CHAPTER 4

Survivability

WEAPONS FIGHTING POSITIONS

Positions may be hasty or deliberate depending on time and material availability Positions may be dug by hand or mechanically (with JD410). Table 4-1 shows required thickness for protection against direct and indirect fire.

Table 4-1. Material thickness (cm/in) required to protect against direct and indirect fire

MATERIAL	DIRECT FIRE			INDIRECT FIRE (Blast exploding 50 feet away)		
	SMALL CALIBER (7.62 MM)	HE SHAPED CHARGE		MORTAR	MORTAR/ ROCKET/HE SHELL	
		85 MM (RPG7)	107-120 MM (RCLR) (SAGGER)	82 MM	120 MM 122 MM	152 MM
Concrete	30 (12)	76 (30)	91 (36)	10 (4)	13 (5)	15 (6)
Gravel, small rocks, bricks, rubble	51 (20	61 (24)	91 (36)	25 (10)	46 (18)	51 (20)
Soil, sand	107 (42)	198 (78)	244 (96)	30 (12)	51 (20)	76 (30)
Timber	91 (36)	229 (90)	274 (108)	20 (8)	30 (12)	36 (14)
Snow (tamped)	183 (72)	396 (156)	None	152 (60)	152 (60)	152 (60)

Individual Fighting

Table 4-2 and Figures 4-1 through 4-3 (pages 4-2 and 4-3) show details and characteristics of different individual positions. The light antitank weapon (LAW) may be fired from any of these positions however backblast area must be cleared prior to firing.

Table 4-2 Characteristics of Individual fighting positions

TYPE OF POSITION	ESTIMATED CONSTRUCTION TIME W/HAND TOOLS (MAN-HOURS)	NUCLEAR WEAPONS
HASTY		
Crater	0.2	Fair
Skirmisher's trench	0.5	Fair
Prone position	1.0	Fair
DELIBERATE		
One-soldier position	3.0	Fair
One-soldier position with 1½-ft overhead cover	8.0	Good
Two-soldier position	6.0	Fair
Two-soldier position with 1½-ft overhead cover	11.0	Good
LAW position	3.0	Fair

NOTES:
1. All deliberate postions provide protection from medium artillery no closer than 30 feet.
2. All positions provide no protection from indirect fire blasts or direct hits from indirect fire.

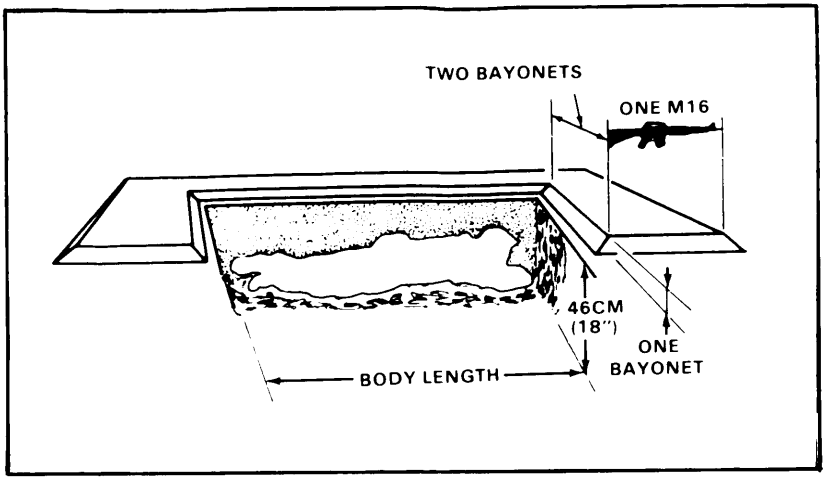


Figure 4-1 Hasty prone position (stage 1)

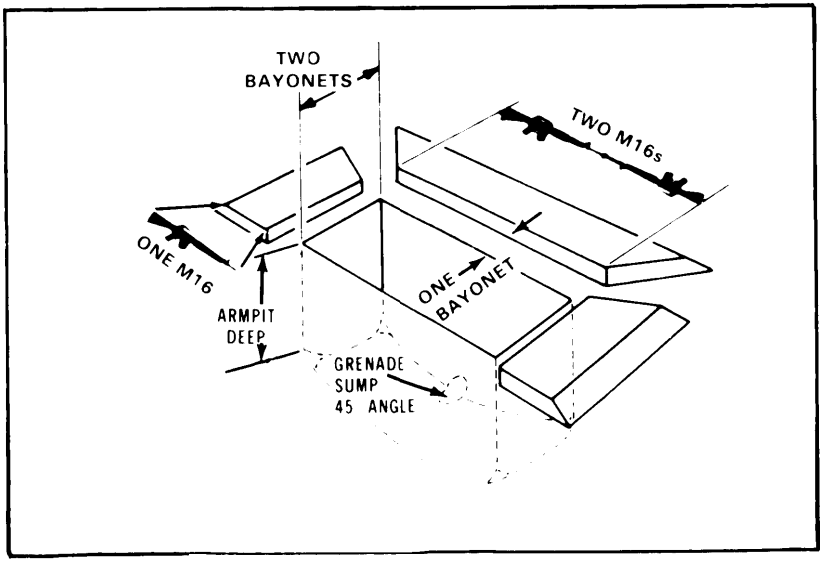


Figure 4-2 Two-soldier firing position (stage 2)

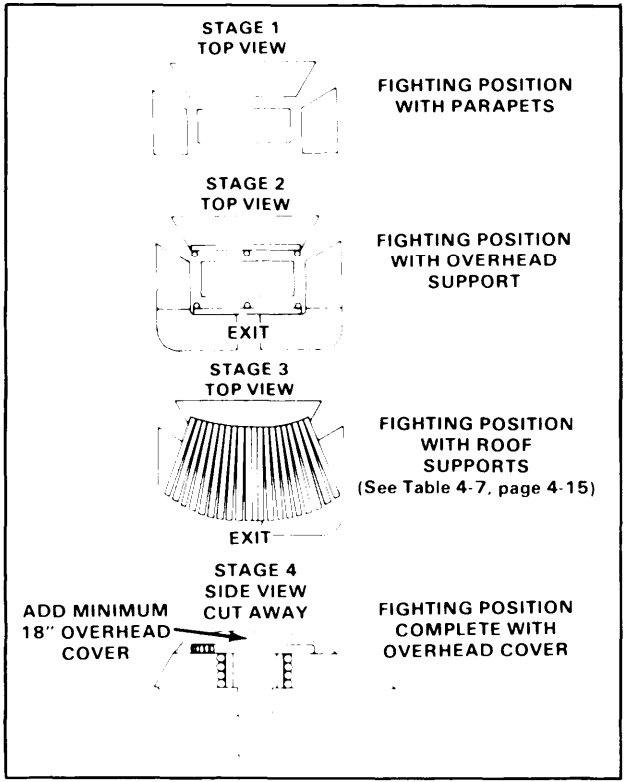


Figure 4-3. Two-soldier fighting position development

Crew-Served Weapons Fighting

See Table 4-3 and Figures 4-4 through 4-9 (paqes 4-4 through 4-7) for specifications and details.

Table 4-3. Characteristics of crew-served weapons positions

TYPE OF POSITION	ESTIMATED CONSTRUCTION TIME W/HAND-TOOLS (MAN-HOURS)	NUCLEAR WEAPONS
Dragon position	4.0	Fair
Dismounted TOW position	11.0	Fair
90mm RCLR position	6.0	Fair
Machine gun position	7.0	Fair
Machine gun position with 1½-ft overhead cover	12.0	Good
Mortar position	14.0	Fair

NOTES:

1. All positions provide protection from medium artillery no closer than 30 feet.
2. All positions provide no protection from indirect fire blasts or direct hits from indirect fire.

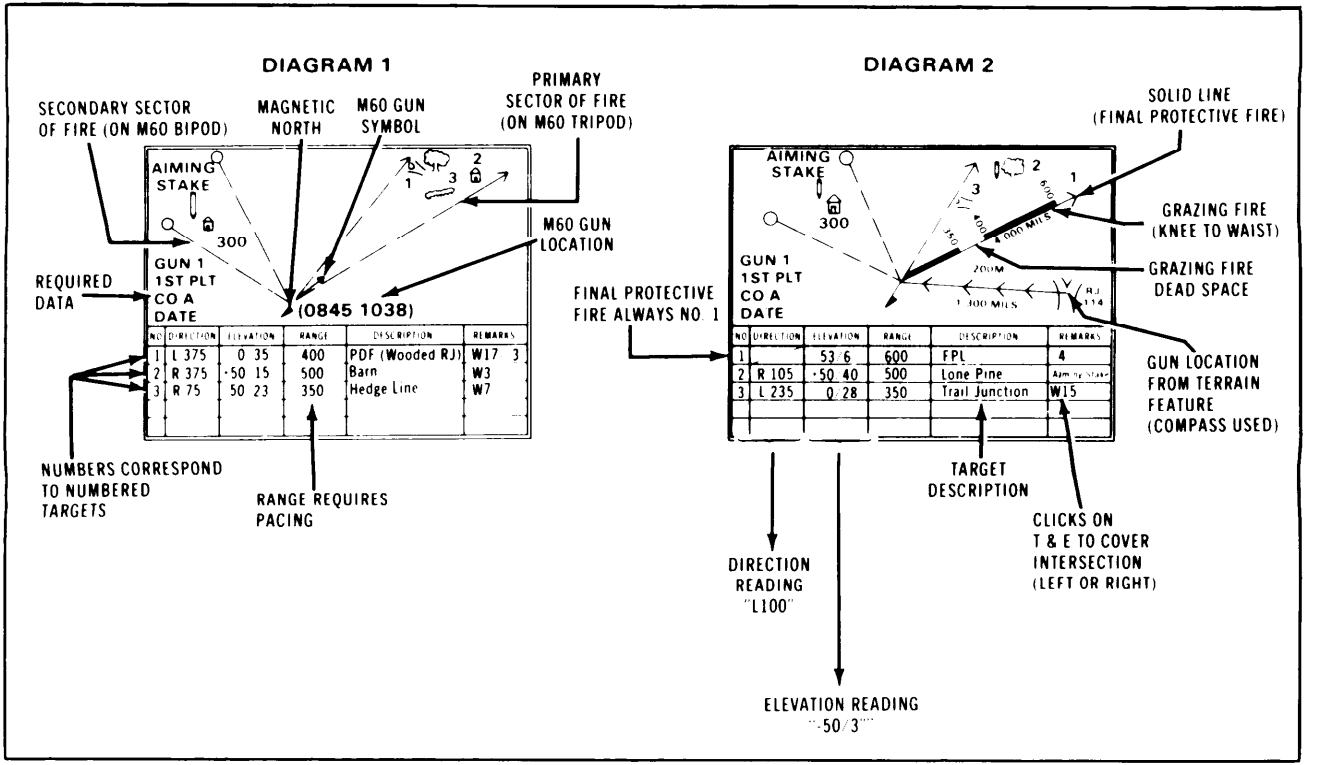


Figure 4-4. Range card

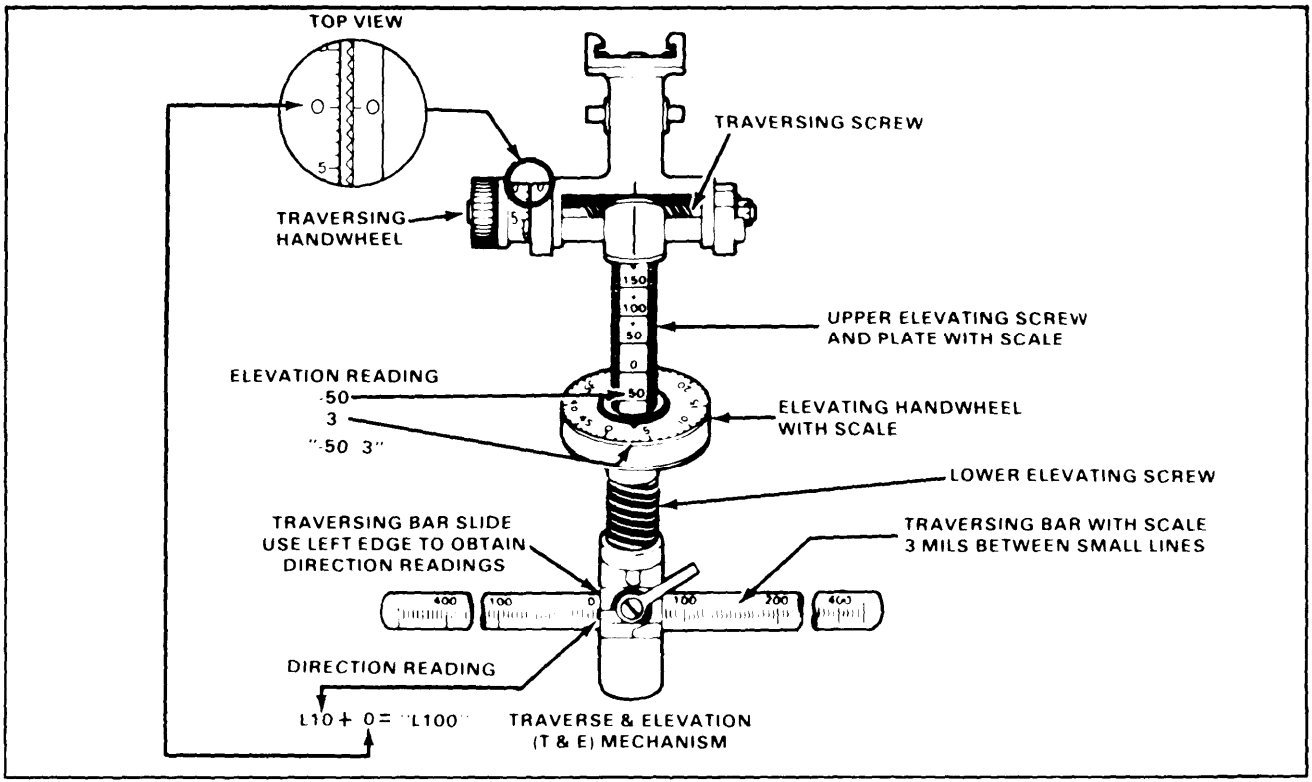


Figure 4-4. Range card (continued)

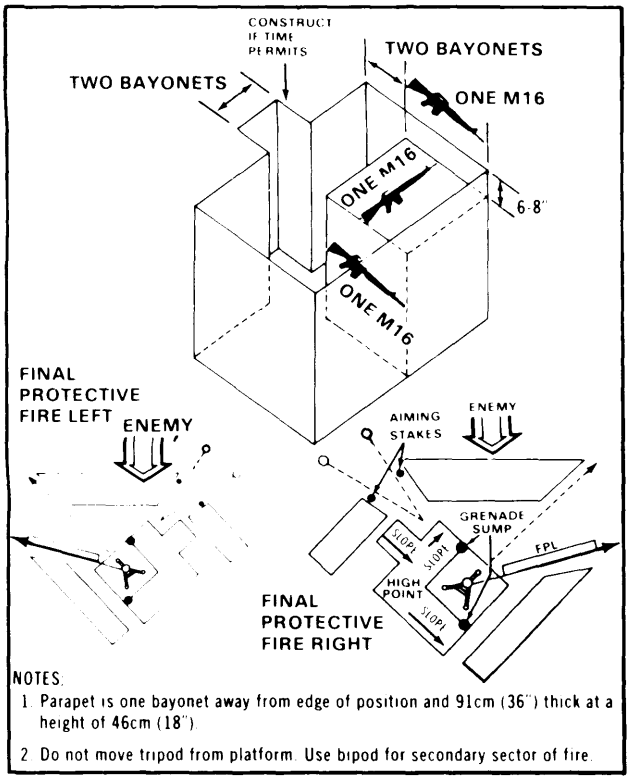


Figure 4-5. Machine gun position

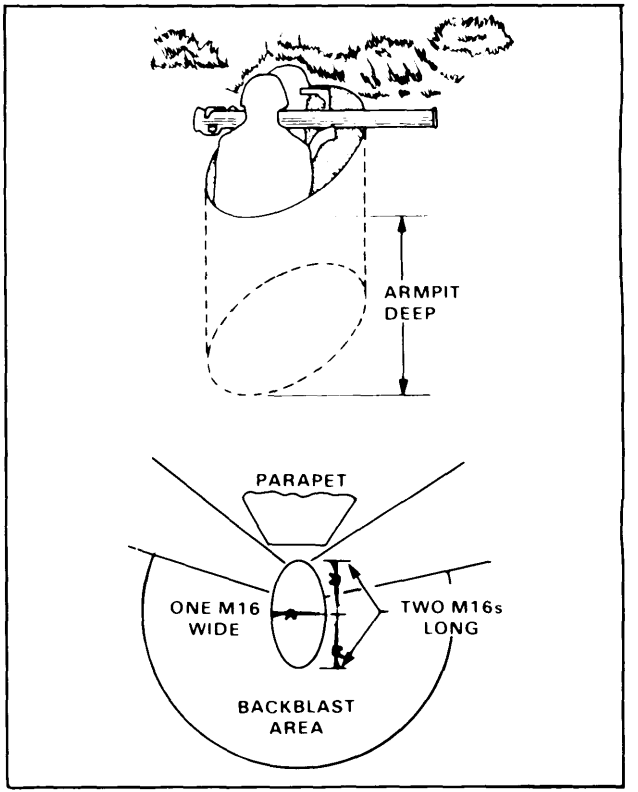


Figure 4-6. 90mm firing position

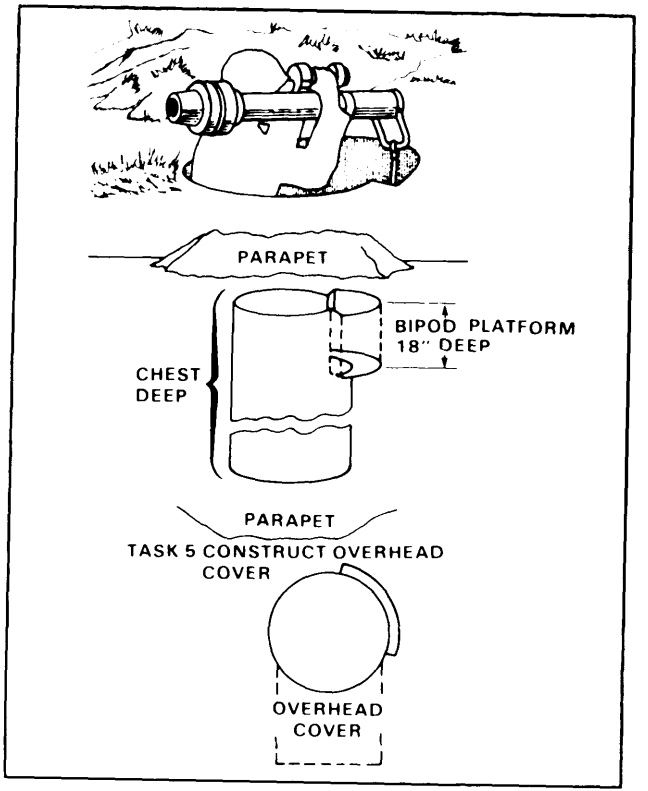


Figure 4-7. Dragon position

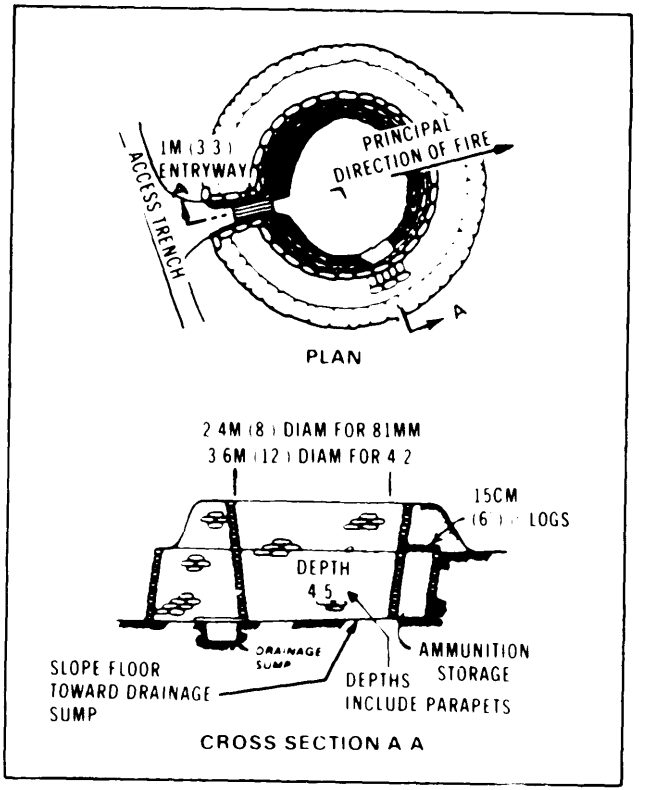


Figure 4-8. Mortar (4.2 in and 81 mm) improved position

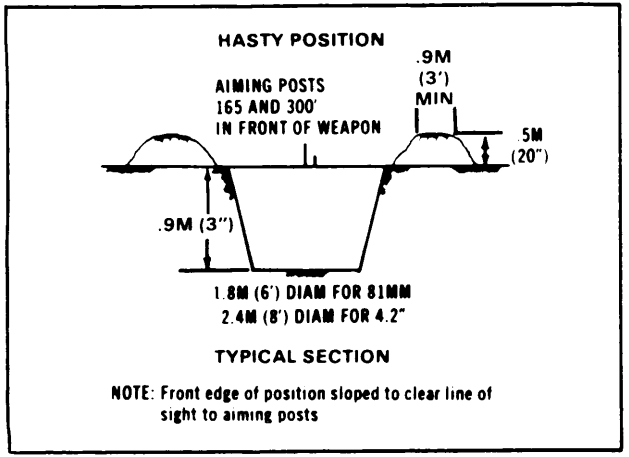


Figure 4-9. Mortar hasty position

VEHICLE POSITIONS

Positions may be fighting or protective, hasty or deliberate. See Table 4-4 for estimated survivablility positions for maneuver units.

WARNING

ENSURE ENGINEER EQUIPMENT (SCOOP LOADERS, M9 (ACE)s. SCRAPERs) BOWLS ARE PERIODICALLY EMPTIED AND NEVER ALLOWED TO REMAIN FILLED OVERNIGHT, PARTICULARLY DURING COLD WEATHER.

Table 4-4. Standard survivability estimates for maneuver units

LEVEL	DESCRIPTION OF RECOMMENDED PRIORITY OF SURVIVABILITY SUPPORT		NUMBER OF HULL-DOWN POSITIONS TO BE PROVIDED PER BATTLE POSITION			
			ARMOR BN	MECH INF BN	ARMOR CO	MECH INF CO
1	TOWs	P				
	Tanks	P				
	APC (Plt and Co HQ only)	50% P				
	TOC	P	80	100	15	15
2	TOWs	P and A				
	Tanks	P				
	APC (Plt and Co HQ only)	P				
	TOC	P	85	175	15	25
3	TOWs	P and A				
	Tanks	P and A				
	APC (Plt and Co HQ only)	P				
	TOC	P				
	Combat Support	P	150	180	30	25
4	TOWs	P and A				
	Tanks	P and A				
	APC (all)	P				
	TOC	P				
	Combat Support	P				
	Combat Train	50% P	160	190	30	30
5	TOWs	P. A. and S				
	Tanks. APC (all)	P and A				
	TOC	P				
	Combat Support	P				
	Combat Train	P	185	295	45	40
6	TOWs. Tanks and APC (all)	P. A. and S				
	TOC	P and A				
	Combat Support	P and A				
	Combat Train	P	265	330	45	45

NOTES:

1. P=Primary, A=Alternate, S=Supplementary hull-down positions.
2. Numbers are rounded to the nearest 5.
3. Combat support vehicles comprise mortars and ADA.
4. Platoon and Co HQ only Allows for four APCS per platoon and two per Co HQ to be dug in.

Hasty Fighting

See Figure 4-10. Berms will not protect vehicles from enemy armor fire.

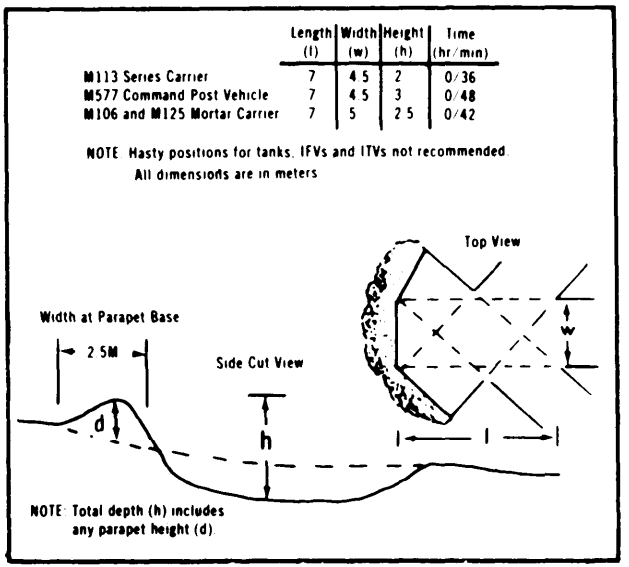


Figure 4-10. Hasty fighting positions for combat vehicles

Deliberate Fighting

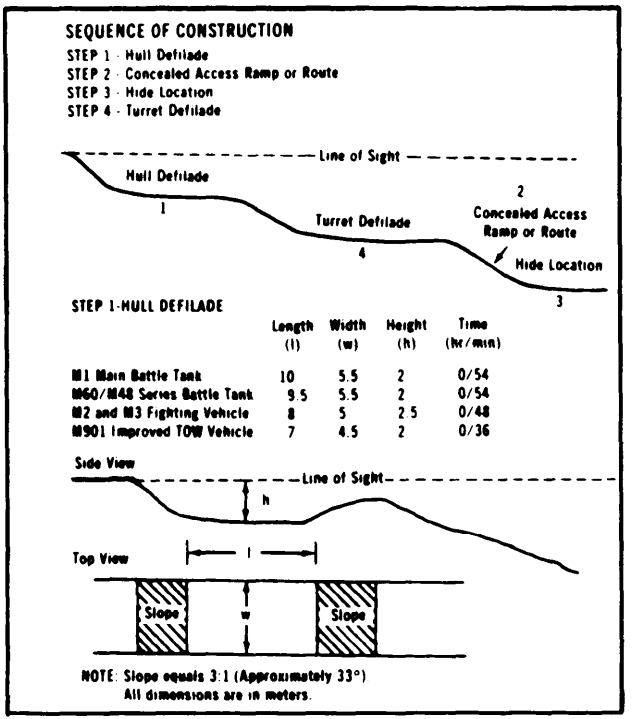
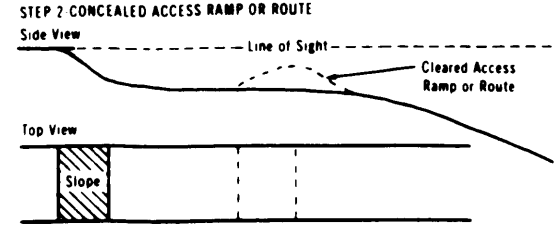
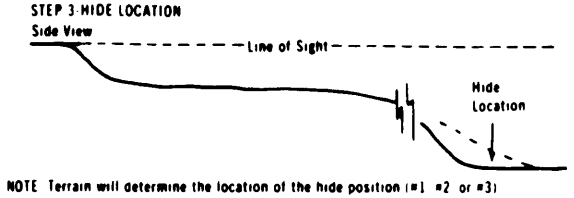


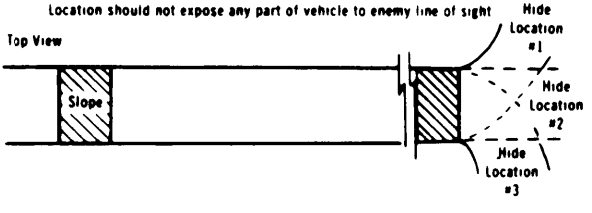
Figure 4-11. Deliberate fighting positions for fighting vehicles



NOTE Slope equals 3 1 (Approximately 33°)
All dimensions are in meters

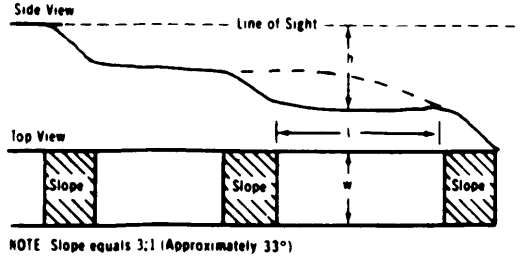


NOTE Terrain will determine the location of the hide position (#1 #2 or #3)
Location should not expose any part of vehicle to enemy line of sight



STEP 4 TURRET DEFILADE

	Length (l)	Width (w)	Height (h)	Time (hr min)
M1 Main Battle Tank	10	5 5	3	1 30
M60 M48 Series Battle Tank	9 5	5 5	3	1 30
M2 and M3 Fighting Vehicle	8	5	3	1 12
M113 Series Carrier	7	4 5	2 5	0 42
M901 Improved Tow Vehicle	7	4 5	3	0 48



NOTE Slope equals 3:1 (Approximately 33°)
All dimensions are in meters

Figure 4-11. Deliberate fighting positions for fighting vehicles (continued)

Artillery and parapet

See Table 4-5 and Figure 4-12 for details. For field artillery platform, refer to Field Manual (FM) 5-103 for details

Table 4-5. Dimensions of field artillery vehicle positions

VEHICLE TYPE	DIMENSION[1]			EQUIPMENT HOURS[3] (D7 DOZER/ M9 ACE)	MINIMUM PARAPET THICKNESS AT BASE M (FT)	REMARKS
	LENGTH M (FT)	WIDTH M (FT)	DEPTH[2,4] M (FT)			
Chaparral (M730) and self-propelled Hawk	7.8 (26)	4.5 (15)	1.2 (4)	0.5	2.4 (8)	
General support rocket launcher	8 (27)	5.1 (17)	9 (3)	0.4	2.4 (8)	
155-mm self-propelled howitzer (M109)	32 (107)	5.4 (18)	1.5 (5)	2.7	2.4 (8)	*
175-mm self-propelled gun (M107)	31.5 (105)	4.8 (16)	1.5 (5)	2.4	2.4 (8)	*
8-in self-propelled howitzer (M110)	32.4 (108)	5 (17)	1.5 (5)	2.6	2.4 (8)	*

*Length accomodates ammunition supply vehicles

NOTES: 1. Position dimensions provide an approximate 9m (3 ft) clearance around vehicle for movement and maintenance and do not include ramp(s).

2. Total depth includes any parapet height.

3. Production rate of 100 bank cubic yards per 0.75 hour. Divide construction time by 0.85 for rocky or hard soil, night conditions, or closed hatch operations (M9). Use of natural terrain features will reduce construction time.

4. All depths are approximate and will need adjustment for surroundlng terraln and fields of fire.

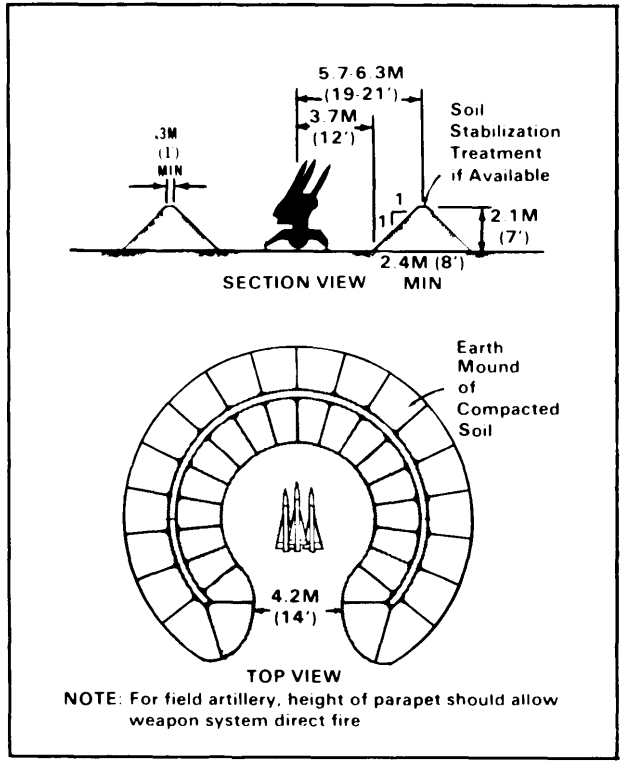


Figure 4-12. Parapet position construction detail

Deep-cut

See Table 4-6 and Figure 4-13

Table 4-6. Dimensions of typical deep-cut position

VEHICLE TYPE	DIMENSION.[1]			EQUIPMENT HOURS[3] (D7 DOZER/ M9 ACE)	REMARKS
	LENGTH M (FT)	WIDTH M (FT)	DEPTH[2,4] M (FT)		
¼-ton truck/CUCV	5.4 (18)	3.6 (12)	2.1 (7)	0.5	Add 2.7m (9 ft) to length for cargo trailer
1¼-ton truck/ HUMMV	6 (20)	3.9 (13)	2.7 (9)	0.7	Add 1.5m (5 ft) to length for gamma goat (M561)
2½-ton cargo truck	8.7 (29)	3.9 (13)	3 (10)	1.1	Add 4.2m (14 ft) to length for cargo or water trailer
2½-ton shop van	8.4 (28)	4.2 (14)	3.6 (12)	1.3	
5-ton cargo truck	11.4 (38)	4.2 (14)	3 (10)	1.5	
5-ton shop van	10.8 (36)	4.2 (14)	3.6 (12)	1.7	
10-ton cargo truck	10.2 (34)	4.8 (16)	3.6 (12)	1.9	
10-ton tractor w/ van semitrailer	15.9 (53)	4.8 (16)	3.6 (12)	2.9	Dimensions shown are for trailer length of 9.3m (30.8 ft) For other trailers, add 6.9m (23 ft) to actual trailer length

NOTES: 1. Position dimensions provide an approximate 9m (3 ft) of clearance around vehicle for movement and maintenance and do not include ramp(s).

2. Production rate of 100 bank cubic yards per 0.75 hour. Divide construction time by 0.85 for rocky or hard soil night conditions or closed hatch operations (M9). Use of natural terrain features will reduce construction time.

3. Ensure drainage is provided.

4. See Table 8-4 (page 8-9) for minimum slope cut ratios.

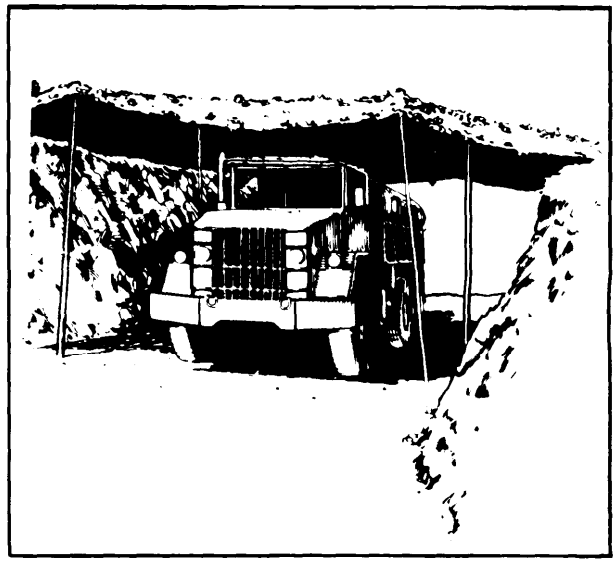


Figure 4-13. Deep cut position

Trenches

Construct trenches to connect fighting positions and provide protection and concealment for personnel moving between position. They may be open with overhead cover or a combination See Figure 4-14.

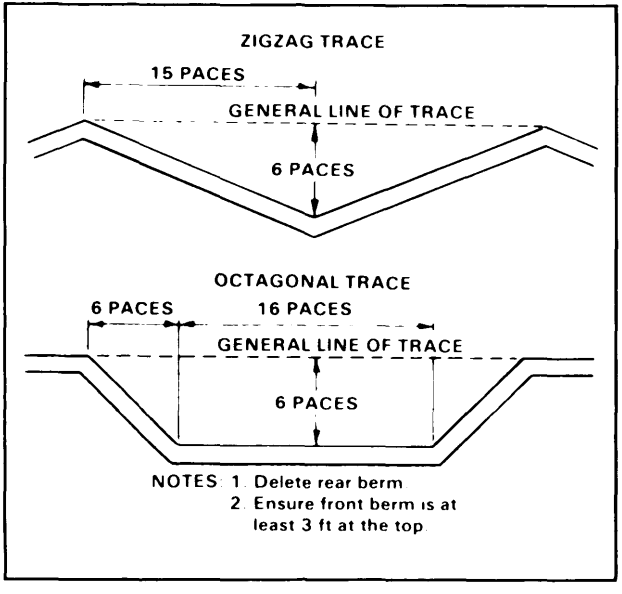


Figure 4-14. Standard trench traces

Revetments

Retaining wall

Materials that can be used for a retaining wall are sandbags, sod blocks (20 centimeters x 45 centimeters), lumber, timber and corrugated metal. When using sandbags, fill bags ¾ full with one part cement to 10 parts earth. Place bottom row as header at about 15 centimeters below floor level. Alternate rows as header and stretcher (Figure 4-15). Slope wall toward revetted face at 1 to 4 slope ratio. See Figure 4-16 (page 4-14) for anchoring method.

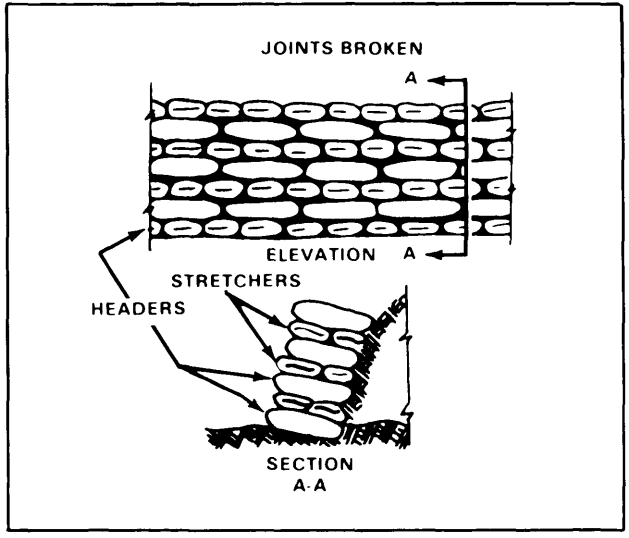


Figure 4-15. Sandbag revetment

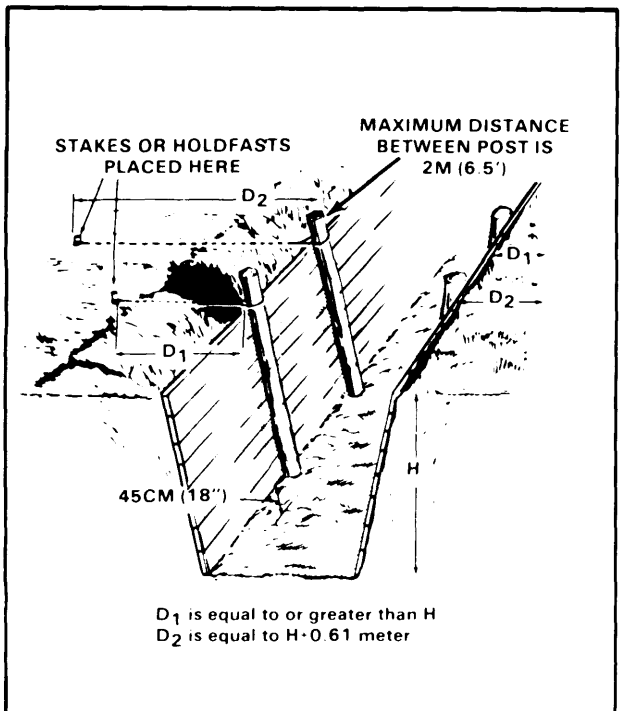


Figure 4-16. Lumber retaining wall anchoring method

Facing revetments

Mainly used to protect surfaces from weather and damage by occupation. Construction material may be brushwood hurdles (Figure 4-17) continuous brush pole and dimensional timbers, corrugated metal or burlap and chicken wire. To emplace a facing revetment tickets should be 8 centimeters (3 inches) in diameter or larger and at a maximum spacing of 1.75 meters (5.7 feet). Pickets should be driven into the ground af least 5 meter(1.6 feet) and anchored at the top IAW Figure 4-16.

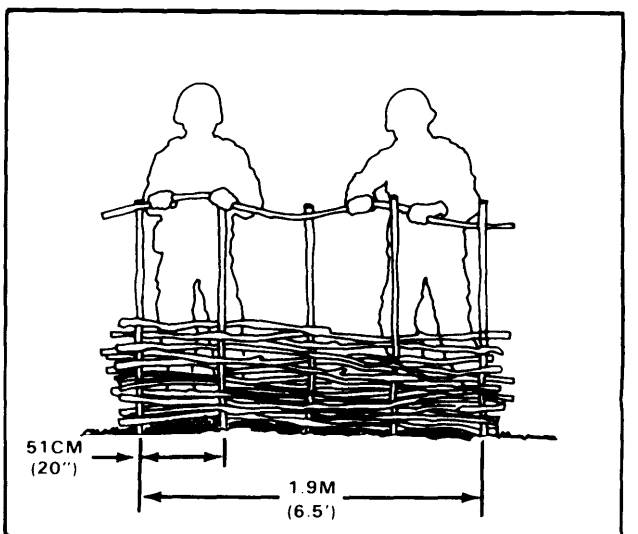


Figure 4-17. Brushwood hurdle

Bunkers

Basic criteria to consider when designing a bunker are the purpose (command post or fighting position) and the degree of protection desired (small arms, mortars, bombs) (Table 4-1, page 4-1). Table 4-7 shows design figures to defeat contact bursts. The bunker can be constructed wholly or partly underground. Prefabrication of bunker assemblies (wall and roof) afford rapid construction and placement flexibility. When using timber, avoid notching construction timber. Common field bunkers are shown Figures 4-18 and 4-19, (pages 4-16 and 4-17). For other bunker design and construction refer to FM 5-103.

Table 4-7. Center-to-center spacing for wood supporting soil cover to defeat contact bursts

NOMINAL STRINGER SIZE (INCHES)	DEPTH OF SOIL (d) M (FT)	SPAN LENGTH (L) M (FT)				
		.6 (2)	1.2 (4)	1.8 (6)	2.4 (8)	3 (10)
	CENTER-TO-CENTER STRINGER SPACING (h) CM (IN)					
	82-mm Contact Burst					
2 x 4	6 (2)	7.6 (3)	10 (4)	10 (4)	10 (4)	8 (3)
	9 (3)	46 (18)	30 (12)	20 (8)	13 (5)	8 (3)
	1.2 (4)	46 (18)	36 (14)	18 (7)	10 (4)	8 (3)
2 x 6	6 (2)	10 (4)	18 (7)	20 (8)	20 (8)	15 (6)
	9 (3)	46 (18)	46 (18)	41 (16)	30 (12)	20 (8)
	1.2 (4)	46 (18)	46 (18)	46 (18)	28 (11)	18 (7)
4 x 4	6 (2)	18 (7)	25 (10)	25 (10)	22 (9)	18 (7)
	9 (3)	46 (18)	46 (18)	46 (18)	30 (12)	20 (8)
	1.2 (4)	46 (18)	46 (18)	46 (18)	25 (10)	18 (7)
4 x 8	5 (1.5)	10 (4)	13 (5)	18 (7)	20 (8)	20 (8)
	6 (2)	36 (14)	46 (18)	46 (18)	46 (18)	46 (18)
	9 (3)	46 (18)	46 (18)	46 (18)	46 (18)	46 (18)
	120- and 122-mm Contact Bursts					
4 x 8	1.2 (4)	9 (3.5)	10 (4)	13 (5)	13 (5)	15 (6)
	1.5 (5)	30 (12)	30 (12)	30 (12)	28 (11)	25 (10)
	1.8 (6)	46 (18)	46 (18)	46 (18)	41 (16)	30 (12)
6 x 6	1.2 (4)	—	—	14 (5.5)	15 (6)	15 (6)
	1.5 (5)	36 (14)	36 (14)	33 (13)	30 (12)	25 (10)
	1.8 (6)	46 (18)	46 (18)	46 (18)	41 (16)	30 (12)

NOMINAL STRINGER SIZE (INCHES)	DEPTH OF SOIL (d) M (FT)	SPAN LENGTH (L) M (FT)				
		6 (2)	1.2 (4)	1.8 (6)	2.4 (8)	3 (10)
	CENTER-TO-CENTER STRINGER SPACING (h) CM (IN)					
	120- and 122-mm Contact Bursts					
6 x 8	1.2 (4)	14 (5.5)	15 (6)	20 (8)	23 (9)	25 (10)
	1.5 (5)	46 (18)	46 (18)	46 (18)	46 (18)	43 (17)
8 x 8	1.2 (4)	19 (7.5)	23 (9)	28 (11)	30 (12)	33 (13)
	1.5 (5)	46 (18)	46 (18)	46 (18)	46 (18)	46 (18)
	152-mm Contact Burst					
4 x 8	1.2 (4)	—	—	—	—	9 (3.5)
	1.5 (5)	15 (6)	15 (6)	18 (7)	18 (7)	18 (7)
	1.8 (6)	43 (17)	41 (16)	36 (14)	30 (12)	25 (10)
	2.1 (7)	46 (18)	46 (18)	46 (18)	38 (15)	28 (11)
6 x 6	1.5 (5)	18 (7)	20 (8)	20 (8)	20 (8)	18 (7)
	1.8 (6)	46 (18)	46 (18)	38 (15)	30 (12)	25 (10)
	2.1 (7)	46 (18)	46 (18)	46 (18)	38 (15)	28 (11)
6 x 8	1.2 (4)	—	—	—	—	15 (6)
	1.5 (5)	25 (10)	28 (11)	30 (12)	30 (12)	30 (12)
	1.8 (6)	46 (18)	46 (18)	46 (18)	46 (18)	43 (17)
8 x 8	1.2 (4)	—	—	—	—	20 (8)
	1.5 (5)	36 (14)	38 (15)	41 (16)	43 (17)	41 (16)
	1.8 (6)	46 (18)	46 (18)	46 (18)	46 (18)	46 (18)

NOTE: The maximum beam spacing listed in the table is 46cm (18 in). This is to preclude further design for roof material placed over the stringers to hold the earth cover.

A maximum of 1-inch wood or plywood should be used over stringers to support the earth cover for 82-mm bursts; 2-inch wood or plywood should be used for 120-mm, 122-mm, and 152-mm bursts.

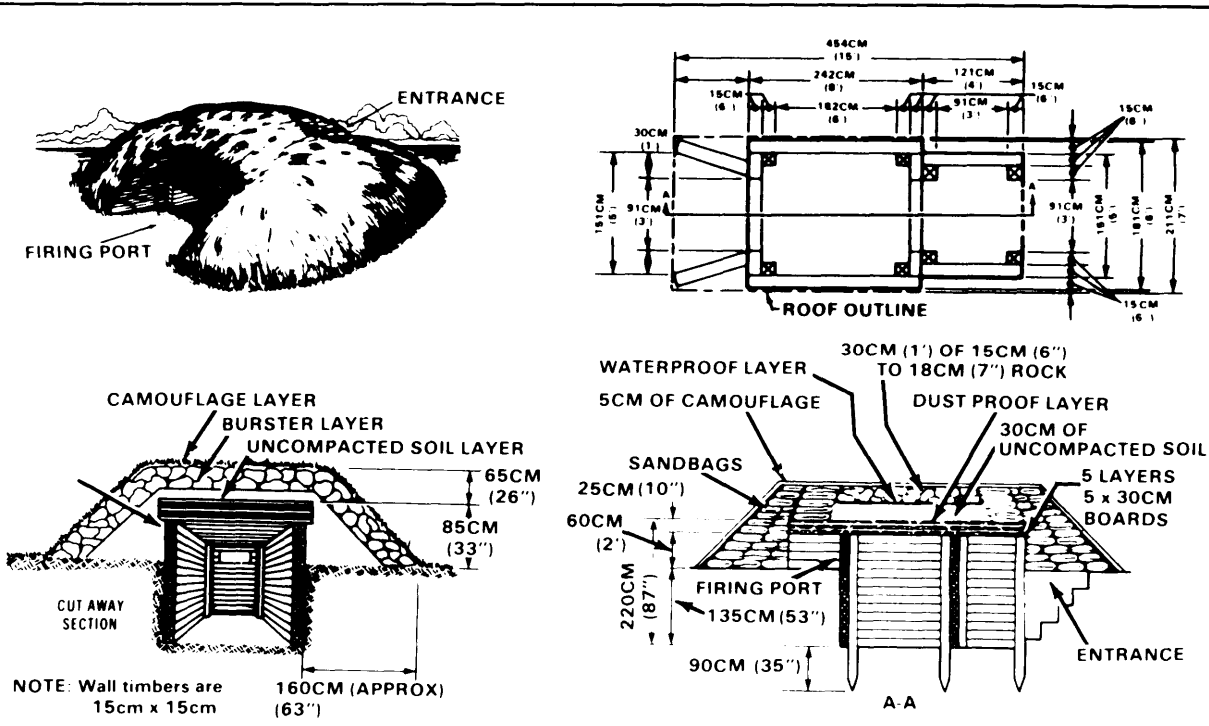


Figure 4-18. Typical bunker

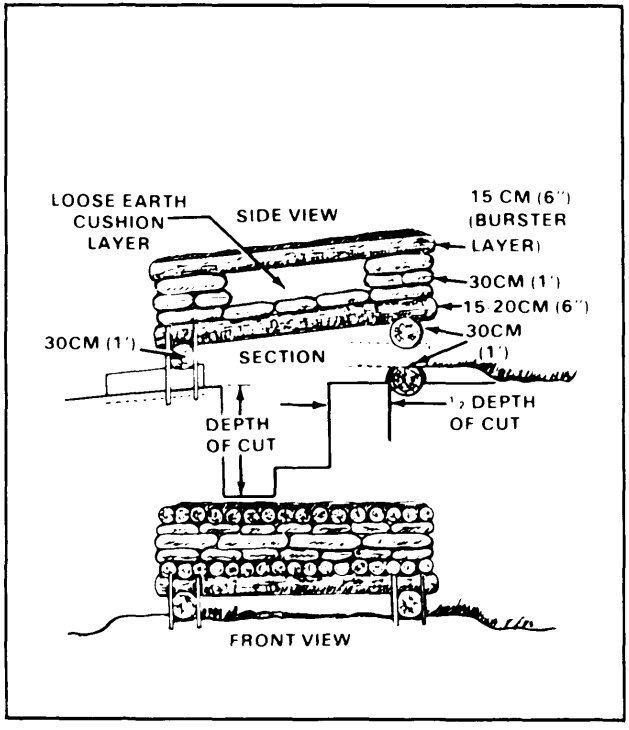


Figure 4-19. Log fighting bunker with overhead cover

Shelters

The most effective shelters are cut and cover. Typical shelters are shown in Figures 4-20 and 4-21 (page 4-18). See FM 5-103 for other more permanent and detailed shelters.

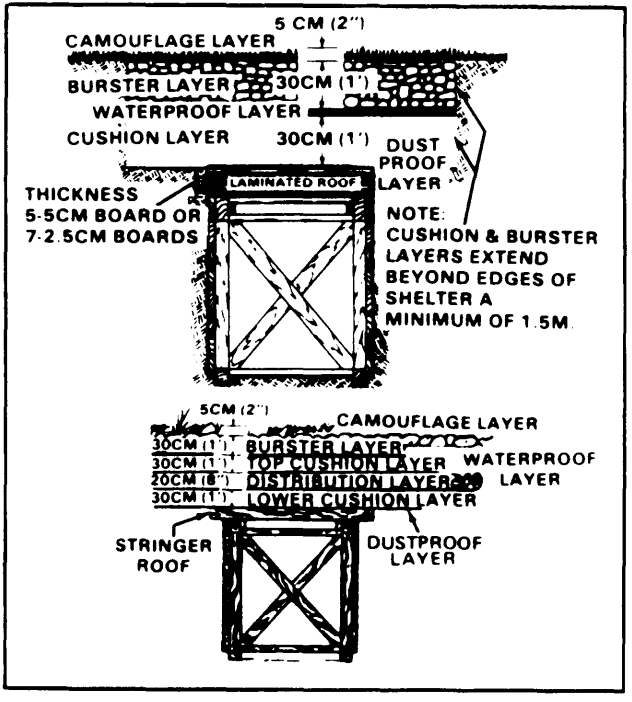


Figure 4-20. Typical cut and cover shelter

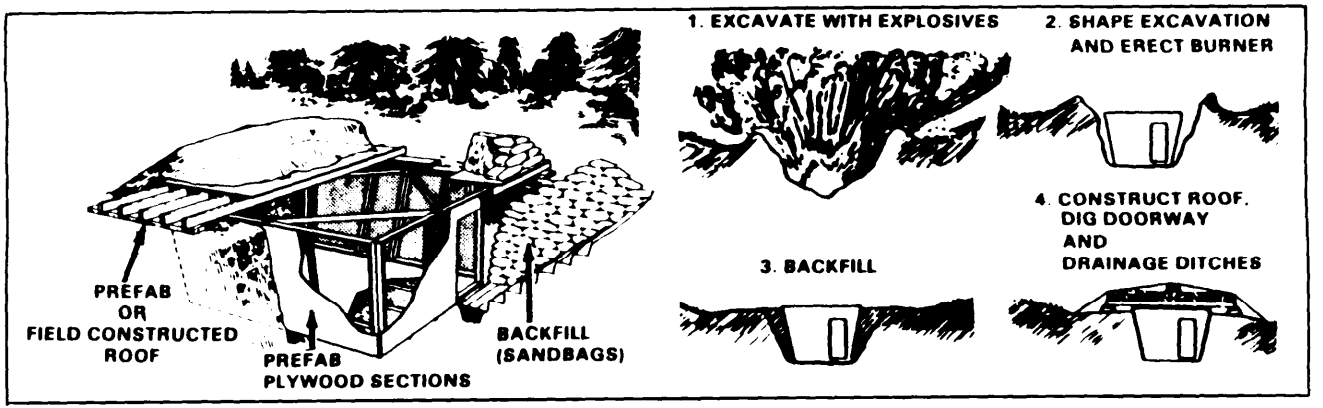


Figure 4-21. Air transportable prefab shelter

CAMOUFLAGE

The purpose of camouflage is to alter or eliminate recognition(shape, shadow, color texture, position, and movement).

Materials

Materials for camouflaging may be natural or man made.

Natural

Natural materials Include vegetation (growing, cut or dead), inert substances of thet substances of the earth (soil and mud) and debris.

Man-made

Man made materials are divided into three groups: hiding and screening (net sets, wire netting, snow fencing, tarpaulins, and smoke); garnishing and texturing (gravel, cinders, sawdust, fabric strips, feather, and spanish moss); and coloring (paints, oil, and grease). Table 4-8 shows expedient paints that can be made in the field.

Table 4-8. Expedient paints

PAINT MATERIALS	MIXING	COLOR	FINISH
No. 1 Local earth, GI soap, water, soot, paraffin	Mix soot with paraffin, add to solution of 8 gal water and ½ lb soap Stir in earth	Dark gray	Flat, lusterless
No. 2 Oil, ground clay, water, gasoline, earth	Mix 2 gal water with 1 gal oil and ¼ to ½ gal clay, add earth. Thin with gasoline or water	Depends on earth colors	Glossy on metal, otherwise dull
No. 3 Oil, clay, GI soap, water, earth	Mix 1½ bars GI soap with 3 gal water, add 1 gal oil; stir in 1 gal clay. Add earth for color	Depends on earth colors	Glossy on metal, otherwise dull

NOTE: Canned milk or powdered eggs can be used to increase binding properties of either issue of field-expedient paints.

Position Development Stages

Planning

Consider the unit's mission, access routes, existing concealment, and size of area.

Occupation

Carefully control traffic to avoid unnecessary movement and disruption of existing concealment. Mark trails and paths and avoid vehicle spacing less than 30 meters apart. The main congested areas(kitchen, command post, and maintenance must be dispersed.

Camouflage maintenance

Inspect the area frequently and upgrade as needed. Maintain light and noise discipline to include equipment blackout. Do not create addtional paths or trails.

Evacuation

Leave area as undisturbed as possible.

Lightweight Camouflage Screen

Estimation

Determine required modules to camouflage vehicle and equipment using Figure 4-22.

Emplacement

Assemble modules into one net (Figure 4-23 page 4-20) and place over vehicle. Keep screen away from all hot surfaces and exhaust systems. Ensure that the appropriate blend (color) is showing. Keep a minimum space of two feet between the net and the vehicle. Screens should never be draped over vehicles (Figure 4-24, page 4-20). Always use the erection set and anchor net system.

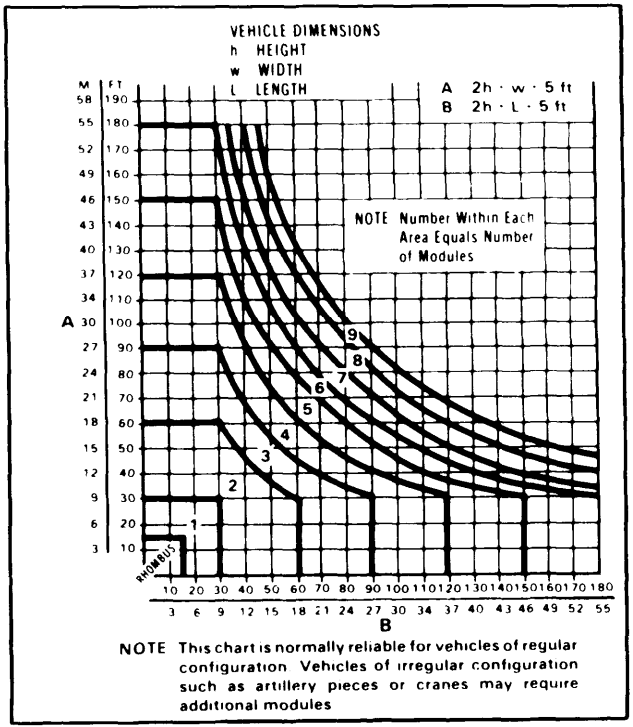


Figure 4-22. Hasty module determination chart

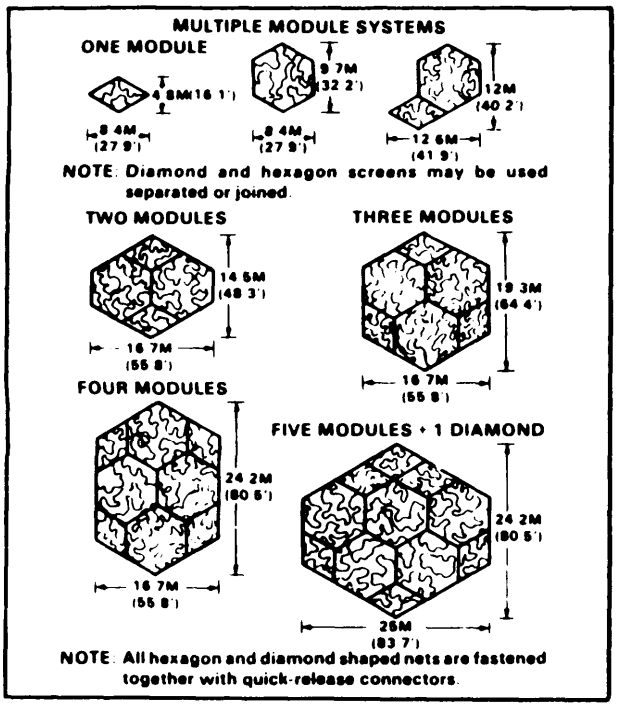


Figure 4-23. Lightweight camouflage screens

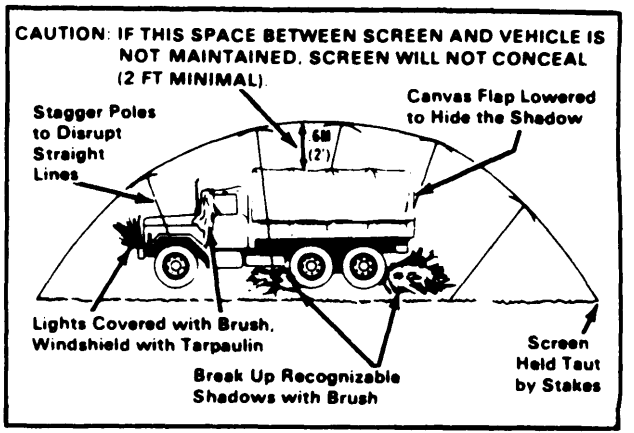


Figure 4-24. Placing net over vehicle