

## CHAPTER 3

# *Mobility and Survivability*

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Mobility and survivability are the primary tasks of the engineer on the battlefield. The platoon leader requires a detailed understanding of this BOS to succeed. This chapter provides the tactics, techniques, and procedures (TTP) needed for the platoon to conduct mobility, countermobility, and survivability.

### MOBILITY

Mobility enables the commander to maneuver tactical units into positions of advantage over the enemy. In the attack, engineers reduce enemy obstacles and fortifications that inhibit maneuver.

Expanded engineer reconnaissance capability is needed to identify routes, existing obstacles, and minefields. Open areas that are level provide good sites for aircraft landing strips; however, in most cases, the soil must be stabilized.

The application of the breaching fundamentals (suppress, obscure, secure, and reduce (SOSR)) and the organization of the force in terms of support, breach, and assault forces are standard. However, open areas may offer greater opportunity to bypass enemy obstacles because of the greater range of mobility afforded by the terrain. Exercise caution when choosing to bypass enemy obstacles, since the bypass may lead the force to the enemy's engagement area (EA). Additionally, expect the enemy to make extensive use of rapid mine-laying techniques that include SCATMINE delivery systems, as well as more conventional methods of mine emplacement.

### OBSTACLE BREACHING

The platoon leader must decide where the best breach location is. Never breach where the avenue of approach crosses the obstacle. The enemy is sure to have pre-planned artillery there. Pick a location away from obvious breaching sites to reduce the threat of artillery. The platoon leader should place himself where he can see the breach site and effectively command and control his platoon. He must be able to signal his breaching reserve (generally a squad) if he sees the breach failing. Observation of the breach site also reduces reporting requirements on the squad leaders to breach and mark the breach site.

Typically, there is a time lag as the maneuver force suppresses the enemy and obscures the breach site for the breach. The platoon leader should also consider dismounting an element from his lead squad to reconnoiter the best breach location during this tactical pause. This will assist the platoon leader in choosing the best breach site.

Obstacle breaching must be a CA effort. Units are more successful if they conduct—

- Obstacle reconnaissance.
- CA rehearsals.
- Breach planning.

For more information on obstacle breaching, see *FM 90-13-1*.

### **Breaching Fundamentals**

When breaching against a defending enemy, the following fundamentals must be applied to ensure success:

- **Suppress.** Neutralize or destroy the enemy's weapons with our own fires. (The support force should have a 3:1 advantage over the enemy's weapons overwatching the obstacle.) Consider the effects and characteristics of the enemy's weapons. Ensure the correct focus of direct and indirect fires and the timely shift or lift of fires. Consider what ammunition is required.
- **Obscure.** Hamper the enemy's observation and target acquisition through the use of smoke (indirect, on board, pyrotechnic), terrain, limited visibility, and stealth.
- **Secure.** Eliminate enemy interference with obstacle reduction and lane usage. Occupy the obstacle with a friendly force and through the use of effective fires.
- **Reduce.** Create lanes through, over, or around an obstacle. Ensure that a company/team has at least one lane through an obstacle and that a battalion TF has two lanes. Consider what additional requirements are needed to guide follow-on forces through the obstacle or to mark and reduce the obstacle.

### **Types of Breaching Operations**

When planning a breaching operation, the engineer leader should consider bypassing the obstacle as his first option. However, the enemy's intent may be to force the unit to turn or channelize into a fire sac. This is why a good reconnaissance of a possible bypass is essential. The unit conducting a bypass must have maximum security during the bypass. If bypass operations are not possible, consider the following options:

***In-stride Breach.*** A unit conducts an in-stride breach when it can be successfully executed under the complete C<sup>2</sup> of a task-organized subordinate unit or when the situation is unclear and rapid movement is critical. Subordinate units serve as both the breach and assault forces. The subordinate commanders synchronize the breaching fundamentals. Doctrinally, TFs and above conduct in-stride breaching.

***Deliberate Breach.*** A unit conducts a deliberate breach when the force-allocation ratios for support, breach, and assault forces are beyond the capability of a task-organized subordinate unit. One or more subordinate units are specifically tasked to perform the role of support, breach, and assault forces. Synchronization is critical and the principle of mass drives task organization.

***Assault Breach.*** A unit conducts an assault breach during the penetration and destruction phases of actions on the objective to destroy an enemy that has had time to emplace protective obstacles. For the assault breach, a rule of thumb is one lane per assaulting platoon. Assault lanes are generally only footpaths until the objective is secured. Mounted assault lanes require the same effort as tactical vehicle lanes.

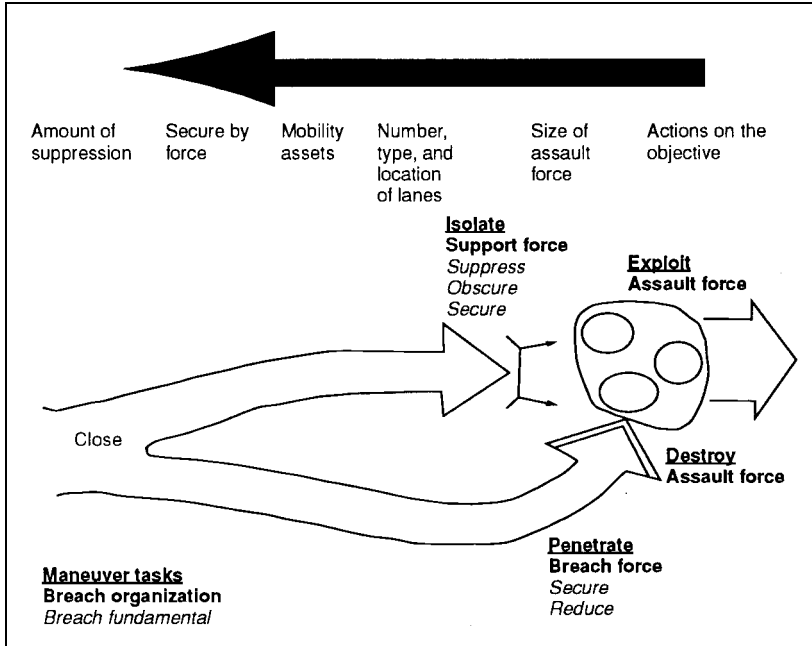
***Covert Breach.*** A unit conducts a covert breach during limited visibility when surprise is essential. The covert breach relies on stealth; quiet, manual lane-reduction techniques; and dismounted maneuver. It can be employed to breach tactical obstacles or protective obstacles (more difficult). It requires the same combat ratios as other breaches for suppression and security, and these points should be considered during the planning process.

### Breach Planning

The following are considered when developing a breaching plan (see *Figures 3-1 and 3-2, pages 3-4 and 3-5*):

- Reverse planning begins with actions on the objective.
- Actions on the objective drive the size of the assault force and determine the number and location of lanes to be breached.
- Lane requirements and the type of obstacle drive the allocation of mobility assets to the breach force.
- Ability of the enemy's infantry to interfere with the breach determines whether to secure the breaching site by force or by fire.
- Ability of the enemy to mass fires at the breaching site determines the amount of suppression required and the size of the support force.

The platoon leader must plan for actions after the breach is complete. Generally, the platoon is responsible for beaching, marking, and providing guides for the lane.



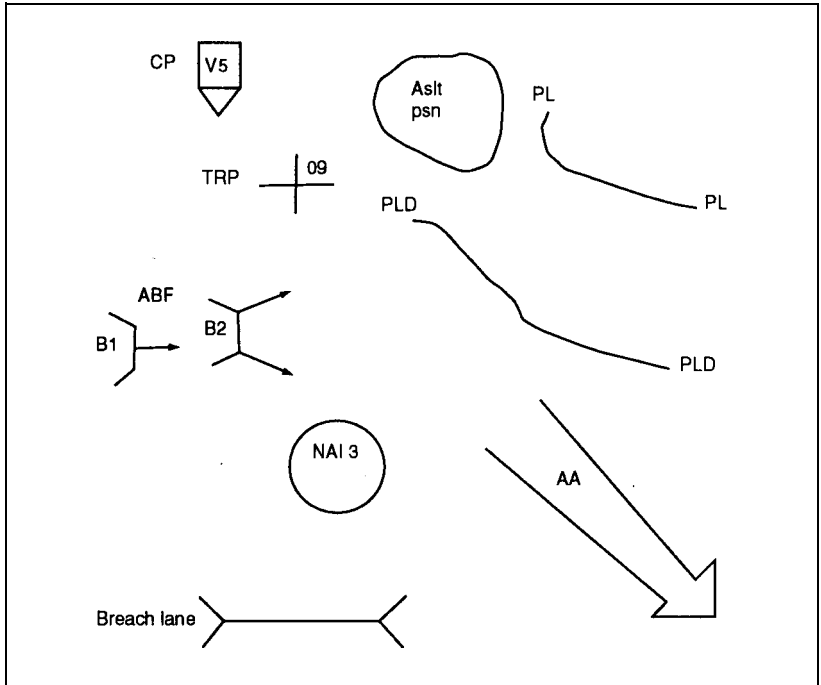
**Figure 3-1. Breach planning**

Normally, the platoon remains at the breach location and continues to improve the breached lane. The platoon must be prepared to reopen the lane if the enemy closes it with artillery-delivered mines. The platoon leader should also plan for vehicles that are stopped in the lane. The platoon may be forced to create an additional lane around the stopped vehicle or extract it from the breached lane.

### Breach TF Organization

The breach TF is organized into three elements:

- Support force—eliminates enemy interference with the breach, isolates the objective area, and destroys enemy weapons that are able to fire on the breach force.
- Breach force—creates lanes in and through the obstacle. While creating the lane through the obstacle, it must also locally secure the breaching site and pass the assault force through the breach.



**Figure 3-2. Breach control measures**

- Assault force—destroys or dislodges the enemy force on the far side of the obstacle and seizes the initial foothold on the objective.

#### Obscurants

To obscure friendly activities and movement, units can use artillery- or mortar-delivered smoke and/or white phosphorous (WP) rounds, generators, smoke pots and M203 grenades, chemical units, and burning diesel. Obscurants—

- Should be preplanned and coordinated with the company commander and the supported TF.
- Can be used for deception.
- Can be combined with supporting fires.
- Can be used over large areas.

### LANE MARKING

The critical components to any lane-marking system are the lane-marking patterns and devices. Lane-marking devices are not standardized Army-wide. *Figure 3-3* shows examples of lane-marking devices. *Table 3-1, page 3-8*, can be used as a guide to choose lane-marking devices. Lane-marking patterns have been standardized Army-wide. Standard breach lane-marking patterns are explained in *FM 90-13-1, Appendix E*. The following are lane markers and their use:

- Entrance markers—indicate the start and the width of a reduced lane. They must be visually different than handrail markers. Entrance markers are placed a minimum of 4.5 meters apart (1 meter for dismounted).
- Handrail markers—define the lane path and indicate the limits of the lane width. Mark, as a minimum, the left handrail.
- Exit markers—indicate the far-side limit of reduced lanes. Exit markers must be visually different from handrail markers but may be the same as entrance markers.
- Entrance-funnel markers—augment the entrance markers. They assist the small-unit commander in guiding the lead unit of his combat column formation.
- Final-approach marker—is a highly visible marker that augments the visual signature of entrance-funnel markers. It provides the assault-force commander with a highly visible reference point toward which to maneuver his formation.
- Far-recognition markers—are highly visible markers located between the final-approach marker and the friendly unit. They are primarily used when passing battalion-sized forces through a lane where distance, visibility, or terrain does not allow the passing force direct observation of the final-approach marker. When possible, far-recognition markers should be different from the final-approach marker.
- Traffic-control post (TCP) or guides—are a two-man team with communications means that assists the commander in controlling the movement of forces. When possible, military police (MP) should man TCPs. However, the breach force should plan to man TCPs until relieved.

The standard levels of lane marking for breach lanes and bypasses are initial, intermediate, and full (see *Figure 3-4, page 3-9*). The following are lane-marking patterns and their use:

- Initial lane-marking pattern—is emplaced by the breach force immediately after the lane is reduced and proofed. It is a signal to the assault force that the lane is ready for traffic to pass through.

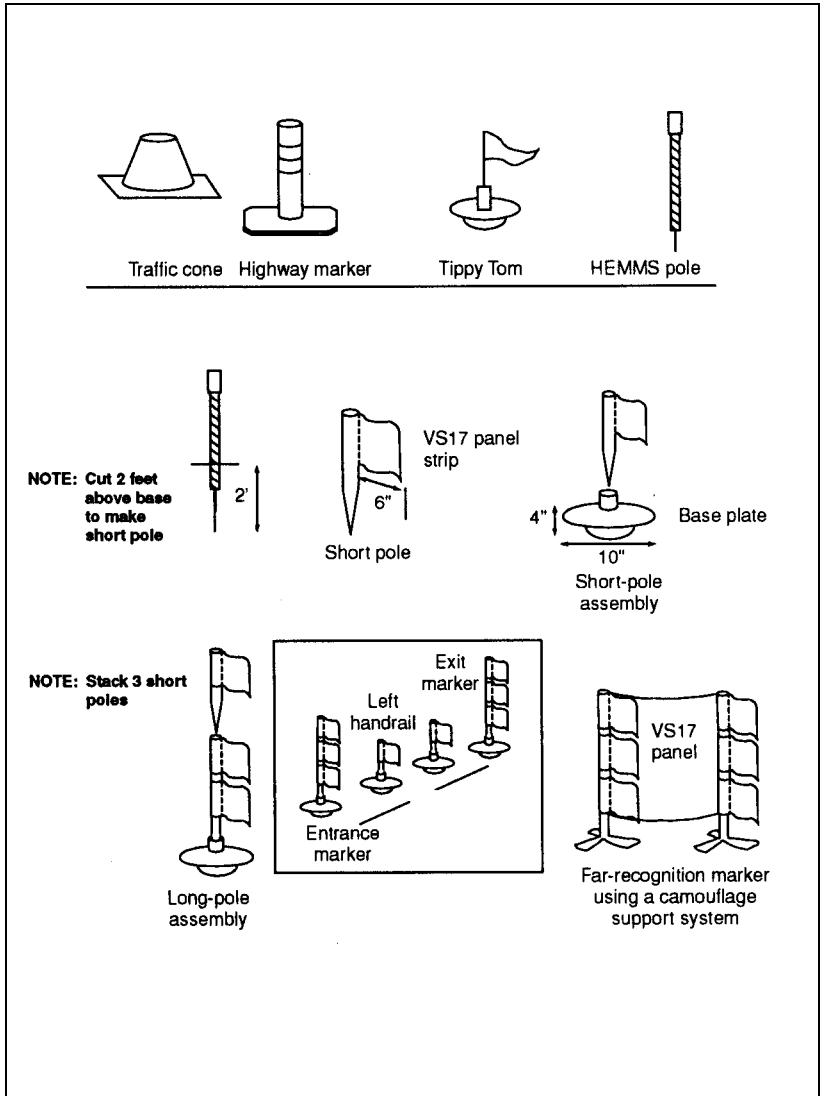


Figure 3-3. Lane-marking devices

**Table 3-1. Breach lane marking**

Markers	Mounted Forces	Dismounted Forces
Handrail and funnel	They— <ul style="list-style-type: none"> <li>• Can be seen by the vehicle commander and driver but-toned up from 50 meters.</li> <li>• Are quick to emplace, mini-mizing soldier exposure.</li> </ul>	They— <ul style="list-style-type: none"> <li>• Are visible to a prone dis-mounted soldier from 50 meters.</li> <li>• Are lightweight and easy to emplace.</li> </ul>
Entrance and exit	They— <ul style="list-style-type: none"> <li>• Can be seen from 100 meters.</li> <li>• Are visually different from handrail and funnel mark-ers.</li> <li>• Are easy to emplace and are man portable.</li> </ul>	They— <ul style="list-style-type: none"> <li>• Are visible from 50 meters.</li> <li>• Are visually different from handrail and funnel mark-ers.</li> <li>• Are easy to emplace and are man portable.</li> </ul>
Final approach and far recognition	They— <ul style="list-style-type: none"> <li>• Can be seen from 500 meters.</li> <li>• Are visually different from each other.</li> <li>• Can be altered to facilitate traffic control through multi-ple lanes.</li> </ul>	They— <ul style="list-style-type: none"> <li>• Are visible from 100 meters.</li> <li>• Are visually different from each other.</li> <li>• Can be altered to facilitate traffic control through multi-ple lanes.</li> </ul>

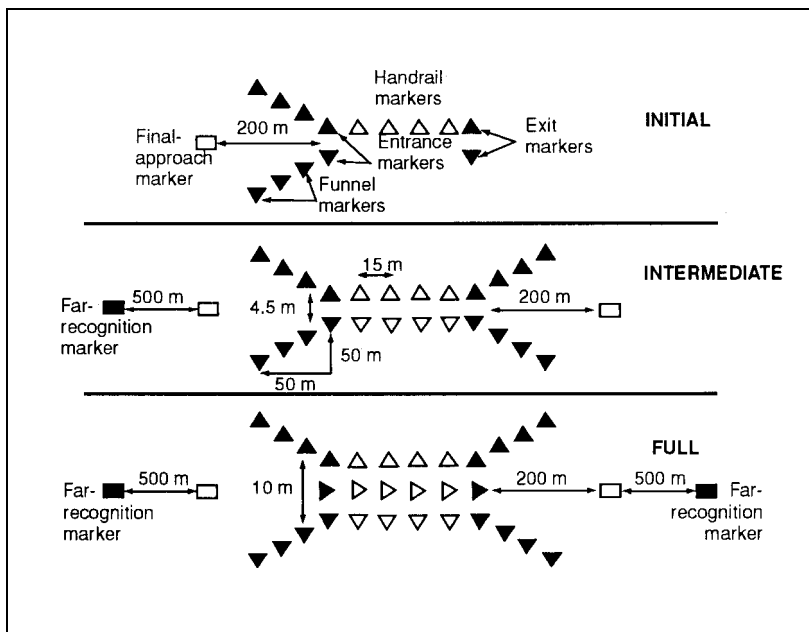
- Intermediate lane-marking pattern—is used for the commitment of larger combat forces who are unable to directly observe the breach or the rearward passage of sustainment traffic. It builds on the initial lane-marking pattern by adding right handrail markers, exit-funnel markers, far-recognition markers, and a far-side final-approach marker.
- Full lane-marking pattern—is usually not part of an initial breaching operation. It is a lane that will support uninterrupted two-way traffic.

*Table 3-2, page 3-10, provides information as to who marks the various types of lanes, when they are to mark the lanes, and what markers they are to use. Lane marking is normally synchronized during the CA rehearsal to ensure that all key leaders understand the marking procedure and standard being employed.*

## COUNTERMOBILITY

Counter-mobility operations are conducted to augment natural terrain with obsta- cle systems according to the commander's concept. This adds depth to the battle in





**Figure 3-4. Lane-marking patterns**

space and time by attacking the enemy's ability to maneuver its forces. With the enemy's movement impeded (disrupted, turned, fixed, or blocked), it is vulnerable to our forces. Engineers advise the commander on the best means to reinforce natural obstacles (terrain) and to emplace tactical obstacles that support his plan. Minefields, wire, antitank ditches (ATDs) or berms, road craters, bridge demolition, and all other traditional obstacles may be effective. For expedient obstacles, units should consider employing local materials.

ATD or berms require extensive preparation but are very effective when properly prepared. Many areas have irrigation ditches that can be used tactically. However, in sandy areas, ditches can easily be filled in. Obstacles should be planned to protect the unit's flanks during offensive operations.

All obstacles can be situational obstacles. Situational obstacles are obstacle resources held in reserve. They have a "be-prepared" mission but not an "on-order mission". Situational obstacles should be considered during planning to give the maneuver commander a flexible response to enemy or friendly maneuver.

**Table 3-2. Lane-marking level—unit responsible, trigger events, and lane markers**

Breach Type	Initial	Intermediate	Full
	Unit Responsible		
Deliberate	TF breach force	TF breach force	Brigade
Covert	TF breach force	TF breach force	Brigade
In-stride	Breach company/ team	TF mobility reserve	Brigade
Assault	Assault platoon	TF assault force	NA
	<b>Trigger Events</b>		
	When— • Lanes are reduced • Passing platoon- or company-sized forces	When passing— • Battalion- or company-sized forces • Forces that can- not see the lane • TF combat trains	When— • Passing brigade- or battalion-sized forces • Situation requires uninterrupted sus- tainment traffic
	<b>Lane Markers</b>		
	Entrance/exit Left handrail Entrance funnel Final approach	The following mark- ers are added: • Right handrail. • Exit funnel. • Far-side final approach. • Far recognition. • Guides/TCPs.	Lane width is expanded to 10 meters. Existing markers are adjusted. Far-side- recognition markers and guides/TCPs are added.

**OBSTACLE PLANNING**

To assist the TF commander in the defense, the TF engineer must integrate obsta- cle planning throughout the TF sector and coordinate with adjacent TFs according to the overall engineer plan.

Each echelon has its own obstacle-control measures for directing the location of obsta- cles on the ground. The division commander and his staff use obstacle zones to control obstacles to support future operations. Within these zones, the brigades plan

obstacle belts, and the battalion TF plans obstacle groups. The engineer will then emplace each obstacle by doctrinal obstacle norms to support the commander.

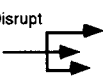
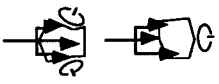
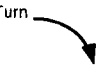
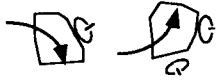



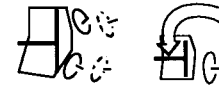
### Protective Obstacles

They are designed to repel the enemy's assault by emplacing them around a unit's defensive position (a survivability task).

### Tactical Obstacles

They are designed and emplaced to (see *Figure 3-5*)—

- Disrupt, which—
  - Breaks up C<sup>2</sup>.
  - Frustrates the enemy's timing.
  - Interrupts formations or attacks the enemy when they are massing into formations.
  - Coerces the enemy into our lines of fire.

Obstacle-Effect Graphic	Application	Examples Conveying Intent	Resource Factor <sup>1</sup>
	Short arrow indicates where enemy is attacked by obstacles.  Long arrows indicate where bypass is allowed and attacked by fires.		0.5
	Heel of arrow is anchor point. Direction of arrow indicates desired direction of turn.		1.2
	Irregular part of arrow indicates where enemy advance is slowed by obstacles.		1.0
	The ends of the vertical line indicate the limit of enemy advance.  The ends of the vertical line also indicate where obstacles tie in to severely restricted terrain.		2.4
Direction of Enemy Attack →			

<sup>1</sup> See FM 90-7, Appendix C, for an explanation of how to use the resource factor.

Figure 3-5. Obstacle-effect graphics

- Fix, which—
  - Slows the enemy's advance within a specified area.
  - Causes the enemy to breach repeatedly.
- Turn, which manipulates enemy maneuver in a desired direction.
- Block, which—
  - Stops the enemy along a particular avenue of approach.
  - Defeats the enemy's breaching effort.

*Figure 3-6* shows how to employ conventional row minefields to obtain the desired obstacle effects and the planning figures for standard minefields by obstacle effect.

### **Situational Obstacles**

Situational obstacles are "triggered" by an event or situation. Once the general location of the obstacle has been determined, it must be refined to better enhance its effect on the enemy. When planning, preparing, and executing situational obstacles (see *FM 90-7*)—

- Identify the need.
- Plan for appropriate resources.
- Plan the obstacle.
- Integrate the obstacle with friendly fires.
- Identify obstacle execution triggers.
- Withhold execution of the obstacle until it is needed.

Situational obstacles can be used to—

- Attack an enemy's vulnerability.
- Exploit success.
- Separate follow-on enemy forces.
- Provide flank protection.

*Tables 3-3 and 3-4, pages 3-14 and 3-15, provide some characteristics of conventional and scatterable mines and are useful in planning minefields. When emplacing standard disrupt, fix, turn, and block minefields, see Figures 3-7 through 3-12, pages 3-16 through 3-21, and Tables 3-5 through 3-8, pages 3-22 and 3-23, for information on the employment of SCATMINE systems. FASCAM systems include the air/ground Volcano, Modular Pack Mine System (MOPMS), Flipper, area denial artillery munition (ADAM), and remote antiarmor mine (RAAM).*

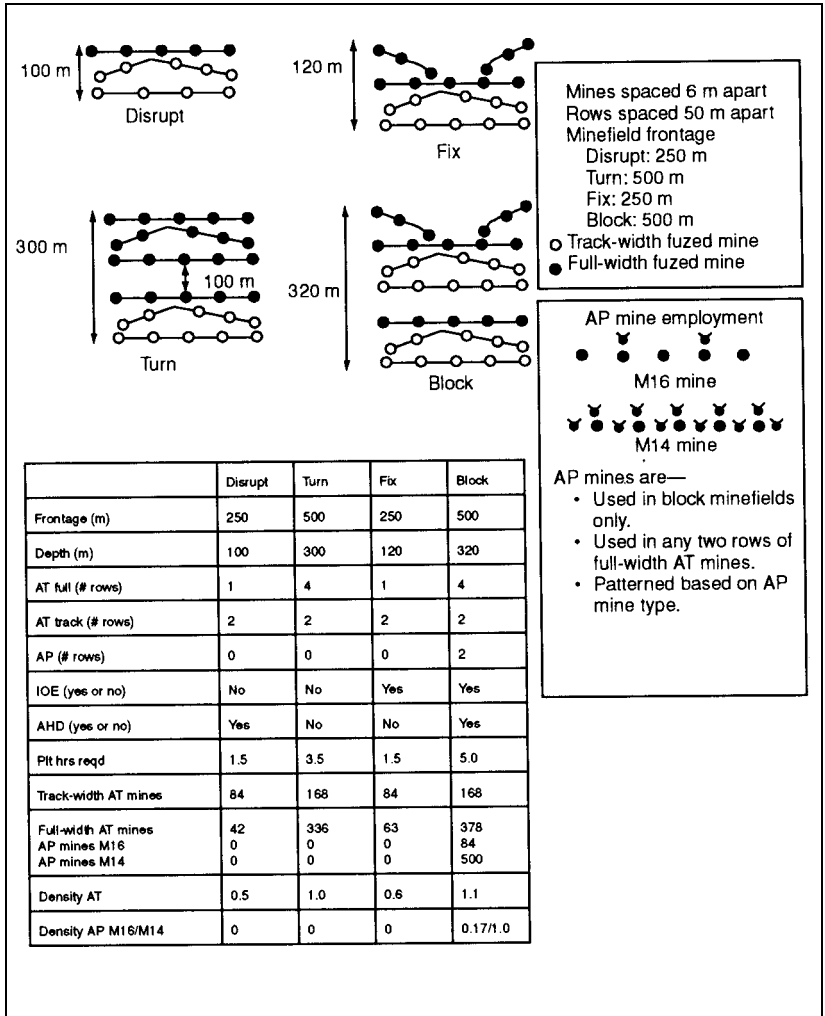


Figure 3-6. Minefield norms

**Table 3-3. Conventional mines**

Mine	Arming Time	Fuzing	Warhead	AHD	Mine Weight	Mines per 5-Ton Dump	Remarks
M14	NA	Pressure	Blast	No	3.3 oz	6,480	
M16A1	NA	Pressure Trip wire	Bounding fragment	Yes	8 lb	672	
M18A1	NA		Directional fragment	No	3.5 lb	1,782	
M86 (PDM)	50 sec		Bounding fragment	100%	1 lb	—	Self-destruct after 4 hours
M15	NA	Pressure	Blast	Yes	30 lb	90	
M15 w/M624	NA	Tilt rod	Blast	Yes	30 lb	90	
M19	NA	Pressure	Blast	Yes	28 lb	196	
M21	NA	Tilt rod	Shape charge	Yes	17 lb	192	

**OBSTACLE SITING**

When determining where to emplace obstacles, the platoon leader should consider the following:

- Supporting the maneuver commander's intent.
- Supporting the CATK plan.
- Supporting the defensive plan.
- Coordinating obstacle locations with the maneuver element, the fire-support officer (FSO), the Operations and Training Officer (US Army) (S3), and the weapons-systems commander.
- Prioritizing the engineer effort.
- Planning the maneuver unit's responsibility.
- Using observation and fields of fire, cover and concealment, obstacles, key terrain, and avenues of approach (OCOKA).

**Company/Team Commanders' Coordination**

The platoon leader must ensure that key obstacles are covered by indirect fire. These obstacles become priority targets for the artillery. When coordinating with company/team commanders, the platoon leader should consider the following:

- Determining the obstacle intent.
- Determining the company's/team's tactical purpose.

**Table 3-4. Scatterable mines**

Mine	Delivery System	Arming Time	Fuzing	Warhead	AHD	Self-Destruct Time	Mine Weight	Mines per 5-Ton Dump
M73	155-mm arty (RAAM)	45 sec 2 min	Magnetic	M-S plate	20%	48 hr	3.8 lb	NA
M70	155-mm arty (RAAM)	45 sec 2 min	Magnetic	M-S plate	20%	4 hr	3.8 lb	NA
M75	GEMSS Flipper	45 min	Magnetic	M-S plate	20%	5 days 15 days	3.8 lb	1,600
BLU 91/B	USAF (Gator)	2 min	Magnetic	M-S plate	No	4 hr 48 hr 15 days	3.8 lb	NA
M76	MOPMS	2 min	Magnetic	M-S plate	No	4 hr (recycle 3 times)	3.8 lb	30 modules (510 mines)
Volcano	Ground/air	2 min	Magnetic	M-S plate	No	4 hr 48 hr	3.8 lb	160 canisters (800 mine)
M72	155-mm arty (ADAM)	45 sec 2 min	Trip wire	Bounding fragment	20%	15 days 48 hr	1.2 lb	36 per M692 projectile
M67	155-mm arty (ADAM)	45 sec 2 min	Trip wire	Bounding fragment	20%	4 hr	1.2 lb	38 per M731 projectile
M74	GEMSS Flipper	45 min	Trip wire	Blast fragment	20%	5 days 15 days	3.2 lb	1,600
BLU 92/B	USAF (Gator)	2 min	Trip wire	Blast fragment	100%	4 hr 48 hr 15 days	3.2 lb	NA
M77	MOPMS	2 min	Trip wire	Blast fragment	100%	4 hr (recycle up to 15 days)	3.2 lb	30 modules (120 mines)
Volcano	Ground/air	2 min	Trip wire	Blast fragment	100%	4 hr 48 hr 15 days	3.2 lb	160 canister (160 mines)

- Ensuring that the obstacles the maneuver company/team commanders emplace on the battlefield serve as a combat multiplier and enhance the direct-fire plan.
- Providing forward security during obstacle emplacement.
- Conducting obstacle turnover with the maneuver company/team and ensuring that indirect-fire support is provided after the obstacle is finished.
- Rehearsing lane-closure plans.

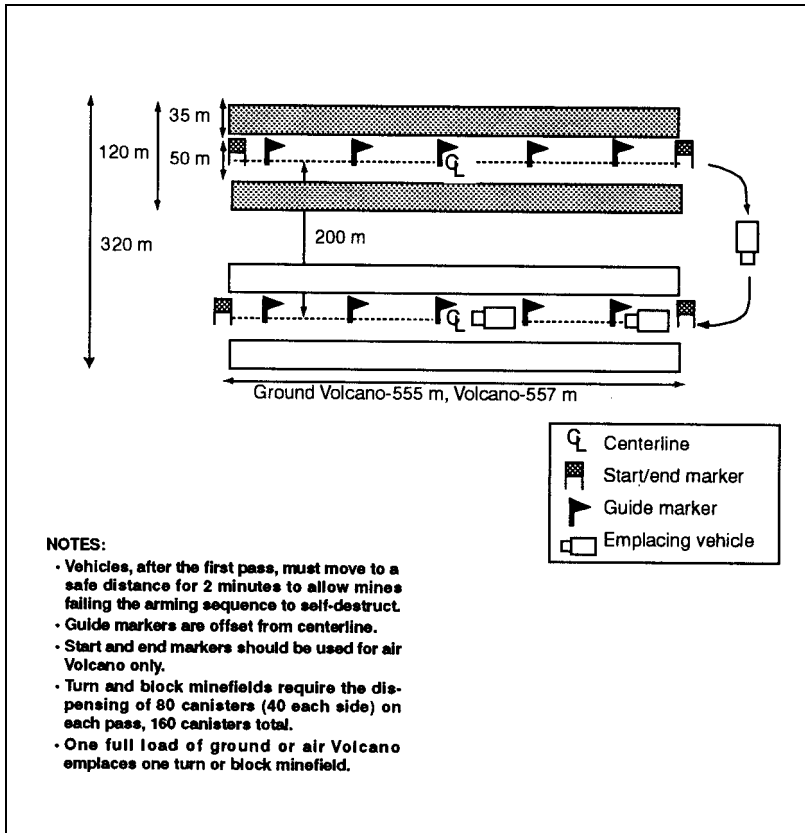


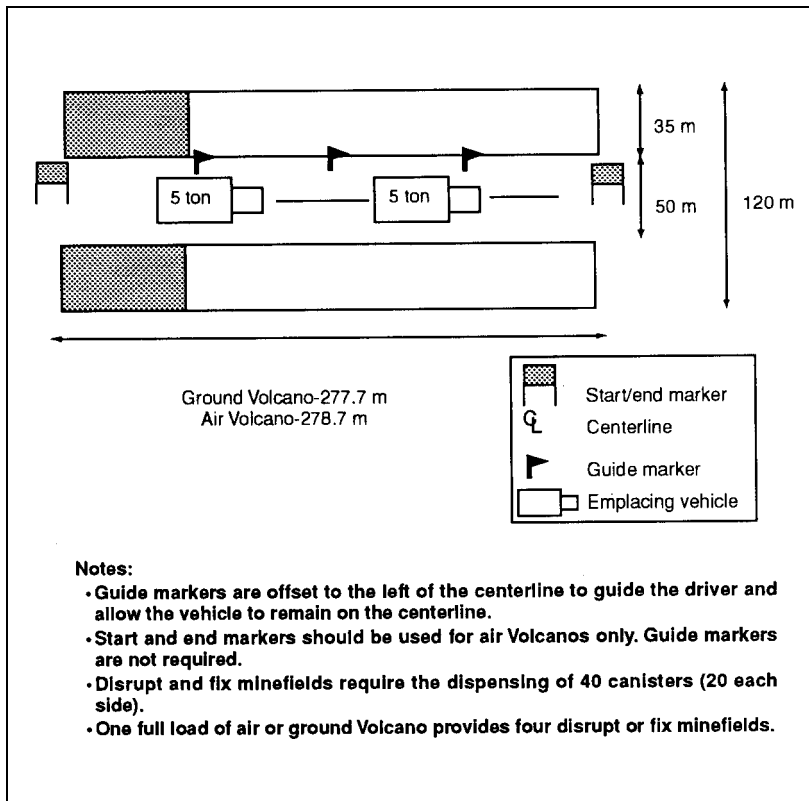
Figure 3-7. Volcano turn and block minefields

### Direct-Fire Integration

When integrating obstacles with direct fire, the platoon leader should consider the following:

- Coordinating with the maneuver element overwatching the obstacle.
- Sighting obstacles with weapons.
- Coordinating with the maneuver element for—
  - Forward security.



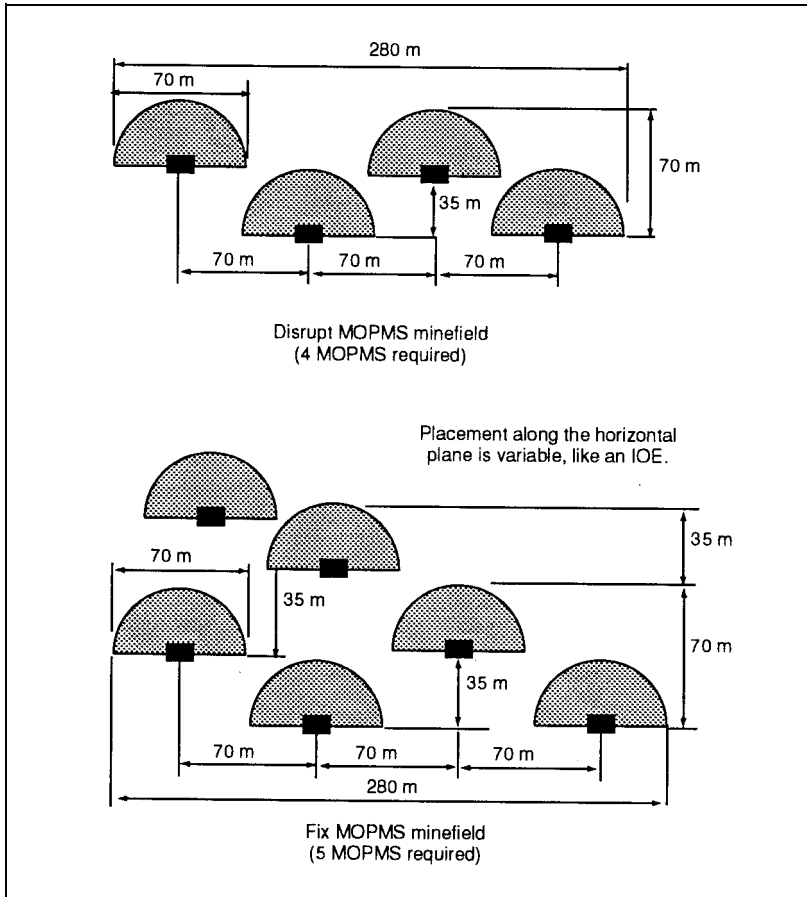


**Figure 3-8. Volcano disrupt and fix minefields**

- Logistics support.
- Obstacle-turnover requirements.

#### Indirect-Fire Integration

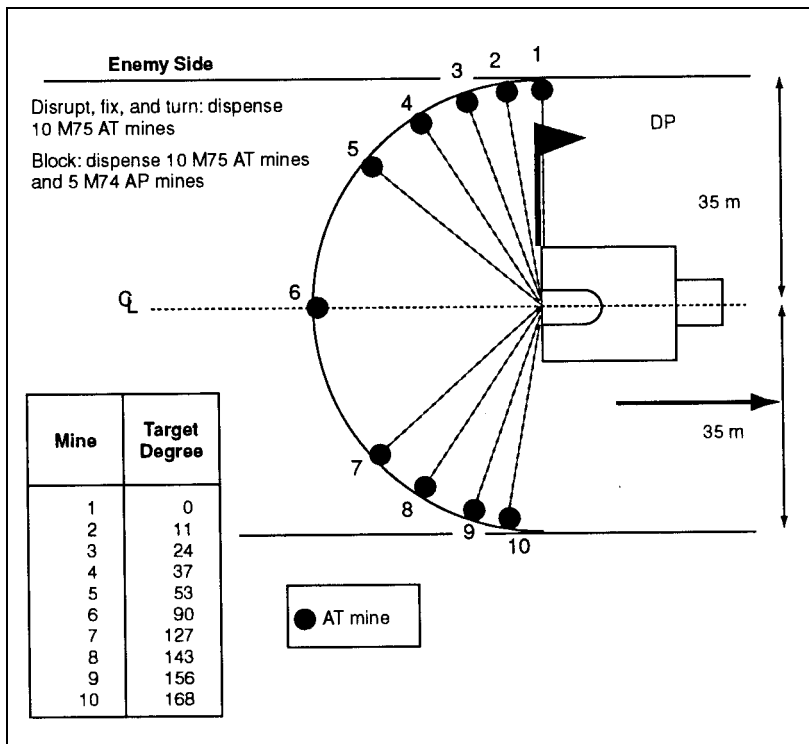
The platoon leader must ensure that key obstacles are covered by indirect fire. These obstacles become priority targets for the artillery. The platoon leader coordinates indirect fire with the company FIST and company/team commander in heavy units. Indirect fire must be coordinated with the FSO and the TF commander if units are light or if the platoon leader is the TF engineer. For more information on



**Figure 3-9. MOPMS disrupt and fix minefields**

integrating obstacles with indirect fire, see *FM 90-7*. When integrating obstacles with indirect fire, the platoon leader should consider the following:

- Ensuring that there are target reference points (TRPs) on every obstacle.
- Preplanning ADAM and RAAM fires.
- Calling for fire nets (engineers).

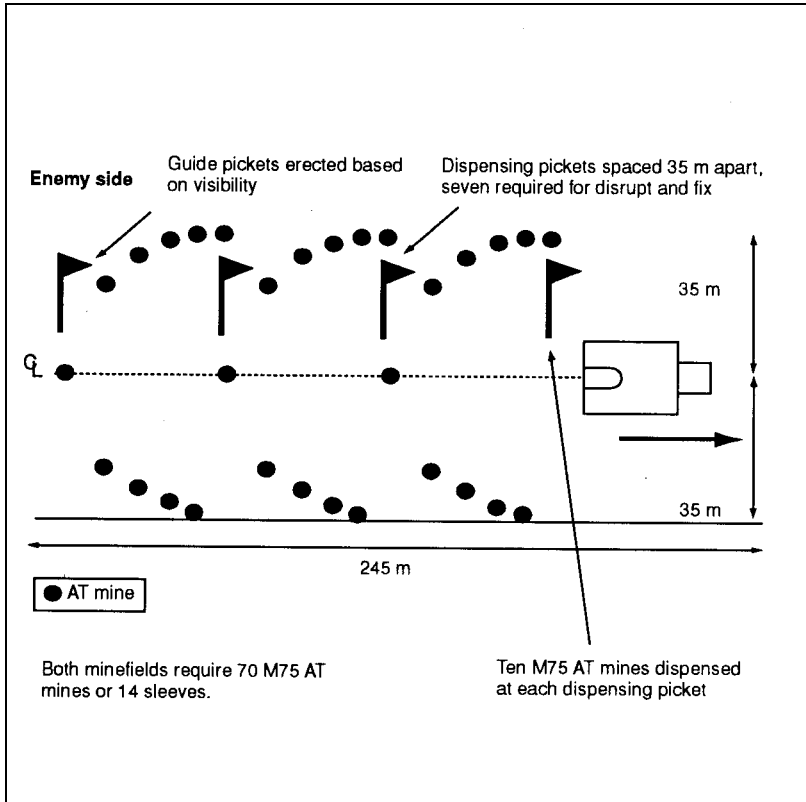


**Figure 3-10. Flipper TTP**

***OBSTACLE CAMOUFLAGE (IF REQUIRED)***

When camouflaging obstacles, the following should be considered:

- Ensuring that the obstacles emplaced support the intent (sometimes you want the enemy to see the obstacles).
- Using reverse slope siting.
- Burying mines.
- Using night and covert emplacement.
- Minimizing dust signatures from the excavation.

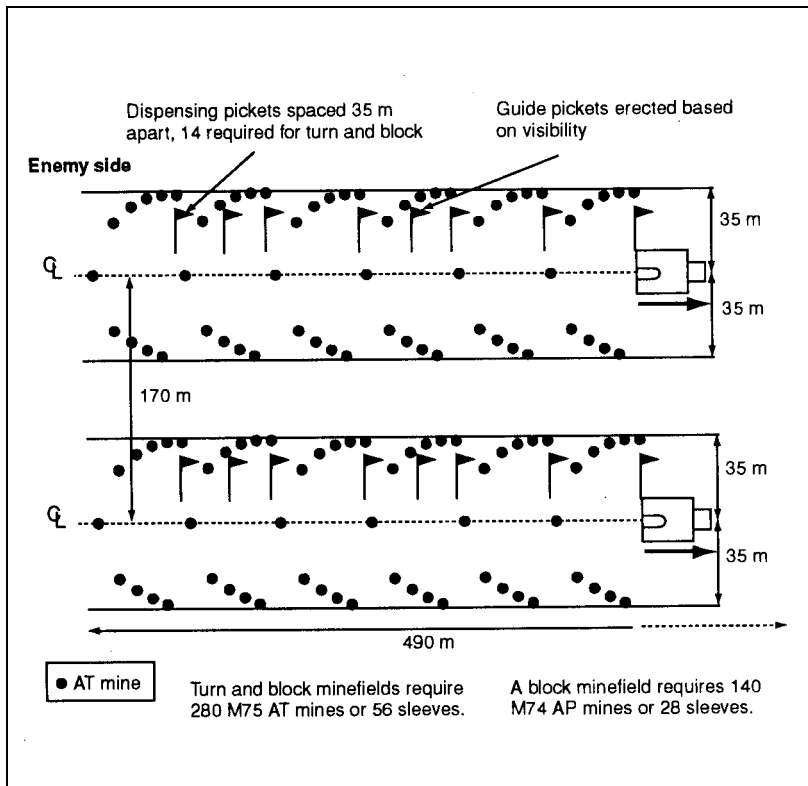


**Figure 3-11. Flipper fix and disrupt minefields**

**OBSTACLE PROTECTION**

The following should be considered for the protection of obstacles:

- Denying the enemy covert breaching opportunity.
- Denying the enemy reconnaissance
- Using observation posts (OPs) and counterreconnaissance.
- Displacing forces during low visibility to cover obstacles.



**Figure 3-12. Flipper turn and block minefields**

- Identifying and destroying the enemy's obstacle breaching equipment and C<sup>2</sup> vehicles.
- Covering the obstacle with direct and indirect fires.
- Patrolling obstacles at night.

## SURVIVABILITY

Preparation of fortifications may be difficult. Fortifications in sandy soils often require revetments. It may be impossible to dig in rocky areas, arctic regions, or locations with a high or perched water table. To counter these problems, you may

**Table 3-5. Flipper planning factors**

Type of Minefield	Depth (Meters)	Front (Meters)	Number of Strips	DPs per Strip	M75 Mines per DP	M74 Mines per DP	Total M75 Mines	Total M74 Mines
Disrupt	70	245	1	7	10	0	70	0
Fix	70	245	1	7	10	0	70	0
Turn	240	490	2	14	10	0	280	0
Block	240	490	2	14	10	5	280	140

**Table 3-6. Volcano planning factors**

Type of Minefield	Depth (Meters)	Front Ground/Air (Meters)	Number of Strips	Canisters per Strip	Total Canisters	Minefields per Load
Disrupt	120	277/278	1	40 (20 each side)	40	4
Fix	120	277/278	1	40 (20 each side)	40	4
Turn	320	555/557	2	80 (40 each side)	160	1
Block	320	555/557	2	80 (40 each side)	160	1

**Table 3-7. RAAM/ADAM planning factors**

Type of Minefield	RAAM		ADAM		Width (Meters)	Depth (Meters)
	Area	Linear	Area	Linear		
Disrupt	0.001	0.2	0.0005	0.1	200	200
Turn	0.002	0.9	0.001	0.4	400	400
Fix	0.002	0.4	0.0005	0.1	200	200
Block	0.004	1.6	0.002	0.8	400	400

**Table 3-8. Mine dump planning factors**

Number of Personnel	Quantity of Mines
2-man team (2 minutes per mine)	25 mines per hour
Squad (8 soldiers)	100 mines per hour
Platoon	300 mines per hour; 3,000 mines per day
Company	6,000 mines per day
<b>NOTE: For planning, soldiers work 10 hours per day.</b>	

have to build up emplacements with existing materials or depressions. *FMs 5-34 and 5-103* provide the standards for dismounted and vehicular field fortifications.

Camouflage is very effective when properly employed. However, you must carefully select patterns and techniques to apply to the local environment. All equipment should have camouflage nets. Other survivability techniques include dispersion and frequent moves.

Direct-fire weapons are more effective from dug-in positions. Logistics areas (brigade support area/division support area (BSA/DSA)) require survivability support. These sites are large, relatively static, and difficult to camouflage. As a result, they are vulnerable to enemy interdiction. Emphasis should be placed on ammunition and fuel dumps.

Digging assets, such as bulldozers, small emplacement excavators (SEEs), or armored combat earthmovers, M9 (ACEs), should be tasked to provide survivability support to these sites. Particular emphasis should be placed on hardening ammunition and fuel-storage locations.

With long-range observation and fields of fire, defensive positions are very vulnerable to offensive fire. This fact, coupled with a lack of natural obstacles, may lead the commander to concentrate the bulk of his engineer effort on survivability positions. Survivability positions enhance the ability of all direct-fire elements to survive indirect-fire preparations and the direct fire from attacking enemy units.

Care should be taken when digging foxholes and tank hide positions in sandy or noncohesive soils since the walls have a tendency to cave in.

### ***PLANNING***

Survivability positions are key to surviving any battle on today's modern battlefield. This is especially true where there is a lack of vegetation and natural hiding positions. The TF engineer must know the following information to start planning:

- Number of positions: primary, alternate, and supplementary.
- Type of position: hull-down, turret-down, or hasty.
- Weapons and vehicle priorities.
- Battle-position and EA priorities.
- Unit priorities.

Once the TF engineer determines the number of positions required, then the number of positions that can actually be put in is determined. The engineer unit's capability is based on the following factors:

- Ten-hour days for soldiers.
- Fifteen-hour days for equipment.
- Time available (days).
- Number of blade teams (BTs) available. ACEs, dozers, combat engineer vehicles (CEVs), and bucket loaders can be used to make blade teams. A blade team must include at least one dozer or ACE.
- Work rates.

For work rates, use the planning factor developed for your area of operation. If work rates are unknown, use the following as a guide:

- One hull-down position (HDP) takes 1.5 BT hours.
- One turret-down position (TDP) takes 3.5 BT hours.
- Fifty meters of ATD takes 1 BT hour.

A variety of variables may increase or decrease the time required to dig a vehicle fighting position or ATD. These variables include, but are not limited to, local soils and terrain, operator experience, additional maintenance down time, and the tactical situation. The difference of blade widths may also affect work rates. The M9 ACE has a shorter blade width than the D7 dozer and requires a minimum of two passes to cut the same width.

Survivability assets should be massed on the commander's number one priority. This focuses the survivability effort and allows the TF engineer to monitor



construction progress. It also reduces the C<sup>2</sup> burden on the engineer platoon and facilitates rapid transition to changing priorities.

The following equations can be used to determine the number of HDPs and TDPs and the length of ATDs that can be emplaced:

$$\text{HDP} = (\# \text{ BTs}) \times (1 \text{ HDP/work rate}) \times (\# \text{ days}) \times (15 \text{ hrs/day})$$

$$\text{TDP} = (\# \text{ BTs}) \times (1 \text{ TDP/work rate}) \times (\# \text{ days}) \times (15 \text{ hrs/day})$$

$$\text{Meters of ATD} = (\# \text{ BTs}) \times (\text{ATD m/work rate}) \times (\# \text{ days}) \times (15 \text{ hrs/day})$$

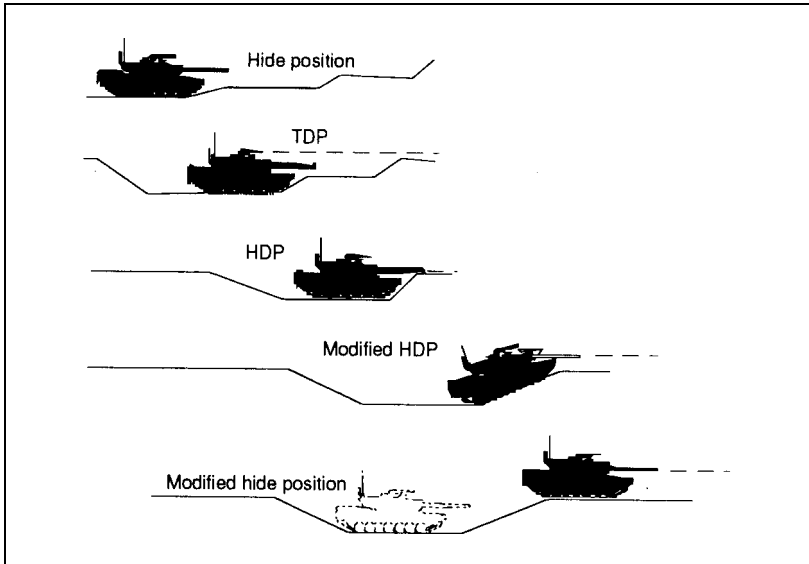
### POSITIONS

Coordination between the engineer/equipment operator and the maneuver element is critical to ensure the proper placement of positions. Without effective coordination, much valuable time is wasted redigging positions. The maneuver element, preferably the gunner or tank commander (TC), must tell the engineer/equipment operator the following:

- Type of position (deliberate or hasty).
- Gun target line.
- Sector of fire.
- TRP.

In heavy units, initial vehicle-fighting-position construction starts with the M9 ACE. The ACE has different digging capabilities than the dozer. In many cases, divisional ACEs start with hasty positions, which are then upgraded to improved positions as time allows. Also, the ACEs may start work before corps-level dozers arrive to augment the construction effort. In this situation, the ACEs would dig the hasty positions and the dozers would improve them. The platoon must plan for this augmentation to efficiently integrate corps assets into the construction effort. In heavy units, the company commander must integrate corps assets; however, in light units, the platoon leader must plan for and integrate corps assets.

*Figure 3-13, page 3-26, shows the different vehicle fighting positions. Some terrain areas may not accommodate a hull or turret defilade. The use of a modified hasty vehicle-position design or simple marking techniques incorporated with terrain mottling may be required.*



**Figure 3-13. Vehicle survivability positions**

Each soldier, not just engineers, must also emplace individual and crew fighting positions. Engineers have some limited assets, such as the SEE, that can assist the maneuver commander in accomplishing this mission. Fighting positions are—

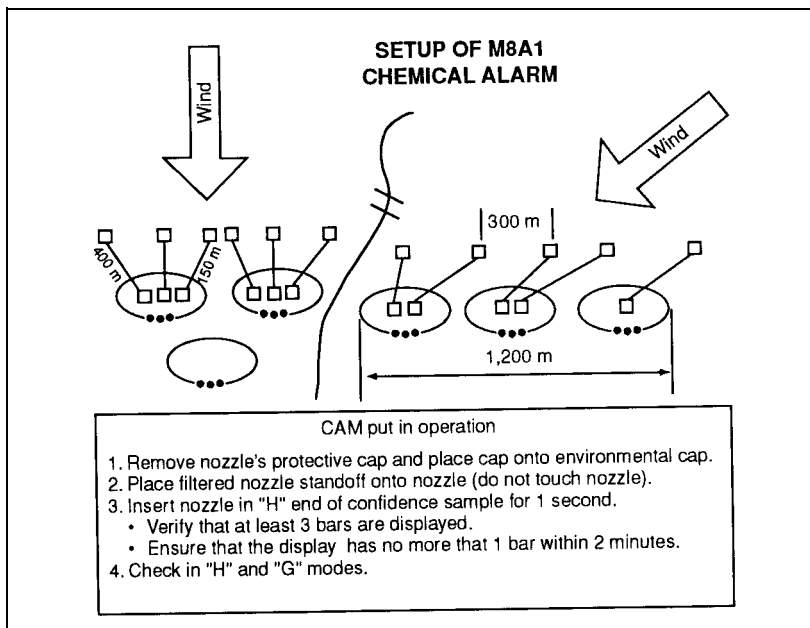
- Located to effectively engage the enemy and mutually support each other.
- Designed to allow weapons to be properly fired.
- Constructed to provide adequate cover (see *Table 3-9*).
- Concealed from the enemy.

#### **NUCLEAR, BIOLOGICAL, CHEMICAL (NBC)**

Chemical and biological weapons are many countries' preferred weapons of mass destruction. Many of our potential adversaries have an NBC capability. *Figure 3-14 and Tables 3-10 and 3-11, page 3-28, detail the NBC threat and protective procedures.*

**Table 3-9. Survivability**

Camouflage	Defensive Positions
<p>Soldiers should consider the following when camouflaging:</p> <ul style="list-style-type: none"> <li>• Breaking up the shape of the object.</li> <li>• Shading the object with natural shadows.</li> <li>• Concealing the shine of the object.</li> <li>• Disrupting the silhouette of the object.</li> <li>• Using folds, gullies, and wadies.</li> <li>• Using reverse-slope positions.</li> <li>• Scaring two to three positions for each vehicle or position.</li> <li>• Using irregular-shaped positions</li> <li>• Building positions a minimum of twice the size of the concealed object.</li> <li>• Exercising noise and light discipline.</li> <li>• Using camouflage for deception.</li> </ul>	<p>Soldiers should know and consider the following facts when constructing defensive positions:</p> <ul style="list-style-type: none"> <li>• Field expedient construction materials, such as corrugated metal, coverts, scrap metal, 40-gallon oil drums, sandbags, and sand-filled ammo boxes, can be used.</li> <li>• Small-arms fire penetrates loose sand 39 inches and sandbag parapets 24 inches.</li> <li>• A minimum of 18 to 24 inches of overhead cover is required to protect against indirect fire.</li> <li>• Revetments are required in sandy soils.</li> <li>• Design details are covered in <i>FMs 5-34 and 5-103</i>.</li> </ul>



**Figure 3-14. M8A1 chemical alarm**

**Table 3-10. Unmasking procedures**

Unmasking with M256 Series Kit	Unmasking without M256 Series Kit	MOPP Gear Exchange
<p>This procedure takes 10 minutes. See <i>FM 3-4</i> for more information.</p> <p>The leader—</p> <ul style="list-style-type: none"> <li>• Checks M256 results to ensure that they are negative.</li> <li>• Selects one or two soldiers.</li> </ul> <p>The soldiers—</p> <ul style="list-style-type: none"> <li>• Move to a shady place.</li> <li>• Unmask for 5 minutes.</li> <li>• Clear and reseal their masks.</li> </ul> <p>The leader—</p> <ul style="list-style-type: none"> <li>• Observes the soldiers for 10 minutes.</li> <li>• Gives the all-clear signal if the soldiers show no symptoms.</li> <li>• Watches for delayed symptoms.</li> <li>• Has first aid available.</li> </ul>	<p>This procedure takes 25 minutes. See <i>FM 3-4</i> for more information.</p> <p>The leader—</p> <ul style="list-style-type: none"> <li>• Checks the M8 paper for liquid contamination.</li> <li>• Selects one or two soldiers.</li> </ul> <p>The soldiers—</p> <ul style="list-style-type: none"> <li>• Move to a shady place.</li> <li>• Break the seal of their mask, with their eyes open, for 15 seconds.</li> <li>• Clear and reseal their masks.</li> </ul> <p>The leader observes the soldiers for 10 minutes. If no symptoms occur, the soldiers—</p> <ul style="list-style-type: none"> <li>• Unmask for 5 minutes.</li> <li>• Clear and reseal their masks.</li> </ul> <p>The leader—</p> <ul style="list-style-type: none"> <li>• Observes the soldiers for 10 minutes.</li> <li>• Gives the all-clear signal if the soldiers show no symptoms.</li> <li>• Watches the soldiers for delayed symptoms.</li> <li>• Has first aid available.</li> </ul>	<p>Soldiers conduct MOPP gear exchange as a two-man team. See <i>FM 3-5</i> for more information.</p> <p>Soldiers—</p> <ul style="list-style-type: none"> <li>• Decon their individual gear.</li> <li>• Prepare their mask for decon and their overgarment for removal.</li> <li>• Decon their mask hood.</li> <li>• Remove their overgarment and overshoes.</li> <li>• Remove their gloves.</li> <li>• Put on their new overgarment.</li> <li>• Put on their new overshoes and gloves.</li> <li>• Secure their hood.</li> <li>• Secure their gear.</li> </ul>

**Table 3-11. NBC threat, detection, and protection**

Agent Type	Agent Class	Agent Effect	M8A	M256	CAM	M8	M9	Protection Required	Skin Decon	Equip Decon
AC	NP	Blood	N	Y	N	N	N	Mask only	N	N
GA	NP	Nerve	Y	Y	Y	Y	Y	Mask and overgarment	Y	N
GB	NP	Nerve	Y	Y	Y	N	N	Mask and overgarment	Y	N
GD	P	Nerve	Y	Y	Y	Yellow	Y	Mask and overgarment	Y	Y
VX	P	Nerve	N	Y	N	Green	Y	Mask and overgarment	Y	Y
HL	P	Blister	N	Y	Y	Red	Y	Mask and overgarment	Y	Y
HD	P	Blister	N	Y	Y	Red	Y	Mask and overgarment	Y	Y
CG	NP	Choking	N	N	N	N	N	Mask only	N	N