first-echelon regiment 2 to 3 hours, and a division 5 to 6 hours to cross a river of moderate width (100 to 250 meters).

When the assault crossing from the line of march is not feasible, the threat uses the prepared assault crossing. Here, the main force deploys at the water obstacle with subunits in direct contact with the opponent. The threat then makes more thorough preparation for the crossing. Success depends on covertness, so the crossing usually takes place at night.

INTELLIGENCE

Detailed knowledge of the river and the adjacent terrain is critical to both tactical planning and to engineer technical planning. The keys are early identification of intelligence requirements and an effective collection plan. Space-based imaging and weather systems can provide invaluable information to the terrain data base. Additionally, information can be gained from other imagery-gathering systems and human intelligence-gathering systems (HUMINT). Multispectral imagery (MSI) from satellites can give the engineer terrain detachment a bird's-eye view of the area of operations. Satellite images, the largest 185 kilometers by 185 kilometers, can be used to identify key terrain and provide crossing locations. They can provide information concerning river depth and turbidity and can be used to identify line of site for weapons and communications systems. With MSI products, commanders can identify and exploit prospective construction materials, locations of existing crossing sites, and near- and far-shore road nets.

When MSI is combined with satellite weather receivers, processors, and the terrain data base, it can be used to identify mobility corridors and establish flood-plain trafficability. When these space systems are used together, the effects of the weather on terrain can be analyzed and used to develop decision-support products for the commander.

The terrain data base is the starting point for obtaining terrain information. Hydrographic studies exist for most rivers in potential theaters of operation around the world. Many of these studies have sufficient detail for identification of feasible crossing sites. Modern information collection and storage technology permit frequent revision of existing data.

Engineer terrain detachments at corps and division maintain the terrain data base and provide information in the form of topographic products. Their use with other tools, such as computers and photography, develops terrain intelligence for staff planners. The planners' terrain analyses in turn determine initial crossing requirements and estimated crossing rates.

Early in the situation analysis, planners identify further terrain intelligence needs for the crossing. They provide this to the Assistant Chief of Staff, G2 (Intelligence) (G2) for inclusion in the intelligence collection plan. This plan directs the intelligence system to gather essential terrain information for a more detailed analysis. Aerial and ground reconnaissance obtain this information on specific river segments and the surrounding terrain and verify the information.

Priority Intelligence Requirements (PIRs)

The following items of tactical and technical information are often PIRs for executing a successful crossing:

- Threat perceptions of friendly crossing intentions,
- Threat positions that can place direct or observed-indirect fires on crossing sites and approaches.
- Location and type of threat obstacles, particularly mines, in the water and on exit banks.
- Location of threat reserves that can counterattack assault units.
- Location of threat artillery that can range crossing sites, staging areas, and approaches.
- Location and condition of existing crossing sites.
- River width, depth, and velocity.
- River bottom conditions and profile.
- Bank height, slope, and stability.

More information requirements are –

- Previous threat tactics defending water obstacles.
- Condition of near-shore and far-shore road nets.
- Flood plain trafficability.

Information Collection

Engineer units have the primary responsibility to collect the terrain information needed for river crossings. If the river is under friendly control, engineer units collect river, bank, and route information. If it is not, maneuver reconnaissance units with attached engineer, long-range surveillance (LRSU), or special operation forces (SOF) can conduct reconnaissance operations or deep patrols to obtain needed information. Organic reconnaissance swimmers from the corps bridge companies obtain far-shore, near-shore, river bottom, and underwater obstacle information. Local inhabitants provide additional information about bridges, river flow, bank stability, road network, ford sites, and other river conditions. Normal intelligence collection assets develop the picture of the threat defense necessary for templating.

Chapter 3
Division Deliberate River Crossing

GENERAL

A division deliberate river crossing is an operation conducted as apart of an offensive operation. Its intent is to quickly cross a water obstacle and rapidly sieze the final objective. It is an audacious attack that is planned and meticulously coordinated with all concerned elements. The deliberate river crossing requires thorough reconnaissance and extensive evaluation of all intelligence. It requires detailed planning and preparation, centralized control, and extensive rehearsals. A deliberate river crossing is costly in terms of manpower, equipment, and time. It is generally conducted against a well-organized defense when a hasty river crossing is not possible or when one has failed. This type of river crossing requires the sudden, violent concentration of combat power on a narrow front, capitalizing on the element of surprise. This chapter describes division deliberate river crossing operations. It will discuss in detail the phases, echelons, organizations, and command and control of this complex operation.

PLANNING THE PHASES

An offensive deliberate river crossing operation has four phases. They are distinct phases for planning, but there is no pause between them in execution.

Phase I: Advance to the river. The first phase is the deliberate attack to seize and secure the near shore of a water obstacle.

Phase II: Assault across the river. The second phase involves units assaulting across a water obstacle to secure a lodgement on the far shore, eliminating direct fire on the crossing sites.

Phase III: Advance from the exit bank. The third phase is the attack to seize and secure exit-bank and intermediate objectives that eliminate direct and observed-indirect fire into the crossing area.

Phase IV: Secure the bridgehead line. The final phase involves units that seize and secure bridgehead objectives to protect the bridgehead against counterattack. This gains additional time and space for buildup of forces for the attack out of the bridgehead.

These phases are followed immediately by an attack out of the bridgehead to defeat the threat forces at subsequent or final objectives. *Figure 3-1, page 3-2,* relates the crossing phases to the objectives described in this chapter.

THE RIVER CROSSING

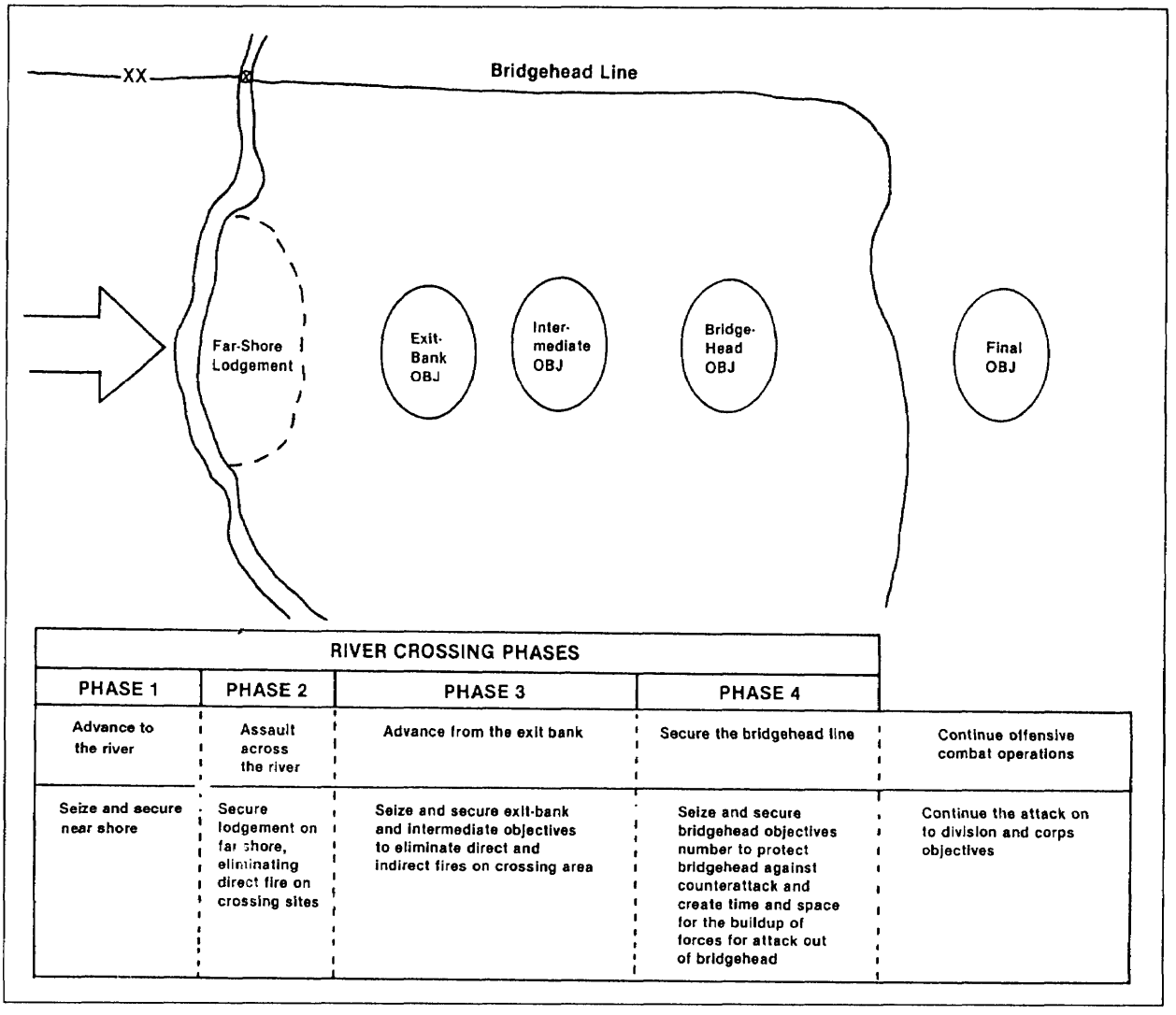
The following section describes the deliberate river crossing operation from division and brigade perspectives. It details the actions required in deep, close, and rear operations by phase (see *Figure 3-2, page 3-3).*

A division is normally the smallest organization that can conduct a deliberate river crossing operation. It is usually an implied task in a larger mission given by corps. The river crossing is not the objective but is part of the scheme of maneuver and overall offensive action against the enemy. The threat will normally use the river as a tactical obstacle system to slow and gain positional advantage against the division's advance. The intent of the division is to maintain its momentum through the crossing.

Mission, enemy, terrain, troops, and time available (METT-T) dictate the force allocation required during each phase of the operation. Aside from the normal planning, detailed march tables are required for the rapid passage of units through the crossing area into the bridgehead. Detailed plans are disseminated before the execution to ensure uninterrupted operation. River crossing operations restrict movement to four to six routes. This requires disciplined and controlled movement to ensure that combat power builds in the bridgehead faster than the threat's ability to react.

An integral part of a river crossing operation is the deception plan. Corps will plan, resource, and control all of the requirements to execute a believable deception so that the threat does not know where the division will conduct the deliberate river crossing operation,

To conduct a deliberate river crossing, a division requires augmentation from corps. Corps must provide bridge companies in direct support to the division for the river crossing operation in addition to other combat engineers required to operate assault boats, provide command and control, and so forth. A corps engineer group commonly supports a deliberate river crossing operation and can remain in place after the division continues the attack to subsequent corps objectives. The engineer group should include one corps combat engineer battalion and two assault bridge companies for each lead brigade. Additionally, corps normally



RIVER CROSSING PHASES

PHASE 1	PHASE 2	PHASE 3	PHASE 4	
Advance to the river	Assault across the river	Advance from the exit bank	Secure the bridgehead line	Continue offensive combat operations
Seize and secure near shore	Secure lodgement on far shore, eliminating direct fire on crossing sites	Seize and secure exit-bank and intermediate objectives to eliminate direct and indirect fires on crossing area	Seize and secure bridgehead objectives number to protect bridgehead against counterattack and create time and space for the buildup of forces for attack out of bridgehead	Continue the attack on to division and corps objectives

Figure 3-1. Deliberate river crossing

provides a corps MP company to assist the division in regulating the traffic and conducting route security in the crossing area. Corps also allocates additional smoke units to assist the division chemical company in obscuring the river crossing area. Finally, corps will provide short-range air defense (SHORAD) and high to medium air-defense altitude (HIMAD) air-defense artillery (ADA) support to protect the bridgehead from air interdiction.

Advance to the River (Phase I)

Once the division has planned the operation, the first phase is initiated. The division will attack to seize near-shore terrain that includes favorable crossing sites and road networks. Normally, a division will advance with two brigades abreast and a reserve brigade trailing. The cavalry squadron can provide a forward or flank screen (see *Figure* 3-3, *page 3-4).* The division tactical command post (DTAC) will control the efforts of the lead brigades. See *FM 71-100.*

Well before the division reaches the river, the cavalry squadron moves ahead of the main body to conduct a reconnaissance of the near shore and predetermined crossing sites. If the tactical situation prohibits the cavalry squadron from moving to reconnoiter the crossing sites, one or both of the lead brigades can conduct the reconnaissance. As the division arrives at the river, the lead brigades establish security on the near shore of the river. The lead brigades develop hasty defensive positions to protect the crossing area and cover the crossing sites with direct and indirect fire.

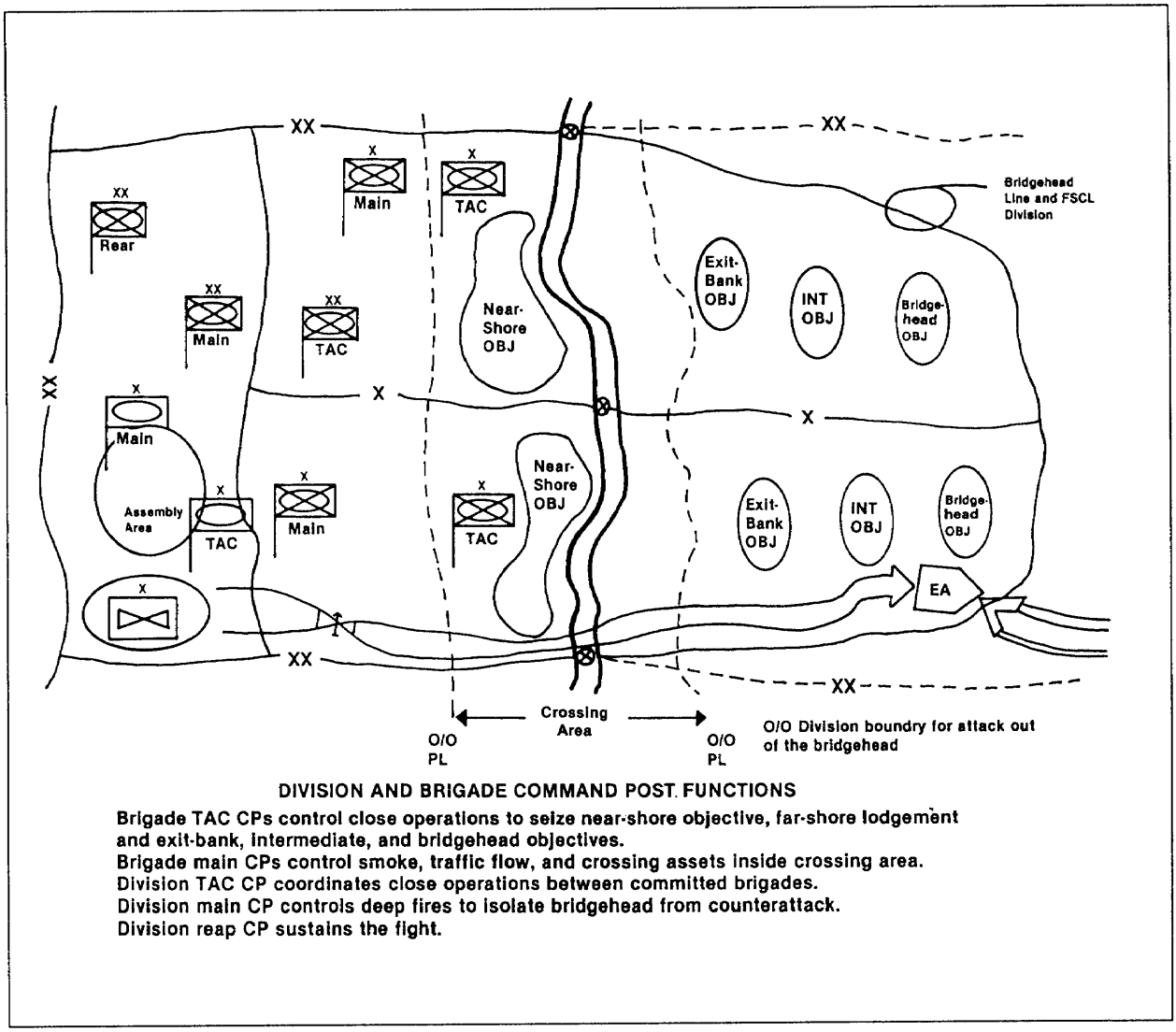


Figure 3-2. Division and brigade command post functions

During the advance to the river, the division main command post (DMAIN) coordinates the counterfires, close air support (CAS), and division aviation brigade support against deep targets. By effectively using these assets, the DMAIN fights the deep battle and isolates the bridgehead.

The division rear command post (DREAR) sustains the division advance. It ensures key classes of supply are pre-positioned forward. Priority is shifted to maintenance of bridge assets and those units supporting the crossing area. See *FM 71-3.*

The brigade tactical command post (BTAC) controls the fight of the task forces within its brigade. The brigade will travel in a formation that is METT-T driven. The brigade seizes objectives that secure the near shore (see *Figure 3-4, page 3-5).*

Each brigade main command post (BMAIN) is the crossing area headquarters (CA HQ) responsible for controlling units that provide the crossing means, traffic management, and obscuration. Normally, corps assets are task-organized by division in direct support of the forward brigades to perform these functions. The BMAIN will control these assets. Once the brigade has secured the near shore, MPs and engineers mark routes to the crossing sites; lay out staging, holding, and call-forward areas; and set up engineer regulating points (ERPs) and traffic control posts (TCPs).

Once the near shore is secured, the DTAC becomes the crossing force headquarters responsible for coordinating close operations of the committed brigades within the bridgehead and crossing area. The bridgehead is the area on the far shore required to

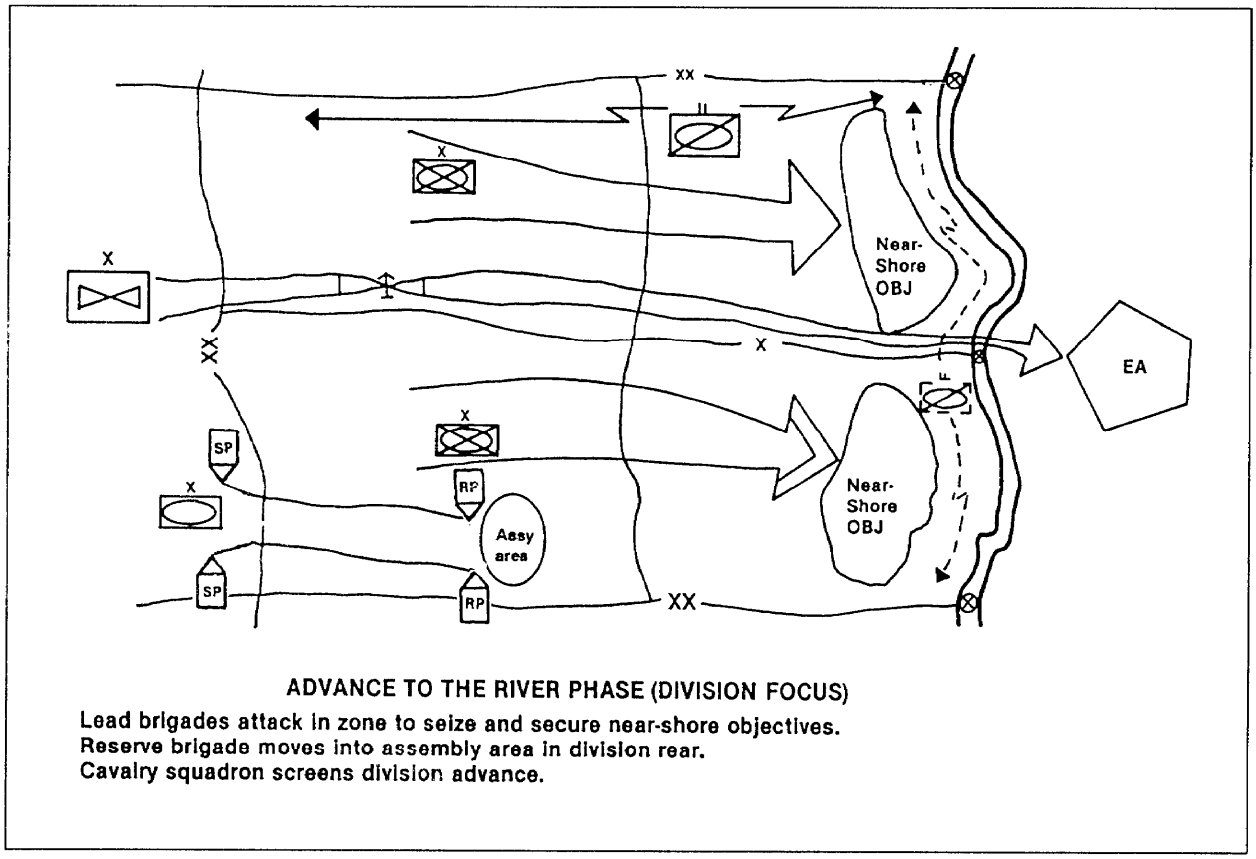


Figure 3-3. Advance to the river phase (division focus)

provide space and time for buildup of combat power to continue offensive combat operations. The crossng area is the area bounded on either side of the river by phase lines in which units move on specified routes and time tables as dictated in the division order.

The DTAC coordinates the efforts of the lead brigades as they prepare to assault across the river.

Assault Across The River (Phase II)

The DMAIN continues to control deep fire assets to isolate the bridgehead. As units advance, deep fires shift to subsequent targets. Division coordinates with corps for SHORAD and HIMAD coverage to protect the bridgehead from enemy air interdiction. Corps will normally provide Patriot and Hawk support. Local air-defense coverage is provided by the division air-defense battalion. Approaches and crossing sites along the river are the highest priority for air defense during the crossing because the river creates lucrative targets at relatively fixed locations that are easily targeted by threat air. Air-defense units occupy positions to engage aircraft with massed fires before the aircraft can reach weapons release points.

The DTAC coordinates the brigades conducting the assault crossing of the river (see *Figure 3-5, page 3-6).* The crossing sites are chosen for cover from observation, a good route system, and sufficient space for assembly areas on the near shore. The crossing sites also have defensible terrain on the far shore of the river to provide a secure base for the continuation of the operation.

The DREAR begins to push packages of Class IV and V supplies to support the hasty defense to secure the bridgehead line.

The BTACs control their own respective assault crossing elements, which are normally dismounted infantry task forces. A corps combat engineer company, operating RB15 rubber assault boats (from the corps bridge companies), transports the dismounted task forces to the far shore. The assaulting dismounted task forces cross the river and secure a lodgement for the reinforcing armor vehicles. The dismounted assault forces are supported by the tanks and infantry fighting vehicles from their task force and by other combat units in attack-by-fire positions (see *Figure 3-6, page 3-7).* Heavy rafts are prepared to transport tanks and infantry fighting vehicles to the far shore for reinforcement of the dismounted infantry, and armored combat earthmovers (ACEs)/dozers are transported to

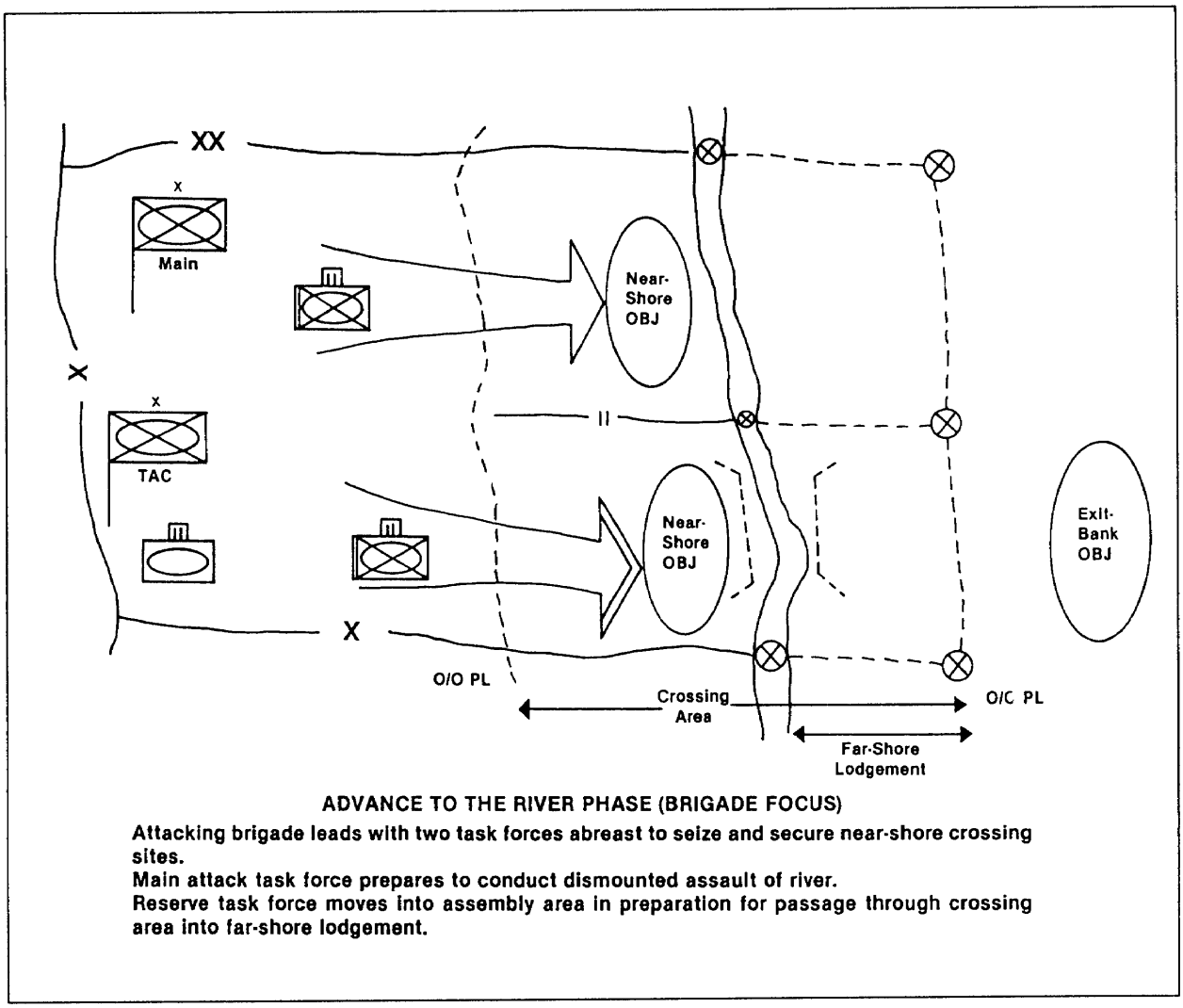
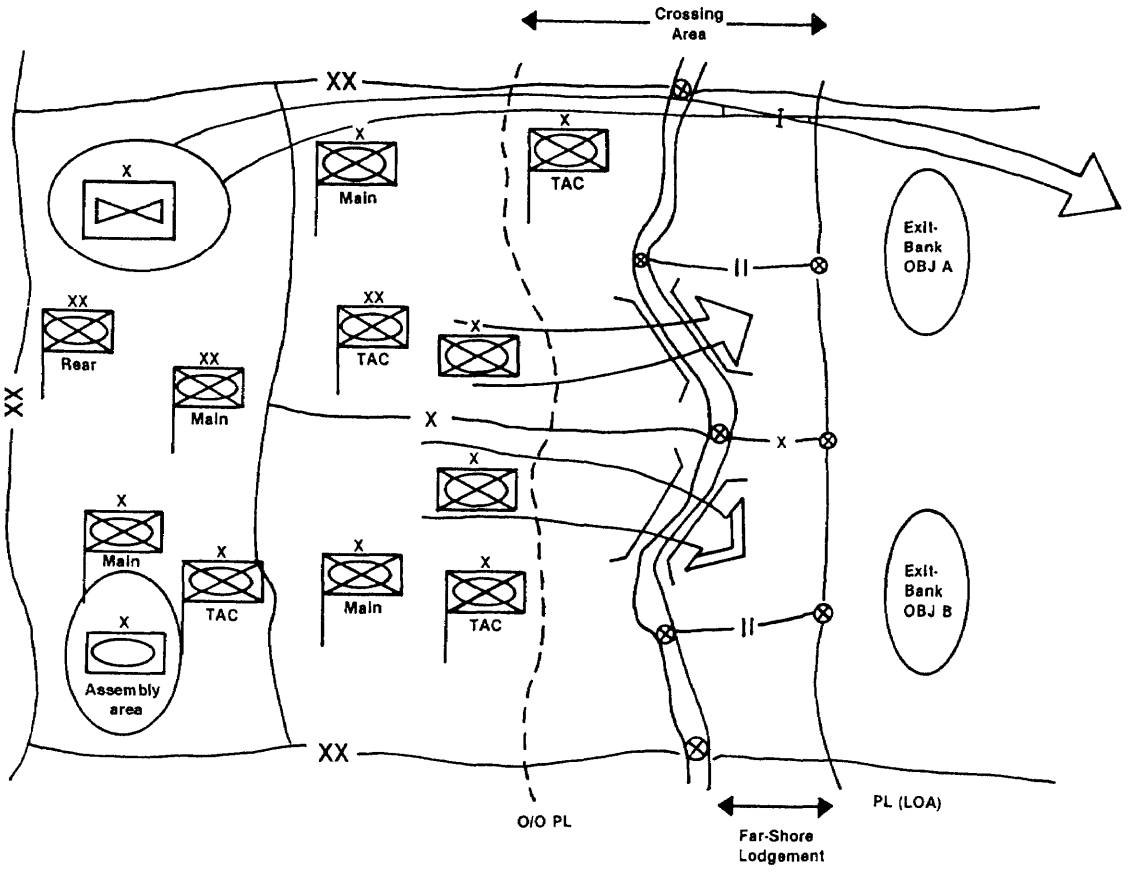


Figure 3-4. Advance to the river phase (brigade focus)

prepare the far-shore exit sites. Rapid reinforcement of dismounted assault troops with armored vehicles may be so critical based upon METT-T that it justifies the use of any expedient method to get the first few armored vehicles across. This includes winching, towing, or pushing the first ones across normally unsuitable places while engineers improve entry and exit points for the rest.

Each BMAIN controls smoke to obscure crossing sites on the river. When employed, the smoke blanket covers several kilometers of the river and river approaches to conceal the actual crossing locations. The CA HQ uses smoke generators, smoke pots, and smoke munitions from division and corps. The BMAIN controls the use of MP and corps engineer units to establish near-shore waiting areas, to mark routes to the crossing sites, and to begin to construct heavy rafts and/or bridges.

The assault crossing of the river can also be an air-assault operation. The intent of this phase is to rapidly place combat power on the far shore to eliminate the threat's direct fire onto the crossing sites and secure terrain for attack positions. Brigades will normally plan phase lines and fire-support coordination lines (FSCLs) for the assaulting dismounted task forces. These lines establish a limit of advance that encompasses the lodgement area. Threat fire into the crossing area will probably continue; however, each crossing site within the crossing area must be isolated from direct fire to enable the construction and operation of rafts. These rafts will then be used to transport armor vehicles for rapid reinforcement of the dismounted infantry task force. Within the crossing area, secured attack positions allow units to form into combat formations before continuing the attack (see *Figure 3-7, page 3-8).*



ASSAULT ACROSS THE RIVER PHASE (DIVISION FOCUS)

Lead brigades conduct dismounted assault crossing of river to secure in-zone far-shore lodgement, permitting the crossing of armored assets on heavy rafts.

Figure 3-5. Assault across the river (division focus)

Advance from the Exit Bank (Phase III)

The division expands its lodgement on the far shore by attacking to seize and secure exit-bank and intermediate objectives. The intent is to eliminate direct and observed indirect fire from the crossing area (see *Figure 3-7, page 3-8).*

The division commander selects exit-bank and intermediate objectives based on METT-T. The river splits the attacking force, limiting massed direct fires beyond the exit bank. Therefore, these objectives are usually smaller and not as far from attack positions as initial objectives used in other offensive operations.

Once the exit banks are secured, the division cavalry squadron will cross either by swimming or rafting their cavalry fighting vehicles. They will then conduct normal screening operations for the division as the armored reinforcements are crossing the river and preparing to advance from the exit bank.

The DTAC controls the coordinated attack of the lead brigades and the cavalry squadron to seize the exit-bank and intermediate objectives.

The DMAIN controls deep fires provided by aviation, artillery, and CAS to block enemy counterattacks into the bridgehead as requested by the DTAC.

The DREAR prepares to push packages of Class III and V that will support the attack out of the bridgehead. They also begin to push Class IV and V supplies for the hasty defense during the last phase of the river crossing operation.

The BMAINs control the movement of their follow-on task forces from staging areas through the crossing areas to the attack positions within the far-shore

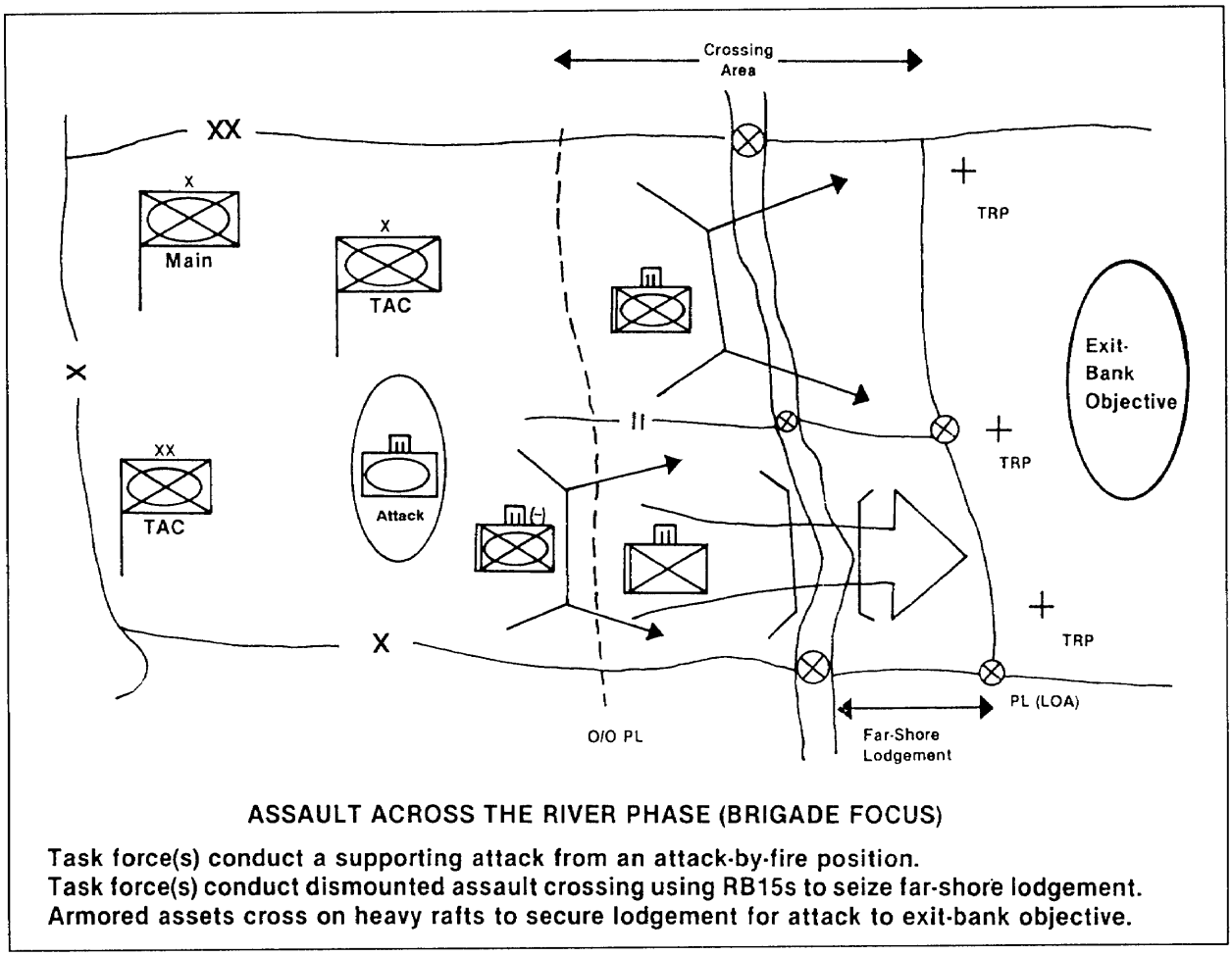


Figure 3-6. Assault across the river (brigade focus)

lodgement. They control the upgrade of crossing sites from assault boats (RB15s) to heavy rafts and/or bridging to ensure that the force buildup can support the advance from the exit bank to intermediate objectives. MPs and corps combat engineers assist movement control through the crossing area.

The crossing areas, bounded by phase lines on the friendly and threat sides of the river, are activated by the BMAIN after the far-shore lodgement is secure. The phase line on the friendly side of the river is usually set 2 to 3 kilometers from the exit bank, out of the range of threat direct-fire weapons. The phase line on the threat side of the river delineates an area large enough for forces to occupy battalion-sized attack positions. During this phase, limited two-way traffic begins to return disabled equipment and casualties.

The BTAC controls the movement out of the attack positions to exit-bank and intermediate objectives. Exit-bank objectives are those positions which when seized eliminate the threat's ability to use direct-fire weapons on the crossing area. Intermediate objectives are those positions from which the threat can provide observation for indirect-fire weapons. The seizure of these objectives also provides depth to the bridgehead to eliminate bottlenecks. This enables expansion of SHORAD coverage, allowing more time to engage aircraft in air avenues of approach on the far shore (see *Figure* 3-8, *page* 3-9).

The task force that conducted the dismounted assault across the river continues to cross armored vehicles and remount dismounts in preparation for support to the main attack.

The brigade commanders establish the order of raft loads based on the division's crossing priorities. Bridge companies run heavy raft sites and begin to construct ribbon bridges. MPs mark routes and control holding areas on the far shore to ensure rapid transit within the crossing area.

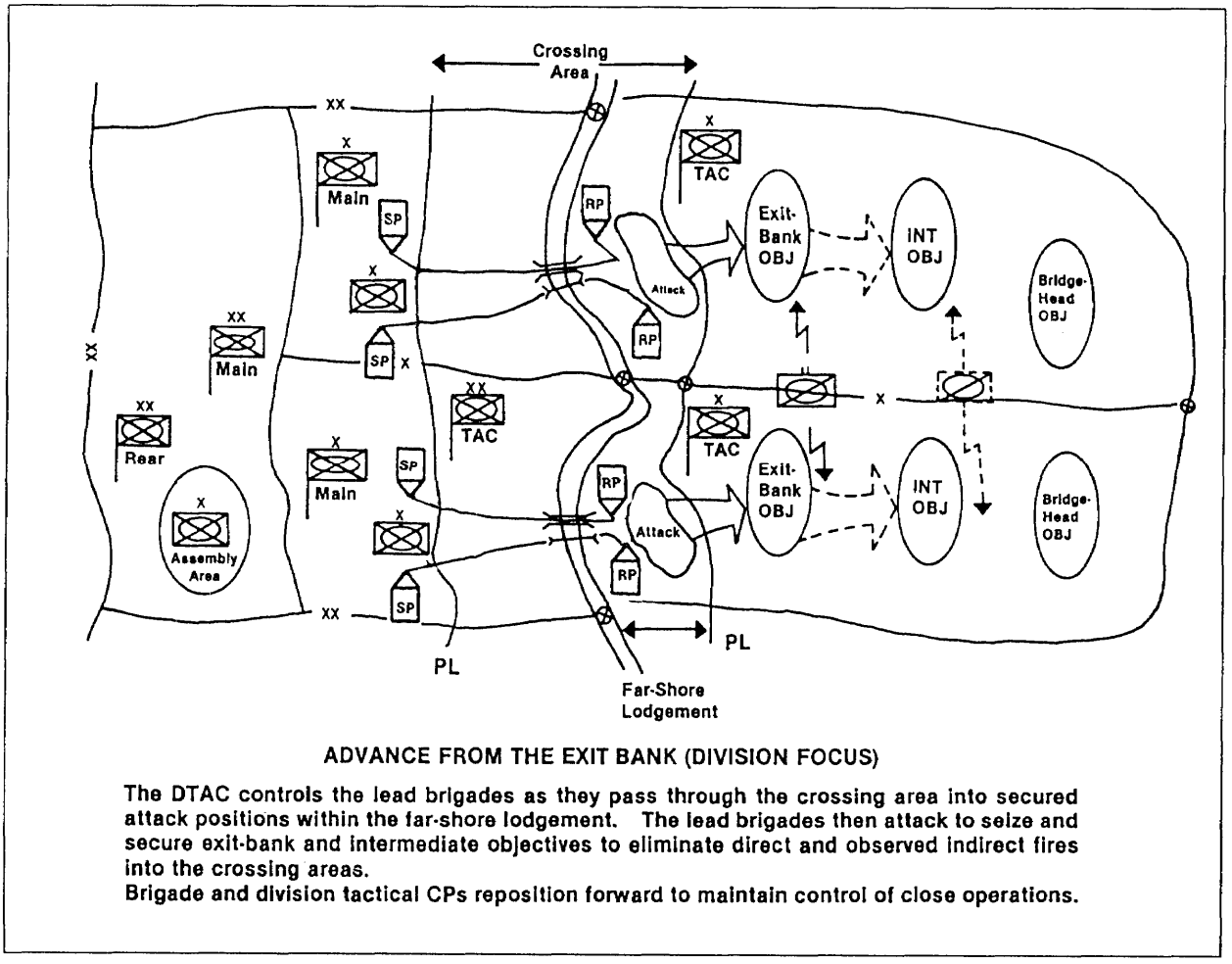


Figure 3-7. Advance from the exit bank (division focus)

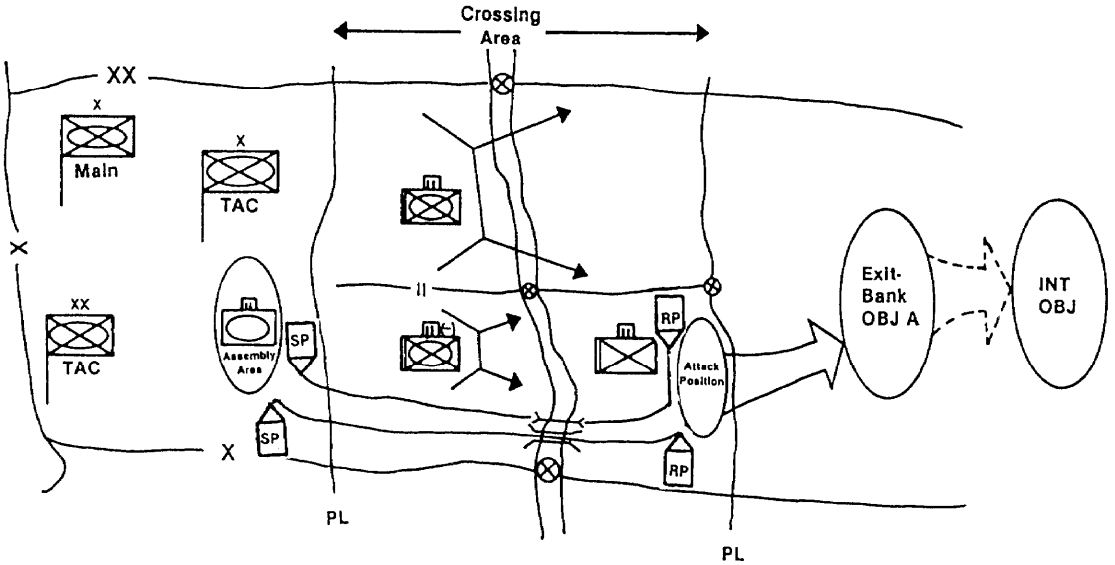
Secure the Bridgehead Line (Phase IV)

The bridgehead must be defendable and large enough to accommodate forces that will break out to continue offensive combat operations. The lead brigades attack to seize and secure the final objectives within the bridgehead — the bridgehead objectives — to prevent the threat from successfully counterattacking against forces within the bridgehead. The lead brigades secure the bridgehead line by rapidly building enough combat power to establish a hasty defense in sector. The cavalry squadron conducts a screen mission. The lead brigades maintain continuous far-shore security to prevent bypassed threat elements from infiltrating back to the river and disrupting activities at crossing sites (see *Figure 3-9, page 3-10).*

The DTAC controls the lead brigades and the cavalry squadron as they secure bridgehead objectives (see *Figure* 3-9) and prepares to move the reserve brigade or other corps forces (breakout forces) into attack positions within the bridgehead. Once bridgehead objectives are secured, the lead brigades establish a hasty defense in sector.

The DREAR begins to push forward needed Class III and V supplies in anticipation of the attack out of the bridgehead.

The BMAIN continues to upgrade and monitor the crossing sites and control movement through the crossing area. The far-bank phase line defining the crossing area is moved just past the intermediate objectives (see *Figure 3-9)* to provide space for breakout forces to assemble in attack positions before the attack out of the bridgehead. MPs mark routes from the exit bank to these attack positions for the breakout force. Once the bridgehead line is secure, the DTAC controls movement of breakout forces through the crossing area to attack positions within the bridgehead. During this phase, specific bridges and/or rafts are designated for full-time return traffic. This ensures that resupply and evacuation of wounded soldiers and disabled equipment occur.



ADVANCE FROM EXIT-BANK (BRIGADE FOCUS)

The brigade main CP controls follow-on task forces through the crossing area into secured attack positions within the far-shore lodgement. The follow-on task forces then attack to seize and secure exit-bank and intermediate objectives to eliminate direct and observed indirect fires from the crossing area.

Figure 3-8. Advance from the exit bank (brigade focus)

The DMAIN controls the aviation, artillery, and available CAS sorties to screen the flanks and interdict threat counterattacks. Deep operations play a key role in the bridgehead defense by targeting threat formations as they move to counterattack. They also eliminate effective artillery fire within range of the bridgehead and destroy other threat artillery forces moving up to the fight.

The elements of the lead brigades that secure the bridgehead line must control avenues of approach into the bridgehead and be large enough to defeat counterattacks. After the bridgehead is secure, the division commander will commit the breakout force into the bridgehead. The bridgehead needs enough space (20 to 30 kilometers deep) to accommodate both the lead brigades and the breakout force with their combat service support (CSS). The bridgehead line must also be deep enough to employ air-defense systems against hostile aircraft before they reach weapons release points to attack crossing sites.

CONTINUATION OF THE ATTACK

Once the division has secured the bridgehead, the division's river crossing is complete. Crossing-area control will be passed to the DREAR and ultimately to corps. The breakout force must complete its passage before continuation of offensive operations. The lead brigades must reorganize and prepare to follow the breakout force as the division or corps reserve. Security forces from corps must come forward to relieve the lead brigades from their bridgehead security mission.

As the breakout force crosses into attack positions, the DTAC begins to focus on the attack out of the bridgehead. Therefore, the DREAR assumes the role of crossing-force headquarters. This allows the DTAC

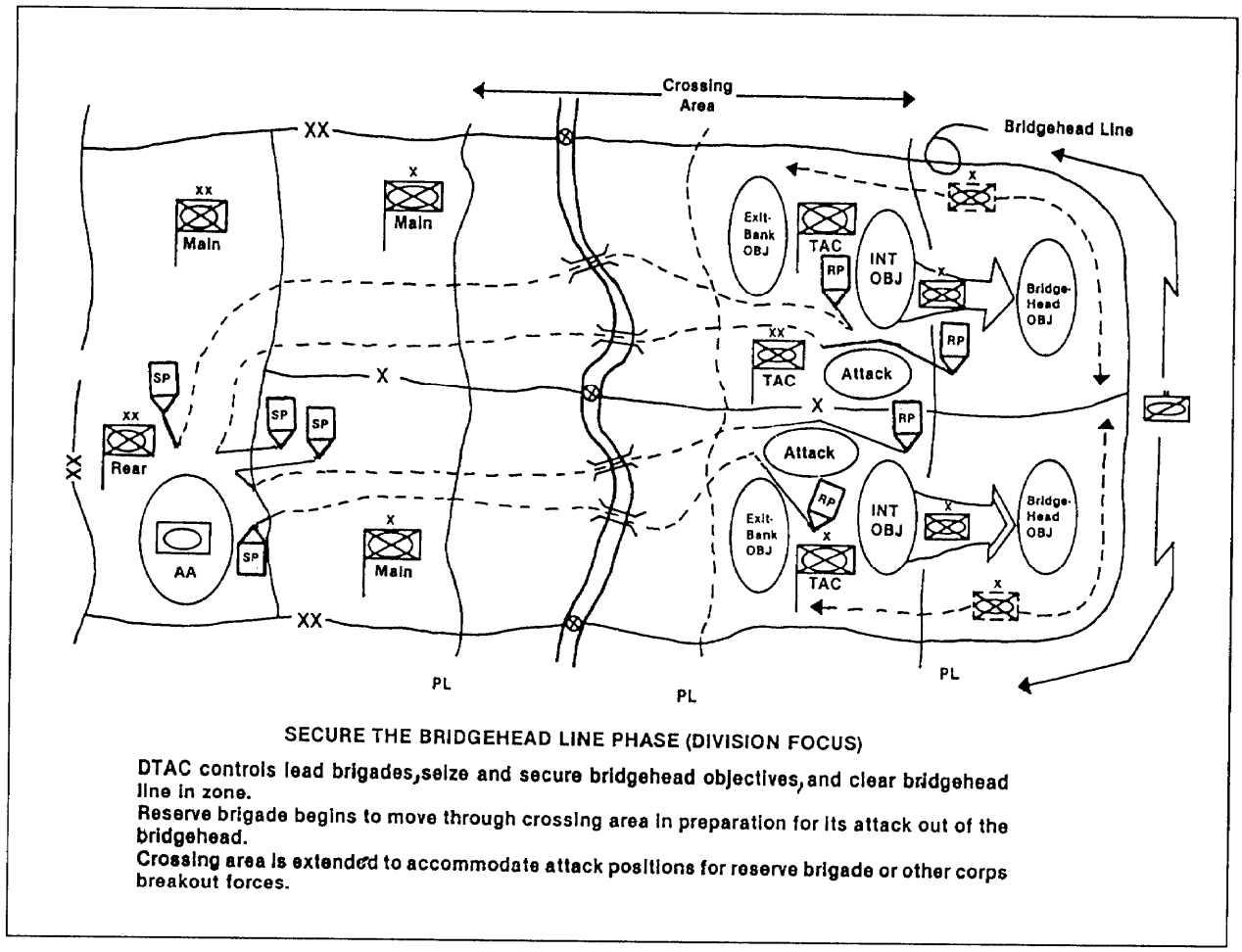


Figure 3-9. Secure the bridgehead line (division focus)

to focus completely on the attack out of the bridgehead, which is usually led by the division cavalry squadron.

The DREAR controls the breakout force movement through the crossing area to the attack positions and two-way traffic facilitating the return of wounded soldiers and disabled equipment. Corps must provide other forces for bridgehead security before the lead brigades reorganize to resume their mission as the division reserve.

Chapter 4
Command and Control

GENERAL

Organization and traffic control are fundamental to successful river crossing operations. They enable the commander to apply the tactics discussed in Chapters 3 and 5. This chapter covers techniques and procedures to establish the crossing organization, maintain control of forces, and hand off responsibilities between echelons as the operation progresses.

ORGANIZATION

Division and brigade commanders organize their forces into bridgehead, support, and breakout forces for river crossing operations. Bridgehead forces seize and secure the bridgehead. Support forces consist of corps combat engineers, bridge companies, MPs, and chemical units, which provide crossing means, traffic control, and obscuration. Breakout forces cross the river behind bridgehead forces and attack out of the bridgehead.

CONTROL ELEMENTS

Division and brigade commanders are responsible for crossing their formations. They organize their staffs and subordinate commanders to help them control the crossing. See *Figure 4-1, page* 4-2.

Division and brigade headquarters operate from echeloned CPs. They are the tactical, main, and rear CPs and provide the staff and communications support for planning and executing river crossings. They may need some temporary augmentation or realignment of internal staff elements for the crossing.

Figures 4-2 and 4-3, pages 4-3 and 4-4, show the necessary control elements for deliberate and retrograde river crossing operations. Each of the control elements is discussed below.

Division Headquarters

The division tactical CP controls the lead brigades' (bridgehead force) attack across the river, since this is the division's close fight. It may reallocate crossing means or movement routes to the river between brigades as the battle develops. For division crossings, a traffic-control cell schedules, routes, and monitors traffic behind the assault brigades. The cell collocates with the division main CP. The Assistant Chief of Staff (Logistics) (G4) provides the cell nucleus. The tactical CP controls the fight and is the crossing force HQ.

The division main CP prepares the river crossing plan. It also directs the division's deep operations to isolate the bridgehead from threat reinforcements and counterattacking formations. As a guide, the main CP displaces across the river after the division reserve.

The division rear CP sustains the crossing as for other division operations. Once the main CP displaces across the river, the crossing becomes a rear operation controlled by the rear CP.

Crossing Force Commander (CFC)

The division commander normally designates an assistant division commander (ADC) as the CFC to take charge of controlling the division crossing.

Crossing Force Engineer (CFE)

A crossing division receives support from a CFE, who is normally the commander of an engineer group from the corps engineer brigade. He provides additional staff planners for the CFC and coordinates engineer support to the crossing area commanders (CACs). The division engineer and division engineer battalions will focus on the fight.

Brigade Headquarters

Brigade headquarters operate from echeloned CPs, the BTAC, and the brigade main CP. The brigade tactical CP controls the advance to and attack across the river. It displaces across the river as soon as practical after the assault across the river phase to control the fight for exit-bank, intermediate, and bridgehead objectives.

The main CP controls the crossing of the rest of the brigade. It prepares the brigade crossing plan and provides the staff nucleus to coordinate it. For brigade crossings, the Supply Officer (US Army) (S4), assisted by the supporting MP unit leader, organizes a small, temporary traffic-control cell collocated with the brigade main CP. The brigade main controls the support force consisting of corps engineers, bridge companies, MPs and chemical units.

Crossing Area Commander

Once the lead battalions assault across the river and secure the far-shore lodgement, the crossing area is activated. The CAC, normally the brigade executive officer (XO), controls the movement of forces inside the crossing area. This leaves the brigade commander

Phases / CPs	ADVANCE TO THE RIVER	ASSAULT ACROSS THE RIVER	ADVANCE FROM THE EXIT BANK	SECURE THE BRIDGEHEAD LINE	CONTINUE THE ATTACK
DTAC (CROSSING FORCE HQ	Coordinates lead brigade's seizing of near-shore objectives	Coordinates lead brigades conducting dismounted assault of the river to seize far-shore lodgement	Coordinates lead brigades seizure of exit-bank and intermediate objectives	Coordinates lead brigades seizure and securing of bridgehead objectives and prepares to cross the reserve brigade (breakout forces)	Controls breakout force's attack out of the bridgehead and passes crossing force responsibilities to DREAR
DMAIN	Coordinates deep operations to isolate division advance to the river	Coordinates deep operations to isolate crossing area and far-shore lodgement	Coordinates deep operations to isolate exit-bank and intermediate objectives	Coordinates deep operations to isolate bridgehead	Coordinates deep operations to isolate enemy attack against corps objectives
DREAR	Sustain the fight	Sustain the fight	Sustain the fight	Sustain the fight	Assume crossing force HQ role
BRIGADE TAC CP	Coordinates lead task forces seizing and securing near-shore objectives	Coordinates the dismounted assault crossing of the river to secure far-shore lodgement	Coordinates TF's attack to seize and secure exit-bank and intermediate objectives	Coordinates TF's seizure and securing of bridgehead objectives	Prepares to reorganize and follow the breakout force attack out of the bridgehead toward division deep objectives
BRIGADE MAIN CP (CROSSING AREA HQ)	Moves and prepares into crossing area to provide traffic control, crossing means, and obscuration	Coordinates assault crossing means for TF dismounts and controls obscuration of crossing sites	Controls follow-on TF's pass-through crossing area into attack positions within far-shore lodgement	Controls passage of brigade units through crossing and prepares to cross breakout force	Brigade CPs pass crossing area control to supporting corps engineer battalion

Figure 4-1. CP tasks (deliberate crossing)

free to direct key activities while an officer directly responsive to him runs the crossing.

The CAC controls –

- Movement and positioning of all elements transiting or occupying positions within the crossing area,
- Security elements at crossing sites.
- Support forces such as engineer, MP, and chemical units within the crossing area.

Crossing Area Engineer (CAE)

Each forward brigade normally has a direct-support engineer battalion from corps. The engineer battalion commander is responsible to the CAC for the engineer crossing means and sites. He informs the CAC of changes, due to technical difficulties or enemy action, that render a crossing means inoperable or reduce its capacity. He commands those engineers tasked to move the force across the river obstacle; they remain at the river as the attack proceeds beyond the exit-bank objectives. The division engineer battalion focuses on supporting the lead brigades at exit-bank, intermediate, and bridgehead objectives and is not normally involved in the river crossing.

Crossing Site Commander (CSC)

Each crossing site has an engineer, either a company commander or platoon leader, who is responsible for crossing units sent to the site. Normally, the CSC is the company commander for the bridging unit operating the site. He commands the engineers operating the crossing means and the ERPs at the call-forward areas for that site. He maintains the site and decides on the immediate action needed to remove broken-down or damaged fighting vehicles that interfere with activities at the site. He is responsible to the CAE and keeps him informed of site status.

Unit Movement Control Officer

Each battalion and separate unit commander designates a movement control officer, who coordinates the

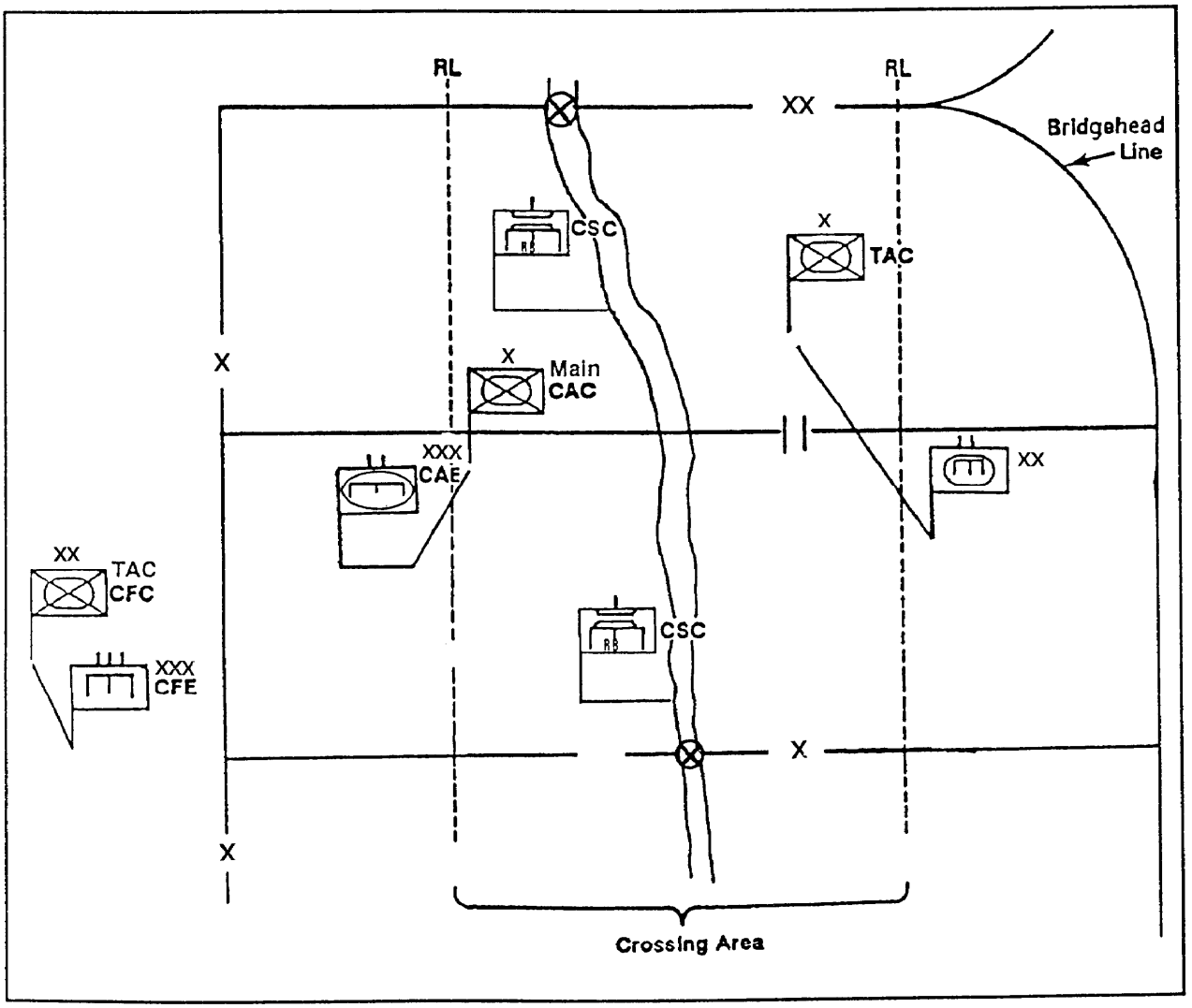


Figure 4-2. Control elements for deliberate crossing

unit's movement according to the movement control plan. He provides staff planners detailed information on the unit's vehicle types and numbers.

COMMUNICATIONS

Figures 4-4 *and* 4-5, *pages* 4-5 *and 4-6,* depict the communications networks for a crossing area after the assault across the river (Phase II). In the hasty crossing example, a brigade making a supporting attack conducts a crossing with its normal slice of combat support forces plus a corps bridge company. More assets are available from division and corps in the deliberate crossing example. Wire is the preferred means of communications in a river crossing when there is sufficient time to prepare it.

CONTROL MEASURES

The commander uses control measures to delineate areas of responsibility for subordinates and to ease traffic control. *Figure* 4-6, *page 4-7* illustrates the control measures described below. A crossing overlay showing the control measures is on page 6-5.

Release Lines (RLs)

As used in river crossing operations, RLs are used to delineate the crossing area. RLs are located on both the

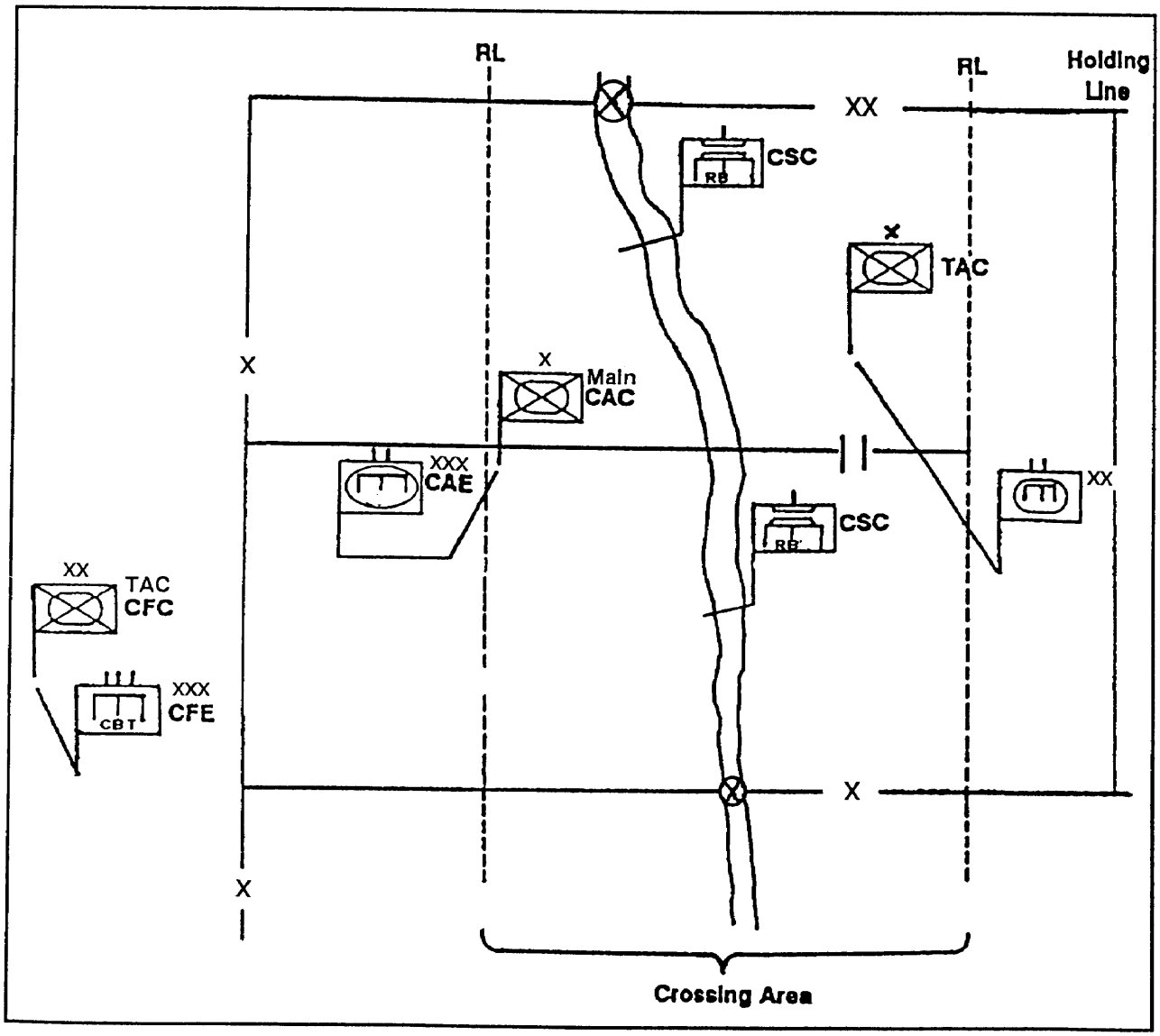


Figure 4-3. Control elements for retrograde crossing

far and near shores and indicate a change in the HQ controlling movement. RLs are normally located within 3 to 4 kilometers of the river and on easily identifiable terrain features, if possible.

Crossing Areas

Crossing areas are controlled access areas that decrease congestion at the river. This permits swift movement of follow-on units. Each lead brigade has a crossing area, defined by brigade boundaries and phase lines (RLs) on both sides of the river. Crossing areas normally extend 3 to 4 kilometers on each side of the river, depending on the terrain and anticipated battle.

Waiting Areas

Waiting areas are located adjacent to the routes or axes of advance. Commanders use them to conceal vehicles, troops, and equipment while waiting to resume movement or for making final crossing preparations. River crossings use the following waiting areas:

- Staging areas
- Call-forward areas
- Holding areas
- Attack positions
- Assembly areas

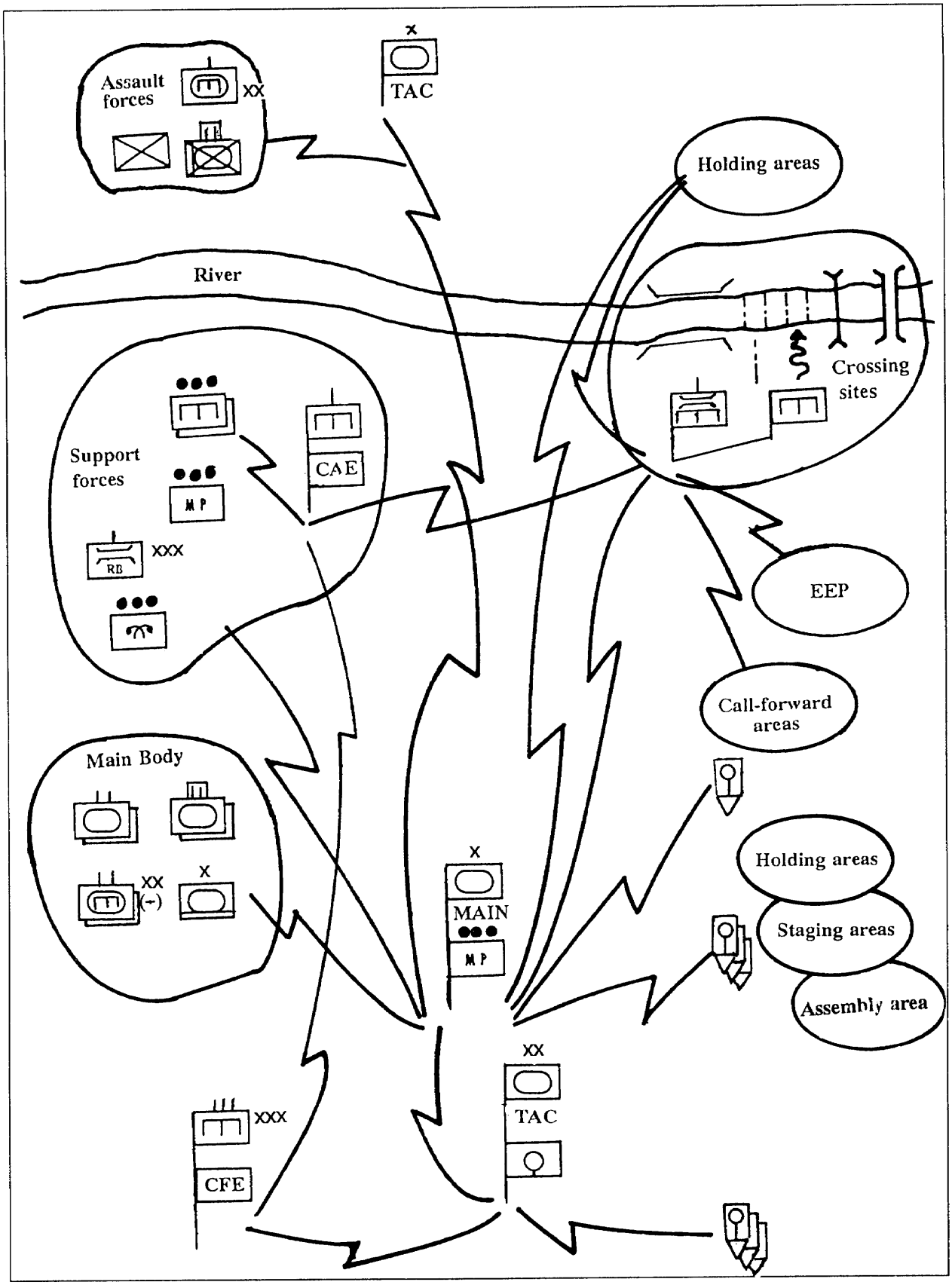


Figure 4-4. Communications for deliberate crossing

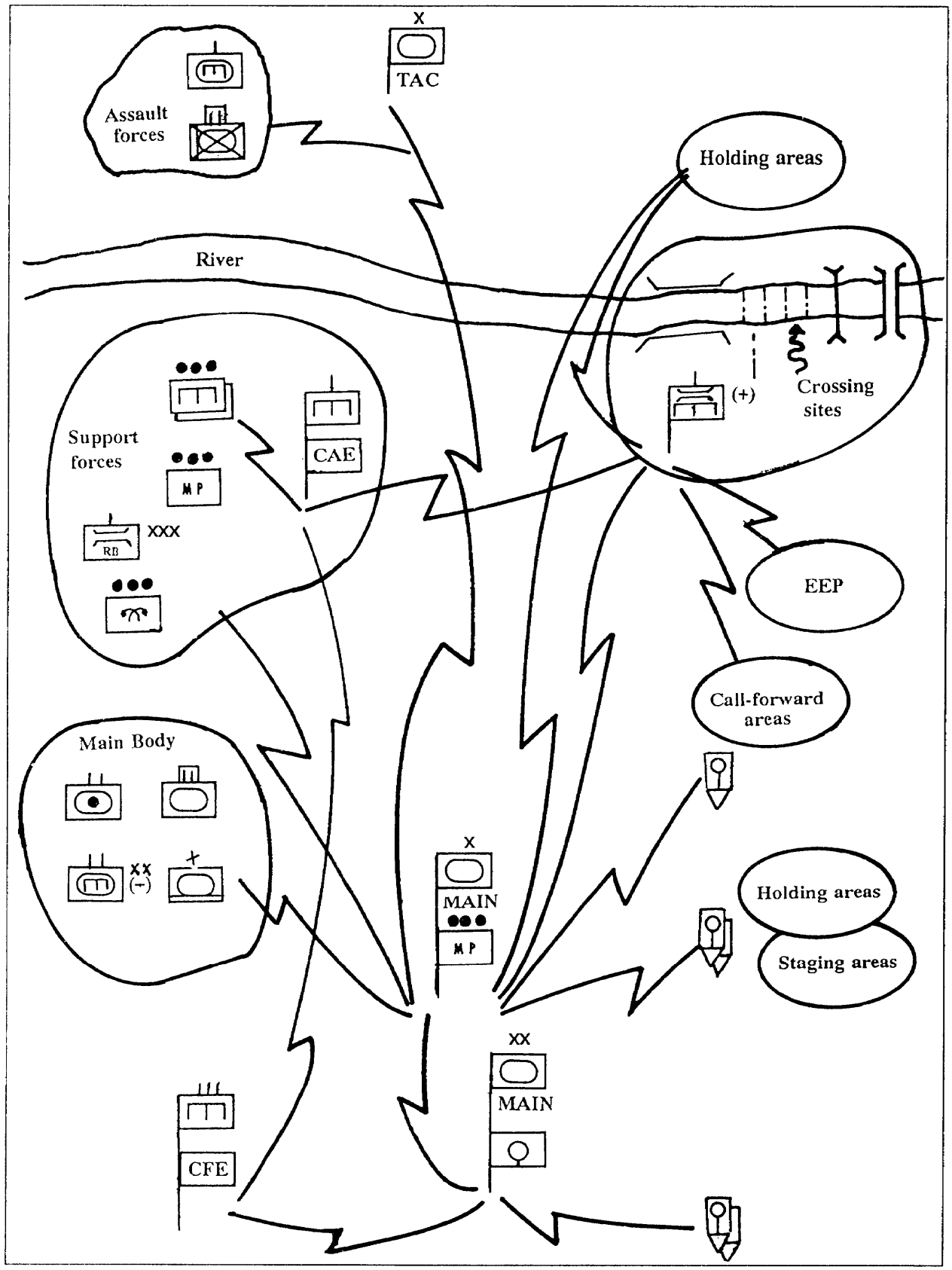


Figure 4-5. Communications for hasty crossing

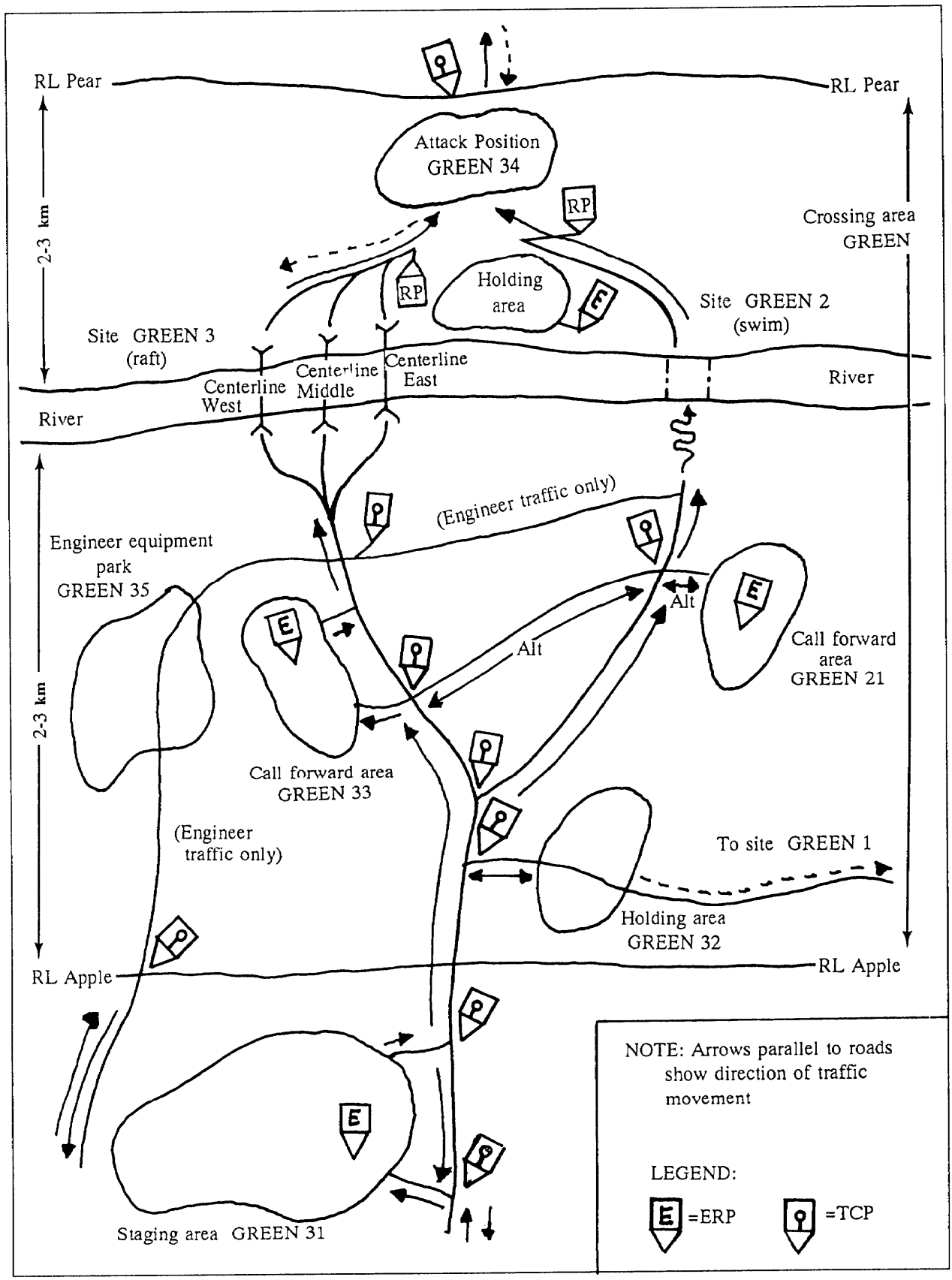


Figure 4-6. Control measures

Staging areas are battalion-size waiting areas outside the crossing area where forces wait to enter the crossing area. The brigade traffic control cell handles unit movement into staging areas. The CAC controls movement from staging areas into crossing areas. MPs operate TCPs at staging areas according to the crossing and traffic circulation plan. MPs emplace temporary signs along the route from the staging area through the crossing area to guide convoys. Units make crossing preparations and receive briefings on vehicle speed and spacing in the staging areas. Staging areas —

- Are located to support the crossing concept.
- Are far enough back to permit rerouting the battalion along other roads or to alternate crossing sites.
- Are easily accessible from major routes.
- Have sufficient area for dispersion of a battalion- size unit.
- Provide concealment.

Call-forward areas are company-size waiting areas located within the crossing area. Engineers use them to organize units into raft loads, or crews use them to make final vehicle swimming preparation. The CAC controls movement from the staging area to the call-forward area. The CSC directs movement from the call-forward area to the crossing site and on to the far-shore attack position. As a minimum, each raft or swim site has its own call-forward area. Call-forward areas —

- Are located to support the crossing plan.
- Are company size within the crossing area.
- Are easily accessible from routes.
- Are planned with a minimum of one per site.
- Are collocated with ERPs.
- Are used to organize units into raft loads.
- Are the final preparation areas before going to the crossing site.
- Are normally operated by an engineer squad.

Holding areas are waiting areas that forces use during traffic interruptions. Units move into these areas when directed by TCPs and disperse rather than stand on roads. They are battalion-size outside of the crossing area and company-size within it. Far-shore holding areas are used to organize return traffic. MPs operate holding areas according to the crossing and traffic circulation plans. Established as needed on both sides of the river, holding areas –

- Are used as call-forward areas for return traffic from the far shore.
- Are located to support the crossing plan.
- Are easily accessible from routes.
- Have sufficient area for dispersion.
- Provide cover and concealment.
- Are defensible.
- Maximize traffic flow with minimum control.

Attack positions are the last positions occupied or passed through by the assault echelon or attacking force before crossing the line of departure. Within the bridgehead, the attack position is the last position before leaving the crossing area or bridgehead line.

Assembly areas are areas in which a force prepares or regroups for further action.

Engineer Equipment Parks (EEPs)

EEPs are areas located a convenient distance from bridge and raft sites for the assembly and preparation of bridge equipment and materiel. They are at least 1 kilometer from the river and hold spare equipment and empty bridge trucks not required at the crossing sites. The CAE places EEPs to avoid traffic congestion at crossing sites and to conceal and disperse equipment. Ideally, routes leading from EEPs to the crossing sites are not the same routes used by units crossing the river.

Traffic Control Posts

TCPs are established to control traffic movement while providing information and directions. In river crossings, TCPs assist the crossing-area HQ in traffic control by reporting movement of units and convoys. TCPs relay messages between the crossing-area headquarters and moving units. The provost marshal identifies locations that need or require TCPs. MPs operate TCPs on both banks of the river to control traffic moving toward or away from the river. MPs operate TCPs at major or critical crossroads and road junctions, staging areas, holding areas, and ERPs.

Engineer Regulating Points

ERPs are technical checkpoints to ensure that vehicles do not exceed the capacity of the crossing means. They help maintain traffic flow. MPs collocate TCPs with ERPs to ensure that all vehicles clear the call-forward areas. An additional ERP role is to give drivers final instructions on site-specific procedures and other information such as speed and vehicle interval. As a minimum, each crossing site requires an ERP at its own call-forward area. If sufficient engineer assets are available, ERPs may be established at far-shore holding areas to regulate rearward traffic. Engineers man the ERPs and report to the CSC.

CROSSING PLAN

The crossing plan is integrated throughout the division and brigade operation orders (OPORDs) and is as detailed as time permits. The crossing annex to the

OPORD contains much but not all of the plan. It has the crossing overlay and the crossing synchronization matrix.

The crossing overlay shows the crossing areas, crossing sites, routes leading up to them from assembly areas, and all control measures necessary for the crossing. See the example in Chapter 6 for a brigade crossing overlay.

The crossing synchronization matrix is a tool to adjust the crossing plan as the battle develops. It shows crossing units in relation to their planned crossing times and locations. See Appendix A for an example matrix.

The task organization and paragraph 5 of the OPORD contain the organization and command portions of the crossing plan. Chapter 6 discusses further development of the crossing plan.

CROSSING CONTROL

Assault Across The River

Battalions task forces (TFs) conducting the assault across the river phase move to the river under the direct control of their brigade commanders. The assaulting battalions using RB15s follow the procedures in Chapter 8. The brigade commander keeps the remainder of the brigade back from the river to avoid congestion. Elements not engaged in security or supporting the crossing occupy assembly areas and prepare for movement across the river.

Crossing Area Operations

After the assault across the river phase, the brigade has an initial lodgement on the far shore and is no longer fighting to seize the exit bank. It now needs its follow-up battalions across as quickly as possible, and it can cross without engaging in combat at the river. The brigade commander activates the crossing area to move forces rapidly and efficiently. The urgent need to get tanks across the river means the raft stage often begins before the secure terrain on the far shore extends clear to the planned release line. Therefore, the crossing area is initially limited to the near shore. The first fighting vehicles swimming or rafting across under this circumstance have limited space to regroup before commitment to the fight.

As the initial battalions across gain terrain to the necessary depth, and as control elements cross to the far shore, the brigade commander extends the crossing area out to the planned release line. Thereafter, units move completely through the crossing area under the CAC's control and exit it in a tactical move.

When rafting, the crossing flow for the follow-up units is generally from a staging area, through the call-forward area and crossing site into an attack position, then onto the subsequent objective. While bridging, the flow is from a staging area, through the crossing site, then out of the crossing area.

Figure 4-7, *page 4-10,* illustrates the traffic flow for a battalion TF follow-up unit during the rafting. This procedure avoids congestion close to the crossing site and helps maintain unit integrity while the battalion rafts. The battalion occupies staging area GREEN 31 and organizes an internal unit crossing order based on its mission on the far shore. When concurrently swimming and rafting vehicles of the same battalion, the swimming ones form up separate from nonswimming ones for movement to the crossing sites, but they remain within their company teams. The ERP at the call-forward area checks vehicles to determine correct load classification and proper loading. When instructed by the CAC, the battalion sends one company team (or the equivalent) from the staging area at a time. TCPs guide their movement en route to a call-forward area, where the company comes under movement control of the CSC.

In the call-forward area at site GREEN 33, engineers manning an ERP organize individual vehicles into raft loads. They guide raft loads down to raft centerlines as directed by the CSC. In the call-forward area GREEN 21, vehicle crews make final swim preparations. The ERP sends them down to the swim site when directed by the CSC.

Vehicles remain under control of the CSC until they are on the far shore. There they proceed to attack position 6, where they regroup as a company team. When ready, they move as directed by the TF commander under the tactical control of the brigade commander.

During the bridging operations, the CAC normally directs the follow-up battalions to move in company serials from the staging area. Each serial moves down to the bridge site, crosses the river, and continues clear through to the attack position. The CAC directs an interval between serials that keeps continuous traffic across the bridge without gaps or traffic jams. A call-forward area remains established in the event the bridge becomes damaged and rafting operations resume.

Units in the attack-by-fire position on the near shore are already inside the crossing area when it starts to function. They remain in position until the CAC directs them to cross the river. Those units move by company

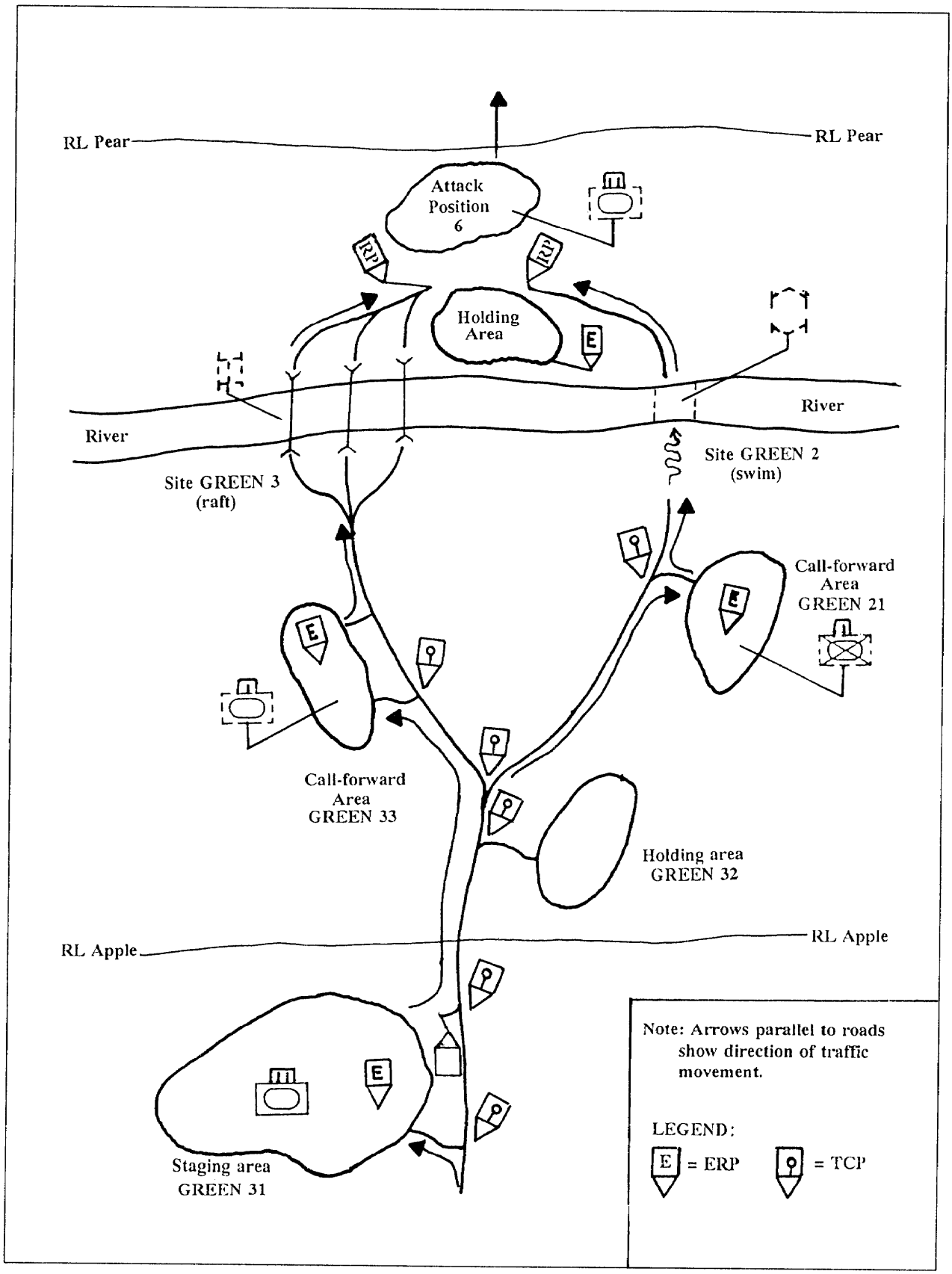


Figure 4-7. Follow-on TF crossing during raft phase

or platoon directly to previously selected call-forward areas or start points (SPs).

Variants of Brigade Crossings

Division has several ways, described below, to allocate the support force and assign responsibility for running the crossing area.

Example 1. The lead brigades, (bridgehead brigade) which is at the river, has its own support force. This is the usual condition for a hasty crossing. The brigade controls all aspects of its crossing. The commander designates the CAC to control the crossing after the lead battalions secure the far-shore lodgement. This leaves the commander free to concentrate on the fight on the far shore, while his own staff and units respond to him to cross the remainder of the brigade. The brigade main CP is the crossing-area headquarters.

Example 2. The attacking brigades (bridgehead), which pass through an in-place force at the river, contain the support force. The bridgehead force coordinates a forward passage of lines with the in-place force at the river. The bridgehead force commander designates the brigade XO to control the crossing. The two brigade commanders mutually agree on when the CAC assumes control of the crossing area from the in-place brigade. The bridgehead force brigade main CPs are the crossing-area headquarters. The CPs of both brigades collocate, as necessary, for the passage of lines.

Example 3. The attacking force brigade (bridgehead) passes through an in-place force at the river, which contains the support force. The bridgehead force brigade commander coordinates a forward passage of lines with the in-place force. The in-place brigade commander designates his XO to control the crossing. The main CP of the in-place brigade is the crossing headquarters. Initially, the CAC controls movement within the near-shore side of the crossing area. The two brigade commanders agree on when the CAC extends movement control to the planned limit of the crossing area on the far shore. The CPs of both brigades collocate as necessary for the passage of lines.

Example 4. Breakout forces move across the river behind bridgehead force brigades. Another unit commander is responsible for the crossing area and the support force. The breakout force moves forward to the crossing area as directed by the division traffic control cell. It moves through the crossing area as directed by the commander responsible for the crossing area.

Transfer of Support Forces to Division

Once the bridgehead forces are across the river, the crossing sites are relatively secure. Since ground maneuver is no longer close to the crossing area, the operation at the river becomes predominantly a bridging and traffic-scheduling problem. Division HQ moves the release line at the rear of the bridgehead force to the far shore. The crossing areas come under direct division control. As directed by the ADC, the brigade commander turns over his crossing area to another officer, normally the CAE, who becomes responsible for the crossing area. He then reports through the CFE to the ADC at the division rear CP. His unit headquarters becomes the crossing area headquarters. *Figure* 4-8, *page 4-13* shows the change in control headquarters.

MOVEMENT CONTROL

Movement control is vital to efficiently move units and materiel up to the crossing area in the sequence needed by the commander. The traffic control cells at division and brigade headquarters exercise movement control through TCPs. The division controls movement from its rear boundary up to the brigade rear. Brigade controls movement from the rear boundary up to the bridgehead line.

The G4 develops the division movement plan according to the movement priorities established by the Assistant Chief of Staff, G3 (Operations and Plans) and provost marshal. The S4 prepares the brigade movement plan according to the priorities established by the Operations and Training Officer (S3). Each unit movement control officer, normally the battalion S4, provides unit vehicle information to the planning headquarters.

The movement plan normally consists of a traffic circulation overlay and a road movement table found in the movement annex to the division or brigade order.

RETROGRADE CROSSINGS

A retrograde river crossing has most of the same control features as an offensive crossing. The rearward passage of lines by friendly units under enemy pressure stress them more severely in the retrograde.

The commander responsible for a crossing area has the same authority as he does in an offensive crossing, but because a brigade establishes a defense along the river concurrent with the crossing, he coordinates crossing activities to avoid conflicts with defensive preparations. For this reason, the responsible officer and his staff should be familiar with both the delaying and defending commanders' tactical plans. He coordinates optimum use of crossing sites by delaying units. As they disengage, they must rapidly pass through the defending force at the holding line and cross the river. The commander responsible for the crossing area reports to the division CP controlling the operation. If

the main CP is forward of the river, this is usually the division rear CP until the main CP displaces behind the river.

When the river is in the division rear area at the start of the retrograde, the crossing begins as a rear operation. The senior corps engineer commander supporting the division becomes the CFE and establishes division crossing areas with corps engineer and MP units. He identifies engineer commanders, as directed by the commanding general, to quickly organize the crossing areas and initiate crossing control. These crossing areas correspond to the brigade boundaries planned by the G3 for the defense along the river.

Each brigade commander establishing a defense at the river appoints an XO to control the crossing area in his sector. When the river is in the brigade's sector at the start of the retrograde, this officer can immediately take charge and organize the crossing area. If the division initially organizes the crossing area through the CFE, it directs the defending brigade to take charge of the crossing area once the brigade has established its hasty defense at the river. Then, the engineer who had been responsible for the crossing area becomes the CAE. The brigade XO coordinates with the division main CP, which retains centralized control of the crossing until only the defending brigade's units remain to cross in that area. The crossing area operates until the commander directs the bridges to be destroyed or removed. At that time, the crossing area ceases to exist.

Turnover of sites from the CAC to defending battalion commanders is by mutual agreement or when directed by the brigade commander. Simultaneous hand-off between or within defensive sectors is not essential. Depending on the tactical situation, the division commander may not allow crossing equipment to remain in place, even though the defending brigade commander desires its retention. Normally, the CAC retains control of the crossing means until delaying units cross the river. He then orders removal of tactical bridge assets. Control of remaining freed bridges then passes to the defending commanders. They are responsible for their defense and ultimate destruction, as discussed in Chapter 5.

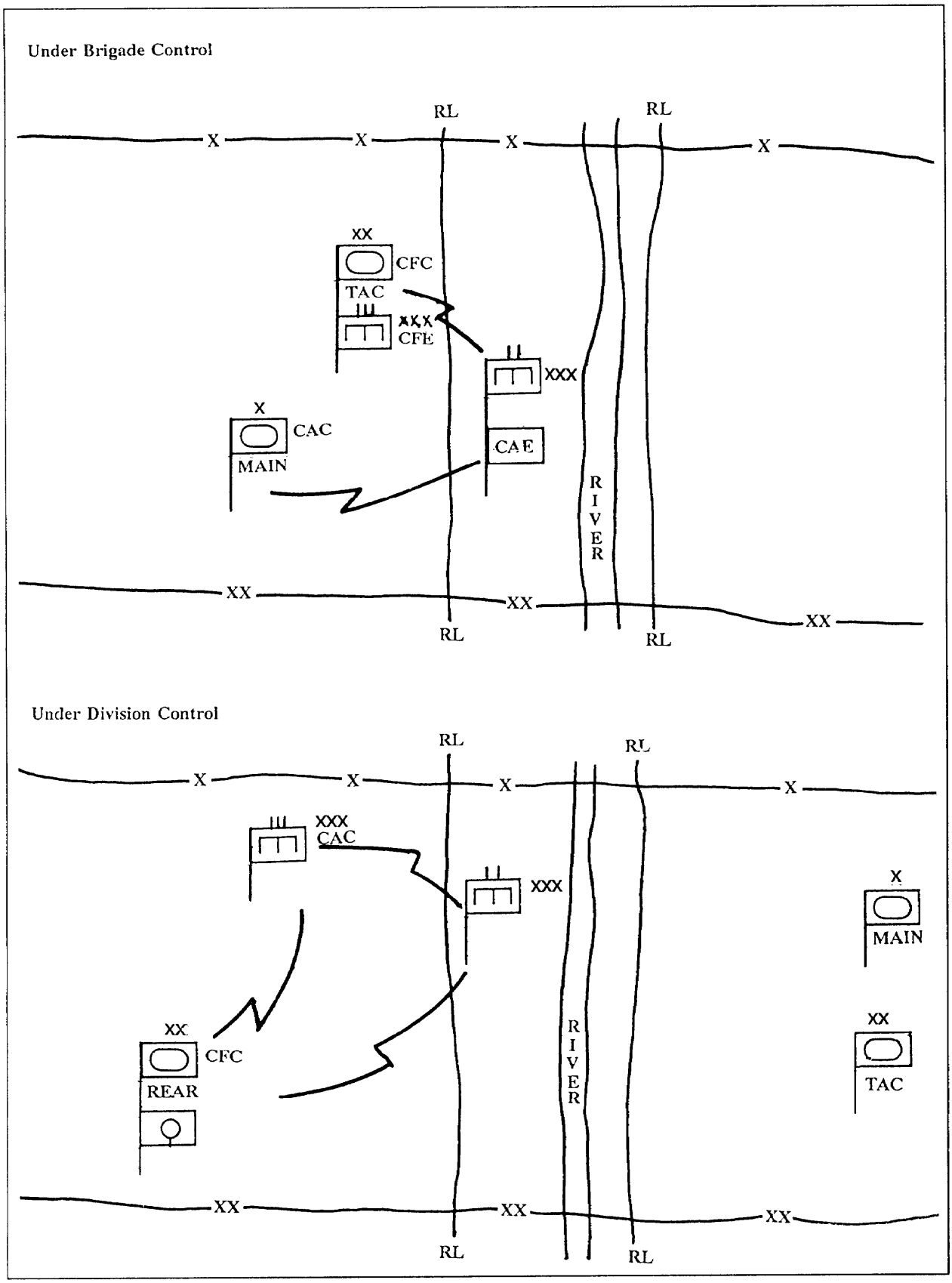


Figure 4-8. Transfer of crossing support

Chapter 5
Retrograde Operations

GENERAL

The goal of a retrograde river crossing operation is to cross a water obstacle while preserving the integrity of the force. A retrograde operation is an organized movement to the rear or away from the threat.

Deception is always planned and executed to deceive the threat and to protect the force during the retrograde operation. As a minimum, these plans seek to conceal the extent of the operation and the actual crossing sites. Smoke, electronic deception, and dummy sites reduce the threat's capability to disrupt the crossing.

This chapter describes only those tactics and techniques used by a division in a retrograde river crossing operation that are different from those used in an offensive crossing. A retrograde crossing features centralized control at division level and detailed planning within the time available. It differs from an offensive crossing in several aspects:

- Initially, both banks of the water obstacle are under friendly control. Accordingly, detailed information concerning the obstacle and the area over which the retrograde are conducted is readily available to the commander.
- All existing bridges and other crossing sites are available to the retrograde force to expedite the crossing.
- In most cases, relative combat power favors the threat.

The same control measures are used in retrograde operations as in offensive operations. *Figure 5-1* shows an example. See Chapter 4 for a discussion of each control measure and a command and control diagram.

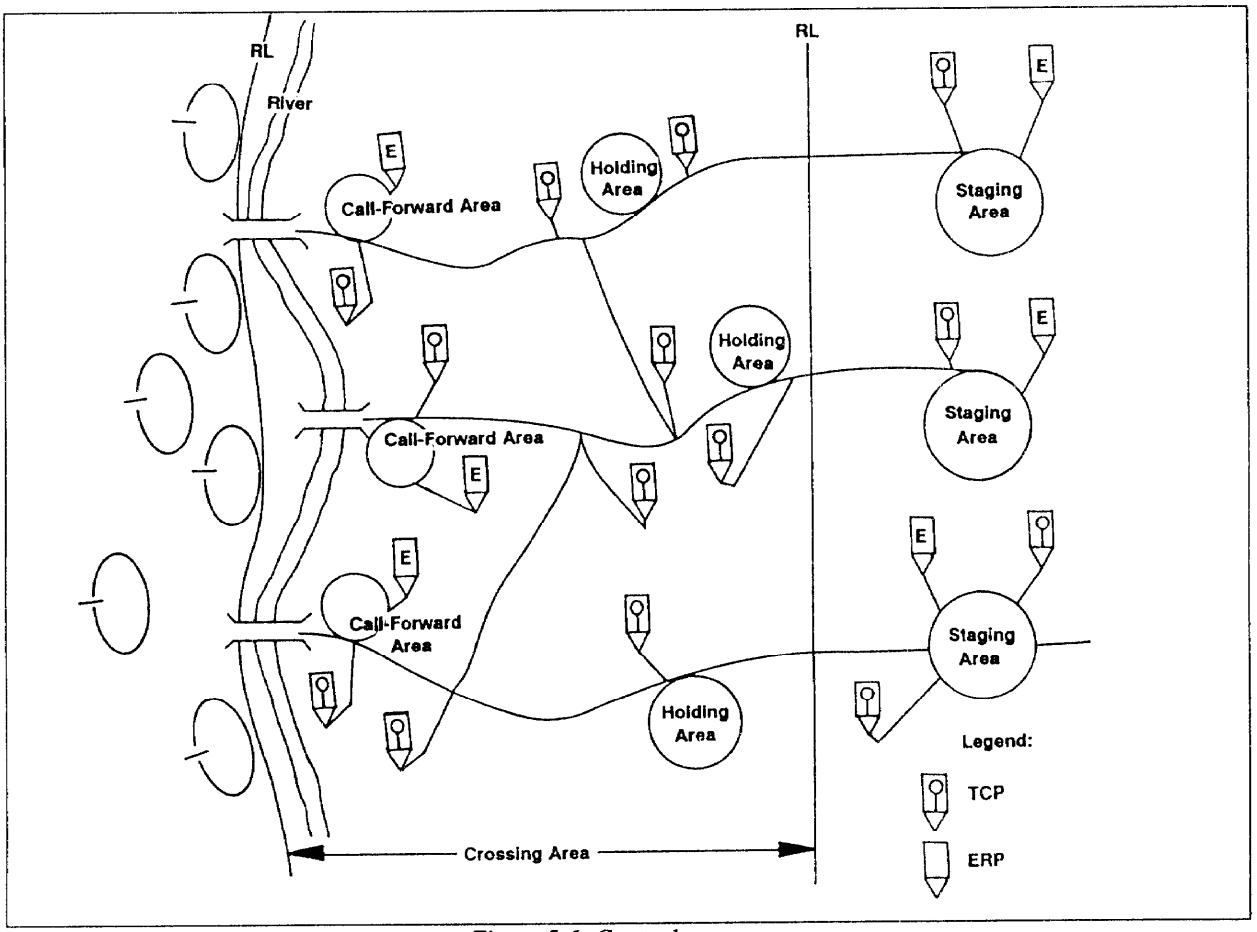


Figure 5-1. Control measures

RETROGRADE TYPES

A retrograde operation may be forced by threat action or by a higher headquarters. A well-planned, well-organized, and aggressively executed retrograde operation provides opportunities for the division to inflict heavy damage on threat troops and equipment while continuing to maintain its fighting integrity. The three types of retrograde operations are delay, withdrawal, and retirement.

Delay

A delay is an operation in which the unit, under threat pressure, trades space for time by inflicting maximum damage on the threat without being decisively engaged in combat. A delay combined with a retrograde river crossing has the following phases:

- Delay
- Crossing
- Defense

Each phase is separate only in planning; they overlap during execution. The employment of military crossing equipment in the retrograde is the reverse of the method used in a deliberate, offensive river crossing operation. *Figure 5-2* relates the retrograde sequence to the crossing stages.

Delay Phase

The delay phase provides security for the main body and has the mission to gain enough time for the unit to accomplish its mission (cross the river). For this reason, delaying units take some risk. The delaying force must deceive the threat and keep it from the river, allowing the main body to cross and establish the exit-bank defense.

Units not assigned tasks in the delay, including those units with a mission to support crossing areas or establish the defense on the exit bank, execute a planned retirement or withdrawal and cross the river as rapidly as possible. To preclude early threat detection of the retrograde, they follow a movement control plan that supports the deception plan.

The delay phase continues until the battle is within communications and fire-support range of the exit-bank defense. The delaying force must be strong

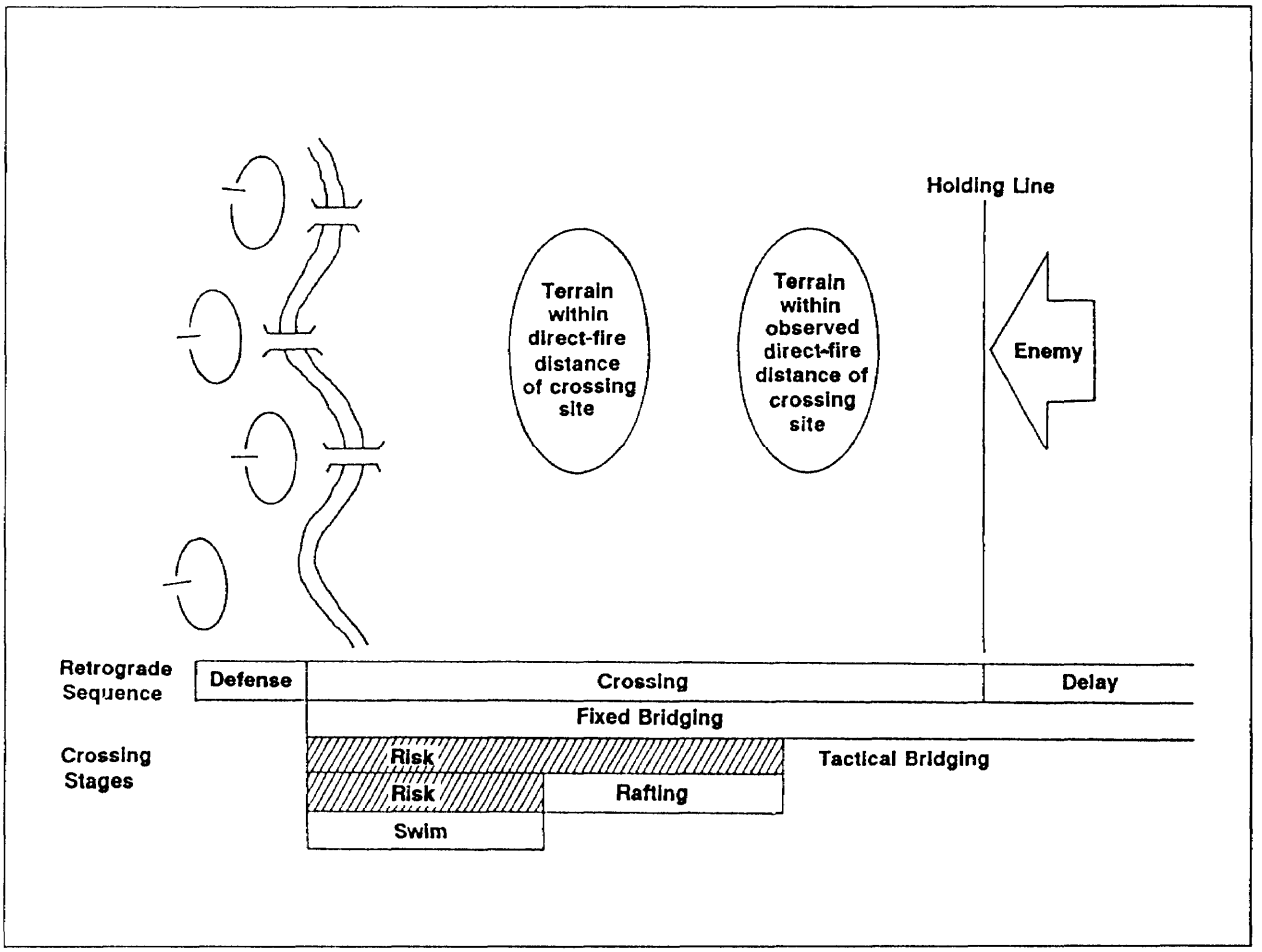


Figure 5-2. Retrograde planning

enough to hold the threat until other units establish the defense. The defending force assumes responsibility for the battle forward of a delay line called a holding line, while delaying units still on the entry bank complete a rearward passage of lines through the defending force.

The division commander establishes the holding line on defensible terrain between the river and the threat. Its location precludes direct and observed indirect fires in the crossing area.

Figure 5-3 shows an example of a retrograde crossing. In this case, the 3rd brigade is the delaying force. It occupies battle positions to the rear of the 1st and 2nd brigades at Phase Line (PL) Plum, the initial delay position (IDP), to help them whhdraw. The 3rd brigade delays the threat forward of the holding line until the rest of the division crosses the river and the 1st and 2nd brigades reestablish the defense along the river.

Crossing Phase

In contrast to normal offensive crossing operations, friendly forces initially control retrograde crossing sites, which may be insufficient in number. The threat usually knows where the logical crossing sites are and attacks them early in the operation, but it must not be allowed to capture them. Friendly forces should develop additional sites to provide flexibility against this possibility.

The commander should attempt to salvage tactical bridges and rafts for future use, but it maybe necessary to use them for the crossing and then destroy them to prevent capture. Fixed bridging must be prepared for destruction and also be protected against ground and air attack. This requires close coordination with the delaying force to preclude cutting off friendly forces or allowing threat seizure of sites intact.

The brigade main CP, commanded by the brigade XO (CAC) is responsible for the passage of all units through the crossing area. The CAC is designated early enough in the operation to begin the required extensive planning. The CAC is designated by the tactical commander to control the movement of the retrograde forces through the crossing area.

Traffic control up to and through the crossing area is a critical problem in crossing operations. For this reason, plans for movement must be detailed, and control of movement is essential. This control is exercised by the CAC with assistance of the delaying force commander (brigade commander). The CAC controls all movement within the crossing area.

It is the responsibility of the CAC to ensure the continuous and orderly flow of the retrograde elements across the water obstacle. His control includes both the ERPs, which ensures that all vehicles are of proper class and size, and also all waiting areas that feed

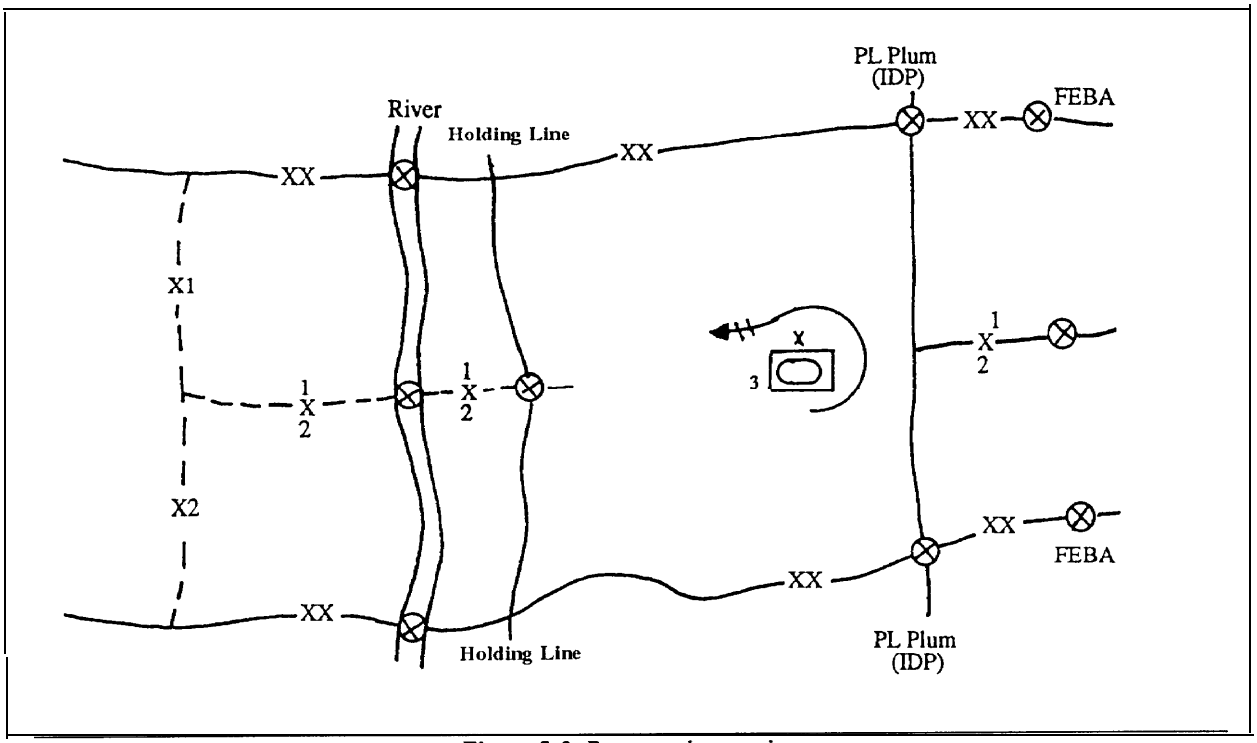


Figure 5-3. Retrograde crossing

vehicles through the crossing area. To assist the CAC, MPs establish and operate TCPs to manage the traffic flow. Crossing site commanders operate the crossing means. The CAC and his staff must synchronize the crossing plan with the commander's tactical plan.

Activity within the crossing area will begin with two-way crossings by combat service support units evacuating nonessential supplies or restocking the delay force. During the early stages of the retrograde, the existing crossing means may be supplemented by tactical bridging. As a minimum, additional tactical bridge assets must be planned and available.

Initially, freed and floating bridges are used to cross the force. The force crosses on bridges as long as possible, since this is the most rapid means. Once the bridges become vulnerable to capture, air attack, or observed indirect fires, they may be converted to rafts or removed. Crossing continues using rafting or swimming vehicles. When the rafts become vulnerable to direct fire, the rafts are removed. The remainder of the delaying force crosses by swimming vehicles or 15-man assault boats. Finally, the crossings are made under the suppressive fires of the defending force's direct- and indirect-fire weapons.

The crossing attempts an orderly flow across the water obstacle while conserving combat power. The retrograde crossing begins as a rear-area operation for the division. Initially, it is a traffic-scheduling problem, centrally controlled by the division. The division establishes crossing areas before crossing maneuver brigades. Crossing area operations are the same as for offensive crossings (see Chapter 3). Even when the division has to establish the crossing areas quickly, under adverse circumstances, it synchronizes crossing support activities (to maintain high movement rates) with those of the defense force (preparing to close the routes) in the crossing areas.

Crossing sites need the highest priority for air defense. This is particularly critical when the threat has air superiority or when air parity exists. The sequence for crossing air-defense units should account for the need to provide continuous coverage of crossing sites.

The division engineers are fully committed to the delay. As a result, engineers under control of the CAE run the crossing sites and support initial preparation of exit-bank defenses.

Defense Phase

The defense phase stops the threat by keeping it out of the crossing area, denying crossing sites upstream or downstream, and destroying forces attempting to cross the river. In particular, it targets potential threat crossing assets. Whether continuing the retrograde further or defending along the river, the division establishes a strong exit-bank defense. The defending force protects the delaying force as it crosses the river after battle handover. The rearward passage of lines by the delaying force is a normal defensive operation, complicated by the river.

Initially the defending force is small. It consists of combat and combat support units not involved in the delay as well as augmentation from corps reserves. Because enough forces are not available to defend all points along the river, the defense depends on rapid lateral movement to concentrate at vulnerable points. In particular, it orients on and protects the crossing sites against threat forward detachments and heliborne forces.

After battle handover from the delaying force, the defending force is responsible for the area between the holding line and defensive positions on the exit bank. Massed fires by the defending force help its elements in contact forward of the river to withdraw, thereby complicating the retrograde crossing.

Figure 5-4 illustrates the staggered nature of the battle handover at the holding line and the subsequent defense at the river. The threat, following its doctrine of direct and parallel pursuit, attempts to reach the river on alternate routes and cut off the delaying force with part of its strength, while other threat elements attempt to cross on the heels of the delaying unit. The defending force accepts battle handover from the last of the delaying force at the holding line and covers its crossing over a freed bridge that is prepared for demolition. Friendly forces at the river prevent the threat from crossing at the site of a demolished freed bridge so that companies securing the crossing site can safely withdraw in turn.

Withdrawal

The withdrawal differs from the delay in that it is an operation in which the unit in contact disengages from a threat force and moves to the rear. Withdrawals are executed when the commander desires to withdraw to control future tactical operations without being forced to do so by threat pressure. A withdrawal follows the same sequence as the delay. The only difference is that the unit may or may not be in threat contact.

Retirement

Retirements are rearward movements away from the threat by a force not in contact. They are normally covered by the security forces of another unit to their rear and are conducted as tactical road marches. A retirement follows the same sequence as the delay.

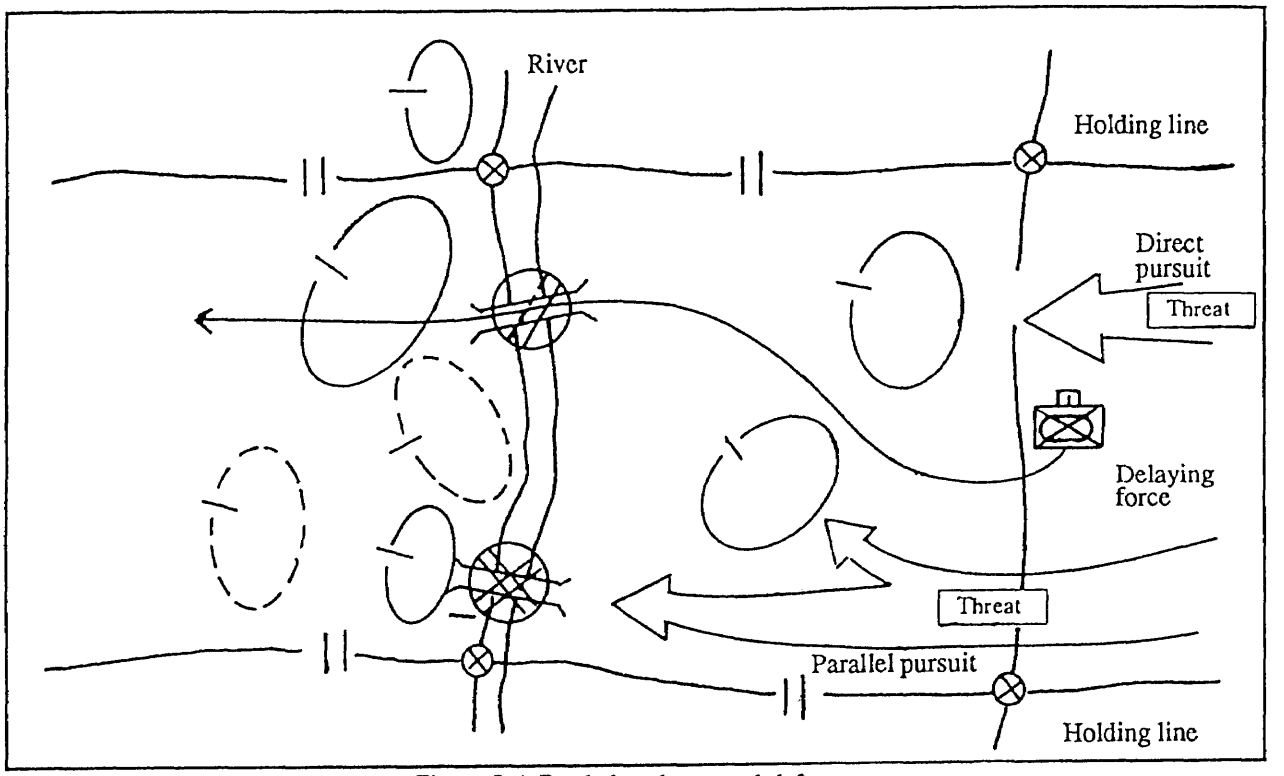


Figure 5-4. Battle handover and defense

DENIAL MEASURES

Denial measures are actions taken to hinder or deny threat use of resources or facilities. In retrograde crossings, the commander includes bridges and crossing sites in his denial measures.

A defending force commander is responsible for preparing the destruction of existing bridging and other crossing means in his sector, such as ferries, to prevent their use by the threat. The CAE controls the engineers who prepare those targets. The timing of their destruction depends on their use in supporting the crossing. When the tactical situation dictates that crossing sites are no longer needed or the risk of capture outweighs their usefulness, the defending force must destroy them. Use of bridges in the retrograde requires a redundant means of bridge destruction and a robust demolition guard with an engineer demolition party. Because of the severe consequences of a premature decision to destroy a site, the division commander usually designates sites as reserve targets and issues specific orders stating under what conditions and by whose authority this destruction can be done. He usually delegates this authority to a defending commander after battle handover from the delaying force, when the only units remaining to cross belong to the defending force. The defending commander may save a selected number of existing bridges for passage of his last elements on the far bank and then destroy them in the face of the threat. This strategy requires close coordination to preclude cutting off friendly units.

Engineers destroy military bridging that they cannot recover quickly. Bridge stocks are in short supply; therefore, if existing bridges are sufficient to support the retrograde, the engineers recover military bridging early. In addition, the denial of major existing bridges can be so important that the commander may choose to destroy them early and rely on military bridging to cross the remainder of his force. Ribbon bridging is preferred for this crossing because of its recovery speed. Engineers either recover lines of communication (LOC) bridges well before the threat arrives or destroy those left in place after the delay.

PLANNING

The division commander identifies the holding line and the units required to fight the delay and defense battles. The division engineer, in conjunction with the G3, identifies crossing sites and required crossing assets. The division staff coordinates for the additional corps assets. The staff uses the planning process identified in Chapter 6.

The commander uses deception to conceal the extent of the operation and the actual crossing sites. Smoke, electronic warfare, and dummy sites reduce the threat's capability to disrupt the crossing. OPSEC keeps the

threat intelligence collectors from identifyng the time and place of such crossing.

The commander may consider retaining fixed bridges in defense of the river line if he anticipates future counterattacks back across the river. He may also partially destroy bridges to ease restoration in future offensive operations, weighing this decision against threat use of the bridges.

A retrograde river crossing combines two of the most difficult forms of combat – a retrograde and a river crossing. It requires detailed planning and skillful execution to preserve the force and defeat the threat.

Chapter 6
Planning

GENERAL

Units plan river crossings the same as any tactical operation, with one major difference. Force allocation against threat units has an added dimension of time. Friendly forces can only arrive on the battlefield at the rate at which they can be brought across the river. This rate changes at different times throughout the operation. This chapter outlines the detailed planning necessary because of this difference.

Corps allocates support elements to the division and provides terrain and threat analysis. It assigns mission objectives to the division. For operations where the corps is crossing the river, it may assign the bridgehead line. Division assigns mission objectives to the brigades and specifies the bridgehead line. It may assign bridgehead objectives to brigades. It also allocates maneuver and support forces to the brigades and develops coordination measures, such as movement schedules, that apply to more than one brigade. It provides terrain and threat analysis to the brigades. The senior corps engineer headquarters allocated to the division for the crossing assists with detailed crossing planning. The lead brigades develop the tactical plans that they will execute. They develop the crossing objectives in order to attain its mission objective. The headquarters of the corps engineer battalion assigned to support each brigade crossing develops the detailed crossing plan. Battalions develop the tactical plan necessary to seize assigned objectives.

The actual planning process for a river crossing is the same as for any tactical operation. Differences occur primarily because of the complexity of crossing a river (which makes extensive calculation necessary) and the need to balance tactics with crossing rates.

Planners do crossing calculations twice. Crossing calculations are critical to course of action (COA) evaluation. They are required to ensure that force buildup supports the COA. Initial planning uses simple calculations and rules of thumb to produce quick force buildup information. Once a commander selects a specific COA, planners make detailed crossing calculations to produce the crossing plan.

THE PLANNING PROCESS

The staff planning process produces a best possible solution to accomplish the unit's mission. As river crossing is normally only one part of an operation on the way to mission accomplishment, river crossing planning is part of a larger planning effort. This chapter discusses those parts of the planning process that are necessary for the river crossing. It does not attempt to discuss the larger planning process necessary for full mission accomplishment.

In order to simplify the explanation of a multistep, multiechelon, and somewhat repetitive planning process, the following section describes it in steps and in two echelons. The shadowed text in the figures shows the step in the planning process being discussed, with the battle staff and engineer planning requirements alongside. A detailed discussion follows, primarily aimed at the division and brigade echelons. In general, the corps identifies the crossing requirement and provides assets, the division does detailed terrain analysis and rough crossing planning, and the brigade does detailed crossing planning.

TASK IDENTIFICATION

The first step is to recognize that a river crossing is necessary (see *Figure 6-1).* Once the mission is received, the staff develops facts and assumptions and conducts a mission analysis. This is done to understand the purpose of the mission and the intent of the commander and the commander two levels up, to review the area of operations, and to identify tasks (both specified and implied), assets available, constraints, restraints, acceptable level of risk, and an initial time analysis.

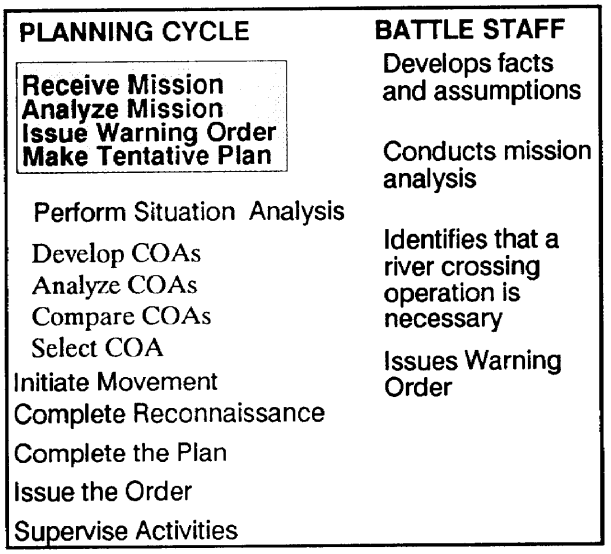


Figure 6-1. Step 1-Receive mission

Mission analysis is conducted according to *FM 101-5*. Corps planners normally identify river crossing requirements when assigning division missions. The corps plan will then provide river crossing assets to the division and may specify crossing the river as one of the tasks assigned to the division. If the mission the corps is assigning does not require a division-level river crossing, it may not specify a crossing. The troop list includes necessary crossing assets, however.

Corps. Normally, if corps identifies the requirement for a river crossing, its warning order includes it. The topographic company supporting the corps provides detailed river data and crossing-area overlays. The topographic company automatically provides necessary topographic data to the division terrain team. See *FM 100-15* for more details of planning at the corps level.

Division. Division will learn that it must cross a river by receiving a specified task in the corps order or by developing an implied task during mission analysis. If the troop list includes bridging assets, the corps anticipates a division river crossing operation.

The division engineer section always examines all rivers in the division area of operations during the mission analysis process. The division terrain team maintains a terrain data base that includes river data and potential crossing sites for the division's area of operation.

Note: Upon identifying a river crossing task, the division engineer and terrain team immediately determine potential crossing sites.

The echelon that first identifies a crossing requirement issues a warning order. This initiates early analysis, troop preparation, and rehearsal.

SITUATION ANALYSIS

The battle staff, including the staff engineer, analyzes the existing situation (see *Figure* 6-2). This analysis includes the threat, friendly troops, terrain, and time available for the mission. This step is primarily designed to acquire the data necessary for the following planning steps, but some early analysis is necessary to generate critical information. The engineer staff officer must very quickly convert raw terrain data and friendly information into crossing rates. This allows the planners to make intelligent decisions about supportable schemes of maneuver.

Division. As a part of the IPB process, the G2 leads the staff development of a defensive situational template along the entire river that the division must cross. The template focuses attention on possible areas of weakness, counterattack forces, and artillery.

The G2, with the division engineer, develops obstacle templates from the line of contact through to the division's objectives. He provides the templates to the brigade intelligence sections for their planning and analysis. The division engineer provides threat obstacle information (particularly along the river) to the brigade engineers.

Brigade. The brigade staff refines the templates provided by division and develops them for a lower level of threat force. The intelligence officer (US Army) (S2) develops intelligence requirements and a detailed intelligence collection plan, with specific emphasis on the far shore. Reconnaissance teams seek information to fill requirements. Obstacle templates are verified by active air and ground reconnaissance as discussed in Chapter 2.

Friendly Troops

Division. The division engineer coordinates for corps engineer units to cross the force, using the simple rule of thumb that every forward brigade requires two bridges. Insufficient bridging assets limit possible COAs.

Brigade. The brigade engineer identifies the crossing sites required for the brigade and for each battalion, based on the number of vehicles. This calculation uses simple assumptions. From it, the brigade engineer determines the approximate time necessary to cross the entire brigade. The crossings required will be important during COA development. The brigade engineer

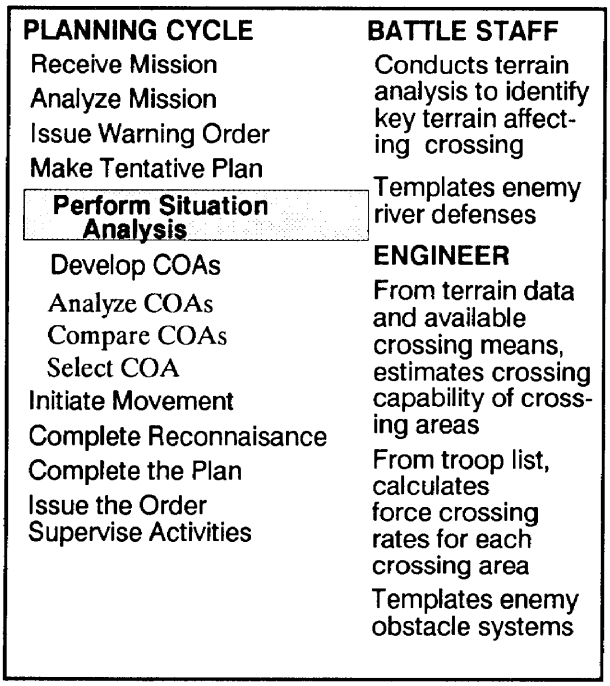


Figure 6-2. Step 2-Perform situation analysis

also determines the amount of bridging available, the number of possible heavy rafts, and the number of assault boats. This information is passed to the CA HQ (BMAIN CP) who is responsible for the control of all crossing means.

Terrain

Division. The division engineer ensures that adequate information is in the crossing-site data base for planning at brigade level. The division terrain team generates crossing-site overlays, site data files, and road and cross-country movement overlays for the crossing areas.

The division engineer determines that sufficient assault, raft, and bridge sites are available within each brigade's area. Generally, a main attack brigade requires assault sites for two dismounted battalions and at least two raft or bridge sites.

Brigade. The brigade engineer, in coordination with the CAE, evaluates all potential crossing sites from both technical and tactical considerations, including –

- Entry and exit road net.
- Cross-country movement.
- River width.
- River velocity.
- River depth.
- Bank conditions.
- Vegetation along shore.
- Obstacles in or along the river.
- Possible attack positions and routes to the river.
- Possible call-forward areas.

The brigade engineer, in coordination with the CAE, then analyzes each site to arrive at a rough crossing-rate capability and the effort necessary to open the site. Operations planners use this information to develop possible COAs. One method to display this data is in chart form (see *Figure 6-3),* while another, preferred method is with a crossing-site overlay (see *Figure* 6-4). The division engineer, in coordination with the CFC (corps engineer group commander), ensures that the crossing requirements of the lead brigades and breakout force are adequately resourced to satisfy each COA.

Site Red #1	Site Red #2	Site Red #3
Bank Prep Time	Bank Prep Time	Bank Prep Time
River Conditions	River Conditions	River Conditions
Vegetation	Vegetation	Vegetation
Full Crossing Rate	Full Crossing Rate	Full Crossing Rate
Remarks	Remarks	Remarks

Figure 6-3. Site comparison chart

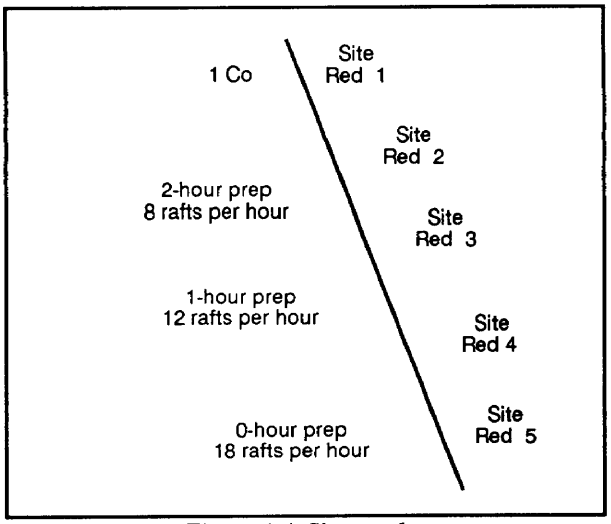


Figure 6-4. Site overlay

The crossing-site overlay is more useful to planners developing potential COAs, because it allows them to see crossing sites in relation to the other terrain features. This overlay shows potential site locations, maximum crossing rate for tanks and other fighting vehicles, and an estimate of the time required to put each crossing site into operation.

The BMAIN CP (CA HQs) evaluates the terrain along the river in terms of OCOKA. The intent is to understand the terrain along the river so that potential COAs can be devised with crossing objectives. The operations planners combine this knowledge with the crossing-site comparisons and threat templates to develop possible COAs.

COA DEVELOPMENT

Division. The G3, along with key members of the battle staff, sketches out possible COAs to accomplish the division mission (see *Figure 6-5, page 6-5).* COAs must include assigned crossing areas for each brigade, as well as brigade boundaries that include terrain necessary to defend the bridgehead against threat counterattacks.

Looking two levels down, the division staff plans an assault crossing site for each anticipated assaulting battalion in a brigade area. A brigade should also have two bridge or raft sites within its boundaries.

Brigade. The S3 looks closely at the avenues leading to brigade mission objectives, particularly at crossing sites feeding the avenues. Developing practicable COAs is normally an iterative process. They first develop a scheme of maneuver to take the final objective, then verify that the force buildup rate across the river is adequate for the scheme of maneuver. If so, the S3

PLANNING CYCLE	BATTLE STAFF
Receive Mission	With commander, sketches out several COAs to develop
Analyze Mission	
Issue Warning Order	
Make Tentative Plan	Develops scheme of maneuver, fire plan, and support for each COA, considering crossing capability and the order of crossing
Perform Situation Analysis	
Develop COAs	
Analyze COAs	
Compare COAs	
Select COA	**ENGINEER**
Initiate Movement	For each COA, selects sites, determines raft and bridge configuration and bank prep, and task-organizes the engineers
Complete Reconnaissance	
Complete the Plan	
Issue the Order	
Supervise Activities	

Figure 6-5. Step 3-Develop COAs

expands the COA to include the tactics required for the crossing.

Tactics required for the crossing consider threat defenses near the crossing sites, threat reaction forces and earliest employment times, and crossing rates at each site. The COA must include exit-bank, intermediate, and bridgehead objectives.

The S3, working with the brigade engineer and CAE, develops the control measures, crossing graphics, and crossing timeline for each COA (see *Figure* 6-6).

COA Analysis

The staff at both division and brigade war-game each COA against likely threat reactions (see *Figure* 6-7). They then attempt to counter each threat response.

The engineer war-games against other variables outside his control, such as terrain difficulties and crossing-equipment losses. He considers what will happen if it takes longer to open a crossing site, if damage slows progress over entrance and exit routes, or if river conditions change. He also considers what will happen if threat action shuts down a crossing site or forces its relocation. He must consider the consequences of equipment failure or loss to threat action. He evaluates the most likely of these against all COAs and develops, within his means, necessary counters (to include alternate sites and routes).

COA Comparison

Division. The division staff examines each COA against both the immediate and follow-on missions (see *Figure* 6-8). Division is particularly concerned with movement of reserve and support forces and compares COAs against these requirements.

Brigade. The brigade staff considers the ability of each COA to handle threat responses, support follow-on

PLANNING CYCLE	BATTLE STAFF
Receive Mission	War-games each COA against possible enemy responses
Analyze Mission	
Issue Warning Order	
MakeTentative plan	**ENGINEER**
Perform Situation Analysis	War-games each COA against terrain changes and equipment loss
Develop COAs	
Analyze COAs	
Compare COAs	
Select COA	
Initiate Movement	
Complete Reconnaissance	
Complete the Plan	
Issue the Order	
Supervise Activities	

Figure 6-7. Step 4-Analyze COAs

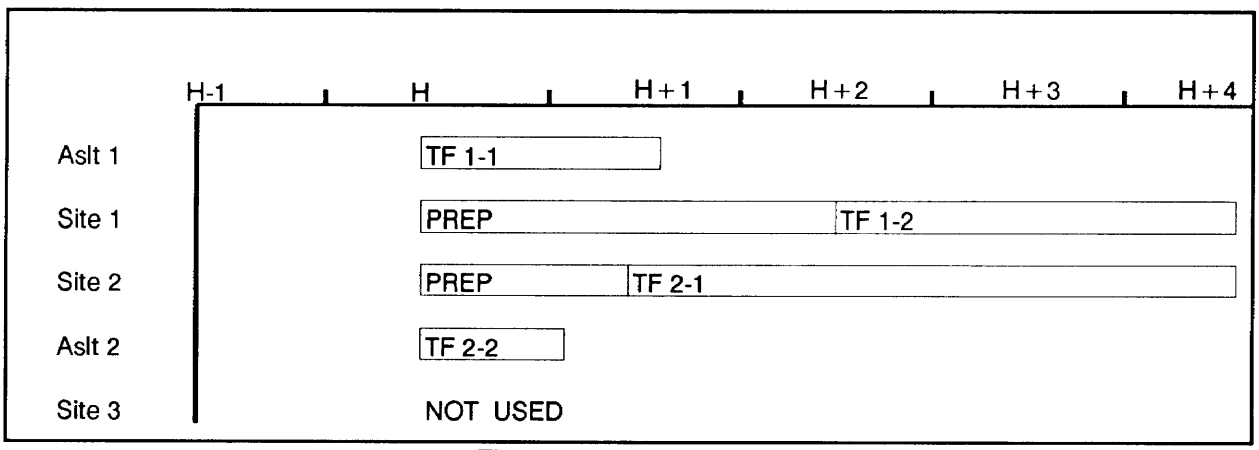


Figure 6-6. Crossing timeline

PLANNING CYCLE	Battle Staff
Receive Mission	Compares and evaluates advantages and disadvantages of the COAs
Analyze Mission	
Issue Warning Order	
Make Tentative Plan	
Perform Situation Analysis	
Develop COAs	Recommends one COA to the commander
Compare COAs	
Select COA	
Initiate Movement	The commander selects a COA and issues a fragmentary order
Analyze COAs	
Complete Reconnaisance	
Complete the Plan	
Issue the Order	
Supervise Activities	

Figure 6-8. Step 5-Compare COAs

missions, provide brigade flexibility, and allow for crossing redundancy.

FORCE MOVEMENT INITIATION

Division. The division staff provides movement orders and route priorities to establish early linkup of support forces with the brigades. They plan and execute deceptive movement of forces to hinder threat identification of the crossing areas.

Brigade. The brigade staff begins moving forces into assembly areas, starts training and rehearsals, and moves necessary corps combat engineer and bridge companies up early to provide equipment and instructors.

DETAILED PLAN

The battle staff converts the selected COA into a plan with sufficient detail for synchronized execution (see *Figure* 6-9). The staff engineer does extensive analysis to develop a unit-by-unit crossing plan and movement schedule. From this analysis, he develops the crossing -capability chart and the crossing overlay (see Figure 6-10). These are his primary execution tools. He develops the crossing synchronization matrix as a

PLANNING CYCLE	BATTLE STAFF
Receive Mission	Converts selected COA into an executable plan
Analyze Mission	
Issue Warning Order	
Make Tentative Plan	
Perform Situation Analysis	**ENGINEER**
Develop COAs	Develops detailed crossing plan
Analyze COAs	
Compare COAs	
Select COA	
Initiate Movement	
Complete Reconnaissance	
Complete the Plan	
Issue the Order	
Supervise Activities	

Figure 6-9. Step 6-Complete the plan

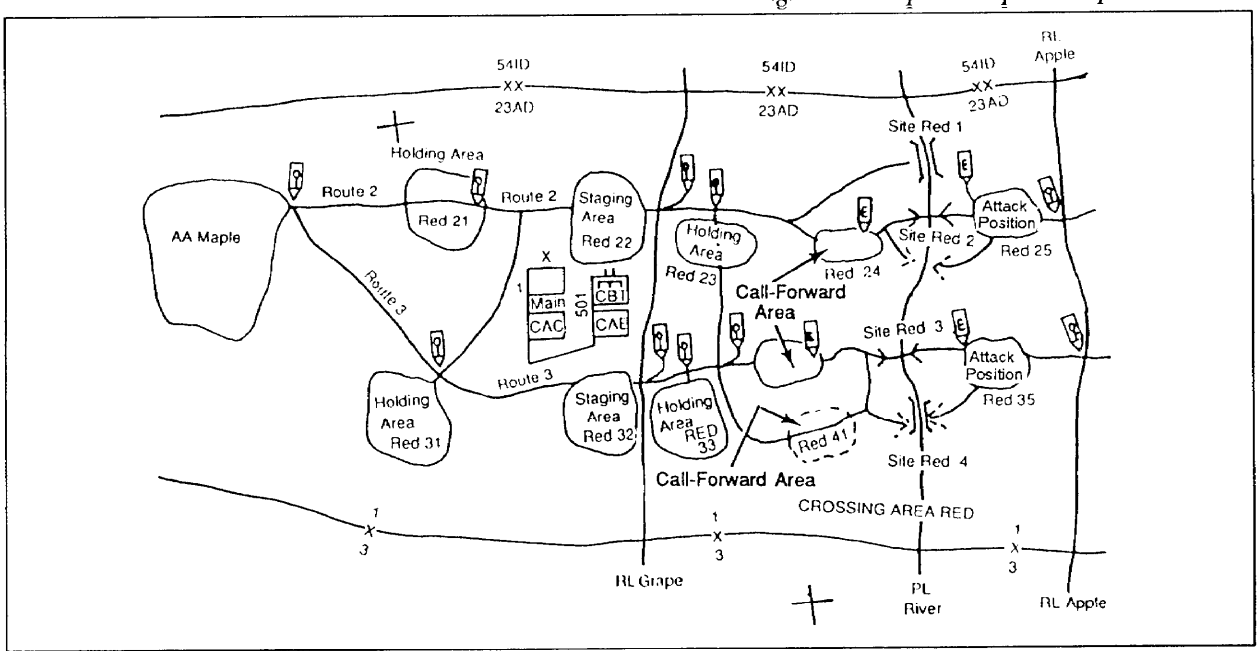


Figure 6-10. Crossing overlay

primary execution tool for the S3. He also helps the traffic-control cell work out the traffic-circulation plan.

While detailed planning is underway, the CAE initiates far- and near-shore reconnaissance to develop sufficient detail for battalion-level planning. He converts this planning into a detailed engineer task list and develops an engineer execution matrix to synchronize it (see Appendix A).

Chapter 7

Crossing Sites

SECTION I. CHARACTERISTICS

GENERAL

This section supplements the general descriptions of acceptable crossing sites in Chapters 2 and 3. Selection of crossing sites is primarily based on the –

- Existing situation and anticipated scheme of maneuver.
- Physical characteristics of the available sites, road networks, and surrounding terrain.
- Availability and capabilities of crossing means.
- Availability of engineer support.

Conflicts between tactical and technical requirements frequently occur. Commanders evaluate the factors bearing on the problem to determine the best overall solution.

CROSSING SITE SELECTION

Each crossing means, except air assault, requires a type of crossing site. They can be ford, assault boat, swim, raft, or bridge sites. Assault battalions use either a ford or an assault boat site (or sometimes a swim site) as an assault site.

Both the desired scheme of maneuver and available crossing means influence crossing-site selection. The division assigns a crossing area to each lead brigade. The brigade chooses which crossing sites to use within its area. When a particular site is important to the division's tactical concept, such as for movement of breakout forces, the division either coordinates with the affected brigade to open that bridge site or moves a bridge to that site once the brigade hands over the crossing area to the division.

Engineer intelligence identifies tentative locations supportable with the available crossing means. Brigade commanders select final crossing sites based on other tactical intelligence and their desired schemes of maneuver. Each site's physical characteristics, required engineer support, and available crossing means influence the decision, but tactical requirements are the most important.

The goal when selecting assault sites is to pick those that allow lead battalions to cross unopposed and rapidly seize far-shore lodgments. If unsuccessful at finding undefended crossing sites, lead battalions cross under threat fire while follow-on and overwatch units provide direct and indirect suppressive fires. Assault sites may or may not coincide with raft or bridge sites.

When selecting swim sites, the goal is to pick those that permit fighting vehicles to rapidly enter, swim across, and exit the water with minimum assistance.

The goal for raft and bridge sites is to pick those that support the greatest volume of vehicle traffic consistent with the scheme of maneuver. Raft and bridge sites are usually on or near major roads to minimize route preparation and maintenance. When the raft and bridge sites are located close together, the bridge site must be upstream of the raft site. This will avoid potential damage that may be caused by disabled rafts drifting into the bridge.

Regardless of the crossing means, each site needs engineers to cross early, reduce obstacles, and develop exit points on the far bank. River banks at otherwise suitable crossing sites often need work for access to the river. Most natural soil becomes unstable under heavy traffic. This condition worsens as fording, swimming, and rafting activities carry water onto it. The required engineer effort varies with soil type, crossing means, and vehicle density.

Natural conditions vary widely. Banks may require little preparation, or they maybe so restrictive that they limit feasible sites. Desirable site characteristics include –

- Minimum exposure to threat direct-fire weapons.
- Covered and concealed access to the river's edge.
- Gently sloping and firm banks allowing rapid entry and exit at multiple points.

Initial and subsequent entry points can vary. Available locations seldom have all the desired tactical and technical characteristics. The best routes through the crossing area normally cross the river at the technically best crossing sites. The best technical sites are not the best tactical sites because they are well known and are heavily defended by the threat. Forces initially crossing at less desirable locations are most likely to avoid detection and gain surprise. Moving laterally along the exit bank, they attack the flank or rear of threat units to seize the better crossing locations. Use of these sites then allows the most rapid buildup of combat power.

PLANNING

Planners need information of potential crossing sites to evaluate their compatibility with proposed crossing plans. Generally, planners need to know–

- Friendly and threat capabilities and probable COAs.
- Site capacity for crossing of troops, equipment, and supplies using various crossing means.
- Engineer support required to develop, improve, and maintain each site.

More specifically, planners need to know the –

- Bank, bottom, and water conditions of the river.
- Impact of forecast or historical seasonal weather conditions.
- Defensible terrain, cover and concealment, and natural or threat-emplaced obstacles on both sides of the river.
- Time and effort required to develop sites, assemble rafts, and construct bridges.
- Entry/exit routes and off-road trafficability.
- Road networks.
- Capability to deny observation, suppress fires, and provide site protection.

REQUIREMENTS

Entry and Exit

A desired feature of all sites is readily accessible entry/exit routes or paths on either bank. Approaches to banks are checked for their ability to support the requirements of the crossing element (width, slope, and trafficability) for wheeled and tracked vehicles. Covered and concealed approaches enhance surprise and survivability; however, multiple routes, free from obstruction, will increase crossing speed and flexibility. Exit-bank conditions often take precedence over entry-bank conditions until equipment and troops can be crossed to develop and improve the site. See *Figure 7-1* for depth requirements.

Routes and Approaches

Units use the following routes and approaches:

- Fords. Dismounted forces may use approaches with steep slopes and heavy vegetation, while vehicle fording requires paths or roads to approach fording sites.
- Assault or swim routes. Assault boat crossings may use more rugged approaches than amphibious vehicles.
- Rafts. Multiple approach routes to rafting sites permit relocation of rafting up- or downstream.
- Bridges. Bridge sites require developed road networks to sustain the crossing capacity.

Vehicles use the following routes and approaches:

- Wheeled vehicles. In general, wheeled vehicles require 3.5-meter path widths and 3.5 meters of overhead clearance. Dry, hard slopes of 33 percent can be negotiated; however, slopes less than 25 percent are desired.
- Tracked vehicles. Tracked vehicles require up to 4-meter path widths and 3.5 meters of overhead clearance. Tanks can climb 60-percent (31-degree) slopes on dry, hard surfaces; however, slopes less than 50 percent are desired.

Waiting Areas

Numerous waiting areas are required for equipment and troops preparing and protecting sites and for troops and vehicles preparing and/or waiting for crossing. These areas should be dispersed, provide cover and concealment, and be accessible to road networks near the sites.

River Conditions

In general, currents less than 1.5 meters per second (MPS) are desired. Narrow segments of the river decrease equipment requirements, crossing time, and exposure. However, resulting increased current velocities may offset any advantage.

OPERATION	Item	Draft (meters)	Remarks
Ford	Personnel	0.10	
	Wheeled Vehicle	0.75	
	Tracked Vehicle	1.20	
Assault/Swim	M113 (APC)	1.50	Sufficient depth for operation of boats or vehicles to be used.
	M548	2.00	
	M2	1.07	
Raft/Bridge	Power boat (27 feet)	1.00	Need deep water close to the bank to preclude grounding of the raft or bridge.
	LTR	0.60 *	
	M4T6	0.75 *	*Power boat draft may govern depth.
	Ribbon	0.60 *	

Figure 7-1. Depth requirements

Banks

Ford banks may be steep and rugged for dismounted troops. Vehicles require less than 33 percent slopes and firm soil conditions. Assault or swim banks may be steep when using assault boats for dismounted troops. Amphibious vehicles may be able to enter over low, l-meter vertical banks, but they require sloped exits. Vertical banks of approximately 1 to 2 meters maybe accommodated by bridge or raft ramps (see *Figure 7-2).* Vertical bank heights for bridges using the equipment listed in the figure do not change for light tactical raft (LTR) or ribbon bridges. For M4T6 and Class 60, the height of the bridge deck can be adjusted to accept a difference in bank heights; however, the limiting factor may become the longitudinal slope of the bridge.

Equipment	Ramp Articulation (Raft)	
	UP	DOWN
LTR	1.0 meter*	0.48 meter*
M4T6	not adjustable	
Class 60	not adjustable	
Ribbon	1.0 meter**	

*This is true when using articulators.
**An approach ramp of 7 feet long provides extra roadway or loading and off-loading vehicles.

Figure 7-2. Bank requirements

Bottoms

Ford bottoms must be free from obstacles, firm, and uniform. Riverbeds may be improved with rock fill or grading equipment. Guide stakes ease crossing. Assault or swim site bottoms must be free from obstructions that interfere with boats or tracks of amphibious vehicles. Raft sites must be free from obstructions that could interfere with boat operations. Bridges emplaced for lengthy periods (4 hours or more) or in strong currents require suitable riverbeds for anchorage. Divers from theater army may be used to conduct river-bottom reconnaissance to ensure the success of the operation.

Threat Situation

Sites masked from threat observation enhance surprise and survivability. The use of existing sites reduces preparation time but requires caution in that the threat may have emplaced obstacles and registered artillery on the site.

SITE ANALYSIS

A ground reconnaissance refines and confirms information gathered from other sources. *(FM 5-36* and *TC 5-210* contain details for the conduct and reporting of site reconnaissance.) From these and other detailed reports, planners may develop charts or overlays to compare alternate sites. Unit SOPs may prescribe specific comparative methods. See *Figure 7-3* for an example.

Bank Preparation Time
- Describe bank height, slope, and stability.
- List time and effort to overcome significant natural and enemy-emplaced obstacles.
- Include day, night, or other reduced-visibility constraints.

River Conditions
- Specify width, depth, velocity, and bottom conditions as appropriate.
- Include variations or unique factors (such as sandbars, turbulence, or depth at bank).

Vegetation
- List space suitable for work sites and assembly areas and available cover/concealment.

Full Crossing Rate
- Describe foot, wheeled, and tracked movement capability on roads, trails, and cross-country
- Describe maximum crossing rate for fording, swimming, or rafting.

Rafting
- Include overall assessment of crossing-site potential.

Figure 7-3. Crossing-site requirements

FIELD CALCULATIONS

Some common relationships and expedients useful during a ground reconnaissance include determining unit measures of speed, measuring river velocity, determining slopes and degrees, measuring river width, and calculating downstream drift.

Determining Unit Measures of Speed

Correlating the desired maximum stream velocity of 1.5 MPS with a familiar comparative unit of measure may help estimate current. The quick-time march rate of 120 steps per minute, with a 30-inch step, equates to 1.52 MPS. Other approximate correlations of 1.5 MPS include —
- 5 feet per second (fps)
- 3.5 miles per hour (mph)
- 5.5 kilometers per hour (kph)

Measuring River Velocity

The current of the river is critical to effective and safe operation. A reasonable estimation involves measuring

a distance along the riverbank and noting the time a floating object takes to travel the same distance. Dividing the distance by the time provides the water's speed (see *Figure 7-4).*

Determining Slopes and Degrees

The slope of terrain is significant (for example, slopes of 7 percent or more slow movement and may require vehicles to operate in a lower gear). Slope, usually expressed as a percentage, is the amount of change in elevation (rise or fall) over a ground (horizontal) distance (see *Figure 7-5).*

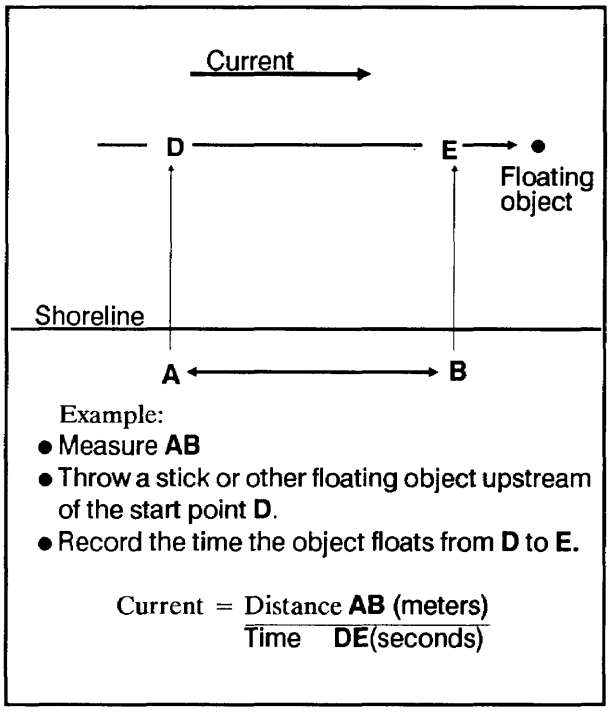


Figure 7-4. Measuring current velocity

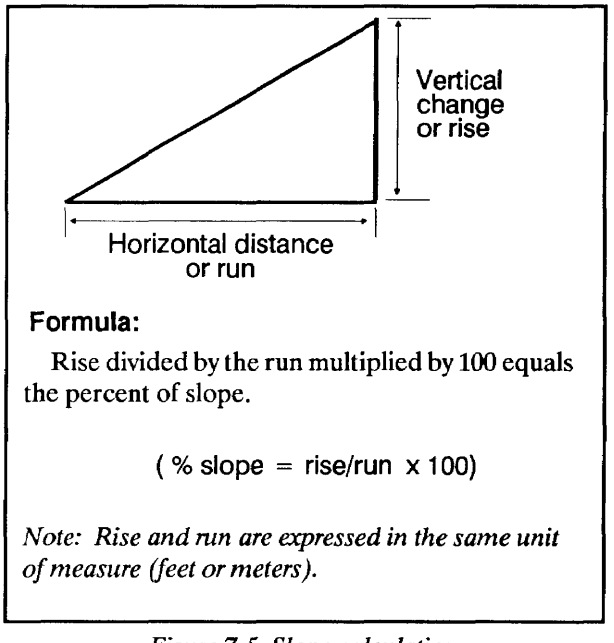


Figure 7-5. Slope calculation

Vehicle capabilities to climb or descend terrain are commonly expressed in percent of slope. For example, tanks can negotiate slopes of 60 percent, based on ideal conditions such as dry, hard surfaces. Rocks, stumps, and loose soil degrade capabilities. Wheeled vehicles are generally limited to a maximum slope of 33 percent.

Means to determine percent of slope include –

- Clinometers. These instruments measure percent of slope and are organic to most engineer units.
- Maps. In this method, one must first measure the horizontal distance along the desired path, then determine the difference in elevation between the starting and ending points of the path. The next step is to ensure that both figures are the same unit of measure (such as feet or meters). The final step is to divide the elevation (rise) by the distance (run) and multiply the result by 100 to get percent of slope (see *Figure 7-6).*
- Line of sight and pace. This method uses eye-level height above ground (usually from 1.5 to 1.75 meters) and length of standard pace (usually 0.75 meter). While standing at the bottom of the slope, the individual picks a spot on the slope while keeping his eyes level. He paces the distance and repeats the procedure at each spot. Adding the vertical and horizontal distances separately provides the total rise and run.

Slope may also be expressed in degrees; however, this provides angular measurements. The method is not commonly used because the relationships are more

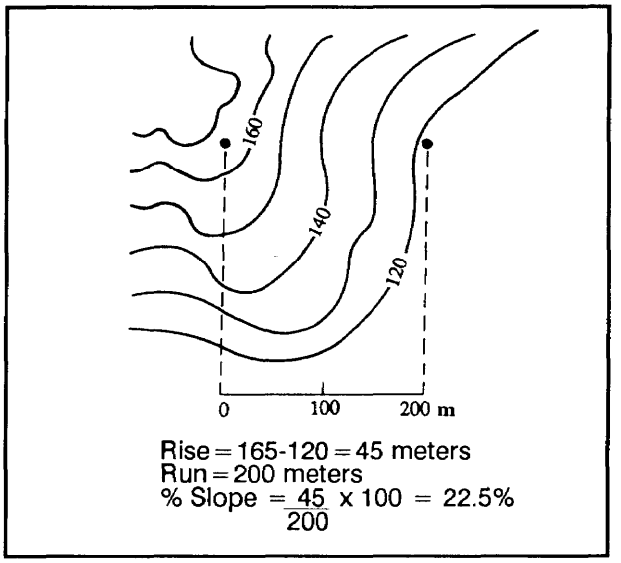


Figure 7-6. Terrain slope

complex than desired for field use. *Figure 7-7* lists some relationships of percent and degree of slope.

SLOPE	DEGREES
100%	45
60%	31
40%	22
20%	11

Figure 7-7. Relationship of slopes and degrees

Measuring River Width

A field-expedient means of measuring river width is with a compass. While standing at the waterline, sight on a point on the opposite side. Note the magnetic azimuth. Move upstream or downstream until the azimuth to the point on the opposite bank is 45 degrees different than the original reading. The distance from the original to the final point of observation is equal to the stream width (see *Figure 7-8).*

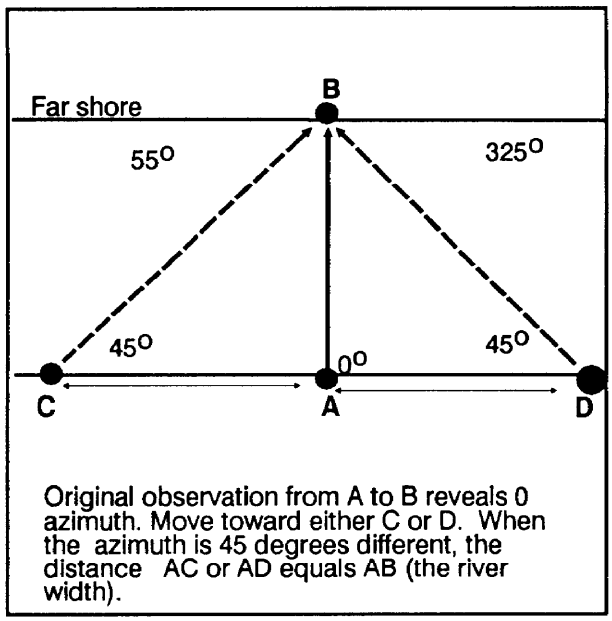


Figure 7-8. River width

Calculating Downstream Drift

The river current causes all surface craft to drift downstream. Each vehicle has a different formula for calculating downstream drift. Amphibious vehicles and assault boats drift more than powered boats and rafts; the latter have a greater capability to negate the effect of river velocity by applying more power.

Amphibious vehicles and nonpowered assault boats are generally limited to water speeds of 1.5 to 2 MPS and 1 MPS respectively (see *Figure 7-9).*

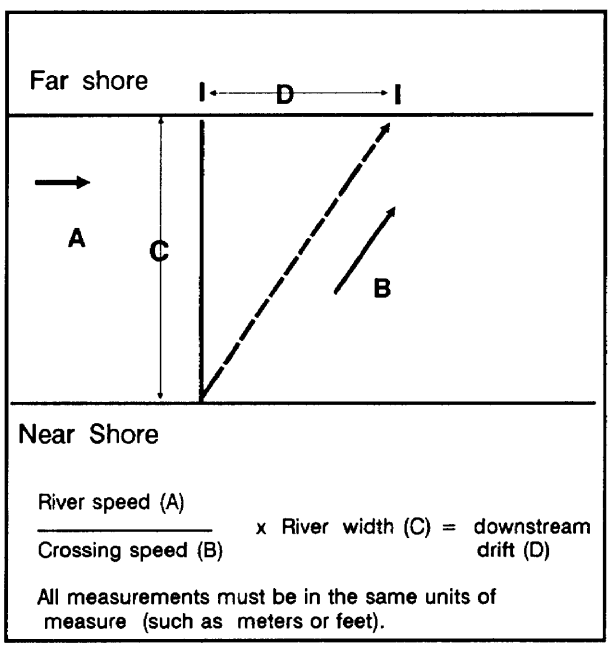


Figure 7-9. Amphibious drift

Crossings with amphibious vehicles and pneumatic boats must compensate for the effect of river current. The following examples show methods:

Example 1. Entry is usually made upstream of the desired exit point. The vehicle or boat is aligned, or aimed, straight across the river, creating a head-on orientation that is perpendicular to the exit bank. However, the current produces a sideslip, downstream forward movement (see *Figure 7-10).* This technique requires operator training in continual adjustment to reach the objective point on the exit bank. This technique results in a uniform crossing rate in the least amount of time and is usually the desired technique.

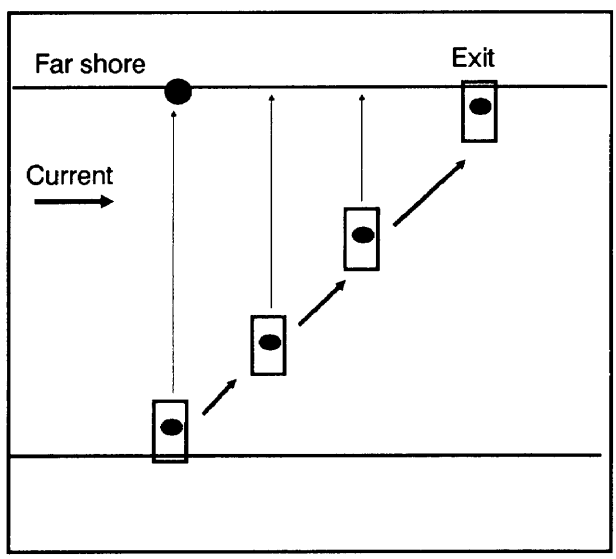


Figure 7-10. Downstream sideslip

Example 2. If the operator continues to aim the vehicle at the desired exit point, the orientation of the craft at the exit point will approximate an upstream heading. The craft path is an arc in proportion to the speed of the river (see *Figure 7-11).*

Example 3. To exit at a point directly across from the entry point requires an upstream heading to compensate for the river's speed (see *Figure 7-12).*

In all three examples, the craft speed relative to the river speed is constant, assuming the engine revolutions per minute (RPM) or paddling rate remains constant.

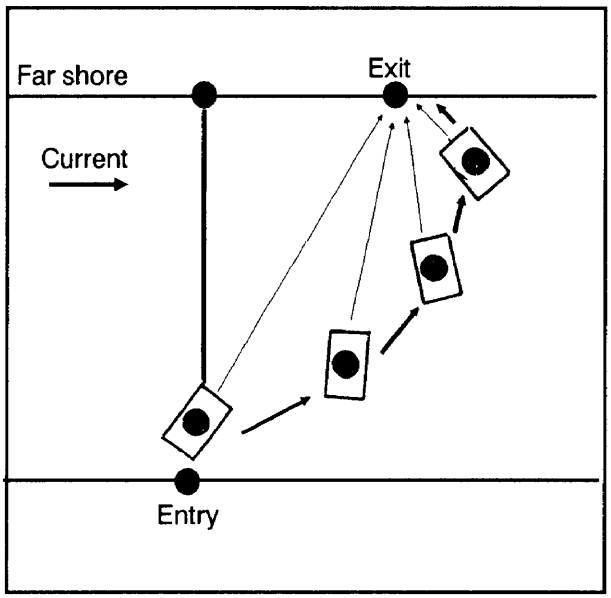


Figure 7-11. Constant aim point

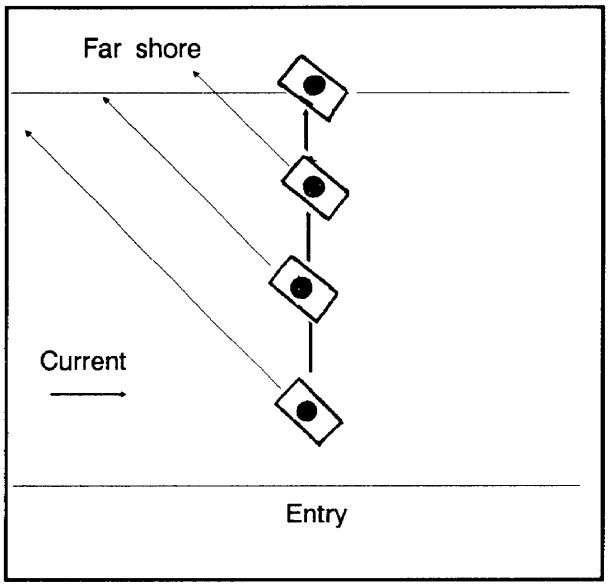


Figure 7-12. Constant heading

Terrain conditions may restrict the location of entry and/or exit locations. Threat situations may require alternate techniques. For example, when aiming at the downstream exit point, the craft moves at a greater speed relative to the banks after entry than it does as it nears the exit. The cause is the river current speed. Use of this technique may be favored when the threat has better observation of the entry bank than the exit bank. Watercraft moving fast and at a changing rate are more difficult to engage effectively.

Section II. Operations

RAFTS

Sites

Assault battalions seize a far-shore lodgement and then clear in zone to secure the crossing sites from direct fire. Quick reinforcement with armored fighting vehicles is critical when the initial assault is dismounted. They have the weapons needed to defeat determined threat counterattacks and can rapidly move units to subsequent objectives. Fighting vehicles cross by swimming or rafting.

Given the vital need to rapidly build combat power on the far shore, the lead brigades should swim fighting vehicles of follow-on battalions whenever practical to save rafts for tanks.

Rafts are usually the initial means for crossing non-swimming vehicles, particularly tanks, on wide, unfordable rivers. It maybe possible to bridge immediately after the assault across the river phase; however, rafting is normally first because —

- Rafts are less vulnerable to threat air and indirect fire due to their size and maneuverability.
- Rafts are quicker to assemble.
- Rafts offer more flexibility in operation, particularly in site selection and subsequent movement between sites.
- Rafts can use existing road nets and banks where access and exit routes are not aligned opposite each other.

Raft assembly begins on order, not according to a preplanned schedule, even though the crossing plan has

an estimated start time. Unless the division commander directs otherwise, the brigade commander, advised by his engineer, decides when to begin rafting. This is always after eliminating threat direct fire on the site and usually after neutralizing observed indirect fire. (Massed threat indirect fire can cover an entire raft site.) The force neutralizes observed indirect fire by suppressing it and obscuring the crossing sites.

The brigade commander also decides when bank preparation can begin, or he may delegate this decision to his engineer. This is a matter of judgement, based on the estimated time required to secure the area. Extra time and effort initially spent on bank preparation avoids interruptions for maintenance later while rafting is in progress.

The key to rapid and effective bank preparation is good engineer reconnaissance, which permits engineers to arrive at the site early, organized and equipped to perform specific tasks to improve the approach. The same is true on the exit bank. Poor bank conditions require early priority for raft movement of engineer equipment across the river. Time spent preparing the exit banks before passing heavy traffic greatly reduces maintenance of the crossing site and speeds force buildup later. Two entry and exit points per centerline make it possible to alternately use one while maintaining the other.

Each lead brigade should have at least two raft sites, each of which has one to three raft centerlines. Terrain, routes, and the tactical plan determine their location. However, they should not be closer together than 300 meters to avoid congestion and the risk that threat artillery concentrations will impact on more than one site during a barrage. Engineers prepare alternate sites as soon as possible to permit relocation in case of threat action or bank deterioration.

Additional control measures are necessary on the river and bank approaches at night. Chemical lights and other discreet markers help drivers find and load onto rafts. Rehearsals include divers, who practice driving on and off of rafts at night. Engineers may need additional communication and night-vision devices to control their operation.

Raft sites include centerlines crossing the river where the rafts operate, the approaches to the centerlines on each shore, and the control and operation structure necessary to conduct rafting operations. *Figure 7-13* illustrates a typical raft site with three centerlines.

An engineer company commander (normally from the bridge company) is the crossing-site commander. He is in command of crossing-site activities from the call-forward area to the far-shore attack position. He

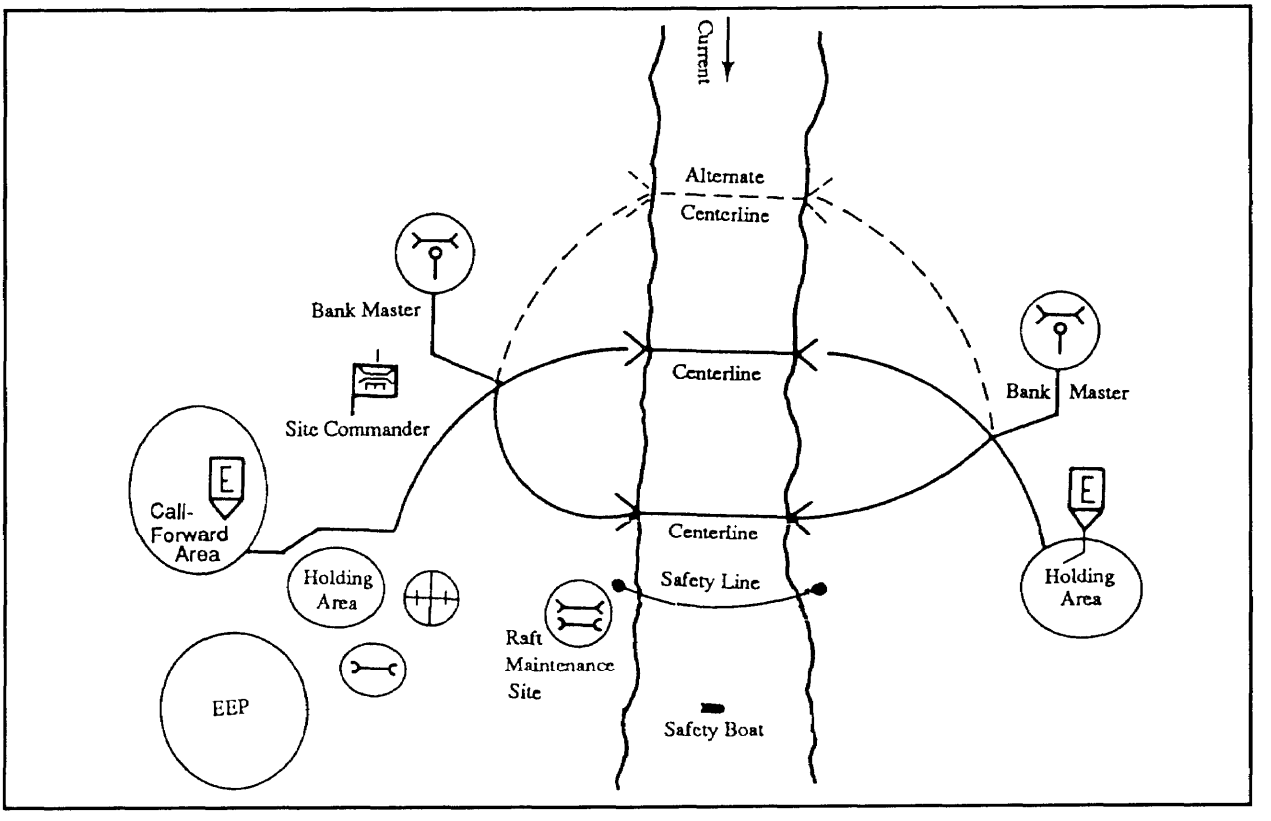


Figure 7-13. Raft site

reports to the CAE. His company headquarters coordinates the following site activities:

- Site layout.
- Raft assembly, operation, and maintenance.
- Opening and closing of raft centerlines.
- Layout of the call-forward area, operation of the ERP, and organization of crossing units into raft loads.
- Route marking from the call-forward area to raft centerlines.
- Movement of raft loads from the call-forward area to raft centerlines, across the river, and into the far-shore attack position.
- Bank and route maintenance.
- Vehicle movement within the site.
- Movement of return traffic from the far shore.
- Liaison from the crossing unit.

The CAE provides corps combat engineers, normally a platoon or more, to the crossing-site commander to use for ERPs, route and bank maintenance, and other tasks beyond the capability of the bridge company.

The CSC designates an engineer bank master, who maintains traffic flow as directed by the CSC or his headquarters. His functions are to –

- Tell the ERP at the call-forward area when to send raft loads to the river.
- Direct each raft load to a centerline.
- Divert vehicles off the road when necessary to a maintenance recovery point, casualty collection point, or small holding area.

Each raft site has one to three active centerlines spaced 100 to 300 meters apart. The 100-meter minimum distance avoids collisions between rafts on adjacent centerlines and reduces the effects of artillery, while spacing centerlines farther than 300 meters apart stretches the ability of one unit to control both land approaches and water operations. Each crossing site has at least one alternate centerline. The CSC switches to the alternate centerline when necessary due to threat fire or bank maintenance.

A platoon leader of the bridge company is in charge of each centerline. A centerline has an embarkation point on the near bank, a debarkation point on the far bank, and rafts operating between these two points. The number of rafts on a centerline depends on river width and unit control. Appendix B gives the number of rafts per centerline based on river width. Maintaining bridge unit integrity on centerlines and crossing sites is critical. It simplifies maintenance and operation of rafts and significantly improves control on the water, as all raft commanders and boat operators have trained together. As six rafts on one centerline are within one bridge company's capability, this is the normal maximum employed. On any centerline, rafts must be the same type and configuration.

Centerlines are marked to guide vehicles approaching and leaving the water and to guide rafts to the correct landing points. Marker stakes or panels are used during daylight, and dim lights (covered flashlights or chemical lights) are used at night (see *Figure 7-14).* Markers include the following:

- Raft guide markers, at a 45-degree angle upstream, guide the raft to the embarkation or debarkation point. The two markers are 3 feet apart, and the marker farthest from the river is 2 feet higher than the other. The raft has the correct approach to the bank when the markers appear to be in a straight line, with one above the other.
- Raft landing markers depict the left and right limits of the embarkation or debarkation point.
- Vehicle guide markers align raft loads with the raft and are visible to both the raft and the vehicles.

Each raft site contains at least one safety boat, normally a bridge-erection boat, for troop and equipment recovery. The bridge company provides the crew of the safety boat, including the boat operator, the boat commander, medic, and lifeguard (two, if possible), The lifeguard-qualified swimmer does not wear boots or load-bearing equipment (LBE). The safety boat also has a float with an attached line for rescuing troops in the water, a boat hook, rocket-propelled lifelines (if available), and night-vision goggles for at least the boat commander. It has a radio on the bridge company net. The safety boat maintains its station 50 meters downstream of the safety line.

When possible, a safety line should be run across the river 100 meters downstream from the last centerline, This line is fastened to the banks and kept afloat by life jackets attached to the line every 30 meters. This rope acts as a catch rope for troops who may fall overboard during rafting operations.

Each crossing site requires an EEP located where the equipment will have easy access to the crossing site. Traffic between the EEP and the riverbank should use a separate route to avoid congestion with the crossing.

Each raft site requires a place along the friendly shore, downstream of the centerlines, for immediate raft repairs, The maintenance area requires an access point to the river for removal and launching of bays and boats. Additional equipment desired at the maintenance area includes –

- A bridge boat to move damaged bays and serve as a spare boat.

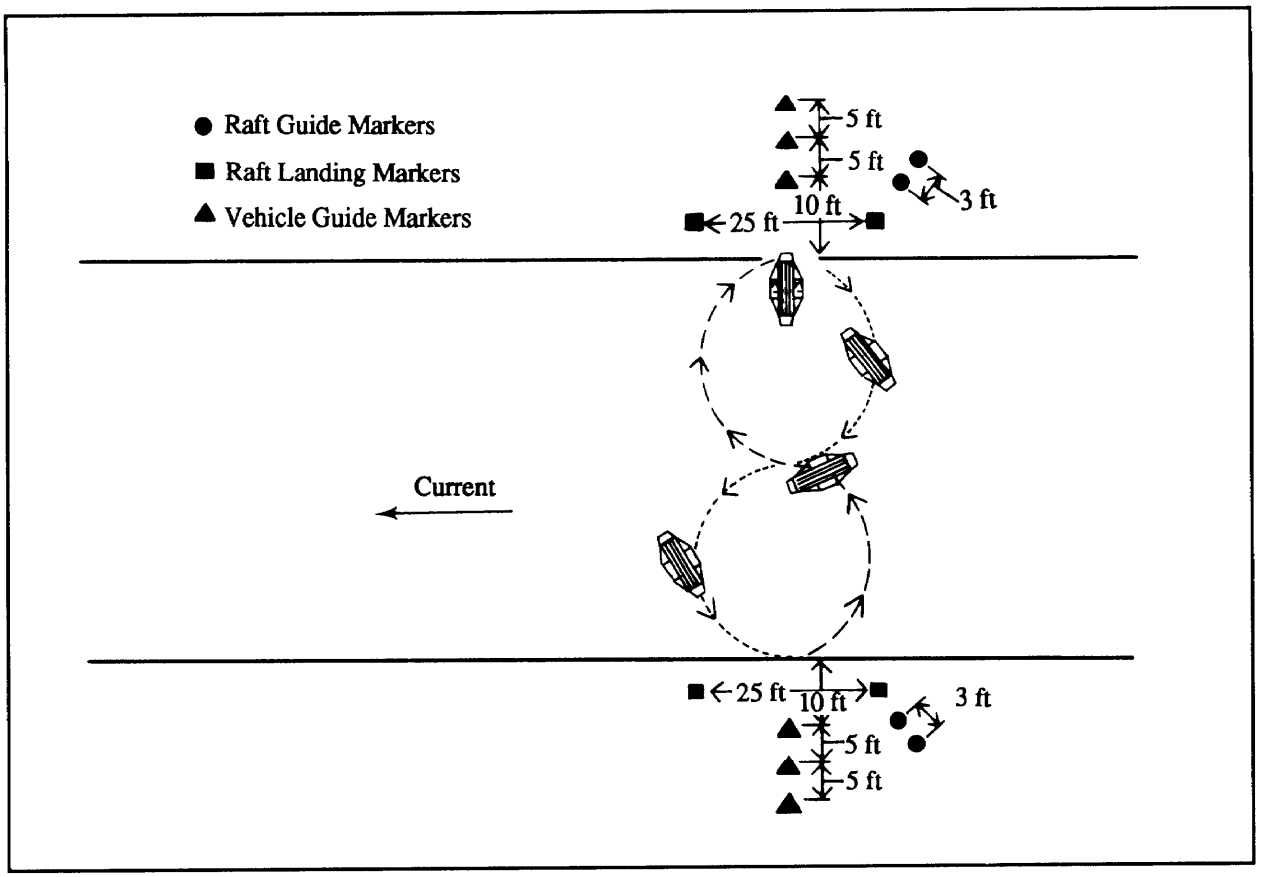


Figure 7-14. Centerline marking and operation

- A crane to remove nonrepairable equipment from the water.
- A bridge truck to transport damaged equipment to the EEP.
- A heavy-expanded mobility tactical truck (HEMMT).
- One interior and exterior bay to use as replacement parts.

The maintenance area is continuously manned with—

- Two mechanics with tool boxes.
- Two fuel handlers.
- Operators of the various pieces of equipment.
- A site supervisor.

Operation

When ordered to begin rafting, the CSC directs the ERP at the call-forward area to begin sending raft loads forward. Units proceed from a staging area to the call-forward area, where engineers at the ERP organize them into raft loads and send them down to the river. Any points along the route that may cause confusion, such as intersections, are either manned with a guide or are marked to ensure that the vehicles do not get lost. Once a raft load nears the river, the bank master directs it to the appropriate centerline. The bank master controls the flow of traffic to the centerlines to ensure that there is a smooth flow of traffic and that centerlines are neither congested nor underused. He establishes the timing required so that raft loads leave the call-forward area and match up with a returning empty raft,

When a raft load reaches the river bank, it is met by an engineer centerline guide. He stops the raft load 10 feet from the edge of the water and holds it there for the raft commander. The raft commander guides the vehicles of the raft load onto the raft. The raft crew chocks the vehicles and issues life jackets to passengers, who dismount from their vehicles (with the exception of the operator and vehicle commander), don life jackets, and move to the rear of the vehicles. Upon reaching the debarkation point, the raft crew guides the vehicles off the raft, collects the life jackets from the passengers, and directs them off the raft. After the raft load debarks, the raft commander checks with the centerline guide for any return vehicles and returns to the embarkation point.

Once on the far shore, the centerline guide directs the raft load to the far-shore attack position, where the unit re-forms.

Maintenance and Refueling

During raft operations, rafts require stops for refueling, preventive maintenance, and minor repairs. The efficiency of the crossing depends on all rafts having enough fuel and on minimal lost time for refueling and normal maintenance. This efficiency requires the bridge company to intensely manage raft maintenance and to operate the maintenance area like a pit crew in an automobile race. When directed, a raft pulls off the centerline and moves to the crossing-site maintenance area.

With the raft secured, the crew begins refueling and maintenance operations. Mechanics assess and repair any minor damages to the raft and the boats. Fuel handlers run fuel lines from the fuel HEMMT to both bridge boats and fuel them simultaneously. If no major deficiencies are identified, the entire process requires 20 minutes. If major deficiencies are identified, the damaged equipment is removed from the raft and replaced with a spare. The damaged equipment will then be removed from the water and sent back to the EEP for repair. When finished, the raft returns to its centerline and another raft is directed in for maintenance and refueling.

Since the maintenance and refueling operation is continuous and requires the removal of a raft from the operation for up to 30 minutes, it is important to account for this reduction in capabilities when planning the operation. As a general rule, it is unnecessary to refuel for the first two hours after rafting begins. Once raft maintenance and refueling begin, one of the six rafts in each bridge company is unavailable for carrying vehicles across the river.

In the event that a raft becomes damaged and needs immediate repair, the raft commander moves the raft to the maintenance area. If the raft loses a boat and cannot make it to the maintenance area without assistance, the raft commander contacts the maintenance supervisor, who sends the maintenance boat out to assist. If the raft is still carrying a load, the raft commander decides which bank he will disembark the load on. Once in the maintenance area, mechanics determine the extent of the damage. If the damage requires significant repair, the damaged equipment will be removed and replaced with a spare. Lengthy equipment repairs are done at the EEP.

BRIDGES

General

Bridges replace or supplement rafts once threat-observed indirect fire is eliminated. Each lead brigade should convert at least one raft site to a bridge site as soon as possible, while keeping other raft sites in operation until a second bridge is in place. Bridges have greater traffic flow rates than rafts. Ribbon is the preferred initial bridge, since it is faster to assemble and easier to move than other types. Once assembled, all float bridges have a crossing rate of 200 vehicles per hour, with vehicle speed at 15 miles per hour. As with rafts, bridge assembly begins on order, not according to a preplanned schedule. Since vehicles cross rivers much faster on bridges than on rafts, early bridge assembly is desirable but must be weighed against the risk that the threat can still bring indirect fires down on an immobile bridge. The bridgehead force brigade commander decides when to begin, with advice from his engineer. He may delegate this decision to his engineer.

Bridges need protection. Air defense, counterfires, and ground-security elements are necessary to defeat threat attacks. Booms on the river protect bridges from collision damage caused by floating and submerged objects.

Bridges are vulnerable to threat long-range artillery fire and air attack even after the assault clears threat forces from the exit bank. For this reason, ribbon bridges operate for a limited period of time, normally two hours, before the engineer bridge units break them apart and move them to other sites. When the division uses this pulse-bridging tactic, its units wait to cross in staging areas and surge across when bridges are in place.

Threat air superiority over the river may prohibit bridge assembly. Sustained threat air attack forces engineers to break established float bridges into rafts. This minimizes destruction of scarce bridge assets yet enables the crossing to continue, though at a slower pace. Engineers prepare alternate sites and position spare equipment nearby in case of threat action.

As the danger from threat action lessens, engineers use the more slowly assembled LOC, M4T6, and Class 60 bridges to augment and then replace the tactical bridges (ribbon or armored vehicle launched bridge (AVLB)). They do this as soon as possible to move ribbon bridges forward on other crossing operations.

Threat bridges captured by the lead brigades are a bonus and speed the crossing. Engineers with the lead brigades neutralize explosive devices and reinforce weak or damaged bridge structures. Commanders rarely base the success of an operation solely on the seizure of intact bridges.

Site Organization

A bridging operation requires a continuous traffic flow to the river. Units must be quickly briefed and moved to the crossing site. To accomplish this, units

receive briefings in the staging areas from the traffic-control personnel. There is no intermediate call-forward area. In order to control crossing vehicles, the engineers from the bridge unit set up an ERP at the bridge access points on each side of the river. These engineers guide vehicles onto and across the bridge, ensure proper speed and spacing of vehicles on the bridge, and prevent vehicles too heavy for the bridge from trying to cross. A recovery team is stationed on the far shore to remove any damaged vehicles from the bridge. The recovery team consists of a medium or heavy recovery vehicle and crew, with sufficient winch cable to reach across the bridge. A typical site setup is shown in *Figure 7-15.*

Any method can be used to mark the route to the bridge, as long as markers are visible to the operators of the vehicles and are masked to observation from above. As the vehicle approaches the bridge edge, markers are spaced 100 feet apart to assist operators in visualizing the required vehicle interval on the bridge.

Operations

At night and during limited visibility, the left and right limits of the bridge treadway are marked with chemical lights to prevent them from driving over the side of the bridge and to cause them to maintain crossing speed.

Actions Under Fire

If the unit comes under fire while on the bridge, those vehicles on the bridge continue moving to the other side and leave the area. Vehicles that are not yet on the bridge stop and go into a herringbone formation or take up concealed positions. Once all vehicles have cleared the bridge, the bridge crew will break the bridge into rafts and disperse them to reduce vulnerability to incoming fire.

Vehicle Recovery

If a vehicle breaks down on the bridge, the bridge crew will immediately attach a winch cable from the far side and drag the vehicle off the bridge. The recovery vehicle will not move onto the bridge and tow the disabled vehicle off, since the critical requirement is to clear the bridge and maintain traffic flow, loss of the vehicle is far less important.

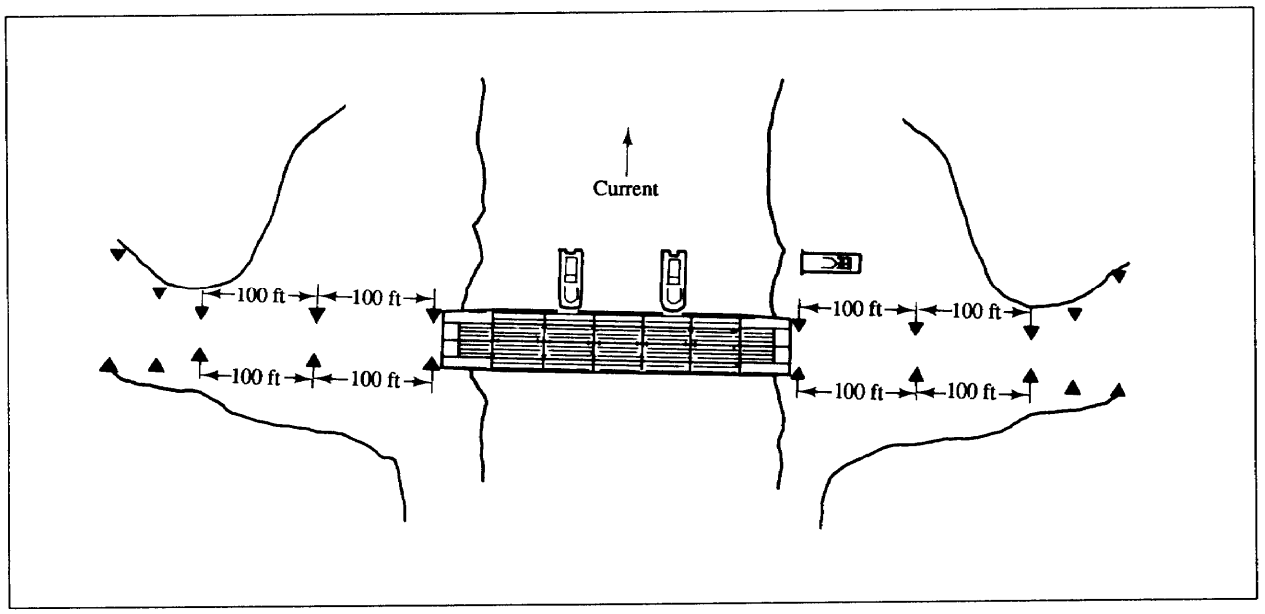


Figure 7-15. Bridge crossing site

Chapter 8
Assault Crossing

GENERAL

The assault across the river phase normally begins with an attack to secure a dismounted infantry lodgement on the exit bank. This may involve an air assault, but the bridgehead force normally assaults using pneumatic boats or swims amphibous vehicles.

The dismounted infantry assault is normally a battalion task force from the bridgehead force. The assault battalion normally crosses in waves, as sufficient boats are seldom available to carry the entire battalion task force across at once. It is a very complex operation, requiring synchronization between multiple-force elements and skilled application of technical procedures. Success requires training and extensive rehearsal

Due to the extreme vulnerability of forces in small boats on open water, the force normally assaults at night or during limited visibility. If it must be conducted during daylight, the assault site must be isolated by fires and smoke to reduce its vulnerability.

This chapter describes the assault boat crossing. It focuses on conducting the crossing at night. It defines the organizational elements required to conduct an assault across a river and the necessary supporting techniques and procedures.

ORGANIZATION

The specific organization used is dependent on METT-T factors, particularly the size of the bridgehead, the distance to exit-bank objectives, and the nature of the threat defense. Regardless of these factors, the assaulting battalion task force will organize into overwatch and assault elements and will be assisted in the assault by other brigade units in attack-by-fire positions.

Assault Overwatch Elements

Each assaulting company has a direct-fire overwatch element under its control. This element covertly establishes an attack-by-fire position along the friendly bank before the assault. They use night vision and thermal sights to locate threat positions. They also develop a fire plan to engage these positions and to provide suppressive fires on all suspected positions. When directed to engage, the overwatch element destroys all known and suspected positions. The direct-fire overwatch elements must be positioned early enough to develop a detailed fire plan. Area suppression is lifted or shifted when assault elements reach the exit bank or mask fires.

Overwatch elements are normally the tanks and infantry fighting vehicles of the assaulting, dismounted battalion task force. If an attached light infantry battalion is conducting the assault, tripod-mounted heavy machine guns and antitank missile systems (augmented by infantry fight vehicles and tanks) provide the overwatch support. They are positioned under the control of the company XO and receive fire commands from the company commander with the assault element.

Supporting artillery battalions and mortars provide indirect-fire support. The assaulting task force has priority of fires from at least one artillery battalion during the assault. Artillery does not normally fire a preparation fire for covert assaults. It lays batteries on priority targets and fires on request. This normally occurs after the initial wave is ashore or upon discovery. If the assault is not covert, the battalion fires a preparation that continues during the crossing of the first wave, lifting on command when the boats approach the exit bank.

Mortars deploy near the river to cover the crossing. Their location should keep them within range of the task force objectives without displacement. Units should stockpile rounds so that mortars can support the operation without replenishment during the assault. Also, they can carry their untouched basic load with them when ordered to cross the river. The mortars primarily support with smoke,

Graphic fire-control measures are essential because of the danger of firing on friendly forces. Boundaries between companies should run along terrain features easily visible in the dark to help control the indirect fires during the dismounted assault.

Counterbattery fire is imperative to the success of the river crossing. The target acquisition battery radars deploy to cover the area before the assault crossing begins.

Smoke is not normally used to support the first wave of a covert crossing because of the risk of losing surprise, but it hides later waves as they cross. If the crossing is opposed, a smoke haze should cover the first wave before it enters the water to reduce direct-fire effectiveness. The assaulting task force commander

initiates smoke obscuration. If smoke generators are available, they deploy to obscure a large length of the river. Additional smoke along multiple sites on the river conceals the true crossing area. This additional smoke may be from smoke pots if nothing else is available.

If units must fire smoke onto the far shore in order to cover the crossing area, they fire it on the command of the assaulting task force commander after surprise is lost. Mortars are the primary means of indirect-fire smoke. Direct-support artillery is generally reserved for supporting fires.

Air-defense teams deploy along the near shore of the river to cover the crossing. Once in place, they remain until the brigade releases them. They can move across the river and link up with the assaulting task force only after other SHORAD air-defense systems have taken position to cover the river. The crossing sites remain the priority air-defense area throughout the crossing.

Assault Across the River Phase

Each lead battalion in a ground assault should have at least one ford or assault boat site big enough to accommodate two companies abreast.

A hasty crossing is more likely to use fording vehicles than a deliberate crossing, since it allows the force to continue across the river without pausing to acquire other crossing means. A ford site should have 300 meters along the near bank at the entry point for deployment of overmatching elements.

Considerations for the use of assault boats (RB15s) include —

- Opportunity for surprise in a silent paddle crossing.
- Speed (MPS using outboard motors).
- Good maneuverability in the water.
- Limited, if any, entry-bank preparation — none on the exit bank.
- Mechanized troops separated from their vehicles and equipment.
- Limited carrying capacity, particularly antitank weapons.
- Limited protection, mobility, firepower, and communications on the exit bank.

The unit protects itself during an assault boat crossing by crossing silently, during periods of limited visibility, and at a location where the threat does not expect a crossing attempt.

Generally, an infantry platoon uses three boats for its personnel and attached elements. If short of boats, the dismounted elements of an infantry platoon equipped with the M2 Bradley can fit in two boats. Allocation of one squad per boat, when possible, preserves unit integrity.

For an assault using RB15s, each company requires at least 200 meters along the river to disperse the boats and ideally 300 meters between companies, This is a total of 700 meters for a battalion assaulting with two companies abreast.

Control is very important, particularly by night when boats can easily become separated or lose direction. Combat experience has demonstrated that engineer and infantry boat rehearsals before the crossing attempt are mandatory for success. These rehearsals should begin as soon as the unit receives the warning order without waiting for the detailed crossing plan.

Consideration for use of air assault are –

- Indirect approach.
- Surprise.
- Flexibility.
- Rapid closing with the threat, if a landing zone is available.
- Weather.
- High threat air-defense priority at the river, requiring a suppression of enemy air-defense effort.
- Separation of mechanized troops from their vehicles and equipment.
- Vulnerability to armored counterattack, requiring a quick ground linkup.

Planning and execution are the same as for other air-assault operations, covered in *FM 90-4.* As with assault boats, rehearsals are necessary, particularly for troops not familiar with air-assault operations.

Against little or no resistance, swimming vehicles may be practical in the assault stage. Considerations for swimming fighting vehicles are —

- Minimum effect on troop organization and control.
- Troop protection, mobility, and firepower on the far bank.
- Early antitank capability on the far bank by vehicle-mounted tube-launched, optically tracked, wire-guided (TOW) missiles.
- Reduced number of vehicles to be rafted.
- Slow swimming speed.
- Poor maneuverability in water.
- Extreme vulnerability to antiarmor weapons while in water.
- Suitable entry and exit points.
- Vehicle preparation.
- Lack of troop training in vehicle swimming operations.

Rapid reinforcement of dismounted assault troops with armored vehicles is so critical that it justifies the use of any expeditious method to get the first few swimming vehicles across. This includes winching, towing, or pushing the first ones across normally

unsuitable places while engineers prepare better entry and exit points for the rest.

The space required to swim vehicles on line is 200 meters of front per company with 300 meters between companies. Less is required if they cross in column. Commanders plan entry and exit sites to account for downstream drift of swimming vehicles.

Assaulting Units

The assaulting task force normally has three dismounted infantry companies of three infantry platoons each to conduct the assault. The task force may have formed company teams, but all assault companies must retain adequate dismounted infantry strength for the assault. Besides its organic infantry and armor, the assault task force has its fire-support team, its air-defense teams, and an attached combat engineer company (with the engineer platoons attached to the assault companies).

The first assault wave moves the bulk of the dismounted force across covertly. This force attempts to provide sufficient security on the far shore, so that the second and later assault waves can cross after surprise is lost. It carries the rifle platoons, attached assault engineers, forward observers, and rifle company command group.

The organization of the first wave permits rapid deployment of the company into a tactical formation on the far shore. Individual boat loads retain unit integrity at the lowest level. The two basic boatload configurations are the rifle squad boat and the rifle platoon headquarters boat (see *Figure 8-1).*

Each boat contains its engineer boat crew and a rifle squad. The squad boat also carries an engineer assault team, while the platoon boat carries the platoon headquarters. The boat force commander is the senior occupant. He commands the force up to the attack position and after they debark on the far shore. The coxswain is the "pilot in command" and commands all boat occupants from the point that they man the boat in the attack position until they debark on the far shore.

Note: Rifle squads illustrated are Bradley squads. The same boat configuration is used for other squads, though they may man more of the boat positions.

First-wave boats carry only critical cargo, such as critical antitank and machine-gun ammunition demolitions and engineer tools required for breaching obstacles.

Platoon boats form a boat group of three boats, spaced 20 meters apart on the water. The boat group forms into a "V," with the platoon leader's boat acting as the guide boat in the center. The two engineer assault teams are from an engineer squad, with the squad leader commanding the team in the right boat and the assistant squad leader commanding the team in the left boat. The assault teams re-form into a squad upon debarking.

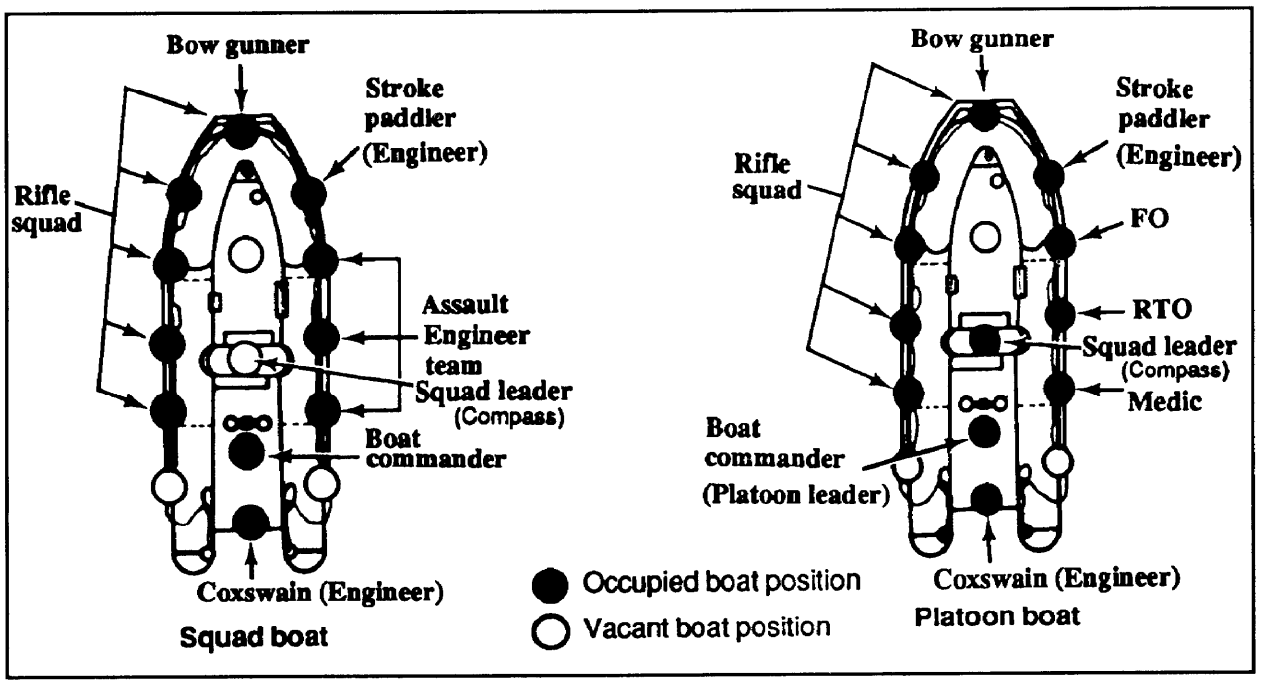


Figure 8-1. Boat load configurations

Platoon boat groups form into company flotillas (see *Figure 8-2).* The company commander commands the guide boat in the center platoon. The company command group disperses between boats, filling in vacant boat positions. Platoon guide boats maintain a 40-meter interval (two-boat interval) between boat groups.

The first wave of the assault consists of all three company flotillas crossing on line. Battalions do not have a prescribed crossing formation. Each company crosses in its own zone and attacks its own objectives.

All undamaged boats return to the near shore after carrying the first wave. The second and later waves carry across the remaining troops and materials that are necessary to seize the far-shore lodgment. They also carry the materials necessary to establish blocking positions and a hasty defense of the crossing area.

If sufficient boats are available, all rifle companies cross in the first wave. If not, the remaining company crosses in the second wave (it may have its own far-shore zone or be the task-force reserve). The second wave carries the company aid station and may include the battalion command group. Since sufficient air-defense systems are in place to cover the crossing area, the brigade may release some or all of the battalion's air-defense teams to cross in the second wave.

The second wave also transports additional material and ammunition not required for the initial assault but necessary to establish a defense. This may include antiarmor weapons and ammunition, laser designators, mines, or pioneer tools. It normally includes tripod-mounted weapons systems such as M2HB .50-caliber machine guns, TOW antitank systems, ground laser location designator (GLLD), and Mark 19 40-millimeter grenade launchers.

If secrecy is not required for the second wave because the first wave is in combat, or if the threat has begun to fire on the crossing area, outboard engines propel the boats so that paddlers are not necessary.

Immediate movement of some heavy antitank weapons across to support the dismounted assault battalion is essential. This is critical enough to justify extraordinary actions. As vehicles carry all heavy antitank weapons, engineers concentrate on forcing a few critical vehicles carrying heavy weapons across immediately after the second wave. They hand carry them, if necessary, even before direct fire and observed indirect fire has been removed from the crossing area. Vehicles cross by swimming or fording or are dragged or rafted across.

Crossing-area engineers begin bank preparation on both the near and far shore, using hand tools and equipment where possible. They swim an ACE or deep ford a bulldozer to get a winch capability to the far shore. Bradleys either swim or ford, with towing assistance if necessary. A bridge-erection boat can tow Bradleys if the current velocity is too high. Using a block and tackle fastened to a tree or picket holdfast, a bridge erection boat can help Bradleys leave the water over unprepared banks. If high-mobility multiwheeled vehicle (HMMWV) weapons carriers are available, they can be waterproofed and pulled across on the bottom with a winch cable. If absolutely necessary,

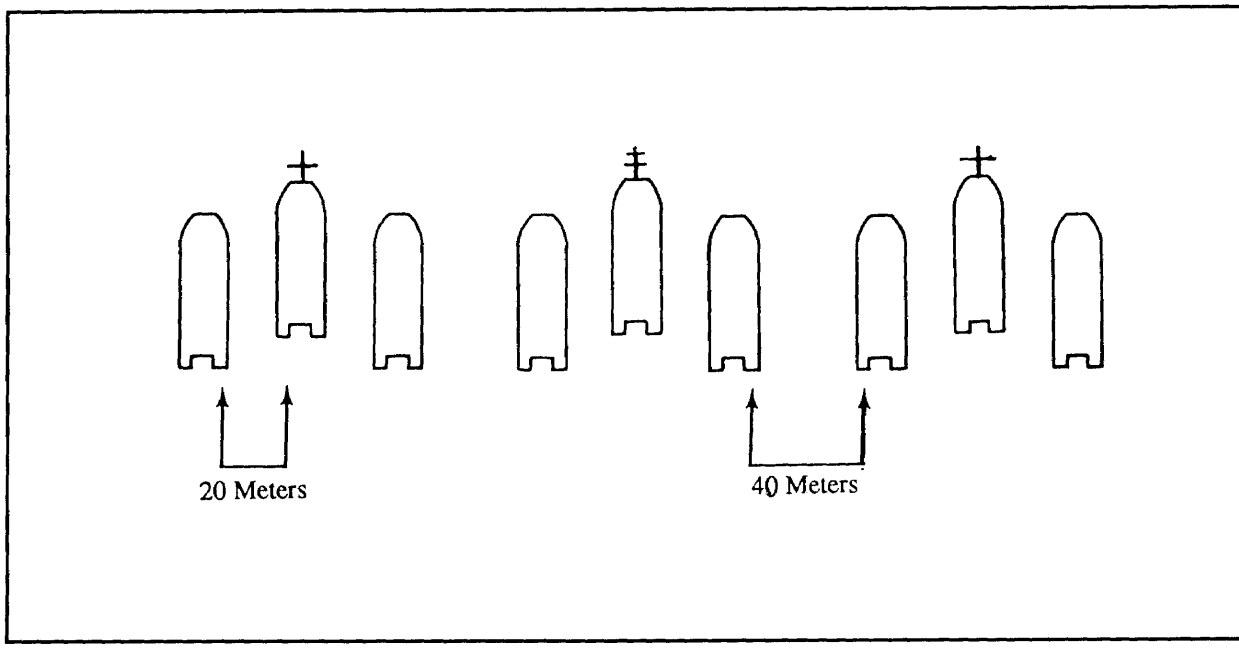


Figure 8-2. Company flotilla

rafting can be used, but this risks destruction of equipment that will be critical later in the crossing.

Note: TOW electronics should be carried across in a boat.

Engineers

Engineers supporting the assault are attached to the assaulting companies as described above. Each company receives an engineer platoon that accompanies the assaulting force on to its objective, helping it fight through obstacles and prepared defenses. The engineers help the assaulting force establish hasty defenses after it has seized its objectives. Engineers normally come from the division engineer battalion that supports the brigade.

Boat engineers operate the boats and cross the assault force. They are in direct support of the assaulting battalion until it has secured its objectives. They remain on the water after the assault force has crossed and continue to carry men and materials across in assault boats until heavy rafts can take over the mission. Boat engineers also improve exit and entrance banks for rafts and boats and assist with crossing the initial heavy weapons. The boat engineers come from the engineer battalion that will remain on the river operating the crossing area.

Two boat engineers are assigned to each assault boat. They are the coxswain and the lead paddler on the right side of the boat (stroke paddler). The stroke paddler controls the stroke during the assault crossing. The boat engineers paddle the boats back for the next wave. Outboard motors normally are used during the second wave.

Normally, an engineer platoon must operate the boats for a first-wave assaulting company. An engineer company can cross the assault battalion of a brigade.

Each assaulting company requires 9 boats plus a safety boat. The assaulting battalion requires 30 boats to carry the assault companies, plus 1 for the battalion commander. If less are available, some companies may not cross in the first wave.

OPERATIONS

Far-Shore Reconnaissance

Tactical reconnaissance of the far shore must cover abroad front to a significant depth to determine details of terrain and threat defenses. This should occur early and cover sufficient terrain to disguise the actual crossing area.

Engineers conduct a technical reconnaissance of the far shore focusing on the immediate crossing area. A swimming reconnaissance team conducts it at night. Divers using snorkels conduct the reconnaissance, if possible. Strong swimmers (Red Cross-certified lifeguards or water-safety instructors) from the engineers supporting the crossing make up the reconnaissance party if divers are not available. Two swimmers make up a reconnaissance team to scout a company crossing area.

The reconnaissance party carries heavily lubricated weapons and wears LBE. They wear running shoes and use swim fins. Swimmers must wear Class 5 life jackets as flotation devices. (US Army flat foam-filled life jackets will not serve.) The swimmers may wear racing goggles but not face masks, which reflect too much light. The swimmers camouflage their faces and hands and tow any necessary equipment in bundles.

Swimmers must carefully avoid splashing. If necessary, they wear weights to ensure that kick strokes are underwater. The party enters the water far upstream from the actual crossing site and floats with the current while crossing. Swimmers use the sidestroke, facing each other and observing behind the other swimmer. This allows 360-degree observation and communication by hand and arm signals. When the swimmers approach the shore, they switch to the breaststroke so that they can observe the landing area. Swimmers must use stealth and caution when approaching the beach. They must keep a low profile in the water and also on the beach. If they are experienced enough and have sufficient confidence in their abilities, they can use camouflage head nets made from small pieces of camouflage net to help conceal them as they approach the beach.

When the swimmers reach shallow enough water and determine that the situation is safe for landing, they remove their fins. If they can immediately enter the woods upon leaving the water, they do so in a rush. If the woods are a distance from the water, one swimmer remains in the water just at the waterline and covers the other as he moves quickly across the beach. Once the inland swimmer has moved to the edge of the woods, he covers his partner, who is moving across the beach to the same position.

Critical information requirements include –

- Bank characteristics at the assault-boat landing areas.
- Water depth to a distance of 15 feet offshore.
- Any obstacles along the shore.
- Locations of threat observation posts.

The reconnaissance team checks potential areas identified from the near shore and evaluates each based on its ability to support assault boats, disembark troops, and moveoff the beach. The reconnaissance party also checks areas where raft and bridge centerlines can be installed.

Far-shore reconnaissance is conducted early and at multiple sites along the shore to generate information necessary for planning and selecting the most suitable areas. Normally, far-shore reconnaissance is conducted by maneuver units supported by engineers.

Far-Shore Preparation

The far shore is prepared immediately before the assault crossing. The preparation team consists of a two-man scout-swimmer team and a two-man cargo team with an inflatable reconnaissance boat – both also from the supporting engineers. The swimmers that have conducted the far-shore reconnaissance are normally best suited to do the far-shore preparation. The preparation team installs landing markers for the flotillas. A separate team normally marks each company zone to speed preparation.

The scout-swimmer team and the cargo team are equipped the same as the reconnaissance party, and they use the same techniques. The scout-swimmer team crosses first, floating downstream to the landing site with the current. Upon landing, they move to the correct landing site for the assault landing and signal for the cargo team to cross. They install transit lights to guide the cargo team as it crosses.

Signaling is accomplished with a flashlight equipped with an opaque filter, sending a prearranged Morse Code letter. The transit lights consist of either two flashlights with opaque filters and directional cones or two chemical lights in their foil wrappers with small areas torn open to release light. The team installs the lights so that one is roughly 1 meter above the water and the other is roughly 2 meters above the water and 2 meters behind it, aligned facing 45 degrees upstream.

The cargo team waits until signaled to cross. It uses a three-man reconnaissance boat as a flotation device to carry marking materials, mine detectors, night-vision goggles, and a radio. The reconnaissance boat is covered with a camouflage net section and is partially deflated after loading so that it floats low in the water to reduce its signature. The camouflage net is secured to the lifelines to aid in holding the cargo in the partially submerged boat. The cargo team crosses oriented on and swimming slightly upstream of the transit lights so that it can drift into shore with the current, limiting noise and splash.

The preparation team installs landing markers as its first priority. These are the same types of markers used to guide the cargo team. They must be adequately visible to the assault force but dim enough not to harm night vision. If flashlights are available, they have opaque and/or colored filters installed to limit the light output. Chemical lights remain in the foil wrappers with only enough foil removed to provide necessary light. All landing markers are transit lights to mark the position and to help the boats set the proper course relative to the current. Normally, if the current is less than 0.5 MPS, the lights are set perpendicular to the river. If the current exceeds 0.5 meters per second, the lights are set at a 45-degree angle to the river, facing upstream. Double transit lights mark the center boat group of the flotilla, and single transit lights mark the flank groups. If colored lights are available, green lights mark the right boat group landing area, white the center, and red the left (see *Figure 8-3).*

The preparation team also makes a final examination of the landing areas for mines or obstacles. If they discover isolated mines, they mark them and the routes around them. If the team finds a major minefield that will significantly hinder the landing at a site, they either notify the assault force and move the site upstream or downstream to avoid the mines or they attempt to breach the minefield. Once the preparation is complete, the team signals the assault force to begin crossing, initiating the movement of the first wave carrying the boats from the attack position. The preparation team then finds cover near the landing area for the center boat of a predesignated boat group (generally the center boat group) and awaits its arrival. This boat

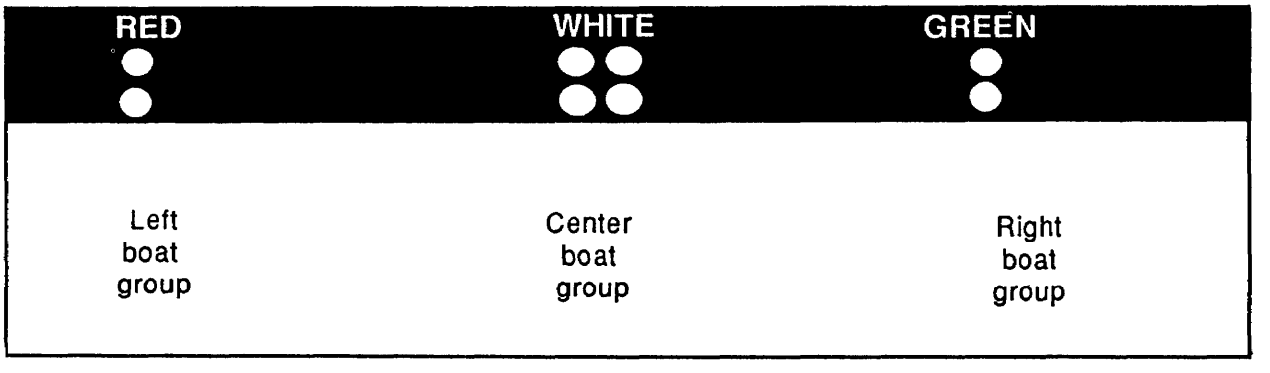


Figure 8-3. Landing marker lights

group is especially alert for linkup with the preparation team. While waiting, the team continues to watch for threat activity and alerts the assault force of any significant changes.

Near-Shore Reconnaissance

Units must be extremely careful to hide reconnaissance elements conducting near-shore reconnaissance in the crossing area or to deceive the threat about what they are doing.

Battalion and company command groups must conduct a daylight reconnaissance of the crossing area. They must see the embarkation and debarkation points and key landmarks to help guide the force when crossing. They must also see the attack position and the routes from it to the river. Company guides must walk the routes from the dismount points to the boat-group positions within the company attack position. Engineer boat coxswains must see the routes they will traverse from the attack position to the water.

Support-force leaders and vehicle commanders must covertly select firing positions and locate concealed routes into the positions for their vehicles during daylight. They should identify sectors of fire and conduct extensive observation within the sectors to acquire specific targets.

Assault Force Rehearsal

An assault boat crossing cannot be conducted effectively in the face of opposition without thorough rehearsal. If possible, the force should conduct two rehearsals. One should be during daylight, to learn the procedures, and one should be at night, under actual assault conditions.

The rehearsal area should be similar to the actual crossing area but away from the river to preserve secrecy. Generally, a rear-area river is the rehearsal area.

Before rehearsal, the boat crews and infantry train together in the actual boat teams assigned for the crossing. Soldiers receive their boat assignments and practice in their assigned positions until the boats can move effectively on the water. The training must include boat carry, launch, embarkation, watermanship, emergency actions, debarkation, and hasty defense.

Note: After rehearsal, boat assignments are not changed!

During training, the coxswain forms the boat team. He forms the crew members in a column of twos in the relative positions they will occupy in the boat, with passengers at the rear of the two columns. He then numbers the crew. The right side paddlers are 1, 3, 5, and 7; the left side paddlers are 2,4,6, and 8, both sides from bow to stern. The stroke paddler is always number 1 and the coxswain is always number 15, regardless of the number of paddlers used. Passengers are numbered consecutively from bow to stern starting with number 11, who is always the bow gunner. The coxswain addresses all crew members by number. When the coxswain wishes to address a command to a pair of paddlers, he uses their numbers together, as in *"1 and 2," "3 and 4."*

Figure 8-4 shows only 8 paddlers. The boat can carry 15 soldiers. If fully loaded, it uses 10 paddlers. Boat position numbers do not change.

All forces participating in the assault crossing rehearse together. The support force moves into position, and the assault force crosses in the same waves it will use for the actual crossing. Rehearsal should cover the assembly area through to seizure of the assault-force objectives.

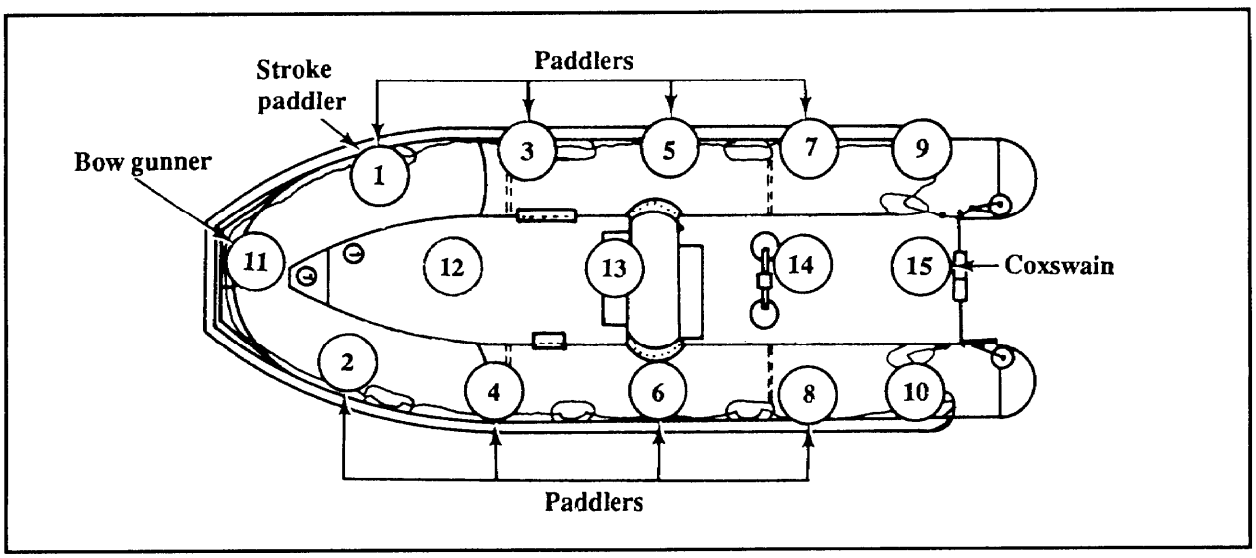


Figure 8-4. Boat numbering

Attack Position Procedures

The attack positions must be large enough to accept a dismounted infantry rifle company. They should be –

- Accessible to trucks or carrying parties bringing the assault boats.
- Concealed from hostile ground and aerial observation.
- Connected with clearly defined foot routes to the river.
- Within 100 to 200 meters of the river.
- In defilade from hostile flat-trajectory fire.

Trucks carry assault boats and life jackets as far forward as possible without compromising secrecy. They are met at the designated unload position by the engineer platoon and company guides from each attack position, who will unload the truck and carry their boats into place. The platoon can carry two at a time, so this will require five trips. If possible, HMMWVs moving at low speed to minimize noise can carry several boats at a time into the attack position.

Within the attack position, boat crews disperse assault boats and life jackets along the boat group routes to the river. The safety boat is positioned as the last boat in the downstream boat group. After the boats are placed in position and inflated, paddles are stowed in the boat at each paddler's location and life jackets are placed on top of them. The remaining life jackets for passengers and coxswain are arrayed behind the boat.

After the boats are prepared, each engineer squad provides a guide to bring the platoon crossing on their boats from the assembly area. The platoon leader sends the guide party to the assembly area, where they link up with their boat groups. The remaining engineers establish local security around the attack position and await the boat groups.

Soldiers arrive in the attack position with their weapons cocked on an empty chamber, selector switches on *SAFE,* and magazines removed. Squad leaders must verify this in the assembly area before moving to the attack position. The soldiers are organized, without the boat engineers, into boat teams and boat groups in the assembly area. They travel as boat groups. When they arrive at the attack position, their guide leads them directly to their boats.

When the boat team arrives at their boat, the coxswain commands, *"Crew, boat stations. "* The team forms on the boat in proper boat positions, with passengers lining up to its rear. The coxswain then directs the team to load and check weapons. The team insert magazines and verify magazine seating but do not chamber rounds. All weapons remain on *SAFE.* Squad leaders verify that all weapons are on *SAFE.* The coxswain then directs the soldiers to sling weapons and don life jackets. Paddlers sling rifles diagonally, so the rifle barrels extend up over the shoulders that will be away from the boat when standing alongside and facing forward. Odd-numbered paddlers sling over their right shoulder, even numbered over their left. This allows carrying the boat at high carry and reduces interference with paddling. Muzzles must be up during all boat operations to prevent punctures. The teams then await the command to proceed to the water.

Embarkation Operations

On order of the company commander, the boat crew paddlers carry the boats to the river. They make no unnecessary stops from the time of departure from the attack position until the boat reaches the bank. The coxswain directs either *"Low carry"* or *"High carry."* In low carry, crew members lift the boat to about knee height by the carrying handles while facing forward and carry the boat at arms length. In high carry, crew members lift the boat to about head height, place it on inboard shoulders, and carry it while gripping the carry handle with outboard hands. Normally, high carry is used for long distances, and the boat is shifted to low carry when approaching the bank. Paddles remain in the boat during carry procedures. Remaining crew members follow the boat to the water.

The boat crew may launch the boat either bow first or stern first. They launch it bow first whenever the water is shallow enough for the team to wade in carrying the boat at low carry. They launch it stern first when the water is too deep for wading or when the launch point has steeply sloped banks. Bow first is the preferred method.

Bow first. On the coxswain's command, *"Launch boat,"* team members perform a low carry and move into the water at a fast walk. When the depth of the water is such that the boat floats free of the bottom, all hands continue pushing it into the river remaining at their relative positions alongside the boat.

As the water reaches the knees of the first pair of paddlers, the coxswain commands, *"One and two in."* The first pair of paddlers climb into the boat, unstow their paddles, and give way together. The coxswain orders each pair of paddlers into the boat in succession by commanding, *"Three and four in," "Five and six in,"* and *"Seven and eight in."* The pairs climb into the boat on command, break out their paddles, and pick up the stroke of the stroke paddler.

The coxswain orders the passengers into the boat after the paddlers by commanding, *"Eleven in," "Twelve in,"* and so forth. Passengers board over the stern and move forward in the boat to their positions. The coxswain enters the boat last and sounds off, *"Coxswain*

in, hold water." He then holds the boat in place until the boat he is guiding on begins to cross.

Stern first. On the coxswain's command, *"Launch boat,"* team members perform a low carry and carry the boat stern first to the water's edge. They launch the boat by passing it back along the line of team members. When the stroke paddler can no longer help pass the boat back, he moves to the bow of the boat and handles the towing bridle. Other team members follow suit, taking their places along the towing bridle between the stroke paddler and the boat.

When the boat is in the water, the coxswain enters the boat and takes his station. He then commands the boat team to load, starting with the rearmost left-hand paddler, that is, *"Eight in," "Seven in," "Six in," "Five in," "Four in," "Three in," "Two in."* Passengers embark next as he commands, *"Fourteen in, " "E/even in."* When the coxswain is ready to cast off, he commands, *"Stroke in."* The stroke paddler casts off, climbs into the boat, and takes his station. The coxswain allows the boat to drift back and turns it to face across the river. He then holds the boat in place until the boat he is guiding on begins to cross.

If motors are to be mounted before the first wave crossing, the coxswain brings the boat in to shore stern first after the boat is manned and holds it in place either by a line to shore or by holding bottom. Two engineers wade to the boat carrying its motor and mount it on the transom.

Tactical Control Afloat

The coxswain navigates the boat, steers it, and directs the paddlers. He controls the movement of the boat in the water as well as embarkation and debarkation from it. He ensures that the boat maintains proper station on the guide boat. The boat commander sits in front of the coxswain and directs the boat in an emergency. He also commands the boat occupants upon landing until the unit has re-formed. The boat commander directs fires from the boat, if necessary.

Each platoon has a platoon guide boat, which contains the platoon headquarters. Other platoon boats position themselves to either side of the platoon guide boat as wingmen to maintain a 20-meter interval for protection against fires and to allow dispersion on landing. They follow the guide boat and land when it does. They open fire from the boat when the guide boat does.

Each company has a command and control (C2) boat, which carries the company commander and leads his flotilla. The platoon guide boats position themselves at double-boat intervals from the C2 boat, maintaining a 40-meter spacing between boat groups. The C2 boat is normally the lead boat of the center platoon.

The battalion command group remains on the near shore until the assault wave has landed. The commander controls the near-shore direct fires and directs changes in landing points if elements of the first wave encounter difficulties. He also directs changes for the following wave. The commander has his own boat and crosses on his own schedule, but he normally crosses with the second wave. The command group normally does not cross in a single boat but is distributed among several boats.

Guide boats in all boat groups are responsible for ensuring that their group lands at the proper place. Landing marker lights are installed as transit lights to assist navigation on the water. The coxswain will see two lights, one above the other. If the boat is moving straight to the landing, the lights will be straight in vertical alignment. If not, the lower light points in the direction the boat must go to be exactly headed for the landing. The boat will not head directly for the transit lights except when the river has no current. The boat heads for the far shore so that the boat's true course is directly for the lights (see *Figure* 8-5).

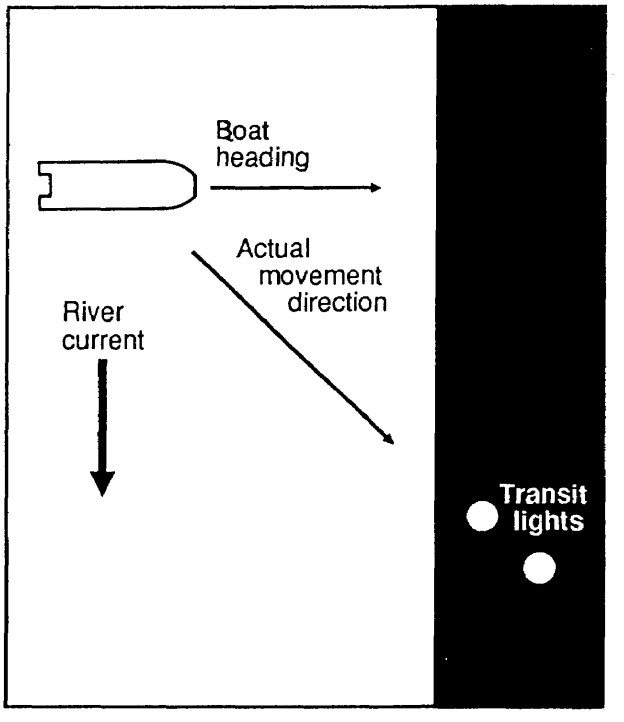


Figure 8-5. Boat course

Normally, the boats will cross slightly upstream from the landing so that they can drift in with the current, To do this, they align so that the lower transit light points slightly downstream (see *Figure 8-6).*

If the force is conducting a crossing where smoke is necessary on the water and it obscures the far shore, other navigation methods include stringing ferry lines across the river for the boats to follow, using floating markers, or travelng on a compass heading.

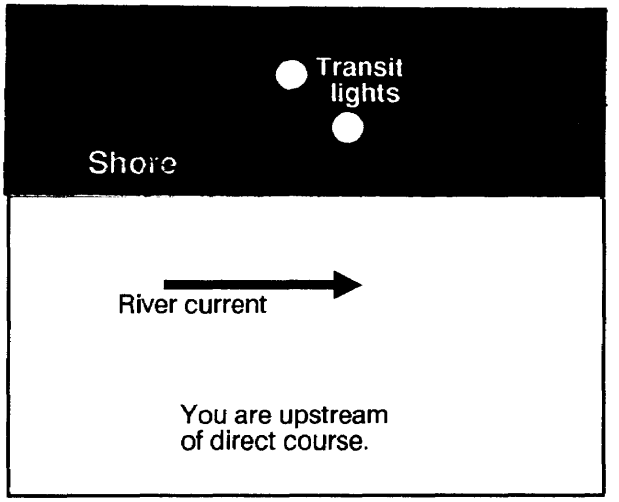


Figure 8-6. Transit lights

Watermanship

Watermanship includes all the skills that the boat crew must exhibit to properly control their boat in the water. It includes individual paddling skills, responsiveness to commands, and the skill of the coxswain.

Individual paddlers use a paddling technique where they push the paddle vertically into the water roughly 1 meter to their front and then power it back through the water by pushing with the upper hand while using the lower (guide) hand for control. At the end of the power stroke, they remove the paddle from the water, turn it outboard and parallel with the water's surface (feathering), and move it forward for the next stroke. The stroke is silent, with the paddlers careful not to strike the side of the boat or to splash.

The stroke paddler sets the pace to control the paddlers. He receives oral commands from the coxswain and establishes and maintains the paddling pace. All paddlers match the stroke of the paddler in front of them, except for the number two man, who matches his stroke with the stroke paddler. If the boat crew has difficulty paddling in unison, the coxswain can exercise oral control by calling cadence. Normal paddling speed is 10 strokes per minute for stealth, 30 strokes per minute for speed.

Commands

"Ho/d water." Paddlers hold their paddles motionless in the water with the blade perpendicular of direction of motion.

"Give way together." Paddlers stroke in unison following the rhythm set by the stroke paddler.

"Slows stroke." The stroke paddler paddles 10 strokes per minute.

"Fast stroke." The stroke paddler paddles 30 strokes per minute.

"Backwater." Paddlers paddle backward in unison with the stroke paddler.

"Rest paddles." Paddlers rest their paddles across their legs.

"Hold bottom. " Paddlers thrust paddles straight down into the river bottom and hold them against the side of the boat as a temporary anchor.

"Land boat." The stroke increases to 30 per minute, with each paddler digging deep into the water for power to drive the boat up on shore. The stroke paddler stows his paddle as soon as the boat grounds, then disembarks and secures the towing bridle to the shore.

"Right, backwater left, give way together." When paddlers execute these commands, the boat turns rapidly to the right. When the boat has turned to the new desired course, the coxswain commands, *"All, give way together."*

"Left, backwater right, give way together. " When paddlers execute these commands, the boat turns rapidly to the left. When the boat has turned to the new desired course, the coxswain commands, *"All, give way together."*

The coxswain can make minor adjustments in boat speed by directing, *"Slow the stroke"* or *"Speed the stroke."*

The coxswain must take the river current into account when trying to hold a course. In low-velocity current, the boat can travel a relatively straight course across the river by crabbing slightly upstream. To do this, the coxswain aims the bow of the boat slightly upstream while sighting on the landing mark. If the mark remains on a constant bearing (it does not drift upstream or downstream), the boat is crabbing correctly and is headed directly for the landing,

If the current velocity is too high for successful crabbing (over about 0.5 MPS) either the boat must start upstream or the coxswain must steer a figure-eight pattern. In both cases, the boat should approach the landing heading into the current to avoid the danger of

broaching. If the boat is launched from far upstream, it generally follows a course similar to the dotted course in *Figure 8-7.* If the coxswain follows a figure-eight course, he steers upstream until aligned with the transit lights, then lets the bow drop downstream and guides on the lights until he reaches the landing point. He then steers upstream to the landing marks (see *Figure 8-7,* solid line). These techniques minimize the amount of time the boat will be traveling slowly against the current while near the threat shore.

The need for a figure-eight course is determined during reconnaissance. The flotilla command boat sets the figure-eight course, completing the downstream turn in alignment with the transit lights. Remaining boats simply maintain station until the last turn upstream toward the landing area. Boat groups then head directly for the transit lights.

Eddy currents (eddies) occur at channel bends, near points of land, and at places where the bottom is uneven. Eddies can be dangerous to small boats. The coxswain must be alert for them.

Smoke

The purpose of smoking the crossing site is to achieve a haze over water that can render direct and indirect fires less effective. It is particularly important not to produce a column of smoke above water that can pinpoint the crossing location. For this reason, smoke is not used if conditions will not hold it close to the surface.

Smoke production is dependent on wind direction. If winds are blowing from the near shore toward the far shore, smoke generators or support-force vehicles can effectively smoke the crossing. If the winds tend to blow parallel to the river, near-shore smoke should not be used, as it will make a smoke wall that will silhouette boats on the river. In this case, floating smoke pots anchored across the width of the river can produce effective smoke. If the wind is blowing from the far shore to the near shore, smoke pots or mortar smoke on the far shore can be effective.

Direct Fire

All boats have a designated gunner at the bow, armed with either a squad automatic weapon (SAW) or a biped-mounted machine gun. The gunners do not fire unless ordered to by the boat commander. If ordered to fire, the gunners engage the most dangerous target or suppress the landing area. Most often, the gunners engage threat weapons firing on the assault force by firing back up the line of threat tracers.

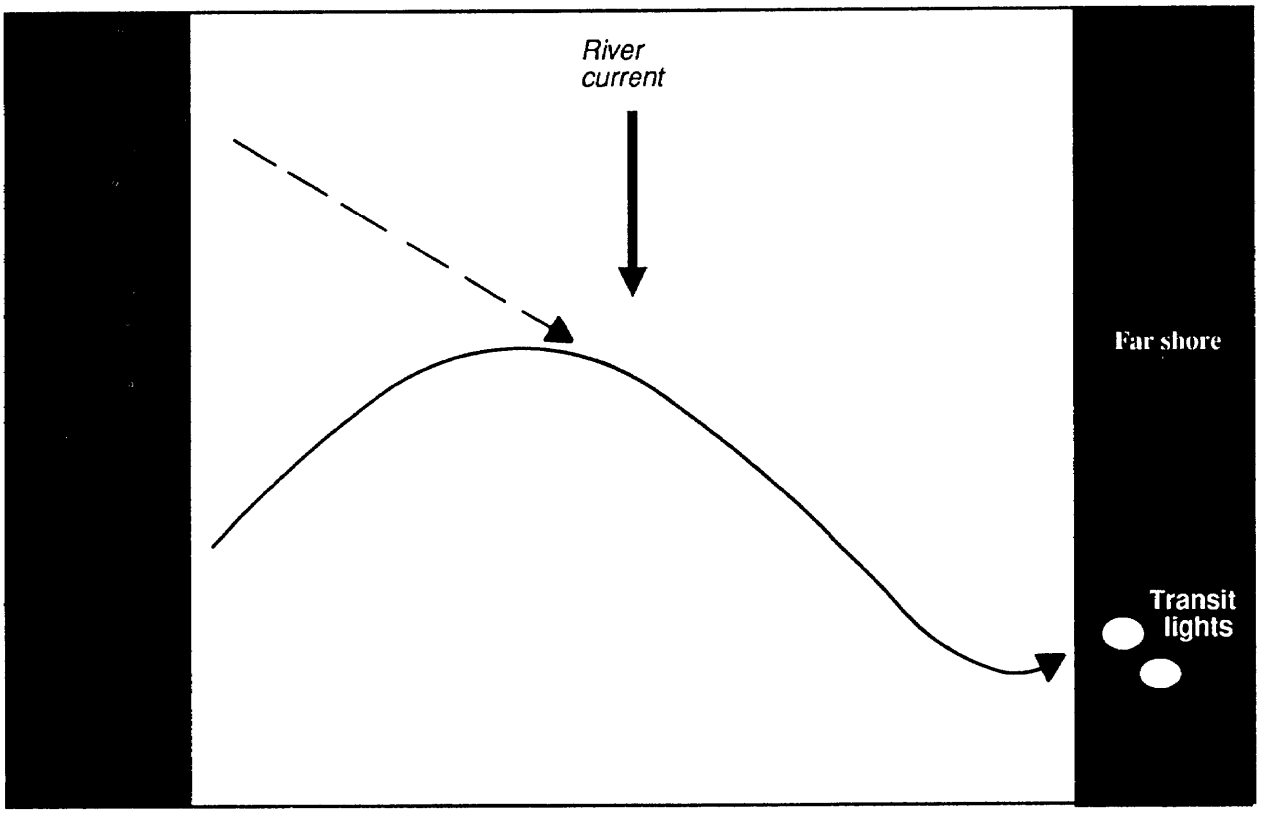


Figure 8-7. Figure eight course

If two passengers are available to be boat gunners, the second back from the bow should be armed with a grenade launcher.

All paddlers observe the paddle of the man to their front. In order to preserve their night vision, they do not look at the threat shore.

Debarkation Procedures

The manner in which the coxswain orders the boat team to land the boat depends on the depth of the water at the landing point.

Shallow water. As the boat nears the landing point, the coxswain directs the boat toward the landing and orders, *"Land boat."* As the boat grounds, paddlers stow paddles and disembark over the side into the water. They then hold the boat for the passengers to disembark. The stroke paddler secures the boat to shore to await return.

Deep water. As the boat comes alongside the shore, the coxswain orders, *"Stroke out."* The stroke paddler stows his paddle and, with towing bridle in hand, gets out of the boat onto shore. He then pulls the boat up close to shore and secures it if he can. Otherwise, crew members will have difficulty debarking. The other crew members stow their paddles. The coxswain then directs debarking by number, beginning with the passengers, then the shoreside paddlers, and finally the riverside paddlers. The coxswain is the last to leave the boat. He and the stroke paddler secure the boat and await return.

Immediately upon leaving the boat, the boat team forms a hasty perimeter. The bow gunner moves directly forward roughly 10 meters and drops prone, observing to his front. The left-side squad members move up and form a prone semicircle to his left, and the right-side soldiers form a semicircle to his right. The squad leader takes charge of his squad and directs all soldiers to drop their life jackets. He then awaits orders from his platoon leader.

Boat Return

As soon as the boat team has formed a hasty perimeter and dropped their life jackets, the stroke paddler recovers them and returns them to the boat.

The boat engineer squad leader (the senior engineer with the boat group) takes charge of all three boats in the boat group. He supervises tying off all three boats in trail and loads all six engineers into the front boat. They then paddle the boat back to the friendly shore, towing the other two boats (see *Figure 8-8).*

On the return, the boat group travels in a relatively straight line to gain distance from the threat shore as rapidly as possible. This will cause the group to drift downstream. Upon reaching the near shore, the boat group turns upstream and travels close inshore until it

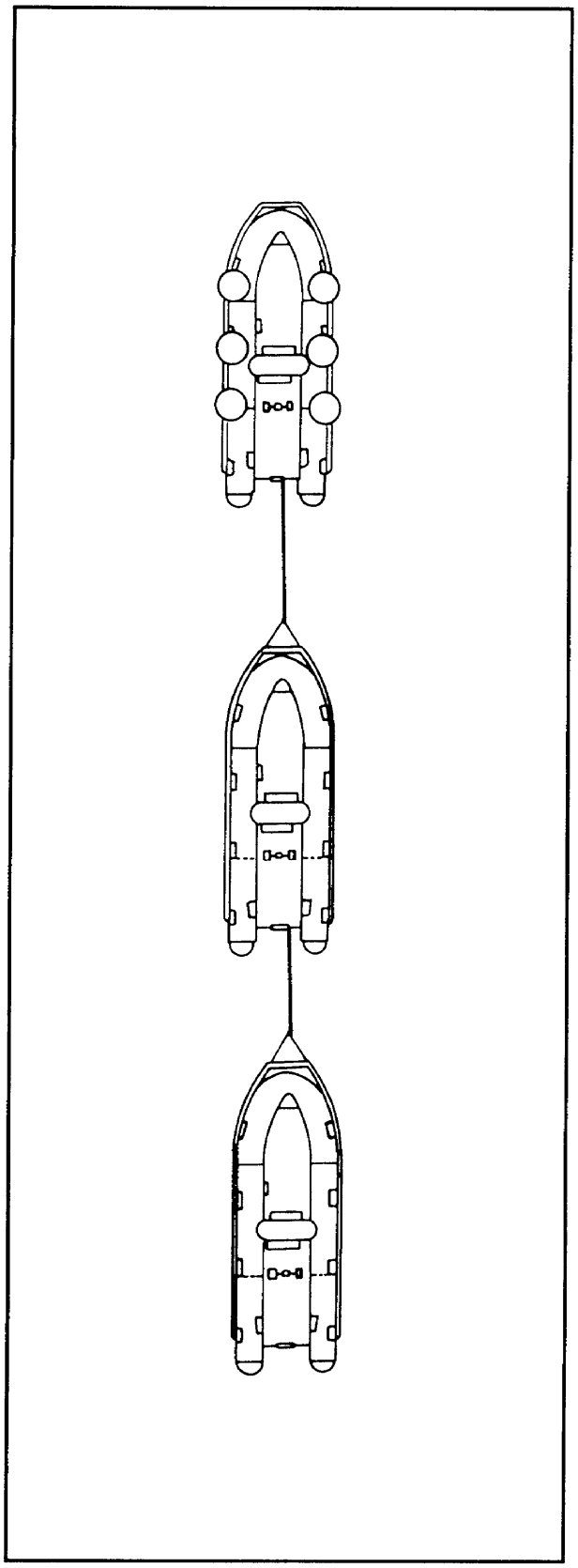


Figure 8-8. Boat return

reaches the departure point (see *Figure 8-9).* A guide from the engineer platoon headquarters guides them in for the next wave.

If the boats mount outboard motors, all three boat crews start their motors on command of the boat engineer squad leader and return independently to the near shore.

Motor Procedures

If motors are available, they speed the crossing significantly. Normally, the first wave uses paddles to cross covertly. After the boats return from carrying the first wave, the motors are mounted. If the boats can be placed in the water without threat observation (in a lagoon or barge basin, for example), the motors are mounted on the boats before the first wave crosses. In this situation, the motors can be started immediately if the crossing is discovered. The motors are also available for returning the boats after the first wave.

If a covert crossing cannot be achieved, the first wave may cross the river powered by motors. In this case, the motors are mounted after the boat crew and passengers have boarded. The crew paddles the boat while the coxswain starts the motor in order to reduce exposure time on the river.

Preparation is critical for success with outboard motors. The primary problem is hard starting. All motors are started and run up to operating temperature during preparation. If any are difficult to start, replacement motors are substituted (the hard-starting motors become backups). After mechanical checks and warmup, the fuel tanks are completely filled with the correct fuel and oil mixture to eliminate condensation. In cool or cold weather, the motors are kept warm until needed, using a warming tent, ambulances with medical markings covered, a heated building, or other means.

A two-man team of engineers from the crossing area engineer battalion carries each motor to the water and mounts it on the boat. The boat is manned and held with the bow toward the river and the stern to the shore. If the bottom is shallow, the paddlers hold bottom. If the water is too deep or the current too strong, a line is fastened to the boat stern to hold it against the shore. The mounting team wades out to place the motor on the stern and fasten it in place. The coxswain directs the paddlers to give way together after the motor is mounted. He then starts the motor, with the boat under way. If the boat has too few occupants to move effectively by paddles (during the second wave, for example), the boat remains at the shore until the coxswain starts the motor.

Cargo Procedures

Porters detailed from the assault battalion task force bring the cargo forward. They carry it to the waterline at the boat launch point to await the return of the boats. When the boats return, the porters load and secure the cargo to the boat. If the cargo includes heavy or pointed items, a temporary plywood floor is placed in the boat before loading.

Porters accompany the cargo to the far shore to unload it. The cargo is unloaded into caches until carrying parties are sent back from the assault force to get it.

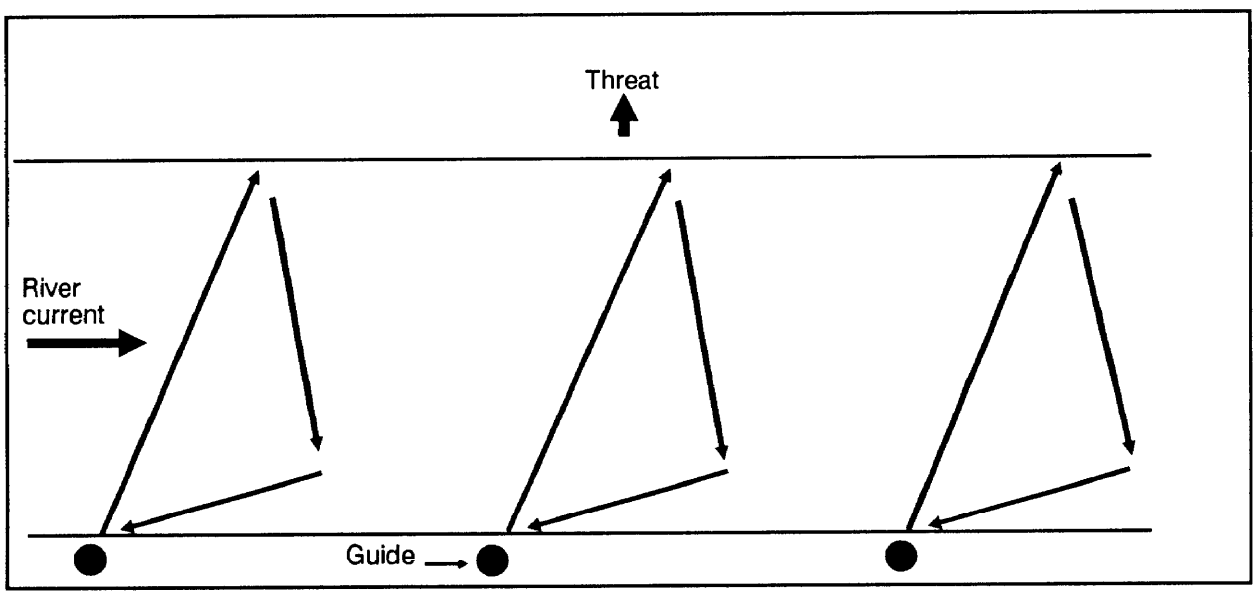


Figure 8-9. Operation of boat group

Casualty Procedures

Platoon medics accompany assault forces in the first wave. They carry their medical bags and night-vision goggles but do not have litters. They treat wounded where they fall, sending walking wounded back to the landing area and leaving more severely wounded where they were treated.

The second wave carries senior aidmen with equipment to establish a far-shore casualty collection point in each company zone. The aid station should provide a blackout shelter such as a tarpaulin or small tent for patient examination along with emergency medical supplies and quantities of intravenous fluids. It also carries litter teams formed from headquarters elements of the assaulting task force. The litter teams carry wounded back to the collection point. The senior aidman at the collection point performs triage and treats patients. Priority patients are evacuated by assault boat as boats are available. All other patients wait until rafts are available.

Safety

Safety is as important in combat as it is in peacetime training. Procedures are established and soldiers are trained in peacetime to be safe in combat. Loss of a soldier to an accident in combat is just as intolerable as losing a soldier in peacetime and is potentially far more dangerous to the force. Safety procedures are particularly important when considering the risks during assault river crossings, where the lost soldier may be the key to mission success. Therefore, all safety procedures must be followed in combat.

The most important safety procedure is building a well-trained force. Nothing is more unsafe than allowing a force of amateurs to undertake a complex, potentially hazardous task where the well-being of all is dependent on each man knowing his job. Peacetime training should never be avoided, because of the potential hazards of a necessary combat task. Training to standard in a controlled environment is the only way to surmount the hazards.

Life jackets are always worn when using assault boats. If Class 5 life jackets (German army style) are available, they are worn over LBE and the diagonally slung rifle. The Class 5 life jacket will support the soldier so equipped and hold his head out of the water. If a life jacket providing lesser flotation is used, such as the standard US Army flat foam-filled life jacket, it is worn over the uniform. The LBE is worn over the life jacket, with the belt unfastened and the rifle slung diagonally over all. Rifle slings are turned around so that the free end is away from the weapon. This allows rapid jettison of the rifle in the water by pulling the free end of the sling to release the fastener.

Weapons are always carried in boats with the bolt forward on an empty chamber and the weapon on *SAFE.* The only exception to this is the bow gunner, who will charge his weapon in the boat when directed to fire. He must put the weapon on *SAFE* before debarking, and the squad leader must verify this by touch.

The soldier can immediately engage the threat, upon landing, by simply taking the weapon off *SAFE* and charging the chamber.

WARNING
The soldier must not take the weapon off *SAFE* and charge the chamber before leaving the boat.

A safety boat is always used during an assault crossing. One safety boat is used for every company flotilla. It contains at least one lifeguard-qualified swimmer (two, if possible), to act as a lifeguard. This lifeguard will not wear boots or LBE. The safety boat will also contain a boat hook and a float with an attached line for rescuing troops in the water. Rocket-propelled lifelines will be included, if available. At a minimum, the boat commander is equipped with night-vision goggles. The crew of the safety boat comes from the supporting engineer force that provides the boats and boat crews, and consists of eight paddlers, the coxswain/commander, a medic, and the lifeguard or lifeguards. It also contains a radio on the company frequency.

The safety boat crosses parallel with the flotilla and about 40 meters downstream. Its crew pays out a climbing rope fastened to the near shore as a guard rope and attaches life jackets as floats every four boat lengths (see *Figure 8-10).* When it reaches the threat shore, the crew ties off the guard rope and then moves back centered in the river. If a man goes in the water or a boat capsizes, the affected boat group makes a quick radio call on the company frequency, indicating the number in the water and the boat group calling. The alerted safety boat holds water, while its crew looks for troops who are in the water or who are caught by the guard rope.

If a soldier goes in the water, he should immediately remove his helmet and release it. He should then roll onto his back. If he is wearing a Class 5 life jacket, he retains his weapon and LBE. If he is wearing a lesser-quality life jacket, he releases his rifle and LBE and drops them. He then allows the current to carry him, stroking and kicking to remain centered in the river or to float to the friendly shore. He stays alert for the guard rope and safety boat. If he reaches the guard rope, he wraps his arms in it or clips a snap link to it on his LBE (if he is wearing LBE). He either waits for the safety boat or moves along the rope to the nearest shore.

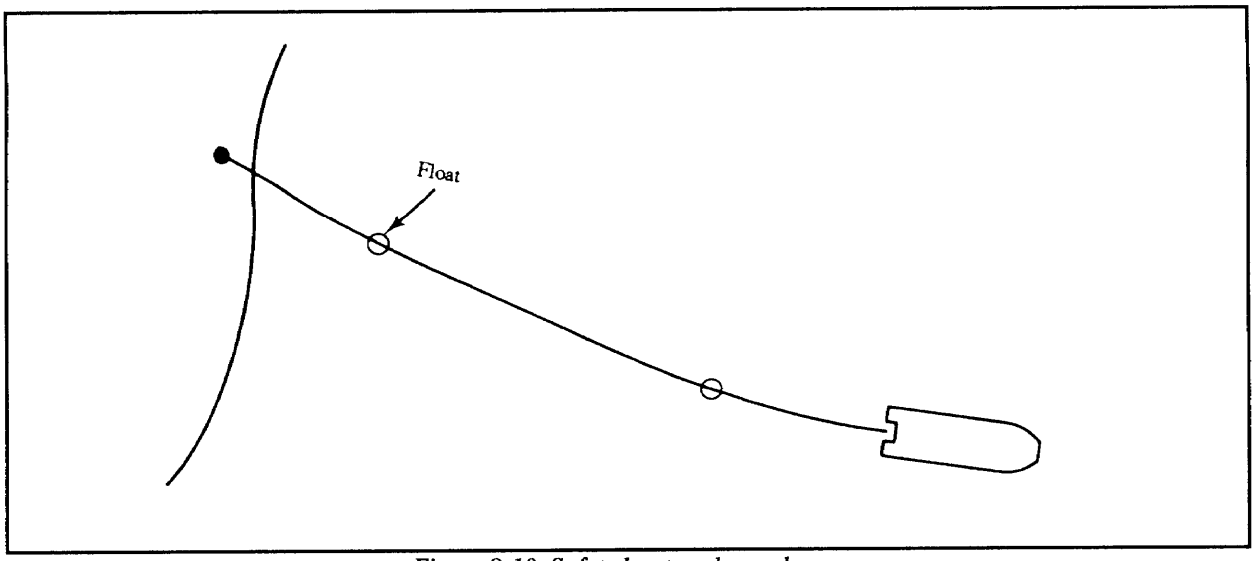


Figure 8-10. Safety boat and guard rope

If the boat is subjected to heavy artillery fire while crossing and if the boat commander directs, the coxswain turns the boat downstream and propels it at a fast stroke with the current out of the artillery impact area. If the boat is subjected to heavy direct fire while crossing, on command of the boat commander all personnel stow paddles, slip over the side while holding the safety line, and propel the boat to shore by kicking with their feet. *Figure 8-11* provides a summary of the steps involved in an assault crossing.

1. Conduct far-shore reconnaissance.
2. Conduct near-shore reconnaissance.
3. Conduct rehearsal (day).
4. Conduct rehearsal (night).
5. Assault force moves into assembly area.
6. Company guides link up with engineer boat platoons.
7. Engineer boat platoons move into attack position.
8. Support force moves into position.
9. Engineer boat platoons distribute and prepare boats.
10. Company guides bring assault force to attack position.
11. Boat teams man boats.
12. Preparation teams prepare far shore.
13. Boat groups carry boats to river and launch boats.
14. Company flotillas cross river.
15. Support force fires suppression (if required).
16. Smoke placed on river (if required).
17. Assault force debarks, deploys, and attacks.
18. Second-wave force moves to river.
19. Boat groups return to near shore.
20. Engineers mount motors (if required).
21. Second-wave force and cargo loaded into boats.
22. Second wave crosses river.
23. Far-shore aid station established.
24. Initial heavy weapons force river.
25. Assault force seizes objectives.
26. Assault force establishes hasty defense.

Figure 8-11. Assault steps, summarized

Chapter 9
Engineer Regulating Point Operations

GENERAL

ERPs ensure effective use of the crossing means. ERPs and TCPs may be collocated to provide control for the river crossing. The CSC uses them to rapidly organize and move the unit through the crossing area.

ORGANIZATION

The CSC establishes ERPs at the call-forward area and, if enough engineer assets are available, at the staging area and the far-shore holding area. He uses additional ERPs only when specific site conditions make it necessary for crossing-area control. The ERP needs sufficient space to layout the dimensions of a raft, brief crossing procedures, and conduct necessary inspections and rehearsals. A hardstand, such as a rest stop or parking lot, is ideal for this purpose but lacks the overhead concealment usually desired. Some ERP functions may be done at separate ERPs to ensure a smooth and rapid flow of vehicles to the river. In this case, it is essential to maintain communications between ERPs.

Typically, an engineer squad mans an ERP. This maintains unit integrity and provides sufficient personnel and equipment for continuous operations. The crossing-site headquarters establishes direct communication with the ERP to control raft load or individual vehicle movement. Depending on the location and purpose of the ERP, it can have the following functions:

- Briefing crossing unit personnel on procedures, including safety.
- Demonstrating ground-guide signals.
- Inspecting equipment to ensure it meets load-class capability of the crossing means.
- Organizing vehicles into raft loads.
- Conducting rehearsals.
- Controlling vehicle movement.

Raft Operations

The ERP configures vehicles into raft loads and sends them to the river to coincide with the arrival of an empty raft. Engineers brief crossing units before their arrival in the call-forward area to make this happen as rapidly as possible. The briefing covers –

- The route and its markings through the crossing site.
- The road speed and interval.
- Raft loading and unloading.
- The location of passengers while on rafts.
- Vehicle configuration for the crossing.
- Disabled vehicle actions and the location of the maintenance collection point.
- Hand and arm signals and signaling devices.
- Brassards, arm bands, or other identification of guides and traffic controllers.
- The issue, wear, and return of life jackets.
- The location of TCPs and engineer guides.
- The location of holding areas and alternate routes.
- The location of the casualty collection point.
- Actions in the call-forward area.
- Actions to take in case of threat fire.
- Company regrouping in the far-shore holding area.

An engineer from the squad running the ERP can brief vehicle crews and rehearse them in movement signals. The staging area is an ideal place to do this, minimizing the time and effort spent organizing crossing unit in the call-forward area, Otherwise, a separate ERP should handle this task.

Figure 9-1, page 9-2, is an example of an ERP at the call-forward area. The engineer squad leader positions himself where he can best control vehicle movement from the call-forward area to the river line. He establishes communication with the crossing-site headquarters. As a crossing unit arrives, the assistant squad leader contacts the unit's commander, who determines the order in which his vehicles will cross. The assistant squad leader then configures individual vehicles into raft loads, while ensuring that the vehicles do not exceed either the weight limit or the maximum dimensions of the raft. He has a space marked out in the exact dimensions of a raft for this purpose. An engineer squad member guides the vehicles onto this mockup raft, using the same procedure to be used at the raft embarkation point on the river. At the same time, another engineer inspects vehicles for proper load classification and dimensional clearances and chalks the raft load number onto the vehicles. Once cleared through the mockup, an engineer guides the raft load to a ready line. The engineer squad leader releases individual raft loads to the river as directed by the crossing-site headquarters.

Items useful for running an ERP could include–

- A TA-1 field phone and RL-39 with wire.
- Two rolls of engineer tape and six stakes.
- Ten traffic markers.
- Flashlights with colored filters.

- Chemical lights.
- Signal flags.
- Chalk.
- Camouflage nets and poles.
- Night-vision goggles.
- Sandbags.

Bridge Operations

Abridge operation requires a continuous traffic flow to the river. Units must be briefed and sent to the crossing site quickly. To accomplish this, engineers brief at staging areas and check vehicle load classification and dimensional clearances. The briefings include the following rules:

- Vehicles will maintain maximum speed of 15 miles per hour while crossing the bridge.
- No vehicles may stop on the bridge.
- No operators will shift or make abrupt changes in speed on the bridge.
- Vehicles will maintain the interval indicated by signs on the side of the road.
- Operators will follow the signals of engineers at ramps and intervals along the bridge.

ERPs maybe established along routes to the crossing site to regulate traffic. A mockup bridge is not necessary for the ERP.

Swim Operations

The ERP for a swim site has necessary briefings and vehicle inspections. Crossing units are responsible for most preparations, but the ERP can assist with a predip site established nearby and provide recovery assets. A-briefing on swimming operations should include–

- Layout of entrance and exit markers.
- Swamping drills.
- Rescue procedures.
- Actions in case of enemy fire.

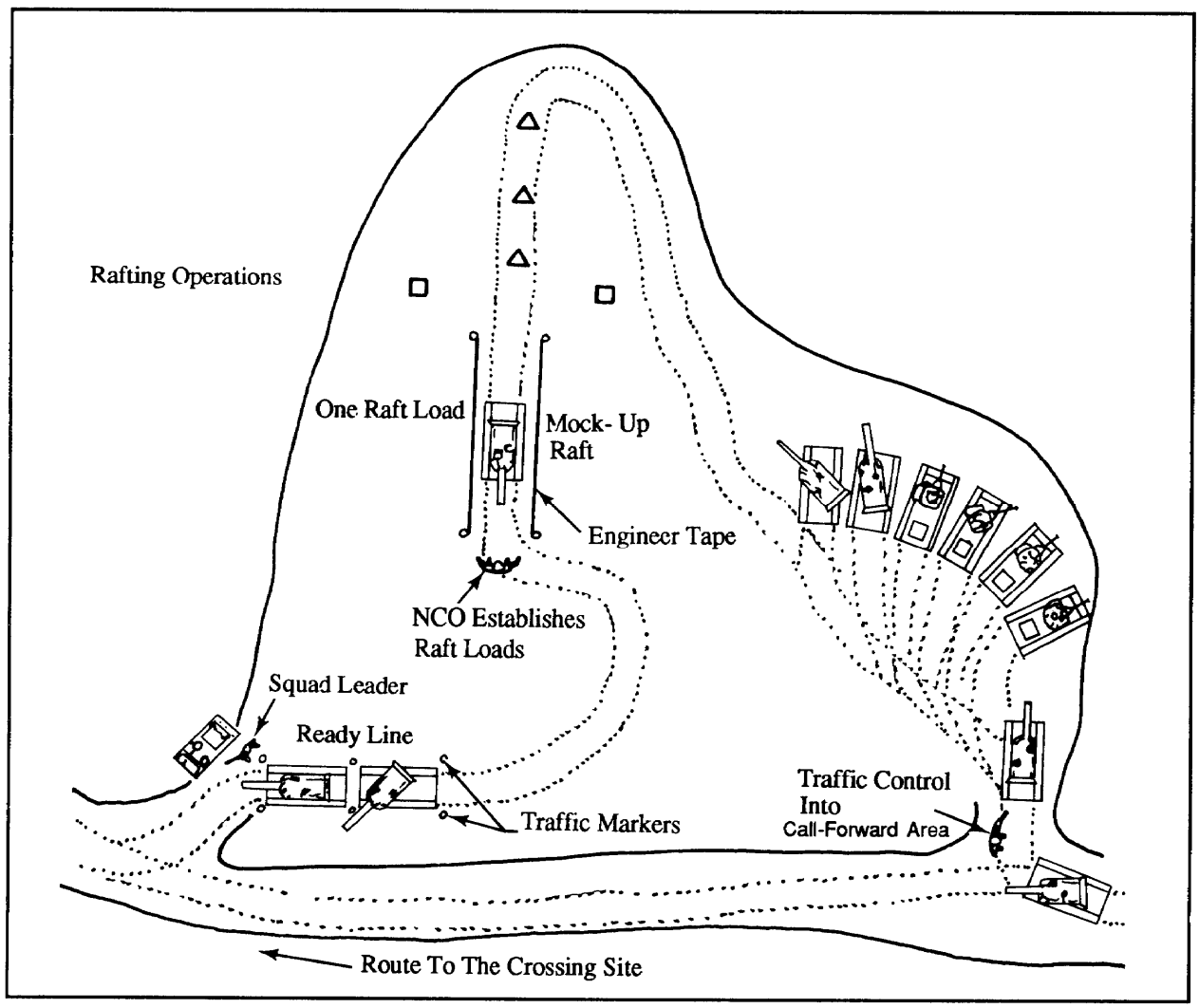


Figure 9-1. ERP layout

Appendix A
Engineer Planning Calculations

This appendix addresses the detailed engineer planning necessary for a river crossing operation. It also describes the charts and overlays used to synchronize and control execution of the crossing. H-hour, as used in this manual, refers to the specific hour the assault phase begins (see *JCS Publication 1-02).*

Initial engineer planning at corps and division levels focuses on providing sufficient engineer assets to handle crossing requirements. The terrain data base maintained by the terrain teams at division and corps provides potential crossing sites and river widths. The division engineer uses this information to construct a site overlay (see *Figure A-l, page A-3).* He labels assault and raft or bridge sites and shows the site capacity and the estimated preparation time for each site (from the terrain data base).

Preparation time is the time required to improve routes and river banks to support the units that will use the site. It also includes the time required to construct rafts and bridges. Raft site capacity is the number of raft round trips per hour. The engineer calculates raft site capacity by determining the raft trips per hour possible on a centerline (using raft turnaround time and the number of possible rafts from *Figure A-2, page A-4)* and multiplying by the number of possible centerlines at the site. Centerlines must be at least 100 meters apart. Assault-site size is 200 meters for each company that can cross in the first wave. *Figure A-1* shows the determination of rafts per hour and assault site capacity for the division crossing overlay. The site overlay on the planning map provides the additional details necessary to ensure that each brigade has sufficient potential crossing sites within its boundaries.

Rules of thumb for making this determination follow:

- A main attack brigade requires 31 assault boats to cross a battalion with three companies in the first wave. With 70 boats, it can cross two battalions at once. For a supporting attack brigade, 21 assault boats are enough to cross a battalion, with only two companies in the first wave. Generally, the boats with the corps bridge companies can handle these requirements.
- A brigade requires two bridges, or the equivalent bridging configured into rafts. This requires a corps combat engineer battalion to operate the crossing area plus one corps float-bridge company for each 100 meters of river width.
- A division crossing requires an engineer group with two corps combat battalions to conduct the crossing and two corps float-bridge companies for each 100 meters of river width.
- If any bridging is M4T6, additional engineers must be assigned to the crossing force to assemble it. Normally, each M4T6 bridge company requires two additional corps combat engineer companies.

The engineer planner also uses the above rules of thumb to task organize engineers that are supporting each crossing area. The division engineer develops a rough crossing timeline using pure battalions. This provides sufficient information for division planning, without requiring detailed knowledge of the brigade's plan (before they have developed one). *Figure A-3, page A-4,* is based on a 6-bay raft and provides necessary planning factors (field trains are not included). *Figure A-4, page A-5,* illustrates a crossing timeline.

The brigade headquarters does the majority of the detailed crossing planning. During situation analysis, the brigade engineer develops a site overlay force buildup matrix to provide initial buildup rate information to the maneuver planners when they outline possible schemes of maneuver (see *Figure A-5, page A-6).* This overlay is the same as the overlay developed at division and may be provided by the division engineer.

Once the commander identifies the COAs to develop, the staff engineer develops crossing area overlays for each (see *Figure A-6, page A-7).* These overlays take the information from the site overlay, along with additional terrain data, and show staging areas, holding areas, call-forward areas, and routes for each crossing site included in the COA. A crossing-area overlay is necessary for each COA. The overlay for the COA eventually selected is later modified by adding ERPs, TCPs, and crossing-area headquarters information and is used to support the operation.

When maneuver planners develop COAs, they assign crossing sites and the order of crossing to units, and they task organize the pure maneuver battalions into task forces. The engineer uses this information to construct a crossing timeline for each COA. He calculates the number of vehicles and 6-bay raft loads for each unit using pure company figures from *Figure A-7 page A-8.* The company raft requirements do not include the field trains. He can then calculate the crossing time for the unit by using the crossing capacity of the site assigned

to it. The crossing timeline shows these crossing periods, by site, based on the order of crossing. The engineer then develops a detailed task organization of engineers to support each COA (see *Figure A-8, page A-9).*

During the comparison of the COAs, the engineer uses timelines, brigade site overlays, and crossing area overlays to demonstrate the differences in the crossing plans. After the commander has selected the COA for the mission, the staff converts it into a detailed plan. The engineer begins by developing a vehicle crossing capability chart.

The engineer first constructs a chart that displays the capacity of each crossing site in terms of raft loads or bridges. Since the crossing rate for rafts is less during darkness, each site shows total raft trips separately, during darkness and during light. An example of the product of this first step is shown in *Figure A-9, page A-10.*

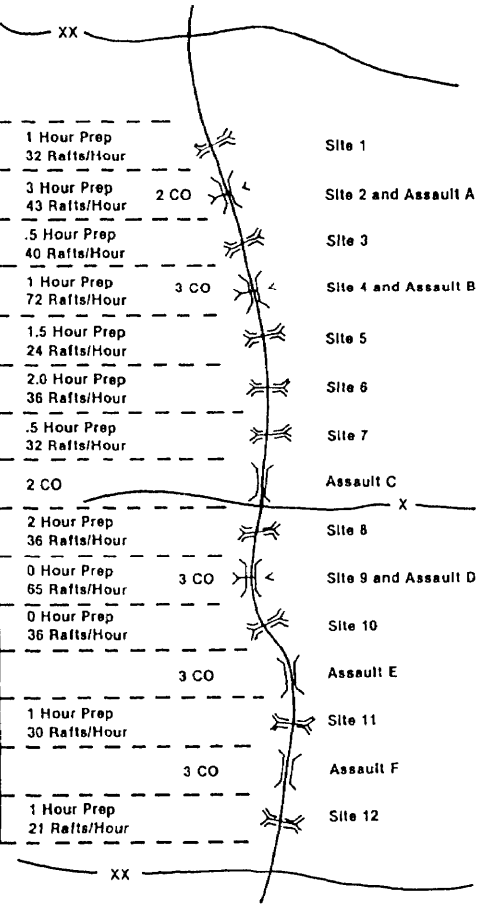
The engineer then blocks out the crossing periods for all units, based on the site assignment and the crossing order in the scheme of maneuver. He uses the factors from *Figure A-7,* bridge capacity, and the final task organization for the scheme of maneuver. After adding the unit crossing periods to the chart (see*Figure A-10, page A-11),* he coordinates it with the S3 to ensure that units will arrive on the far shore by the times they are needed in the plan. If not, the S3 and engineer work together to adjust the crossing order of subordinate units. The basic technical information remains constant as different crossing sequences are checked until one meets far-shore requirements. The vehicle-crossing capability chart is the primary tool for finalizing the crossing plan.

After the crossing order has been established, the engineer develops the crossing synchronization matrix (see Figure A-11, page A-12). This is the tool that the CAC and CAE will use to synchronize the execution of the crossing. It is constructed as a chart, with unit locations and activities by time displayed on the upper half and terrain occupation displayed by time on the lower half. The staff can follow each unit's location as the operation progresses and can easily see potential conflicts resulting from changes. The matrix also provides critical information for traffic control.

The crossing synchronization matrix is constructed backwards, by first portraying the unit crossing times established from the vehicle crossing capability chart, then using road movement times to show route usage and staging-area times. The assaulting unit and assault overwatch element times are added also. Once all of the units are displayed, the same information is transferred to the lower terrain portion of the matrix. The staff immediately resolves any conflicts they discover while preparing the matrix.

The final engineer planning step is the development of the engineer execution matrix (see Figure A-12, page A-13). It displays subordinate unit task assignments, by time. It is useful both for tracking unit execution and for aiding decisions if changes to the plan are required.

Site	Note 1 River Width (M)	A Note 2 Raft Round Trip/Hour/ Centerline	X B Note 3 Number of Rafts	Note 4 River Front (M)	X C Note 5 Number of Centerlines	= D Rafts/Hour
1	175	5.4	2	300	3	32
Assault A and 2	160	5.4	2	410	4	43
3	180	5	2	400	4	40
Assault B and 4	140	6	2	600	6	72
5	150	6	2	250	2	24
6	150	6	2	310	3	36
7	165	5.4	2	300	3	32
Assault C	150	6	2	390	NA	NA
8	150	6	2	350	3	36
Assault D and 9	160	5.4	2	610	6	65
10	170	5.4	2	375	3	32
Assault E	175	5.4	2	415	NA	NA
11	180	5	2	300	3	30
Assault F	175	5.4	2	585	NA	NA
12	170	5.4	2	250	2	21



Notes

1. River width taken from terrain data base and/or recon.
2. Raft round trips per hour per centerline from Figure A-2.
3. Number of rafts per centerline from Figure A-2.
4. Available river frontage determined from terrain data base and/or recon.
5. Number of centerlines is 1 per every 100 m of river frontage.

Figure A-1. Division site overlay

River Width (meters)	Round Trip (minutes)	Number of Round Trips per hour	Number of Rafts
75	7	8.6	1
100	8	7.5	1
125	9	6.7	1
150	10	6	2
175	11	5.4	2
225	12	5	2
300	16	3.75	3 to 5

Figure A-2. Raft centerline data

Unit	Vehicles	Raft Trips Required
Armor Battalion	121	88
Mechanized Battalion	145	51
Field Artillery Battalion	65	23
Engineer Battalion (ERI)	89	48
Air Defense Artillery Battery	52	12

Figure A-3. Unit raft requirements

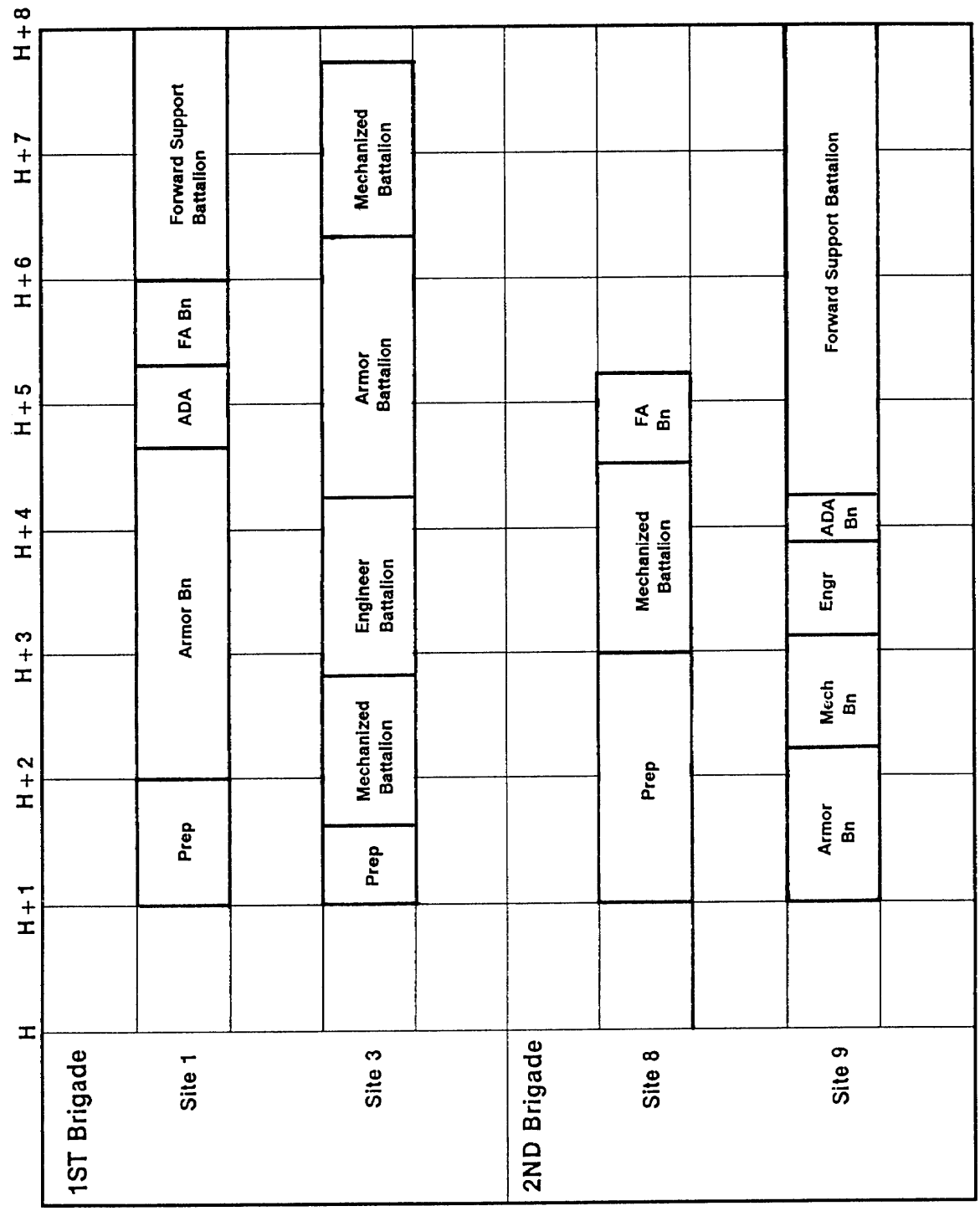


Figure A-4. Rough division crossing timeline

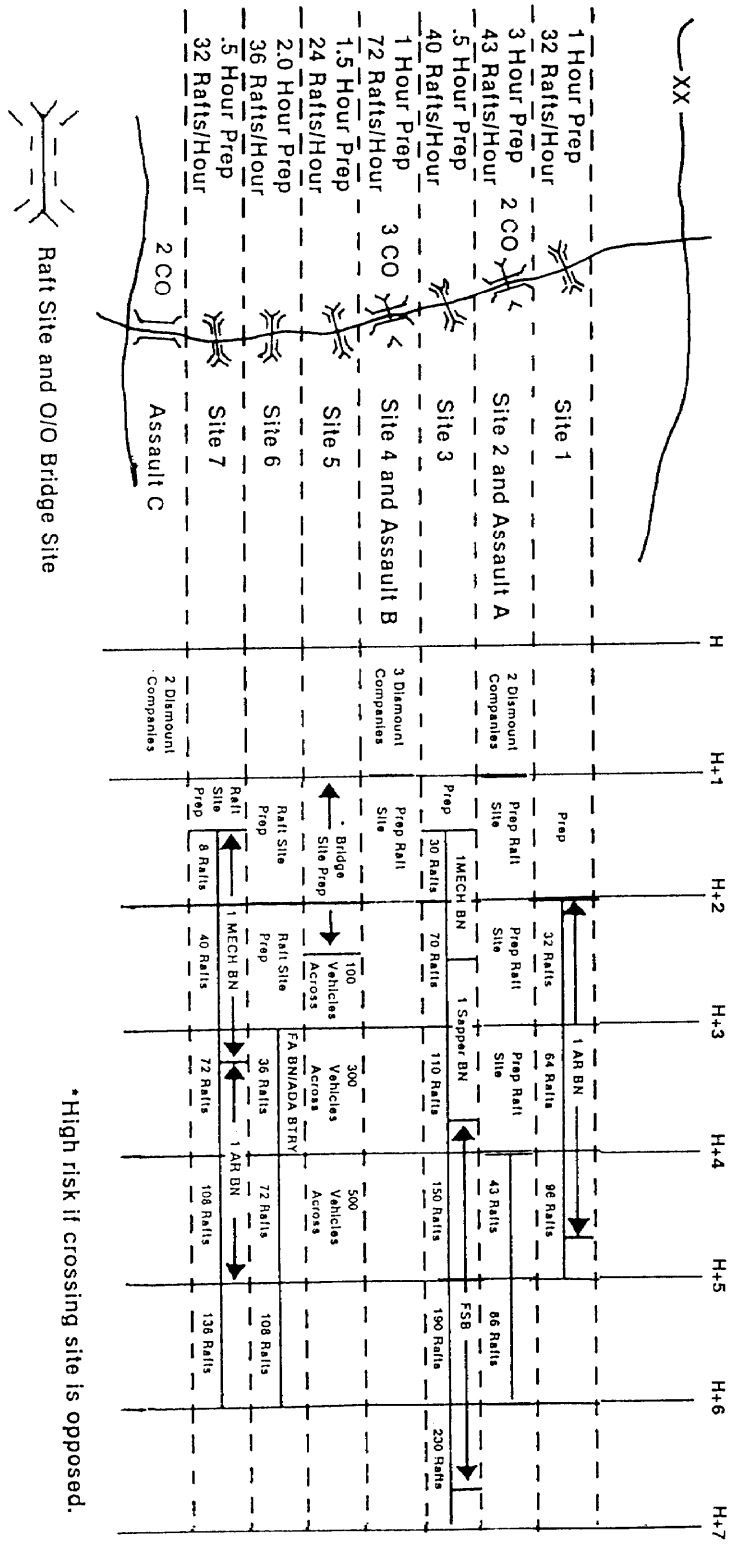


Figure A-5. Brigade crossing site force buildup matrix for COA 1

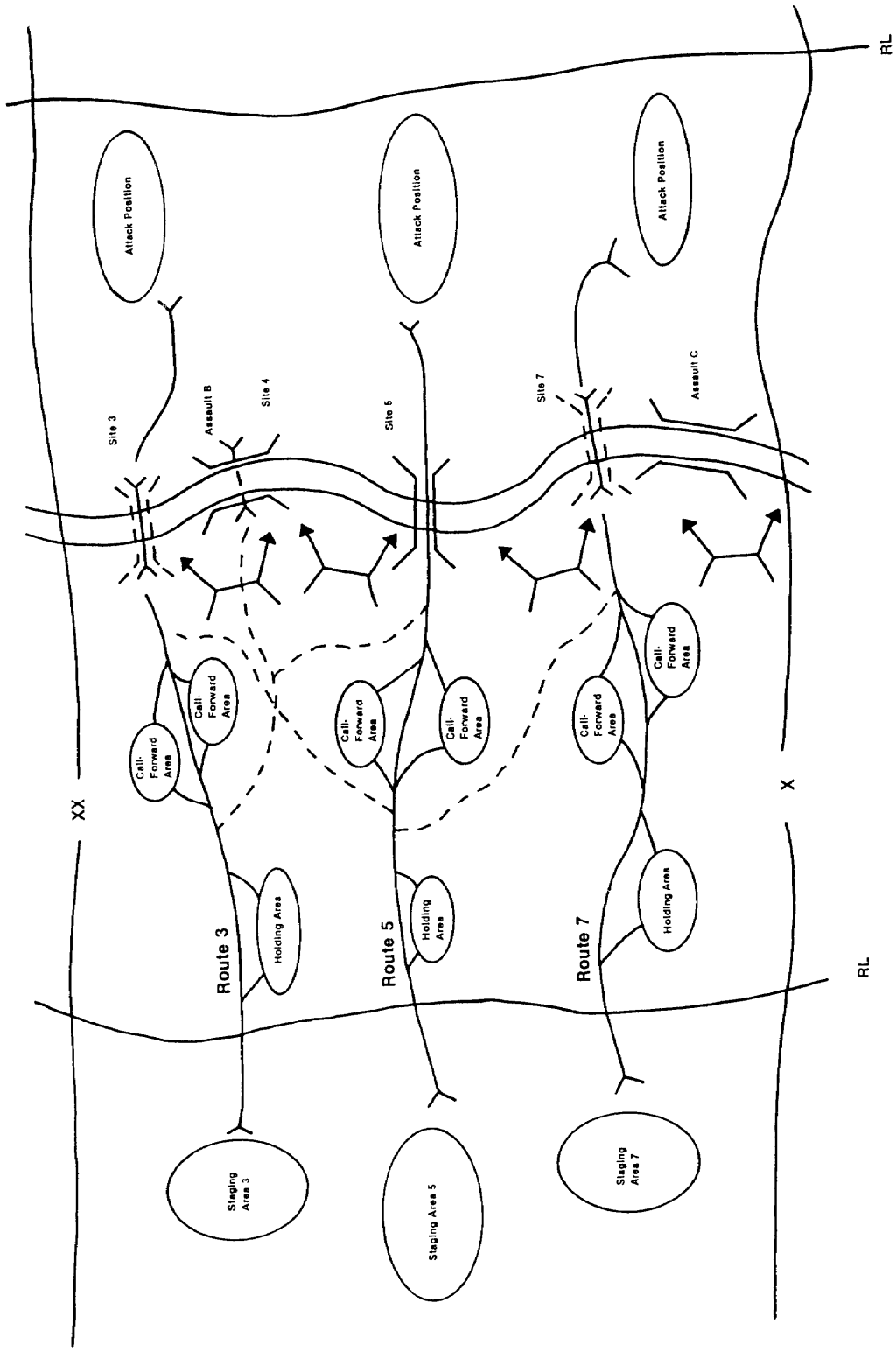


Figure A-6. COA crossing area overlay for COA 3

Unit	Vehicles	6-Bay Rafts Required
Tank Company	18	17
Mechanized Company (Bradley)	19	7
Mechanized Company (M113)	18	4
Antitank Company (ITV)	17	4
Armored TF HQ	8	4
Mechanized TF HQ	8	2
Armored TF Combat Trains	29	12
Mechanized TF Combat Trains	30	13
Mortar Platoon	8	2
Scout Platoon	6	2
Engineer Platoon (+)	10	5
Engineer Company HQ	6	3
ADA Pit	5	1
Division Cavalry Troop	9	9
Armored Cavalry Regiment Troop	29	16
Armored Cavalry Regiment Squad HQ	10	5
155-SP Artillery Battery (Division)	20	6
155-SP Artillery Battery (Corps)	16	5
Brigade TAC CP	8	1

Figure A-7. Pure company raft requirements

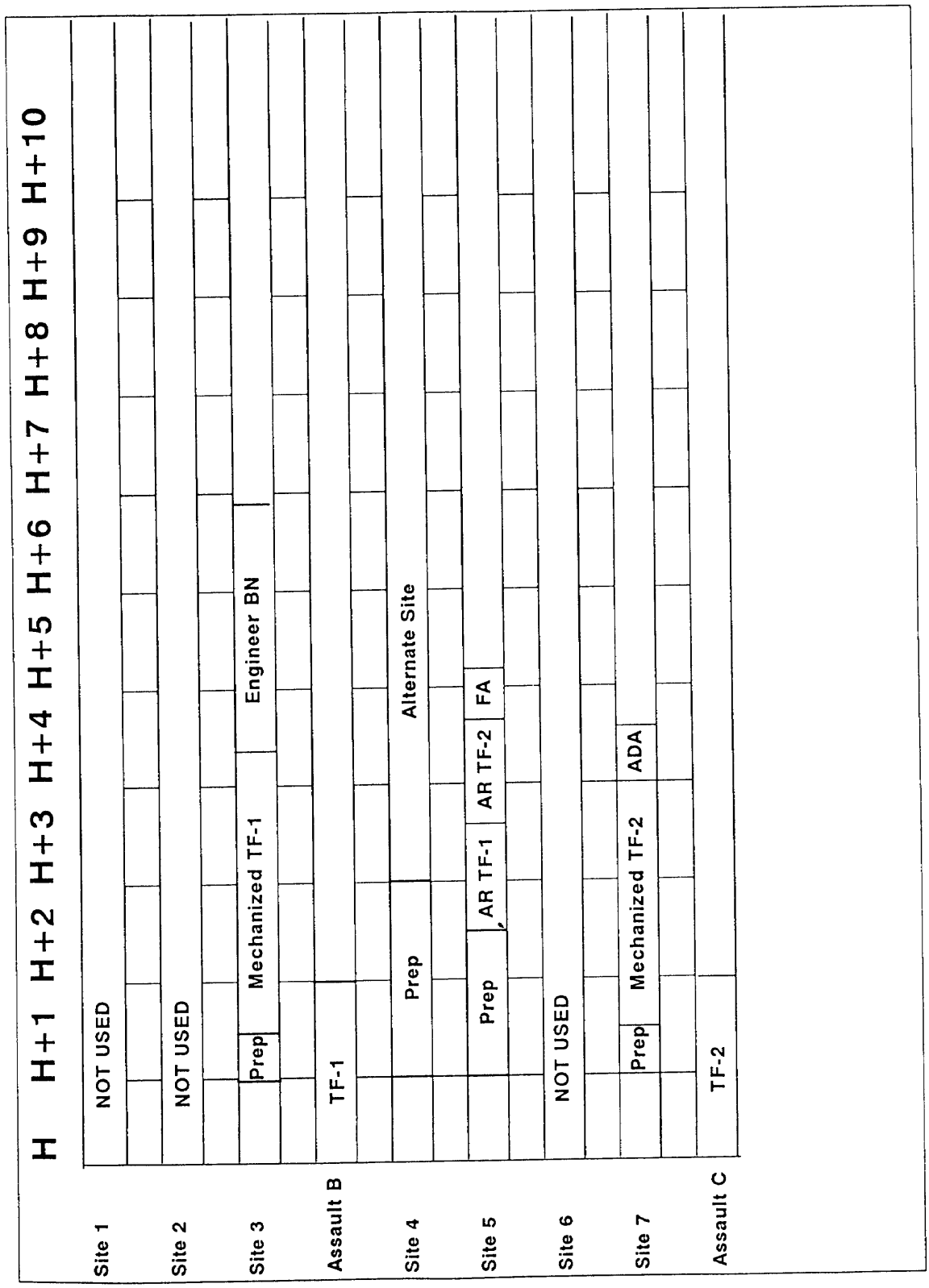


Figure A-8. Brigade crossing timeline for COA 3

SITE	CROSSING MEANS	TRIPS/HR DAY	TRIPS/HR NIGHT	BMNT H	H+1	H+2	H+3	H+4	H+5	H+6
3	8 Six-Bay Ribbon Rafts; Convert to Bridge	40	26		Site Prep & Const	26 Rafts	40 Rafts	Const Bridge	Bridge	
5	Bridge	200 Vehicles/ Hour	200 Vehicles/ Hour		Site Prep/ Const Bridge		85 Veh	200 Vehicles	Bridge 200 Vehicles/Hour	
7	6 Six-Bay Ribbon Rafts; Convert to Bridge	36	24		Site Prep & Const	24 Rafts	48 Rafts	Const Bridge	Bridge	

Figure A-9. Initial vehicle-crossing capability

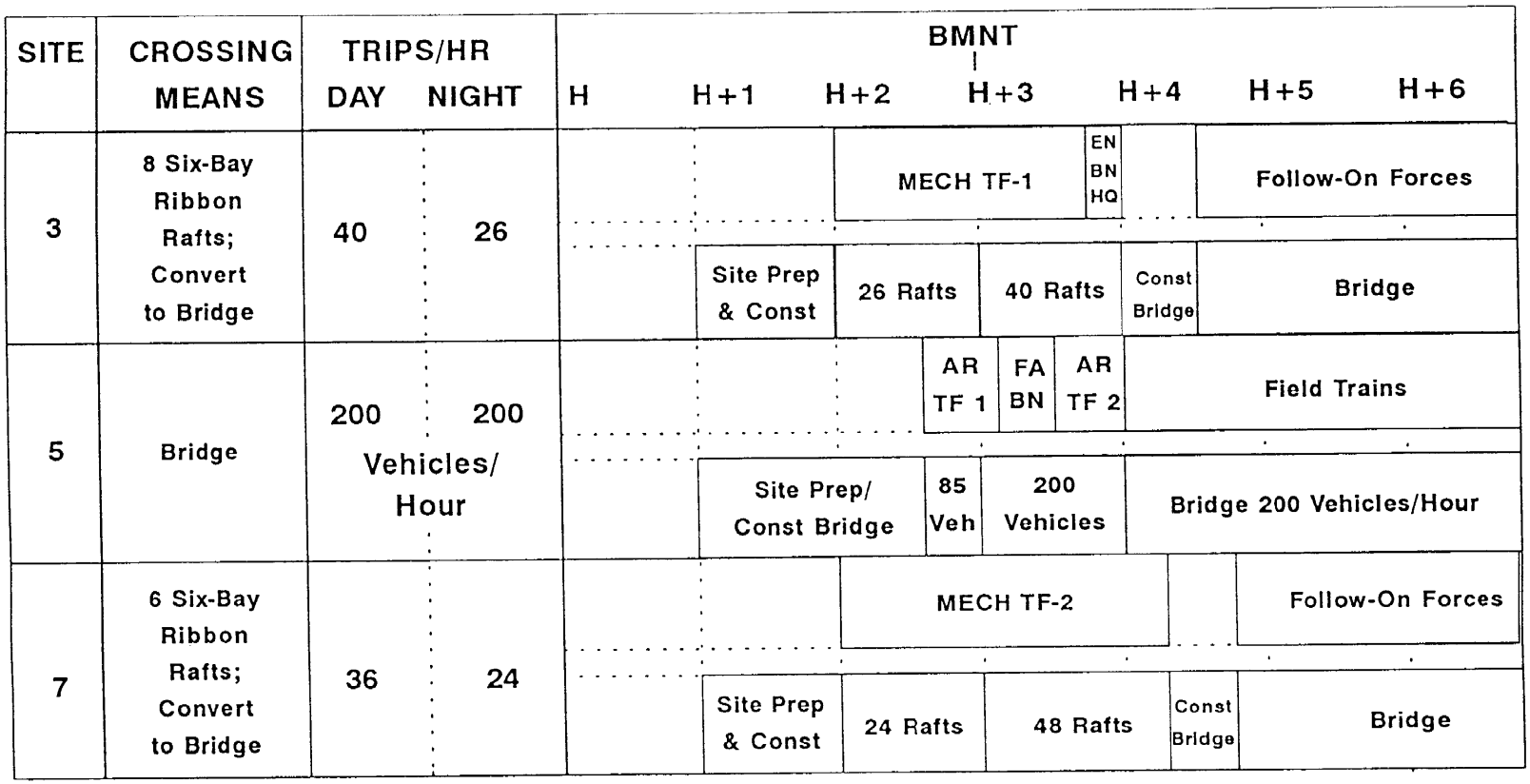
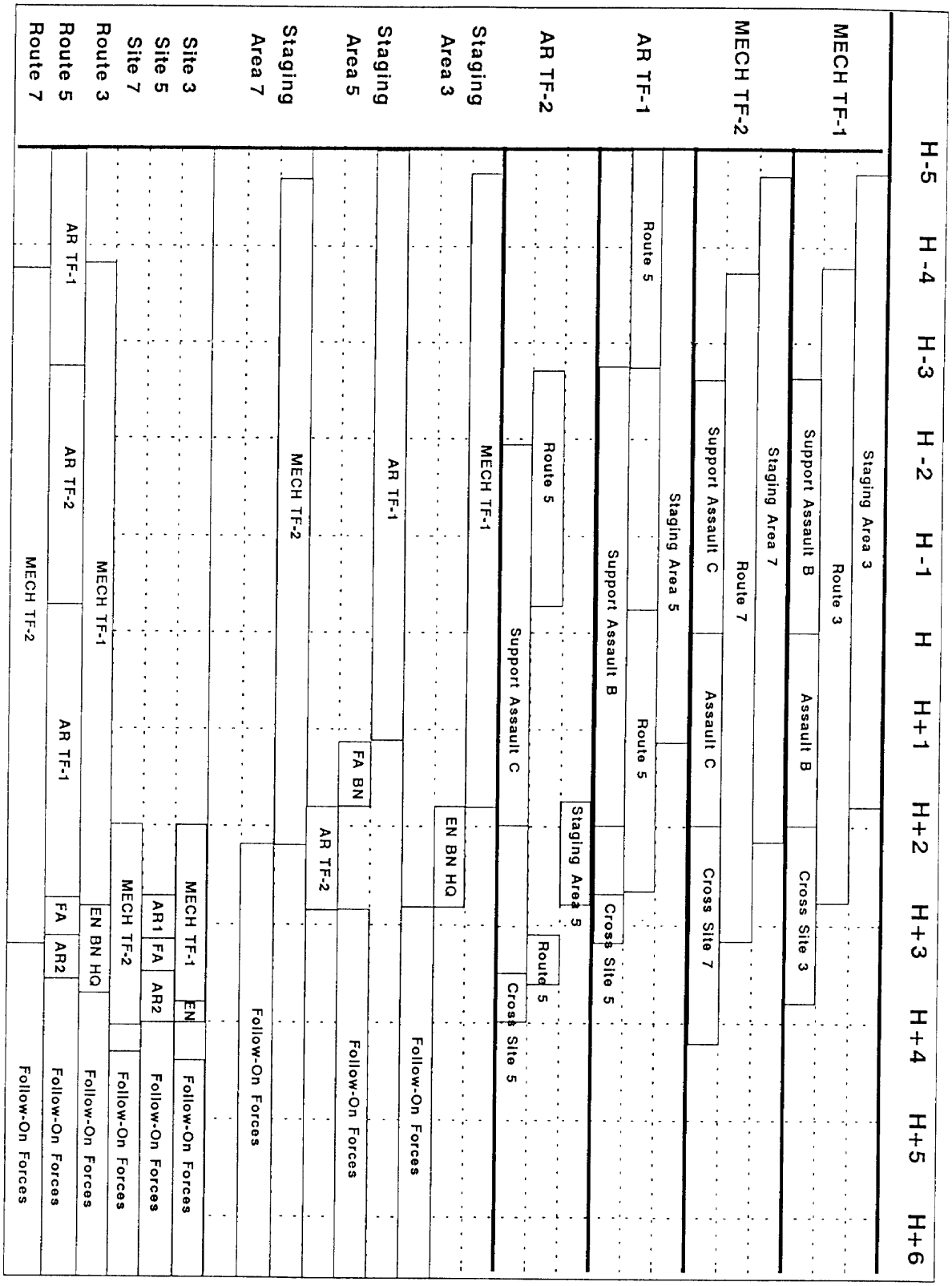


Figure A-10. Final vehicle-crossing capability


H-5
H -4
H-3
H -2
H -1
H
H+1
H+2
H+3
H+4
H+5
H+6
MECH TF-1
MECH TF-2
AR TF-1
AR TF-2
Staging Area 3
Staging Area 7
Staging Area 5
Staging Area 3
Staging Area 5
Staging Area 7
Site 3
Site 5
Site 7
Route 3
Route 5
Route 7
Support Assault B
Support Assault C
Assault B
Assault C
Cross Site 3
Cross Site 7
Cross Site 5
Route 3
Route 7
Route 5
Route 5
Route 5
Cross Site 5
EN BN HQ
FA BN
AR TF-1
AR TF-2
MECH TF-1
MECH TF-2
EN
AR1
FA
AR2
Follow-On Forces

	H-3	H-2	H-1	H	H+1	H+2	H+3	H+4	H+5
A/237	Move to Site B / Move to Site 3	Prep RB15s / Establish ERPs	Assault boat operations Assault Site B			Prep Site 3	Route maintenance of Route 3 Operate crossing Site 3		
B/237	Move to Assault Site C	Position and prepare boats	Assault boat operations Assault Site C				Route maintenance of Route 7		
C/237		Move to Site 7	Establish ERPs			Prep Site 7	Operate crossing Site 7		
D/237		Move to Site 5	Establish ERPs			Prep Site 5	Route maintenance of Route 5 Operate crossing Site 5		
203 AFB CO	Deliver Assault rafts			Move to equipment Park 3		Build rafts; Site 3	Operate raft Site 3		Bridge; Site 3
204 AFB CO	Deliver Assault rafts			Move to equipment Park 5		Construct bridge; Site 5		Bridge; Site 5	
205 AFB CO	Deliver Assault rafts			Move to equipment Park 7		Build rafts; Site 7	Operate raft Site 7		Bridge; Site 7

Figure A-12.Engineer execution matrix

Appendix B
Crossing Means

GENERAL

Crossing means is the equipment used to carry a force across a water obstacle. This equipment is specially designed to operate within certain limits, and commanders must understand these limits if the force is to cross safely.

A safety matter that affects operational use is the load capacity of rafts, bridges, and equipment. The quantities shown on the Equipment Characteristics Chart, page B-3, are the normal capacities or the design capabilities. In exceptional circumstances, certain safety factors or margins allow increased loadings. These capacities have been deliberately omitted here because they are not intended for use in operational planning. The standard or design capabilities are provided for normal crossings. The exceptional category is intended for special situations using the terms **caution** or **risk** crossings.

In addition to the command decision required to employ caution and risk crossing loads, commanders must consider the physical status of the equipment. Thus, crossing area or crossing force commanders obtain a professional judgement from the engineer. He weighs these factors with the tactical needs prior to directing increased loading, keeping in mind that the equipment may be lost for future use.

In a normal crossing, the vehicle class number is equal to or less than the bridge classification number, vehicles maintain 30-meter intervals on fixed or floating bridges, and speed is restricted to 15 mph. Sudden stopping or acceleration is forbidden.

In a caution crossing, vehicles with a classification exceeding the capacity of the bridge by 25 percent are allowed to cross under strict traffic control, The caution class number of standard freed or floating bridges may be obtained from FM 5-34, TC 5-210, or other appropriate TMs. Caution crossings require the vehicle to remain on the centerline and maintain a 50-meter distance from other vehicles. They also require vehicles not to exceed 13 kph (8 mph), not to stop, not to accelerate, and not to shift gears on the bridge.

A risk crossing may be made only on standard, prefabricated freed and floating bridges. Risk crossings are made only in the greatest emergencies. The vehicle moves on the centerline and is the only vehicle on the bridge. It does not exceed 5 kph (3 mph), does not stop, does not accelerate, and does not shift gears on the bridge. The vehicle class number must not exceed the published risk class for the bridge type being crossed. After the crossing, and before other traffic is permitted, the engineer officer reinspects the entire bridge for any damage.

This appendix supplements a general description of crossing means discussed in Chapter 4. It provides a pictorial review as well as equipment capability tables useful in selecting crossing means and planning crossing operations.

Available crossing means dictate both crossing operations and the force buildup rate on the far shore. Since the available crossing means often limits his options, the commander must understand the transportation of forces across the water before developing his tactics.

The military means to cross a river are –

- Fording vehicles.
- Boats.
- Aircraft.
- Amphibious vehicles.
- Rafts.
- Bridges.

FORDING VEHICLES

Combat vehicles can ford shallow rivers that have limited stream velocity and stable beds. Some vehicles have kits to increase fording depth. Fording is possible for stream velocity less than 1.5 meters per second. Riverbeds at fording sites must be firm and free of large rocks and other obstructions. Vehicle operator manuals contain specific depth capabilities and required adaptations.

Boats

Pneumatic assault boats are the primary crossing means for dismounted infantry and accompanying elements. For light infantry, assault boats may be the only means required if air resupply is available. They carry 12 assault troops and a two-man engineer crew in a silent or powered crossing.

Aircraft

Army aircraft are an alternative to assault boats for dismounted infantry. They give the force the capability to concurrently seize objectives from the exit bank out to the bridgehead line. Helicopters also lift other

crossing assets from rear areas to the river and carry essential combat support and critical resupply across the river.

Amphibious Vehicles

Some combat vehicles can swim. Bank entry and exit points must be clear of obstructions and have slopes consistent with vehicle capabilities. Current velocity sets limits. Crews of amphibious vehicles prepare and inspect each vehicle before entering the water. Engineer assistance, including recovery vehicles and standing cables, maximizes swimming opportunities.

Rafts

Heavy rafts are often the initial crossing means for tanks and other fighting vehicles. They are faster to assemble than bridges and can operate from multiple sites to reduce their vulnerability. The two types of heavy rafts currently available are ribbon and M4T6. The LTR supplements heavy rafts for vehicles under MLC 16.

Bridges

Rafts alone cannot handle the total volume of traffic in the needed time. Floating bridges are the primary means to rapidly cross the force and its supplies. The same units that provide heavy rafts also provide float bridges. They often assemble bridges from the rafts used earlier. Ribbon, M4T6, and Class 60 bridges are currently available.

The ribbon bridge is the primary assault bridge because it is quick to assemble. The M4T6 bridge replaces the ribbon bridge, which continues to move forward with the advancing force. Because it is manpower-intensive, the M4T6 is slower to assemble than the ribbon bridge. Preassembly of M4T6 floats in rear areas significantly reduces final assembly time on the river. The Class 60 bridge supplements M4T6 bridges. It is an old system still available in some depots; however, it is labor-intensive and requires an air compressor and a crane.

Fixed bridges rest on the river banks and intermediate supports instead of floating on the water. They span ravines as well as rivers. They have limited use for the initial assault, because they are slow to assemble and vulnerable to threat action. Where appropriate, they supplement or replace float bridges. Engineers also use fixed bridges to repair existing damaged bridges. The M2 Bailey bridge and medium girder bridge (MGB) are currently available. The AVLB can be used to cross short gaps.

Equipment Characteristics Chart

Equipment	Allocation	Transportation	Capabilities	Assembly/ Propulsion	Remarks/ Limitations
Pneumatic 15-man assault boat	L-series TOE provides: 18 per Div Ribbon Bridge Co. 27 per Corps Float Bridge Co. 9 per Sep Bde Engr Co. 27 per Corps Ribbon Bridge Co. 80 per Assault Boat Team. 21 per MGB Co. 21 per M2 Co.	20 deflated boats per 2 1/2-ton truck. Inflated boat is an 8-man carry. Deflated boat weighs 290 pounds.	Carries: 12 Infantrymen and 3 Engrs with paddles. or 12 Infantrymen and 2 Engrs with OBM. or 3,375 pounds of equipment.	Inflation time is 5 to 10 minutes with pumps. Paddled speed is 1.5 MPS (5 fps). Speed with OBM is 4.5 MPS (15 fps).	Maximum current velocity with paddle is 1.5 MPS (5 fps). 3 pumps, 11 paddles per boat. OBMs must be requested separately. 20-percent exit slope desired.
Pneumatic 3-man reconnaissance boat	L-series TOE provides: 3 per Combat Engr Co. 18 per Corps Float Bridge Co. 12 per Div Ribbon Bridge Co. 18 per Corps Ribbon Bridge Co.	Carried by backpack (1-man carry). Boat and backpack weigh 57 pounds.	Carries: 3 soldiers with equipment. or 675 pounds of equipment.	Inflation time is 5 minutes with a pump. Paddle speed is 1.0 MPS (3 fps).	Maximum current velocity is 1.5 MPS (5 fps). 1 pump 3 paddles per boat. No provisions for OBMs.
Armored personnel carrier (APC)	J-series TOE provides: 12 per Engr Co of Div Engr Bn. 1 per Inf Co (Mech) (BIFV). 14 per Inf Co (Mech) (M113). 9 per Armored Engr Co (ERI).	Self-propelled. Class 13 vehicle.	Carries: 12 soldiers with equipment.	Preparation time for swimming is 10 minutes. Track propulsion in the water. Swim speed is 1.6 MPS (5.3 fps). Can ford up to 1.5 meters (5 feet).	Maximum current velocity is 1.5 MPS (5 fps). Drift (meters) = $\frac{\text{current}}{1.6} \times$ river width (meters)
Bridge erection boat - shallow draft (BEB-SD)	L-series provides: 12 per Div Ribbon Bridge Co. 15 per Corps Ribbon Bridge Co. 18 per Corps Float Bridge Co (M4T6).	Carried by: One 5-ton bridge truck with cradle. or One medium-lift helicopter. Boat weighs 8,800 pounds.	Carries a 3-man crew and: 12 soldiers with equipment. or 4,400 pounds of equipment.	Launch time from the cradle is 5 minutes.	Draft: 22 inches for normal operations. 26 inches when fully loaded. 48 inches for launch from the cradle.
27-foot bridge erection boat (BEB)	L-series provides: 12 per Div Ribbon Bridge Co. 15 per Corps Ribbon Bridge Co. 18 per Corps Float Bridge Co (M4T6). *Note: Units will normally have either the BEB-SD or the 27-foot BEB.*	Carried by: One 5-ton bridge truck with cradle. or One 2 1/2-ton truck with pole trailer. or One medium-lift helicopter when procedures are certified.	Carries a 3-man crew and: 9 soldiers with equipment. or 3,000 pounds of equipment.	Launch time from the cradle is 5 minutes. Launch time from the 2 1/2-ton truck when using a crane or wrecker is 5 minutes. Maximum speed is 15 knots.	Draft is 40 inches.
Bradley infantry fighting vehicle (BIFV)	J-series TOE provides: 13 per Inf Co (Mech) (BIFV). 12 per Cav Troop of an ACR. 19 per Cav Troop of a Div Cav Squadron.	Self-propelled. Class 24 vehicle.	Carries: 10 soldiers with equipment.	Preparation time for swimming is 18 minutes. Track propulsion in the water. Swim speed is 2 MPS (6 fps). Can ford up to 3.5 feet (1.07 meters).	Maximum current velocity is 0.9 MPS (3 fps). Drift (meters) = $\frac{\text{current (MPS)}}{2} \times$ river width (meters) Drift (feet) = $\frac{\text{current (fps)}}{6.6} \times$ river width (meters)

Raft Crossing Capabilities

River width (feet)	246	328	410	492	610	738	861	964	1148	1312	1476	1640	1968	2296	2824	2952	3280	3808	3936
River width (meters)	75	100	125	150	188	225	263	300	350	400	450	500	600	700	800	900	1000	1100	1200
Minutes per round trip	7	8	9	10	11	12	14	16	18	20	22	24	26	29	32	35	38	41	45
Round trips per hour	8	7	6	6	5	5	4	3	3	3	2	2	2	2	1	1	1	1	1
Number of rafts per centerline	1	1	1	2	2	2	3	3	4	5	5	5	6	6	6	6	6	6	6

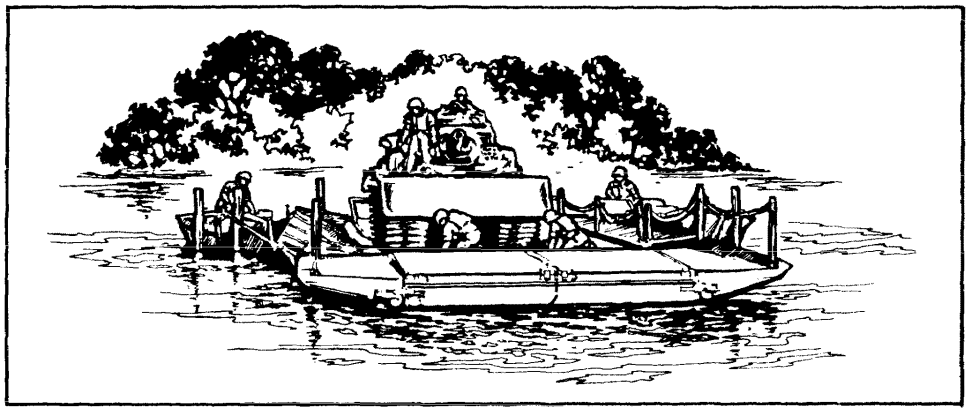
Notes:
1. This table is valid for ribbon, M4T6, Class 60, and LTR rafts in currents up to and including 1.5 MPS (5 FPS). This data assumes use of experienced crews under ideal conditions.
2. Round trip times include the times required to load and unload the raft.
3. Crossing times will take 50 percent longer at night.
4. If the river width falls between 2 columns, use the value found in the next higher column.

Boat/Raft Planning Factors

Equipment	Characteristic	River Width (1.5 MPS Velocity) Velocity		
		75 meters	150 meters	300 meters
Pneumatic assault boat with OBM	Minutes per round trip Trips per hour	3 20	4 15	5 12
Pneumatic assault boat without OBM	Minutes per round trip Trips per hour	4 15	6 10	10 6
Rafts (LTR, M4T6, and ribbon)	Minutes per round trip Trips per hour Rafts at each site	7 8 1	10 6 2	16 3 3

Notes:
1. Factors are average based on load/unload time and safety.
2. Planning times are for stream velocities up to 1.5 MPS for faster stream velocities, classification must be reduced to caution or risk crossings, and an engineer analysis must be made of actual site conditions before planning times may be assessed.

Ribbon Raft



Launch Restrictions			
	Free Launch	**Controlled Launch**	**High-Bank Launch**
Minimum depth of water required *centimeters* (inches)	Ramp bay 112 (44) Interior bay 92 (36) *	76(30)**	76(30)**
Bank height restrictions *meters (feet)*	0-1.5 (0-5)	0	1.5-8.5 (5-28)
Bank slope restrictions	0-30 percent	0-20 percent	Level ground unless the front of the truck is restrained

* The launch is based upon a 10-percent slope with the transporter backed into the water. The required water depth for a 30-percent slope with a 5-foot bank height is 183 centimeters (72 inches). Interpolate between these values when needed.

** This is recommended water depth. Launch could technically be conducted in 43 centimeters (17 inches) water.

Allocation of Ribbon Bridge (L-Series TOE)		
	Division Ribbon Company*	**Corps Ribbon Company**
Number of bridge platoons	2	3
Number of interior bays	20	30
Number of ramp bays	8	12
Number of bridge erection boats	12	15
Longest bridge that can be constructed meters (feet)	148 (485)	215 (705)

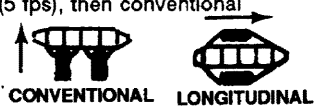
*The ribbon company will be eliminated from all active-component divisions by the end of FY 93 as a result of ERI.

Ribbon Raft (Cont.)

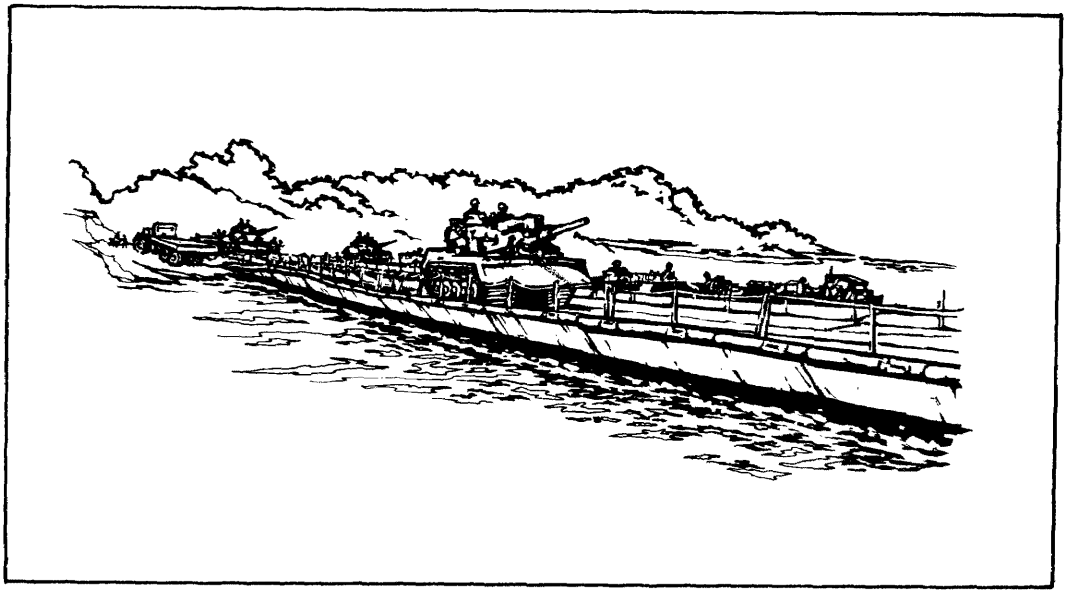
Ribbon Raft Design											
Capabilities	**Assembly Time (in minutes)**	**Load Space**	**Current Velocity (MPS/fps) and Load Class**								
Raft	(increases by 50 percent at night)	meters (feet)		0-.9 0-3	1.2 4	1.5 5	1.75 6	2 7	2.5 8	2.7 9	3 10
3 bay (2 ramps/ 1 interior	8	6.7 (22)	L C	45 45	45 45	45 35	40 25	40 15	35 10	30 0	25 0
4 bay (2 ramps/ 2 interiors)	12	13 (44)	L C	70 60	70 60	70 60	60 55*	60 40*	60 30*	55 15*	45 0
5 bay (2 ramps/ 3 interiors)	15	20.1 (66)	L C	75 75	75 70	75 70	70 70*	70 60*	70 50*	60 25*	60 0
6 bay (2 ramps/ 4 interiors) wheeled/tracked	20	26.8 (88)	L C	96/ 80 96/ 70	96/ 80 96/ 75	96/ 80 96/ 70	96/ 70 70/ 70	96/ 70 70/ 70	96/ 70 55/ 55	70/ 70 30/ 30	70/ 70 0

*Three BEBs are required for conventional rafting of 4.5 or 6 bay rafts in currents greater than 1.5 MPS (5 fps).

Notes:
1. When determining raft classification, L refers to the longitudinal rafting and C refers to conventional rafting.
2. If the current velocity in the loading/unloading area is greater than 1.5 MPS (5 fps), then conventional rafting must be used.
3. The roadway width of a ribbon raft is 4.1 meters (13 feet 5 inches).
4. The draft of a fully loaded ribbon raft is 61 centimeters (24 inches).
5. Never load vehicles on ribbon ramp bays. Only interior bays may be loaded.
6. Each raft requires a minimum of two BEBs for propulsion.



Ribbon Bridge



Number of Boats Needed for Anchorage of a Ribbon Bridge	
Current Velocity (MPS/fps)	**Number of Boats: Number of Bridge Bays**
0 to 1.8/0 to 6	1:6
2.1 to 2.5/7 to 8	1:3
2.7/9	1:2
Over 2.7/Over 9	Bridge must be anchored using an overhead cable system
Anchorage of ribbon bridges is normally accomplished by tying BEBs to the downstream side of the bridge. The number of boats required is shown in the table.	

Bridge Design

The number of interior bays =

$$\frac{\text{Gap (meters)} - 14}{6.7}$$

OR

$$\frac{\text{Gap (feet)} - 45}{22}$$

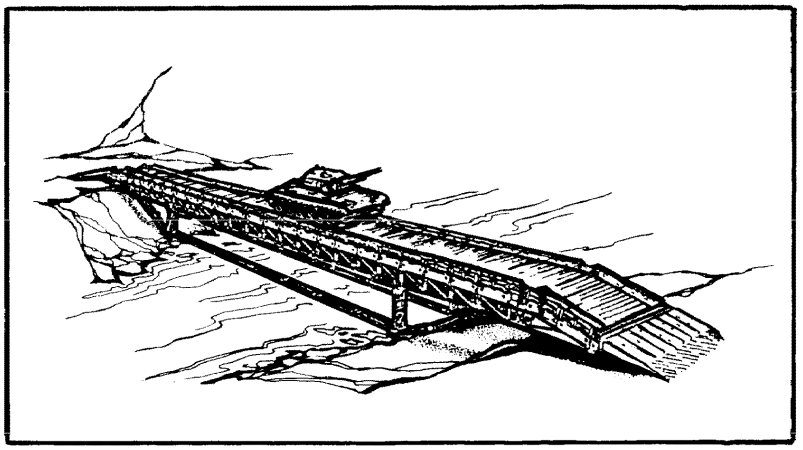
Notes:
1. Two ramp bays are required for all ribbon bridges.
2. During daylight hours, a ribbon bridge can be constructed at the rate of 200 meters (600 feet) per hour. Reduce by 50 percent at night.
3. Bridge can cross 200 vehicles per hour with 30 meters spacing at 16 kilometers per hour.

Determination of Bridge Classification

Type of Crossing	Current Velocity (MPS/fps) and Load Class							
meters feet	0-.9 0-.3	1.2 4	1.5 5	1.75 6	2 7	2.5 8	2.7 9	3 10
Normal (wheeled/tracked)	96/ 75	96/ 75	96/ 70	96/ 70	82/ 70	65/ 60	45/ 45	30/ 30
Caution (wheeled/tracked)	105/ 85	105/ 85	100/ 80	100/ 80	96/ 80	75/ 65	50/ 50	35/ 35
Risk (wheeled/tracked)	110/ 100	110/ 95	105/ 90	105/ 90	100/ 90	82/ 75	65/ 65	40/ 40

Medium Girder Bridge

Allocation and Transportation
1. Four bridge sets per corps MGB company. 2. Two reinforcement sets per corps MGB company. 3. Two erection sets per corps MGB company. 4. Each MGB set requires seven 5-ton dump trucks and seven 4-ton bolsters for transportation. 5. Each link reinforcement set requires one 5-ton dump truck and one 4-ton bolster trailer for transportation. 6. Each erection set requires one 5-ton dump truck and one 4-ton bolster trailer for transportation.



Work Parties for MGB	
Bridge Length	**Work Party**
4 and 5 bay SSB (26 to 32 feet or 7.9 to 9.8 meters)	1 NCO and 8 personnel
6 through 12 bay SSB (38 to 50 feet or 11.6 to 15.2 meters)	1 NCO and 16 personnel
All DSBs	1 NCO and 24 personnel
Anchorage party for DSBs (if required)	8 personnel
Link reinforcement party	8 personnel

SSB Length and Classification			
Bridge Length		Number of Bays	Military Load Classification
Feet	Meters		
26	7.9	4	60
32	9.8	5	60
38	11.6	6	40
44	13.4	7	30
50	15.2	8	30
56	17.1	9	24
62	18.9	10	20
68	20.7	11	16
74	22.6	12	16

Medium Girder Bridge (Cont.)

Building Times (Good Conditions)											
Bridge Type	**Single Story**			**Double Story without LRS**					**Double Story with LRS**		
Bridge Size	5 bay	8 bay	12 bay	4 bay	8 bay	12 bay	18 bay	22 bay	13 bay	18 bay	22 bay
Daylight (hours)	0.50	0.75	1.00	0.75	1.00	1.50	1.75	2.00	2.00	2.75	3.00
Night (hours)	0.75	1.00	1.25	1.25	1.50	2.00	2.75	3.00	3.00	4.00	4.50

Notes:
1. 25-meter by 20-meter assembly site required.
2. Only MGB company personnel required for assembly/disassembly.
3. Increase time 20 percent for untrained troops.
4. Increase time 30 percent for inclement weather.

DSB length and Classification				
Bridge Length		**2E + Number of Bays**	**MLC**	
Feet	Meters		without LRS	with LRS
37	11.3	1	60	
43	13.1	2	60	
49	14.9	3	60	
55	16.8	4	60	
61	18.6	5	60	
67	20.4	6	60	
73	22.3	7	60	
79	24.0	8	60	
85	26.9	9	60	
91	27.7	10	60	
97	29.6	11	60	
103	31.4	12	60	
109	33.2	13	50	60
115	35.1	14	50	60
121	36.9	15	40	60
127	38.8	16	40	60
133	40.5	17	30	60
139	42.5	18	30	60
145	44.2	19	24	60
151	46.0	20	24	60
157	47.9	21	20	60
163	49.7	22	16	60

Light Tactical Raft

Allocation and Transportation

1. Six sets per corps float bridge (H-series).
2. Six sets per LTR team (L-series).
3. One set has four pontoons and four deck bays.
4. One set is transported on two 2 1/2-ton trucks and on one pole trailer.
5. Each bay is 3.35 meters (11 feet) long and weighs 2,850 pounds.

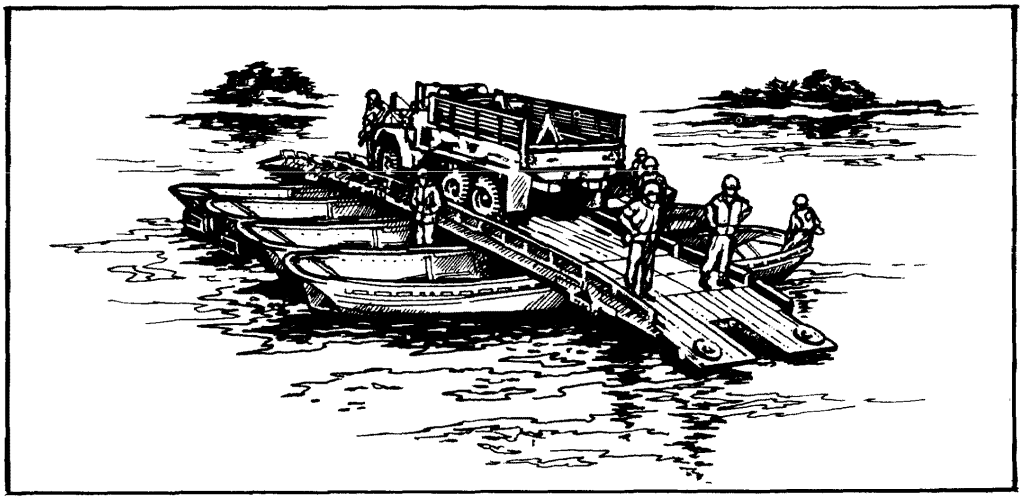
Notes:
1. Refer to TC 5-210 for methods of construction.
2. Articulators allow the ramps to be adjusted up 1 meter (41 inches) or down .48 meters (19 inches).
3. Roadway width is normally 9 feet.
4. All classifications are based on a normal crossing.
5. Construction times increase by 50 percent at night.
6. The draft of an LTR raft with outboard motors is 61 centimeters (24 inches).
7. To determine the number of LTR sets required to bridge a given gap, use the formula:

$$\frac{\text{Gap (meters)}}{14} = \text{Number of sets}$$

OR

$$\frac{\text{Gap (feet)}}{44} = \text{Number of sets}$$

8. 10 meters (33 feet) x 15 meters (50 feet) area needed for assembly.



Methods of Propulsion

Type	Draft	Restrictions
Outboard motors (25 or 40 HP)	24 inches	4 per LTR set
BEB, shallow draft 27-foot BEB	22 inches 40 inches	Availability of boats
Tow lines	Path across the river must be free of obstructions	Current must be slow (0 to 3 fps)
Ferry systems (trail or flying)	Path across river must be free of obstructions	Current must be fast

Light Tactical Raft (Cont.)

Raft/Bridge Design and Classification								
Raft	Assembly Time	Load Space	Current Velocity (MPS/fps) and Load Class					
		meters (feet)	1.5 5	2 7	2.5 8	2.75 9	3 10	3.5 11
4 pontoon/3 bay with articulators	30 minutes	9.15 (30)	12	12	12	8	4	0
4 pontoon/3 bay without articulators	25 minutes	9.15 (30)	16	16	12	8	4	0
4 pontoon/4 bay with articulators	36 minutes	12.5 (41)	10	10	10	6	2	0
5 pontoon/5 bay with articulators	40 minutes	15.85 (52)	9	9	9	8	5	2
5 pontoon/5 bay without articulators	35 minutes	15.85 (52)	16	14	11	8	5	2
6 pontoon/4 bay with articulators	45 minutes	12.5 (41)	13	13	13	13	12	5
6 pontoon/4 bay without articulators	45 minutes	15.85 (52)	18	18	18	18	12	6
Bridge	150 feet per hour 45.7 meters per hour	NA	16	13	11	8	5	2

Bridge Design

Floats (bays) required for normal bridges are-

$$\left(\frac{\text{Gap (meters)} + 2}{4.6}\right) \times 1.1$$

OR

$$\left(\frac{\text{Gap (feet)} + 2}{15}\right) \times 1.1$$

Round up to the nearest whole number.

Floats required for reinforced bridges are-

$$\frac{\text{Gap (meters)}}{3} \times 1.1$$

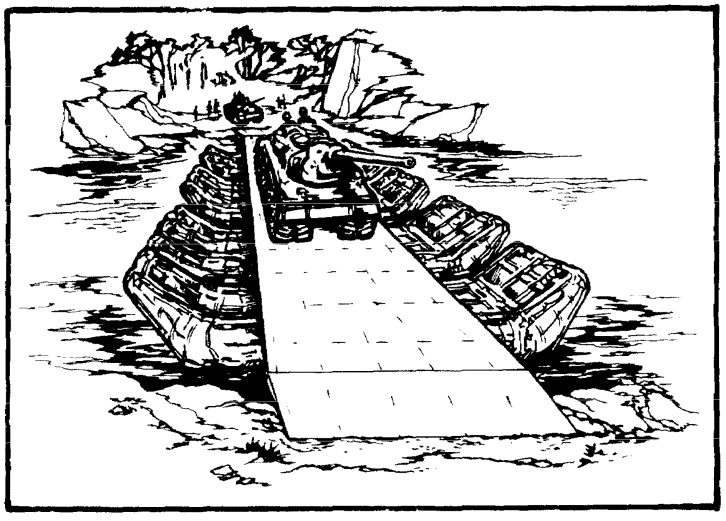
OR

$$\frac{\text{Gap (feet)}}{10} \times 1.1$$

Round up to a number divisible by 3.

Note: For reinforced bridges, two-thirds of the total number of floats must be equipped with offset saddle adaptors.

M4T6 Bridge



Determination of Site and Personnel Requirements			
Length for Normal Assembly meters (feet)	**Units Needed for Assembly**	**Number of Assembly Sites**	**Time (hours)**
45.5 (150)	1 company	2	4
61 (200)	1 company	2	5
76 (250)	1 company	2	6
91.5 (300)	2 companies	3	4
106.5 (350)	2 companies	3	5
122 (400)	2 companies	4	5.5
152 (500)	2 companies	5	6
183 (600)	3 companies	6	4
213 (700)	3 companies	6	5 to 7
244 (800)	3 companies	6	6 to 8
305 (1,000)	3 companies	6	7 to 10
366 (1,200)	3 companies	6	8 to 12

Notes:
1. Refer to TC 5-210 for methods of constructing M4T6 bridges.
2. Increase construction times by 50 percent for reinforced bridges.
3. Increase all construction times by 50 percent at night.
4. Draft of an M4T6 bridge is 101.6 centimeters (40 inches).

Allocation and Transportation

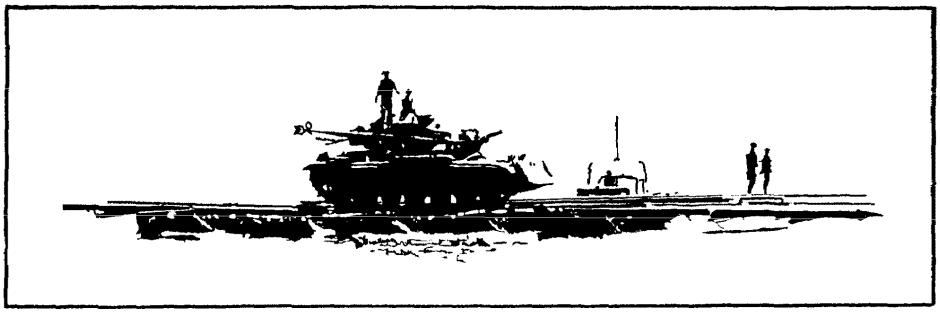
1. Each series corps float bridge company (M4T6) has six sets of M4T6 and 18 BEBs.

2. One set provides-

141 feet (43 meters) normal bridge
or
96 feet (29 meters) reinforced bridge
or
one 4-float normal raft
or
one 5-float normal raft
or
one 4-float reinforced raft and one 5-float reinforced raft
or
one 6-float reinforced raft

3. The M4T6 is normally transported using 5-ton bridge trucks. One bay of bridge, disassembled, can be loaded on one 5-ton truck. Bays can also be preassembled and flown to the river, using medium-lift helicopters.

M4T6 Raft

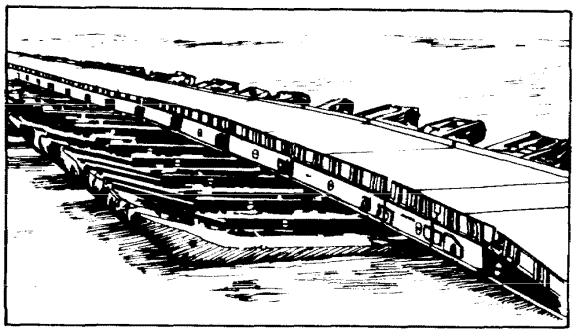


M4T6 Raft Design and Classification						
Current Velocity (MPS/fps) and Load Class						
Raft	**Load Space** meters (feet)	1.5 5	2 7	2.5 8	3.5 11	**Assembly Times**
4-float normal	15.7/51.6 (wheeled/tracked)	50 55	45 50	40 45	30 35	Per 4-float raft: -5 bridge trucks -2 BED-SD -1 platoon, 2 1/4 hours (when preassembled, 1 1/2 hours)
4-float reinforced	11.6/38.3 (wheeled/tracked)	50 55	50 55	45 50	35 40	
5-float normal	20.3/66.6 (wheeled/tracked)	55 60	50 55	45 50	35 40	Per 5-float raft: -6 bridge trucks -2 BED-Sd -1 platoon, 3 hours (when preassembled, 1 1/2 hours)
5-float reinforced	15.2/50 (wheeled/tracked)	60 65	60 65	55 60	45 50	
6-float reinforced	16.2/53.3 (wheeled/tracked)	65 70	65 70	65 70	45 50	Per 6-float raft -7 bridge trucks -2 BED-SD -1 platoon, 3 3/4 hours (when preassembled, 1 3/4 hours)
Notes: 1. Refer to TC 5-210 for methods of constructing M4T6 rafts. 2. Roadway width of an M4T6 raft is 4.2 meters (13 feet 10 inches). 3. Draft of a fully loaded M4T6 raft is 66 centimeters (29 inches). 4. Construction times increase by 50 percent at night.						

Bridge Classifications									
M4T6 Bridge, Normal					**M4T6 Bridge, Reinforced**				
Crossing Type	**Current Velocity (MPS/fps) and Load Class**				**Crossing Type**	**Current Velocity (MPS/fps) and Load Class**			
	1.5/ 5	2/ 7	2.5/ 8	3.5/ 11		1.5/ 2	2/ 7	2.5/ 8	3.5/ 11
Normal (wheeled/tracked)	45/ 55	40/ 50	35/ 45	25/ 30	Normal (wheeled/tracked)	75	70/ 75	65/ 70	27 30
Caution (wheeled/tracked)	58/ 59	54/ 55	49/ 51	35/ 37	Caution (wheeled/tracked)	80	79	73/	43 45
Risk (wheeled/tracked)	66/ 67	62/ 63	59/ 60	43/ 45	Risk (wheeled/tracked)	90	90	87	59 60

Class 60 Floating Equipment

Allocation and Transportation
1. Five sets in a Class 60 float bridge company. 2. One set has 41 meters (136 feet) of bridge. 3. One disassembled bay per 5-ton bridge truck. 4. Two BEBs per set. 5. 40-meter by 40-meter (120-foot by 120-foot) assembly area. 6. Varied assembly time, according to experience. 7. Roadway width of 4.1 meters (13 feet 6 inches). 8. Air compressor, crane, and BEBs for each raft/bridge construction site.



Raft Design

Raft Type	Load Space meters (feet)	Classification Based on Current Velocity			
		1.5 MPS 3 fps	2 MPS 7 fps	2.5 MPS 8 fps	3.5 MPS 11 fps
4-float normal (wheeled/tracked)	15 (51)	40/45	40/45	35/40	25/30
5-float normal (wheeled/tracked)	20 (66)	50/55	50/55	45/50	30/35
5-float reinforced (wheeled/tracked)	15 (51)	55/60	50/55	50/55	35/40
6-float reinforced (wheeled/tracked)	16 (54)	65/75	65/75	60/70	50/55

Notes:
1. One set makes only one raft.
2. The draft of a fully loaded raft is approximately 29 inches (.75 meters).

Bridge Bay Requirements

Class 60 Bridge with Normal End Span	Class 60 Bridge with Reinforced Span
Number of bays = $\frac{Gap(meters)}{4.6} \times 1.1$ *OR* $\frac{Gap(feet)}{15} \times 1.1$ *Round final answer up to the next whole bay/float.*	Number of bays = $\frac{Gap\ (meters) + 2}{4.6} \times 1.1$ *OR* $\frac{Gap\ (feet) + 2}{15} \times 1.1$ *Round final answer up to the next whole bay.*

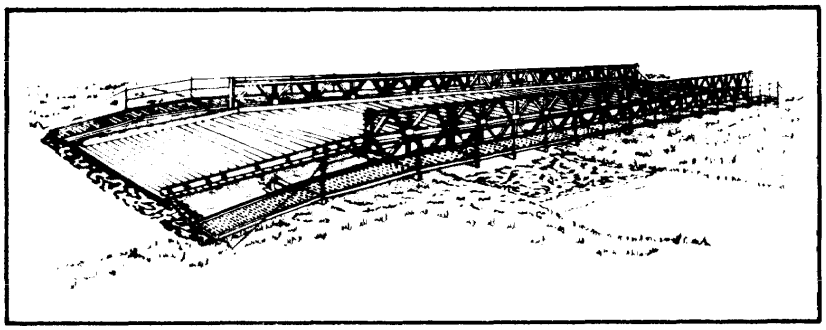
Class 60 Floating Equipment (Cont.)

Bridge Classification				
Class 60 Bridge with Normal End Span				
Crossing Type	1.5 MPS 5 fps	2 MPS 7 fps	2.5 MPS 8 fps	3.5 MPS 11 fps
Normal (wheeled/tracked)	55/55	45/55	40/50	22/25
Caution (wheeled/tracked)	60/60	56/60	52/56	34/37
Risk (wheeled/tracked)	67/60	67/70	62/67	46/50
Class 60 Bridge with Reinforced End Span				
Normal (wheeled/tracked)	55/65	45/55	40/50	22/25
Caution (wheeled/tracked)	62/67	56/61	52/56	34/37
Risk (wheeled/tracked)	72/77	67/72	62/67	46/50

Notes:
1. Bridge classifications assume the use of 15-foot end sections. For longer end sections, refer to TC 5-210.
2. For risk and caution crossing information, refer to TC 5-210.
3. Assembly times increase by 50 percent at night.

Bridge Assembly Requirements			
	0 to 250 feet (0 to 75 meters)	250 to 525 feet (76 to 160 meters)	526 to 1,000 feet (161 to 300 meters)
Assembly time	3 hours	3 to 5 hours	5 to 8 hours
Number of bridge sets	2	5	8
Manpower (combat engineer company)	1	2	5
Number of sites	2	3 to 5	6

M2 Bailey Bridge



Allocation/Transportation
1. One set per corps panel bridge company. 2. One set requires twenty-nine 5-ton dump trucks for transportation.

Estimated Time for Assembly									
Span (feet)	Type of Construction								
	SS	DS	TS	DD	TD	DT	TT	DT	TT
	Time (hours)								
	Construction by manpower only							One crane	
40	1 1/2								
60	1 3/4	2							
80	2	2 1/2	3						
100	2 1/4	3	3 1/2	4 1/4					
120		3 1/2	4	5	6 3/4				
140		3 3/4	4 1/2	5 3/4	7 1/2	11 1/4		10 1/2	
160			5	6 1/4	8 1/2	13 1/4	19	11 3/4	16 1/4
180				7	9 1/2	14 3/4	21 1/4	13 1/4	18 1/4
200						16 1/4	24	14 1/2	20 1/2

Notes:
1. 20-meter by 30-meter assembly site required.
2. Assembly crew required in addition to bridge company personnel.
3. See FM 5-34 or TM 5-277 for more information.

M2 Bailey Bridge (Cont.)

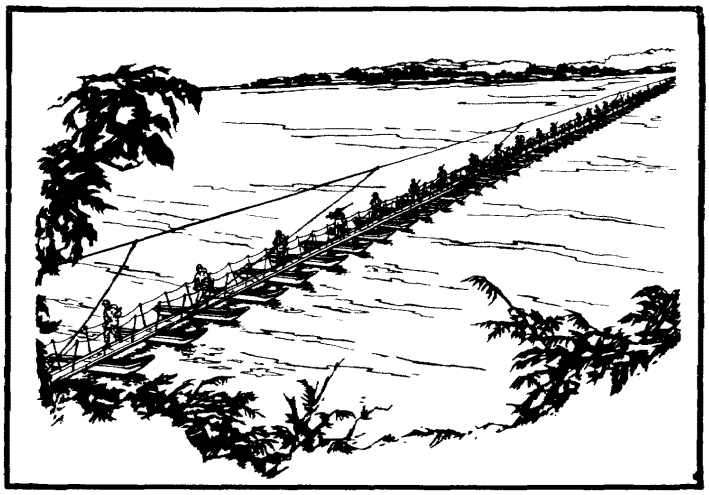
CLASSES OF BAILEY BRIDGE M2

(BY TYPE OF CONSTRUCTION AND TYPE OF CROSSING)

TYPE OF CONSTRUCTION	RATING	SPAN (FT)																			
		30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	210
SS	N	30	24		20	20	16	12	8											
		30		24																
	C	42	36	33	30	24	20	16	12											
		37	34	31	29															
	R	47	40	36	33	30	24	19	14											
		42	38	35	32	30														
DS	N			75	75	60	50	40	30	20	16	12	8							
				70	65	60	55	45	30											
	C			83	77	68	60	50	37	30	23	18	14							
				76	73	69	60	50	39	32										
	R			88	85	78	66	55	42	34	27	21	17							
				84	79	75	64	55	44	36	30									
TS	N						85	65	50	35	30	20	16	12	8	4				
							80	65	55	40	35									
	C						95	74	57	47	38	31	24	18	15	10				
							90	75	60	49	41	33								
	R						100*	82	64	52	43	35	29	22	17	13				
							90*	82	66	54	45	38	31							
DD	N								80	65	45	35	30	24	16	12	8			
									80	70	55	45	35							
	C								86	72	57	47	39	32	25	19	15			
									90	76	61	50	42	35						
	R								96	80	64	53	44	36	30	24	18			
									90	83	68	56	48	40	33					
TD	N									90	75	55	45	35	30	20	16	12		
										90*	80	60	55	45	35					
	C									100*	83	65	57	47	37	31	24	18		
										90*	90*	72	62	51	41	34				
	R									100*	91	74	64	54	45	37	29	22		
										90*	90*	80	70	58	48	40	32			
DT	N											70	70	60	55	45	35	30	20	16
												80	70	60	55	50	45	35		
	C											80	80	77	69	57	48	39	32	25
												90*	90*	85	78	64	58	43	36	
	R											90	88	85	80	64	55	46	38	31
												90*	90*	90*	89	74	60	51	43	35
TT	N														80	70	55	45	35	24
															75	70	60	55	40	
	C														100	80	66	59	48	38
															90*	90*	75	66	52	43
	R														100*	90	77	68	55	46
															90*	90*	87	77	62	51

Notes: N = Normal C = Caution R = Risk
1. Upper figure represents wheeled-load class, limited by roadway width.
2. Lower figure represents tracked load class.

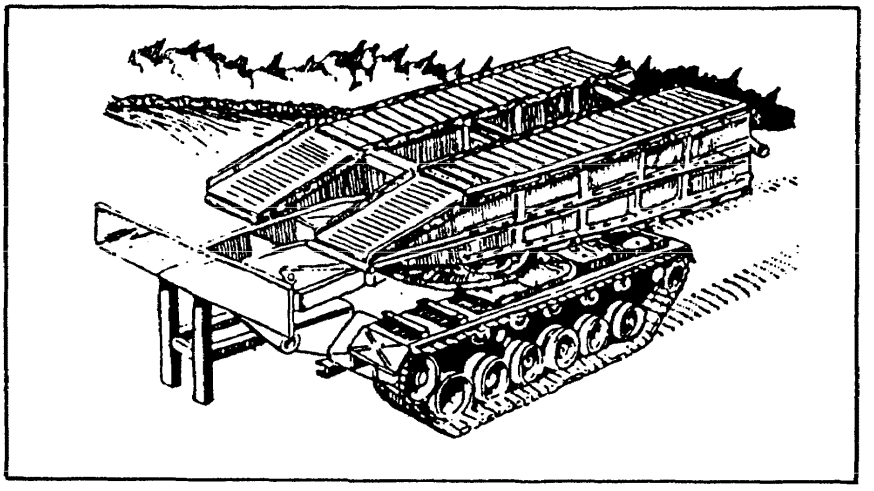
Aluminum Foot Bridge



Allocation/Transportation
One set provides- 472.5 feet of normal footbridge or 100 feet of expedient light-vehicle bridge or 14 expedient three-pontoon rafts

Assembly Time	
Daylight	15 minutes plus 1 minute per each 15 feet of bridge
Night with illumination or moonlight	20 minutes plus 1 1/4 minute per each 15 feet of bridge
Blackout	30 minutes plus 2 minutes per each 15 feet of bridge
The time includes installation of anchor cables and deadmen. These figures are based on trained and experienced troops assembling from stockpiled parts. Allow additional time for assembly from trucks for any anticipated anchorage difficulties, enemy interference, or other delaying factors.	

Armored Vehicle Launched Bridge (AVLB)



Allocation	Transportation	Emplacement	Capacity Class	Limitations/Remarks
Engineer battalion of armor/infantry/infantry (M) division: 4 launchers 6 bridges Engineer company of armor/infantry (M) separate brigade: 3 launchers 3 bridges	Bridge carried on launcher (modified) M48A5 or M60A1 chassis. Spare bridge folded on low-bed trailer (25-ton) with 10-ton tractor. Bridge weighs 15 tons.	Launched in 2 to 5 minutes by buttoned-up 2-man crew. Retrieved from either end. One man exposed to guide and connect. Vehicle turning in soft earth within 5 meters of bridge ends limits retrieval.	Class 60 vehicle 19.2 meters (63 feet)* AVLB spans, 18.3 meters (60 feet) using prepared abutments 17.4 meters (57 feet) using natural earth	M48A and M60A1 are diesel. Scissors launch requires 10 meters or 32 feet overhead clearance. Maximum launch slope: 28 percent uphill 19 percent downhill 11 percent side slope
*For crossings that exceed MLC 60, see current safety of use message.				

Ice Bridging

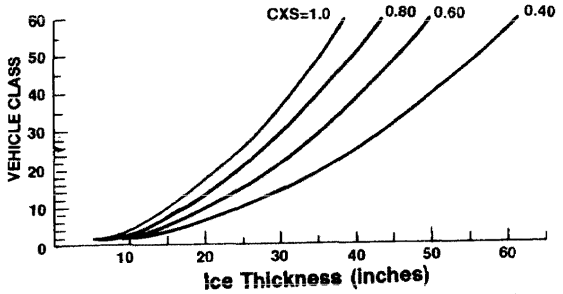
Bridge Width Determination

Vehicle class		Recommended Bridge Width (Effective Flood Area) and Vehicle Spacing (feet)
Wheeled	Tracked	
1	1	90
2	2	120
3	4	150
4	5	180
5	6	195
6	7	205
7	9	220
8	10	230
9	11	240
10	12	250
11	14	260
12	15	270
13	17	280
14	18	290
16	20	300
18	22	310
20	25	320
22	27	330
24	30	340
26	32	350
28	35	360
30	37	380
35	45	400
40	50	430
45 and over	55 and over	460

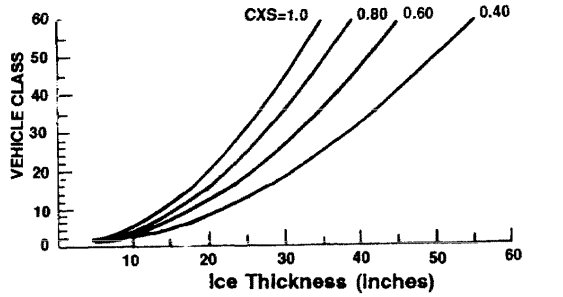
Recommended bridge widths for ice supported by water (extracted from SIPRE Report 36)

Strength Factor

S = 1	Ice is solid, and temperatures have remained at or below freezing for the previous week.
S = .9	Ice is solid, and temperatures have been above freezing during the day but drop below freezing during the night.
S = .7	Ice is not solid, and water or air pockets are found in between layers of ice.
S = .6	An air pocket is under the ice, so the ice is not floating on the water underneath.



Required ice thickness for wheeled vehicles.



Required ice thickness for tracked vehicles.

Color Factor

C = 1 Ice is clear (transparent)
C = .9 Ice is semiclear
C = .8 Ice is white
C = .7 Ice is discolored (stained brown or yellow)

Ice Depth Requirements

Personnel	Ice Thickness Requirements (inches)		
	Strong C = 1, S = 1	Medium C = 0.8, S = 0.8	Weak C = 0.7, S = 0.6
On skis	1.5	2	3
In file with 2-meter interval	3	4	5
On snowmobile	3	4	5

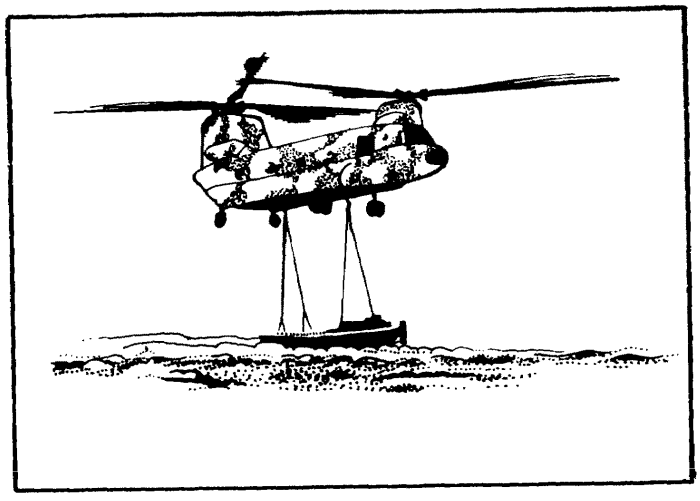
Determining the Class of Ice

$$\text{Class (wheeled)} = \frac{T^2 \times C \times S}{25}$$

$$\text{Class (tracked)} = \frac{T^2 \times C \times S}{20}$$

T = Ice thickness in inches
C = Color factor (see color factor chart)
S = Strength factor (see strength factor chart)

Helicopters



Typical External Loads		
Equipment	**Weight (pounds)**	**Remarks**
M4T6 fixed spans 23 feet 4 inches, Class 100 30 feet 0 inches, Class 65 38 feet 4 inches, Class 35 45 feet 0 inches, Class 25	 12,900 15,600 18,800 20,900	Components assembled in 8-foot 4-inch and 15-foot 0-inch increments. May be transported in packages to reduce load. Load class may be increased by varying deck size
LTR Pontoon load Deck load	 6,000 10,500	Separate loads delivered to assembly site for final assembly. Combination load placed on water surface.
Pneumatic assault boat	290	Transported in bundle or inflated mode.
27-foot BEB	6,800/8,800	Also lifted in bow and stern configuration.
M4T6 float bridge components Float without deck Float with deck Two floats with partial deck	 6,700 11,700 16,900	Additional loading contained in TM 5-450-11. Loads placed on water or shore for further assembly.
Ribbon bridge bays Interior bay End bay	 11,700 12.000	Placed directly on water surface.

Glossary

AA assembly area

ACE armored combat earthmover

ACR armored cavalry regiment

ADA Air Defense Artillery

ADC assistant division commander

advance from the exit bank The third phase of a river crossing operation in which units seize and secure exit-bank and intermediate objectives to eliminate direct and observed-indirect fire into the crossing area.

advance to the river The first phase of a river crossing operation involving a deliberate attack to seize and secure the near shore of a water obstacle.

AFB assault float bridge

alt alternate

APC armored personnel carrier

AR armor

assault across the river The second phase of a river crossing operation in which units assault across a water obstacle to secure a lodgement on the far shore, eliminating direct fire on the crossing sites.

assembly area An area in which a force prepares or regroups for further action.

assy assembly

attack position The last position occupied or passed through by the assault echelon before crossing the line of departure. Within the bridgehead, it is the last position before leaving the crossing area or bridgehead line.

attack-by-fire position The location from which a force attacks an objective with direct fire.

ATTN attention

AVLB armored vehicle launched bridge

BEB-SD bridge erection boat - shallow draft

BEB bridge erection boat

BIFV Bradley infantry fighting vehicle

BMAIN brigade main command post

BMNT beginning morning nautical twilight

Bn battalion

breakout force A division's reserve force, normally a brigade or another division from corps, that attacks out of a secure bridgehead.

bridgehead force A force, normally two ground-maneuver brigades, that assaults across a river to secure the bridgehead for the passage of a breakout force.

bridgehead line In offensive river crossing operations, the limit of the objective area when developing a bridgehead.

bridgehead objective Objectives within enemy avenues of approach to the bridgehead occupied to stop the enemy from counterattacking the bridgehead. Once secured, these objectives establish a bridgehead line.

bridgehead An area on the enemy's side of the water obstacle that is large enough to accommodate the majority of the crossing force, has adequate terrain to permit defense of crossing sites, and provides a base for continuing the attack.

BTAC brigade tactical command post

Btry battery

C2 command and control

CA HQ (crossing area headquarters) A headquarters, normally the brigade main CP, that controls all crossing means, traffic control, and obscuration of the crossing area. It is normally augmented by a corps engineer battalion headquarters and elements from MP and chemical units.

CAC (crossing area commander) An individual, normally the brigade executive officer, who controls the support forces within the crossing area.

CAE (crossing area engineer) The commander of the corps engineer battalion or bridge battalion that assists the CAC in controlling engineer support within the crossing area.

call-forward area Company-size waiting areas located within the crossing area. Engineers use them to organize units into raft loads; crews use them to make final vehicle swimming preparations.

CAS close air support

Cav cavalry

CFC (crossing force commander) The individual, normally an ADC, designated by the division commander to control the lead brigades during the assault across the river to secure the bridgehead line.

CFE (crossing force engineer) The commander of a corps engineer group that provides planning support to the CFC and coordinates engineer support to the CACs.

Co company

COA course of action

const construction

CP command post

crossing area Controlled access areas that decrease congestion at the river. They are defined by brigade boundaries and phase lines (release lines) on both sides of the river.

CSC (crossing site commander) The individual, normally an engineer company commander or platoon leader, responsible for crossing units sent to a specific site. He commands the engineers operating the crossing means and the ERPs at the call-forward areas and staging areas for that site.

CSS combat service support

DA Department of the Army

DD double double

Div division

DMAIN division main command post

DREAR division rear command post

DS double single

DSB double story bridge

DT double triple

DTAC division tactical command post

EA engagement area

EEP (engineer equipment park) An area located a convenient distance from bridge and raft sites for assembly and preparation of bridge equipment and material.

EN engineer

Engr engineer

ERI Engineer Restructuring Initiative

ERP (engineer regulating point) Technical checkpoints to ensure that vehicles do not exceed the capacity of the crossing means and to give drivers final instructions on site-specific procedures and other information such as speed and vehicle interval.

exit-bank objective The objective based on METT-T that, once secured, eliminates direct fire into the crossing area.

FA field artillery

far-shore lodgement That area on the far shore that, once secured, eliminates direct fire on the crossing sites and provides an attack position for units to occupy before attacking to exit-bank and subsequent objectives.

FEBA forward edge of the battle area

FM field manual

FMFM Fleet Marine Forces Manual

FO forward observer

fps feet per second

FSB forward support battalion

FSCL fire-support coordination line

ft feet

G2 Assistant Chief of Staff (G2) (Intelligence)

G3 Assistant Chief of Staff (G3) (Operations and Plans)

G4 Assistant Chief of Staff (G4) (Logistics)

GLLD ground laser location designator

H H-hour

HEMMT heavy expanded mobility tactical truck

HIMAD high to medium air-defense altitude

HMMWV high-mobility multiwheeled vehicle

holding area Waiting areas that forces use during traffic interruptions.

holding line A graphic control measure used in retrograde river crossing operations to delineate the crossing area. It is drawn on defensible terrain between the river and the enemy. Its location precludes direct and observed indirect fires into the crossing area and serves as the battle handover line during retrograde.

HP horsepower

HQ headquarters

HUMINT human intelligence-gathering systems

IDP initial delay position

in inches

Inf infantry

INT OBJ (intermediate objective) METT-T driven objectives that secure the crossing area from observed-indirect fire

IPB intelligence preparation of the battlefield

ITV improved TOW vehicle

JCS Joint Chiefs of Staff

km kilometer(s)

kph kilometers per hour

LBE load-bearing equipment

LOA limit of advance

LOC lines of communication

LRS link reinforcement set

LRSU long-range surveillance

LTR light tactical raft

m meter(s)

Maint maintenance

Mech mechanized

METT-T mission, enemy, terrain, troops, and time available

MGB medium girder bridge

MLC military load classification

MO Missouri

MP military police

mph miles per hour

MPS meters per second

MSI multispectral imagery

NA not applicable

NATO North Atlantic Treaty Organization

NCO noncommissioned officer

O/O on order

OBJ objective

OBM outboard motor

OCOKA observation, cover and concealment, obstacles, key terrain, and avenues of approach

OPORD operation order

OPSEC operations security

PIR priority intelligence requirements

PL phase line

Prep preparation

RB ribbon

RL (release line) Phase lines used in river crossing operations to delineate the crossing area. RLs, located on both the far and near shores, indicate a change in the headquarters controlling movement.

RP release point

RPM revolutions per minute

RTO radio telephone operator

S2 Intelligence Officer

S3 Operations and Training Officer

S4 Supply Officer

SAW squad automatic weapon

secure the bridgehead line The final phase of a river crossing operation in which units seize and secure bridgehead objectives to protect the bridgehead against counterattack and to create time and space for the buildup of forces for the attack out of the bridgehead.

Sep separate

SHORAD short-range air defense

SIPRE Snow, Ice, and Permafrost Research Establishment

SOF special operation forces

SOP standing operating procedure

SP start point

SS single single

SSB single single bridge

staging area Battalion-size waiting areas outside the crossing area where forces wait to enter the crossing area under the control of the CA HQ. Units make crossing preparations and receive briefings on vehicle speed and spacing in this area.

STANAG standardization agreement

support force The units from corps and division that provide the crossing means, traffic control, and obscuration for units traversing the crossing area.

TAC tactical command post

TC training circular

TCP (traffic control post) Posts established by MPs to control traffic movement while providing information and direction to crossing units.

TD triple double

TF task force

TOE table(s) of organization and equipment

TOW tube-launched optically tracked, wire-guided missile

TRP target reference point

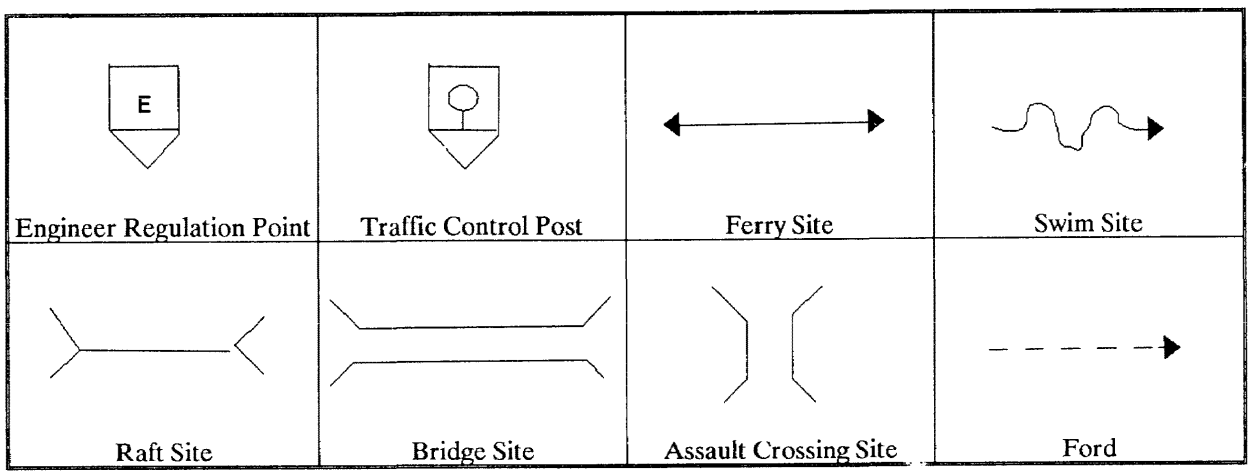
TS triple single

TT triple triple

US United States

XO executive officer

River Crossing Symbols



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SIPRE Report 36. *Airfields on Floating Ice Sheets for Regular and Emergency Operations.* Apr 56.

STANAG 2395. *Opposed Water Crossing Procedures.* ATP35(A). Dec 91.

DOCUMENTS NEEDED

These documents must be available to the intended users of this publication.

DA Form 2028. *Recommended Changes to Publications and Blank Forms.* Feb 74.

READINGS RECOMMENDED

These readings contain relevant supplemental information.

FM 6-20-30. *Tactics, Techniques, and Procedures for Fire Support for Corps and Division Operations.* 18 Oct 89.

FM 6-20-40. *Tactics, Techniques, and Procedures for Fire Support for Brigade Operations (Heavy.).* 5 Jan 90.

FM 6-20-50. *Tactics, Techniques, and Procedures for Fire Support for Brigade Operations (Light).* 5 Jan 90.

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