

APPENDIX A

Selected Threat Countermobility Equipment and Obstacles

THREAT ENGINEER ORGANIZATION

OVERVIEW

This appendix provides a detailed discussion of Threat obstacle equipment and the types of obstacles that Threat forces could employ, including existing obstacles. A knowledge of this equipment and obstacles is essential to understand Threat countermobility forces and doctrine. This section contains the organization and equipment of Threat engineer units. The following units are displayed in this section:

- **Engineer company**, motorized rifle and tank regiment (figure A-1).
- **Engineer battalion**, motorized rifle and tank division (figure A-2).
- **Personnel within the engineer battalion**, motorized rifle division (MRD) and tank division (TD) (figures A-3 through A-9). The major items of equipment that are organic to each Threat engineer company are included in table A-1.

MAJOR ITEMS OF EQUIPMENT

ITEM	QUANTITY	ITEM	QUANTITY
ATGL, RPG-16	4	Radios:	
APC, BTR-60	3	HF or VHF, manpack, low-power,	
Truck, UAZ-69/469	1	R-104m or R-107	4
Truck, KrAZ/Ural/ZIL	8 ¹ /9 ²	VHF, vehicle mount, medium-	
Truck, dump, MMZ 555	2	power, R-123	4 ¹ /7 ²
Truck, van, ZIL (maintenance)	1	Notes:	
Truck, crane, K-61	1	1. Personnel and equipment for the engineer company, motorized rifle regiment, BTR or BMP equipped.	
Truck, crane shovel, E-305V	2	2. Personnel and equipment for the engineer company, tank regiment.	
Bridge, tank-launched, MTU/MT-55	1 ¹ /3 ²	3. Numerous variations may exist: Frogmen may be attached to assist in the reconnaissance of water obstacles. Some companies may be equipped with 5 KMM truck-launched bridge spans instead of 4 TMM bridge spans. PMR/PMZ minelayers are normally towed by trucks. Some units may have BTR-152s for this purpose. Some units may have GMZ armored tracked minelayers instead of PMR towed minelayers. Some units may have up to six one-axle cargo trailers in addition to the two-axle cargo trailers. Some units may have tractor-trailers to carry heavy tracked equipment on long road movements.	
Bridge, truck-launched, TMM	4		
Ditching machine, BTM/MDK	1		
Dozer, BAT/BAT-M/PKT	1		
Dozer blade, BTU	3		
Bucket excavator, PZM	3		
Minelayer, towed, PMR-3/PMZ-4	3		
Mineclearing plow, KMT-4/6	9 ¹ /27 ²		
Mine roller-plow, KMT-5	3 ¹ /9 ²		
Water filtration set, MAFS, on ZIL with trailer	1		
Trailer, cargo, 2-axle	2		

Table A-1

**ENGINEER COMPANY,
MOTORIZED RIFLE AND TANK REGIMENT**

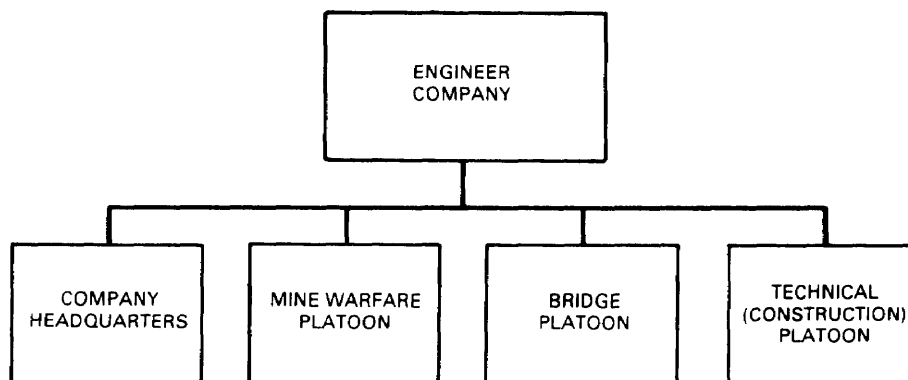


Figure A-1

**ENGINEER BATTALION,
MOTORIZED RIFLE AND TANK DIVISION**

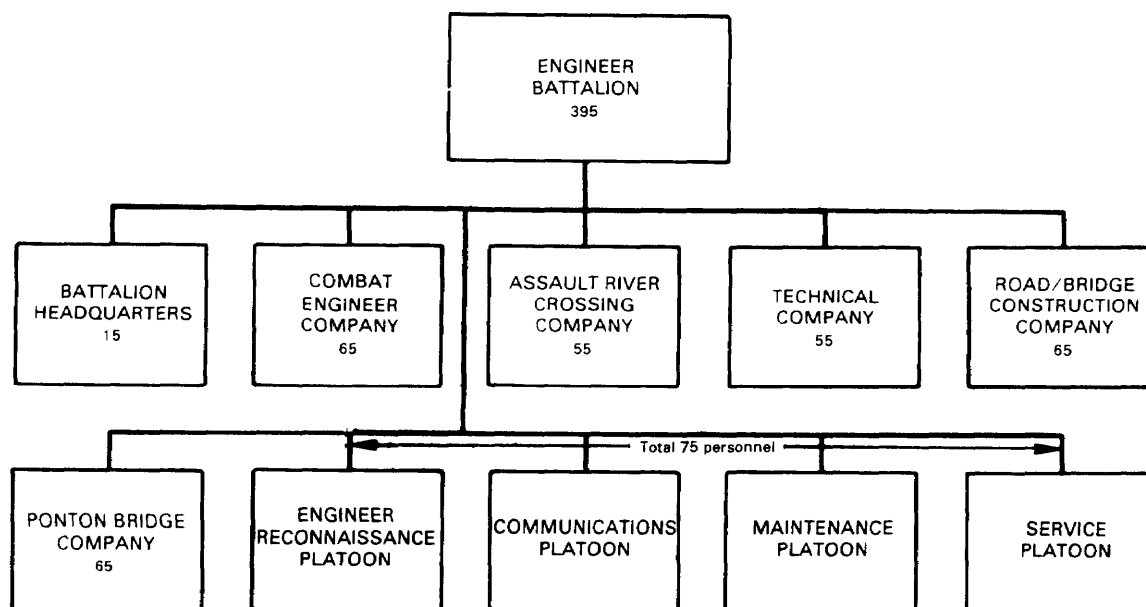


Figure A-2

**BATTALION HEADQUARTERS,
ENGINEER BATTALION, MRD AND TD**

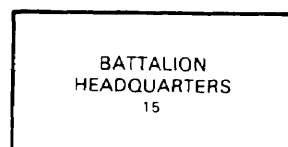


Figure A-3

**COMBAT ENGINEER COMPANY,
ENGINEER BATTALION, MRD AND TD**

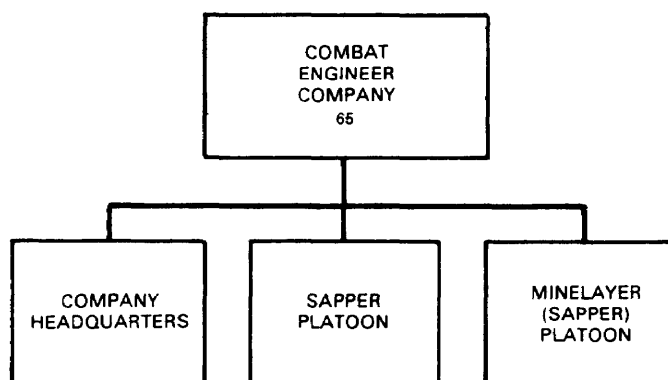


Figure A-4

**ASSAULT RIVER-CROSSING COMPANY,
ENGINEER BATTALION, MRD AND TD**

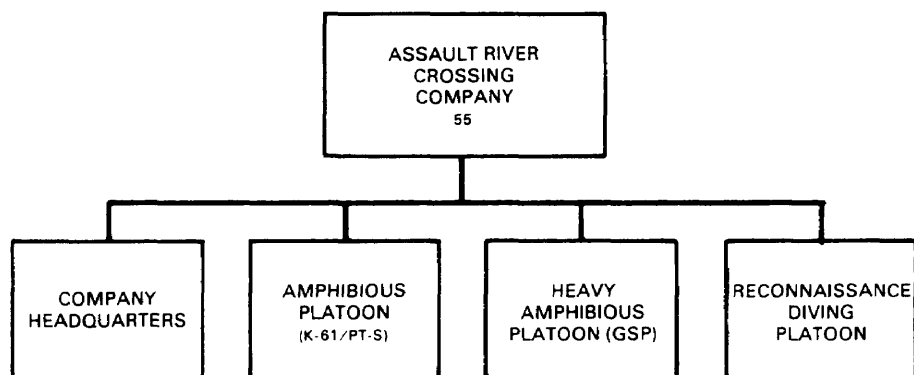


Figure A-5

**TECHNICAL COMPANY,
ENGINEER BATTALION, MRD AND TD**

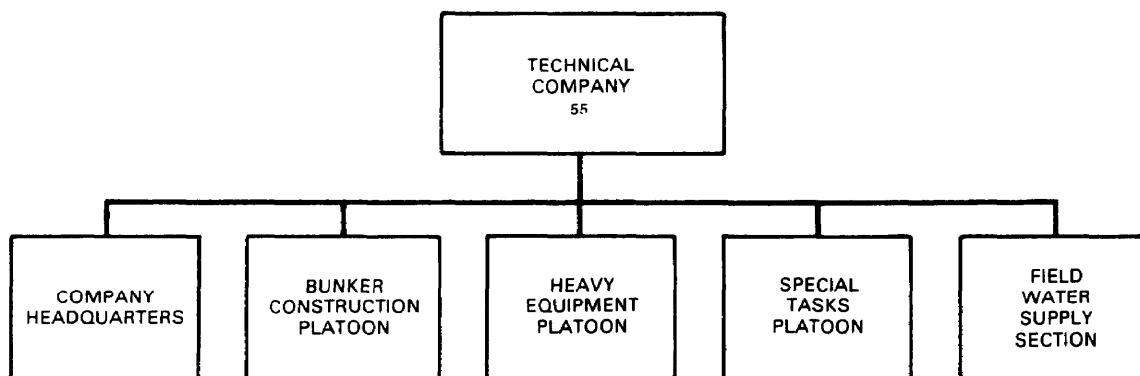


Figure A-6

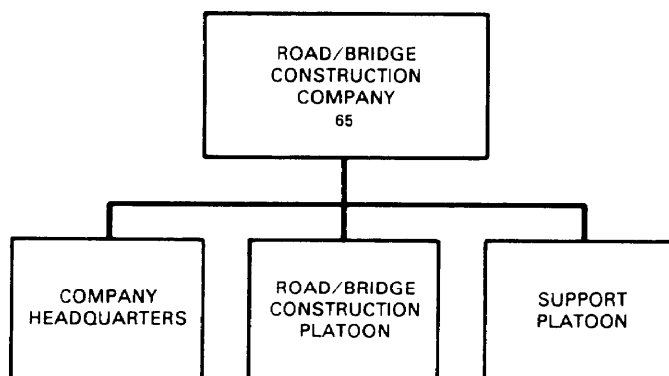
**ROAD/BRIDGE CONSTRUCTION COMPANY,
ENGINEER BATTALION, MRD AND TD**

Figure A-7

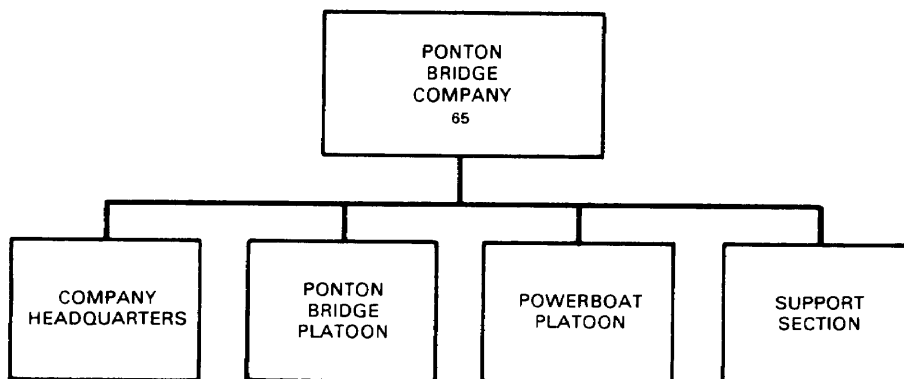
**PONTON BRIDGE COMPANY,
ENGINEER BATTALION, MRD AND TD**

Figure A-8

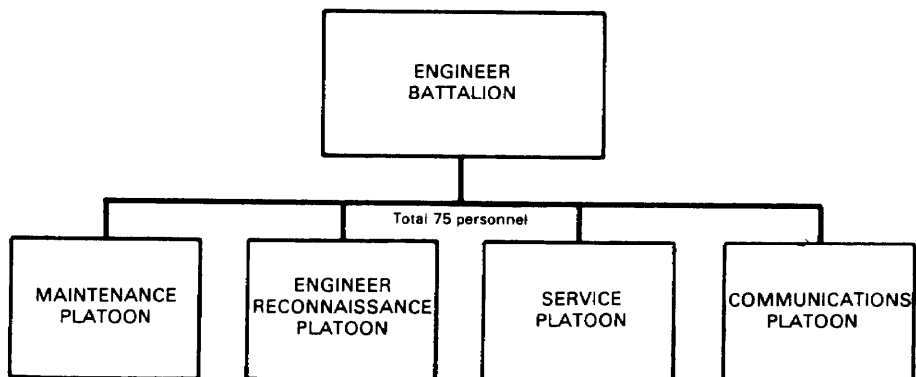
**COMBAT AND SERVICE SUPPORT STRUCTURE,
ENGINEER BATTALION, MRD AND TD**

Figure A-9

THREAT COUNTERMOBILITY EQUIPMENT

THREAT MINE DELIVERY EQUIPMENT

The following is a description of equipment included in Threat mine delivery systems (figures A-10 through A-13).

MINELAYING CHUTES

Before the introduction of mechanical mine-laying equipment, the Warsaw Pact made wide use of simple chutes for laying antitank mines. They were attached to the sides or rear of trucks or BTR-152 armored personnel carriers. The mines were fed on the chute by hand and slid to the ground. This method was used when a minefield had to be laid rapidly. Later models of these chutes incorporated an automatic arming device for use with TM-62 type mines.

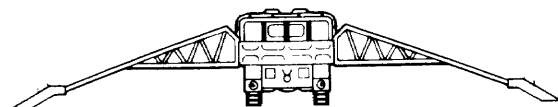
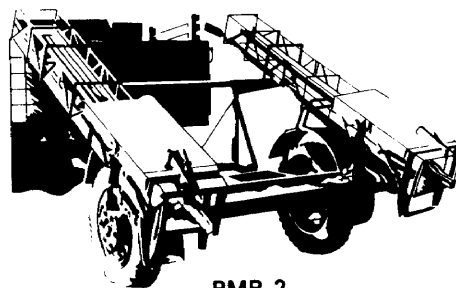


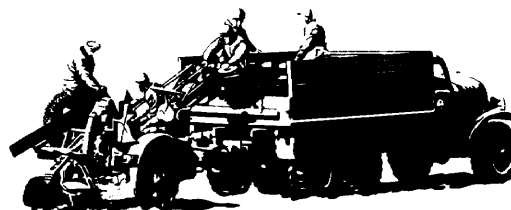
Figure A-10

PMR-2 AND PMR-3 TOWED MINELAYERS

The PMR-2 is a two-wheeled trailer with two chutes. The upper part of the chute has a wide mouth into which the antitank mines are loaded. They then slide down a double roller conveyor into the distributing mechanism, which spaces them at intervals of 4.0 or 5.5 meters. The mines are laid on the surface and buried by a follow-up team if required. The trailer is normally towed by a heavy truck or a BTR-152 armored personnel carrier. The PMR-3 has a single chute and the operator can select mines to be either surface laid or buried 30- to 40-centimeters deep. Mines are laid at predetermined spacings of 4.0 or 5.5 meters. The PMR-3 is normally towed by a ZIL-157 truck which carries 300 TM-46 or similar antitank mines. A fully loaded BTR-152, carrying 120 mines, can lay a minefield 0.48 kilometers long when the mines are spaced at 4-meter intervals.



PMR-2



PMR-3

Figure A-11

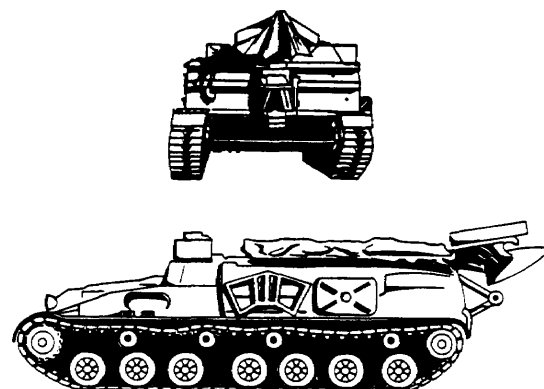
GMZ TRACKED MINELAYER

The GMZ tracked minelayer is based on the chassis of the SA-4 (Ganef) surface-to-air missile system. The driver is seated at the front of the vehicle on the left side with the engine to the right. This leaves the rear of the vehicle clear for the mounting of the mine-laying equipment and the stowage of mines. The suspension of the GMZ consists of seven road wheels with the drive sprocket mounted at the front and the idler at the rear. There are four track return rollers. The minelayer mechanism is of the plough type and resembles the Soviet PMR-3 and the East German MLG-60 mechanical minelaying systems. Like the latter systems, the GMZ can lay the mines on the surface or bury them. Infrared vision equipment enables the GMZ to carry out minelaying operations during darkness. The GMZ is replacing the PMR series of towed minelayers throughout the Threat forces. Specifications include—

Crew: 4

Weight: 25 tons

Width: 3.2 m (10.5 ft)



Length: (vehicle) 8.7 m (28.7 ft)

(plough lowered) 10.3 m (33.9 ft)

(plough raised) 9.1 m (30.0 ft)

Height: 2.7 m (8.5 ft)

Max speed: (road) 50 km/h

Mine storage: 200

Burial depth: 4/min

Minelaying rate, surface: 8/min

Figure A-12

ANTITANK MINELAYING HELICOPTERS

Soviet military periodicals have indicated that they are using a helicopter-borne anti-tank minelaying system to protect the flanks of armored spearhead units. The system is basically a chute attached to the side of the helicopter down which mines slide to the ground. Helicopters seen with this system are the Mi-4 Hound (estimated carrying capacity 200 metallic antitank mines such as the TM46 with MVM fuze) and the Mi-8 Hip C (estimated carrying capacity 400 metallic antitank mines).



Figure A-13

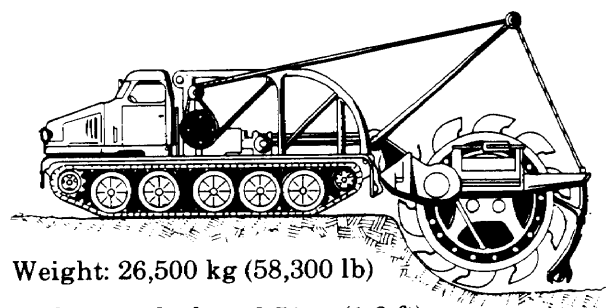
EARTHMOVING EQUIPMENT

The following is a discussion of Threat earthmoving equipment (figures A-14 through A-19).

BTM DITCHING MACHINE

The BTM ditching machine, first appearing in 1958, consists of a rigid-wheel, multibucket excavator, mounted on an AT-T heavy tracked artillery tractor chassis. The ditching wheel has 10 buckets and is mechanically regulated for depth by a cable. The latest model tractor has an insulated, heated cab, plus an engine preheater that enables it to function in extremely low temperatures. It is also believed to be equipped with a special vent which, combined with the tightly sealed cab, permits it to operate in contaminated areas for limited periods of time. Specifications include—

Height: (transport position) 4.3 m (14.1 ft)
 Height: (operating position) 3.5 m (11.4 ft)
 Width: 3.2 m (10.4 ft)
 Length: (transport position) 7.22 m (23.6 ft)
 Length: (operating position) 10.82 m (35.4 ft)



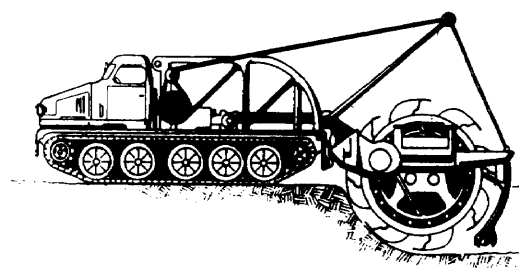
Weight: 26,500 kg (58,300 lb)
 Width/track shoe: 0.51 m (1.6 ft)
 Ground clearance: 0.42 m (1.3 ft)
 Maximum speed: 35 km/h (21 mph)
 Ditching depth: 1.5 m (4.9 ft)
 Ditching width: 1 m (3.2 ft)
 Digging capacity: 240 m³/h (8,474.4 ft³/hr)
 to 800 m³/h
 (27,462 ft³/hr)
 (depending on soil type)

Figure A-14

BTM-3 DITCHING MACHINE

The BTM-3, which entered into production during 1968, is a modified version of the BTM and was developed for the primary mission of excavating frozen soil. Although the outward appearance is the same as the BTM, the bucket assembly is much heavier and stronger, and on occasion is equipped with as few as eight buckets. The BTM-3 was previously designated the BTM-TMG. Specifications include—

Length: 7.6 m (24.7 ft)
 Height: (transport) 4.3 m (14.1 ft)
 Height: (operating) 3.5 m (11.4 ft)
 Weight: 29 tons (23,636 kg)
 Width of track shoe: 0.51 m (1.6 ft)
 Ground clearance: 0.42 m (1.3 ft)



Maximum speed: 35 km/h (21 mph)
 Ditching depth: 1.5 m (4.9 ft)
 Ditching width: 0.61 m (2.0 ft)
 Digging capacity: 90 m³/h (3,177.9 ft³/hr)
 in frozen soil, 240 m³/h
 otherwise

Figure A-15

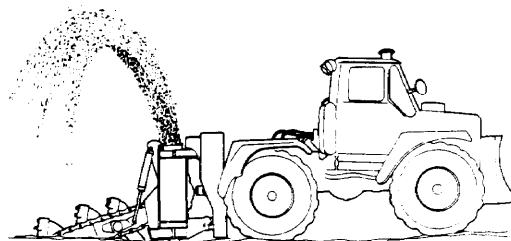
PZM/PZM-2 DITCHING MACHINE

The PZM consists of a bulldozer blade mounted on the front of the T-150K wheeled tractor and a trenching component mounted on the rear. The PZM-2 is also equipped with a front-mounted winch for use in excavating in frozen soil when traction may be insufficient. The unique feature of the PZM is that it can slew its boom to excavate either a narrow trench or a wide ditch. No other ditching machine is known to have this capability. The PZM can make repeated passes through the trench. The PZM is equipped with filtration vents for operating in contaminated environments. Specifications are—

Height: 2.87 m (9.4 ft)

Width: 2.5 m (8.2 ft)

Length in travel position: 5.9 m (19.3 ft)



PZM

Wheel width: 2.5 m (8.2 ft) or 3.5 m (11.4 ft)

Bucket width: 0.6 m (1.9 ft)

Trench width: 0.8 m (2.6 ft)

Trench depth: 1.5 m (4.9 ft)

Digging capacity: 250 to 300 m³/h

Maximum speed: 50 km/h

Figure A-16

BAT DOZER

The BAT dozer first appeared in 1958 and is used extensively by the Soviet Union and other Communist countries. However, due to serious deficiencies, it is being replaced by the BAT/M. Specifications are—

Height: 3.2 m (10.5 ft)

Width: 4.8 m (15.8 ft)

Length: 10 m (33 ft)

Weight: 25,300 kg (51,999 lb)

Width of track shoe: 0.51 m (1.6 ft)

Ground clearance: 0.42 m (1.4 ft)

Maximum speed: 23 km/h (14.4 mph)

Winch capacity: 18,181 kg (39,998 lb)

Earthmoving capacity: 120 to 200 m³/h
(4,237 to 7,062 ft³/h)

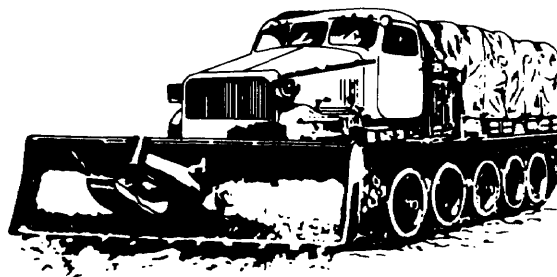
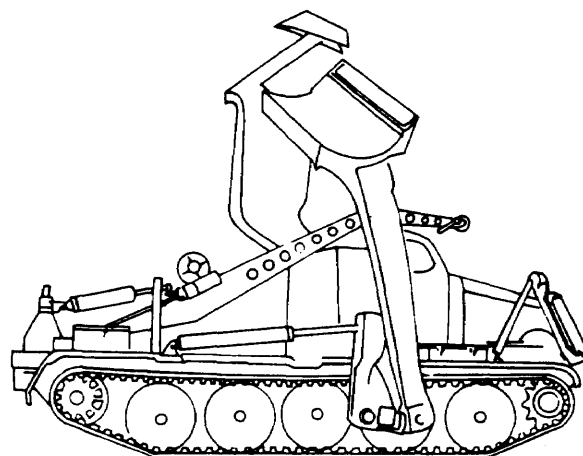


Figure A-17

BAT/M DOZER

The BAT/M dozer consists of a hydraulically operated bulldozer blade mounted on the heavy tracked artillery tractor, AT-T, and a full slewing crane which has an earth auger attachment (mounted behind the cab). The bulldozer blade is tilted back over the cab in the transport position, thus eliminating the heavy nose effect of the BAT dozer. The BAT/M is a highly versatile piece of equipment and is replacing the BAT as the standard dozer of Soviet engineer units. Some of its uses include the preparation of river banks prior to bridge launching, route preparation and the preparation of artillery fortifications. Specifications are—



Weight: 27.8 tons (25,300 kg)

Height: (transport position) 3.51 m (11.5 ft)

Height: (operating position) 3.2 m (10.4 ft)

Width: 4.79 m (15.7 ft)

Length: (transport position) 6.9 m (22.7 ft)

Length: (operating position) 10.00 m (32.8 ft)

Weight: 26,000 kg (57,200 lb)

Width of track shoe: 0.51 m (1.6 ft)

Ground clearance: 0.42 m (1.3 ft)

Maximum speed: 35 km/h (21 mph)

Winch capacity: 25,000 kg (55,000 lb)

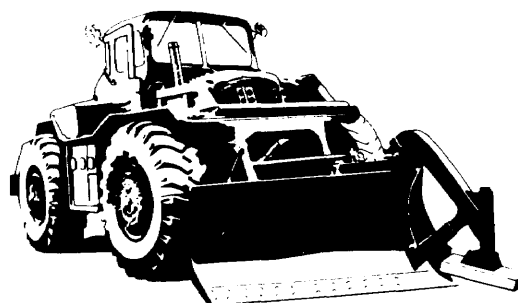
Crane capacity: 2,000 kg (4,400 lb)

Earthmoving capacity: 120 to 400 m³/hr

Figure A-18

PKT WHEELED TRACTOR

The PKT is a large all-wheel-drive tractor which began production in 1970. It has a hinged blade on the front which is equipped with a float boom to limit the depth of the cut to 150 millimeters. The blade can be used in the V-blade configuration for snow clearing, in the straight position for bulldozing, and in the angled position for angle-dozing. Specifications are—



Height: (operating position) 3.07 m (10 ft)

Width: 3.23 m (10.5 ft)

Length: (operating position) 7.9 m (25.9 ft)

Weight: 21,000 kg

Maximum speed: 45 km/h (27 mph)

Winch capacity: unknown

Earthmoving capacity: 80 to 100 m³/h
(2,824.8 - 3,531 ft³/hr)

Figure A-19

THREAT MINES AND OBSTACLES

DEFINITION

Threat doctrine broadly defines obstacles as anything that can get in the way or hinder the movement of a military force. Threat tactical literature describes the following two major categories:

- **Incidental obstacles.** Incidental (existing) obstacles are those which are part of the normal environment such as urban areas, forests, or rivers. They also include obstacles created as a byproduct of warfare rather than intentionally. Examples are destroyed equipment, urban rubble, shell craters, and fallout from nuclear weapons.

- **Deliberate obstacles.** Deliberate obstacles are created with the intention of impeding an enemy’s maneuver. The emphasis of Threat obstacle employment is stopping or delaying enemy tank forces. Minefields are an example of a deliberate obstacle. However, the Threat is aware of the obstacle value of incidental obstacles and is capable of enhancing that value.

The purpose of this section is to catalog mine and other obstacles that US forces might encounter. All of the obstacles considered are deliberate. Figure A-20 shows the three major categories of deliberate obstacles. Most of these obstacles are commonly understood, in general terms, from their names.

DELIBERATE OBSTACLES

Can be contaminated with toxic chemicals
and/or nuclear radiation

MINEFIELDS	NONMINE ANTITANK OBSTACLES	NONMINE APERS OBSTACLES
Nuisance Scatterable Hasty/protective Deliberate	Rivers/canals Craters/ditches Abatis/tree blowdown Posts/dragon’s teeth Walls, embankments and cribs Field/permanent fortifications Inundated areas LOC demolitions Urban rubble	Barbed wire/tape Field/permanent fortifications Caltrops

Figure A-20

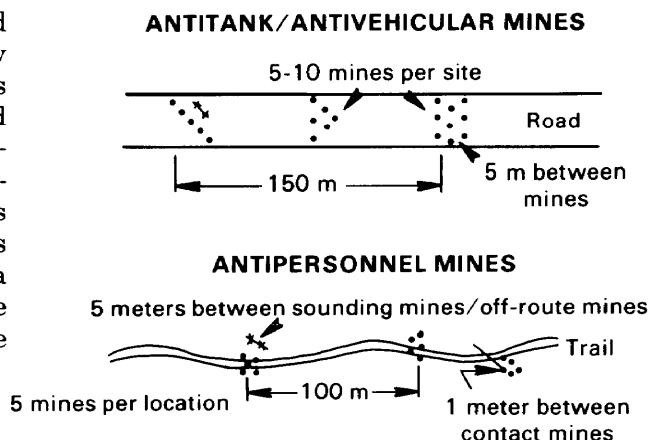
MINEFIELDS

This section will subdivide mines and minefields into four broad groupings. These are nuisance minefield, remotely delivered

minefield, hasty/protective minefield, and deliberate minefield (figures A-21 through A-23). All of these may contain all antitank mines, antipersonnel mines, or a mixture of the two in any proportion.

NUISANCE MINEFIELDS

A relatively small number of mines employed to harass, confuse, and demoralize an enemy is known as a nuisance minefield. The mines may be placed behind enemy lines by inserted forces or left behind when the Threat withdraws. Nuisance mines are considered especially effective once an attacking force has become mine-conscious. The minefield causes an attacker to pause and deploy every time a few mines are encountered. The mines are usually buried or concealed and may not be covered by fire.

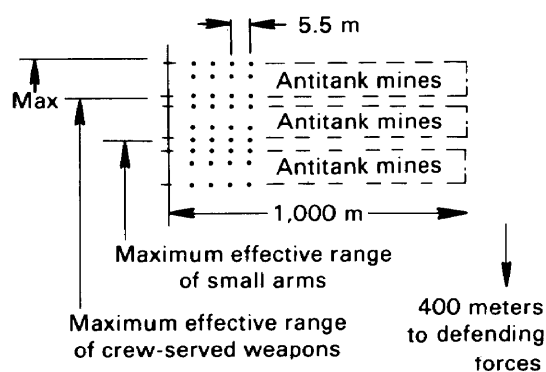


Notes: Mines are placed to minimize detectability and buried to 2.5 cm. They are integrated with other obstacles.

Figure A-21

DELIBERATE MINEFIELDS

Deliberate minefields are a belt or belts of buried conventional AT and/or APers mines. The mines may be placed and buried by hand or by a mechanical plow-type planter. In the latter case, some hand work would be necessary to reduce evidence of disturbance to the ground. The mines are laid in accordance with some pattern in anticipation of eventual recovery by the laying force. Generally, deliberate minefields will be of considerable depth and density and will be covered by fire.



Notes:
Mines are placed to minimize detectability and buried up to 40 cm below ground.
Some nuisance AP mines likely.

Figure A-22

REMOTELY DELIVERED MINEFIELDS

There is currently little evidence that the Threat has devoted extensive interest to the development of remotely delivered mine systems. Given the technical capability of

Threat countries, development of more sophisticated mines and delivery systems is highly probable.

HASTY/PROTECTIVE MINEFIELDS

Hasty/protective minefields are rapidly emplaced, surface-laid fields of conventional mines (antitank or antipersonnel). They consist of one or more belts with the mines surface-laid in some kind of pattern for ease of recovery. The mines may be placed by hand or from dispensing chutes mounted on vehicles or helicopters. The purpose of such a field is to protect a unit during halts, to protect working parties, or to protect exposed flanks from attackers. Hasty minefields can be converted into deliberate minefields and will usually be covered by fire.

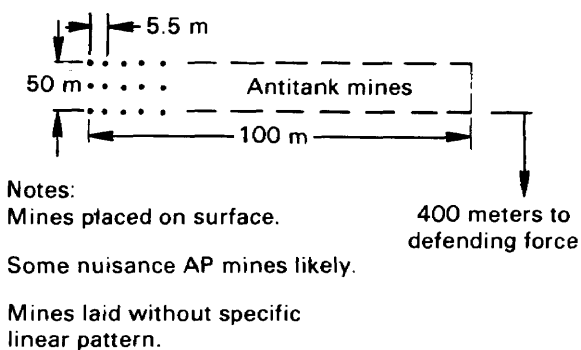


Figure A-23

MINES, ANTIPERSONNEL

The following paragraphs describe anti-personnel mines currently in use by Threat forces (figures A-24 through A-28).

PMN ANTIPERSONNEL BLAST MINE

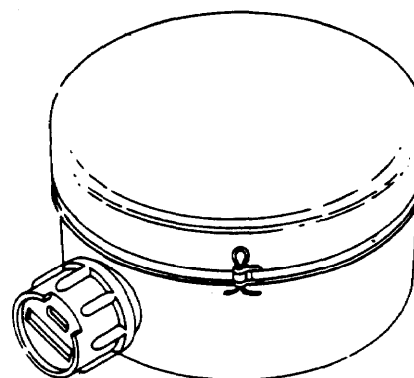
This mine is one of the standard Soviet antipersonnel mines. It has a plastic cylindrical case that contains an adapter for the firing assembly and one for the detonator. Four equally-spaced radial ribs on the bottom of the mine give the case added strength. The PMN is pressure activated and will detonate when .015 pounds per square inch is applied. Specifications are—

Weight: 600 g

Dimension: 11.1 cm diameter x 5.6 cm height

Main charge: 240 g TNT

Type: blast



Activating force: pressure

Lethal radius: unknown

Figure A-24

POMZ-2 AND POMZ-2M

The POMZ-2 antipersonnel fragmentation mine consists of a sharpened wooden stake approximately 30 centimeters long, a serrated cast iron cylinder filled with Trinitrotoluene (TNT), an MUV or VPF pull fuze, and a trip wire. The POMZ-2 is one of the standard Soviet antipersonnel mines. Late models are designated the POMZ-2M. They have a threaded fuze well and five rows of fragmentation, whereas the POMZ-2 has six rows. Specifications are—

Weight: 2 kg

Dimensions: 6-cm diameter x 13.5-cm height

Main charge: 75 g TNT

Activation force: pull fuze and trip wire

Lethal radius: 5 meters

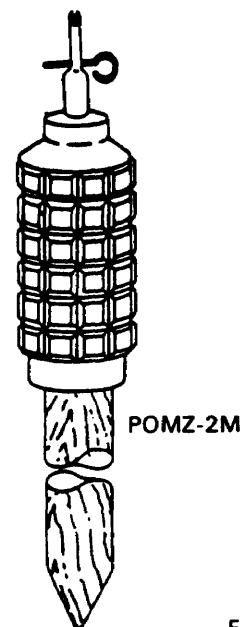
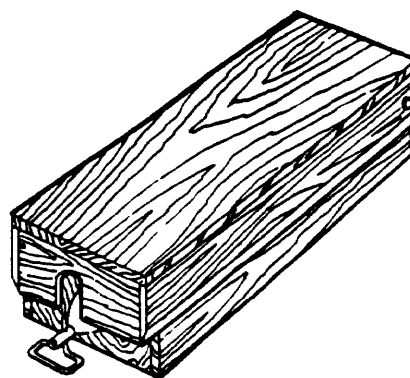


Figure A-25

WOODEN ANTIPERSONNEL BLAST MINES

The PMD-6 wooden antipersonnel mine was developed before World War II and was first used operationally in the Soviet/Finnish Winter War of 1939/40. The mine consists of a wooden box with a hinged lid that overlaps the sides. A deep groove is cut in the front end of the lid so that it may fit over the fuze and rest on the striker retaining pin. Some mines have a safety device which consists of a safety rod which prevents the lid from actuating the fuze prematurely. Pressure on the lid forces the winged retaining pin from the striker, and this detonates the mine. The PMD-6M is the postwar model of the PMD-6 and has the MUV-2 pull fuze. The PMD-7 followed the PMD-6 and is a smaller mine and therefore has less explosive. The PMD-7ts has a mine body made of a single block of wood hollowed out for the charge. The PMD-57 is a postwar wooden antipersonnel mine. Specifications are—



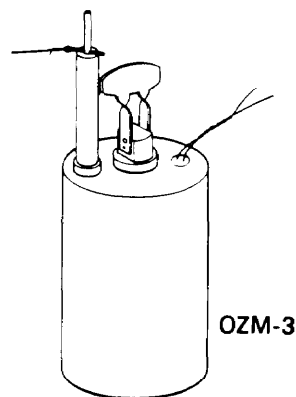
PMD-6

Weight: 300 g
 Dimension: 15 x 7.5 cm x 6.5 cm
 Main charge: 75 g TNT
 Activating force: pressure
 Lethal radius: unknown

Figure A-26

BOUNDING ANTIPERSONNEL MINES

During World War II, the Soviets used the improvised OZM (fragmentation obstacle mines). These consisted of an artillery shell (122 or 152-millimeter) or a mortar (120-millimeter) shell buried in the ground, nose down. Under the nose was UVK-1 propellant assembly and a flash tube running to the surface. These were detonated by remote control. Although intended primarily for antipersonnel use, these mines were capable of disabling an armored vehicle. The cylindrical OZM-3 bounding fragmentation antipersonnel mine, introduced after the war, can be set off by remote control, pull fuze, pressure fuze or a pull-tension fuze. When set off, the base of the mine detonates, causing the mine to bound. The height of the explosion (1.5 meters) is determined by a tethering wire. This mine has a lethal radius of 9 meters. No information on the OZM-4 mine is available.



OZM-3

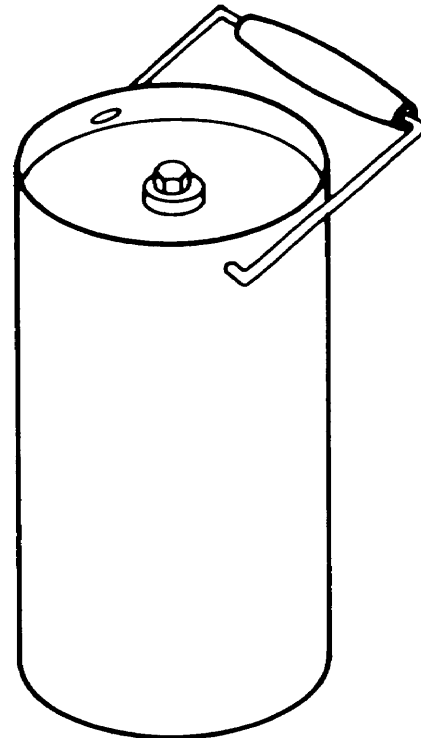
Specifications for the OZM-3 are:
 Weight: 3 kg
 Diameter: 7.5 cm
 Height: 12.0 cm
 Main charge type: TNT
 Weight of main charge: 75 g

Figure A-27

MINES, SPECIAL PURPOSE (CHEMICAL)

The KhF-2, dating from World War II, is still in the Threat force inventory. It is fired electrically by an observer stationed up to 300 meters distant. The firing of the electric detonator ignites the propellant, which hurls the mine upward out of the container, simultaneously igniting the delay fuze. After a delay of 1 to 1.5 seconds, the delay fuze sets off the explosive charge, shattering the mine and spreading the liquid contaminant over an area of 250 to 300 square meters with an average concentration of 20 to 25 grams per square meter. Characteristics are—

	KhF-1	KhF-2
Weight:	8.71 kg	8.71 kg
Diameter:	150 mm	185 mm
Height:	350 mm	280 mm
Main charge:	tolunol or melinite	unknown
Weight:	103 g	unknown
Quantity of agent:	4.5 liters (mustard or lewisite)	unknown



KhF-2

Figure A-28

MINES, ANTITANK

The following paragraphs list antitank mines currently in use by the Threat (figures A-29 through A-35).

TM-46 ANTITANK MINE

The TM-46 is metallic and can be laid either by hand or mechanically. The MVM pressure fuze is used for mechanical laying, or the MV-5 fuze for hand laying. The mine is detonated as follows (MV-5): pressure applied to the pressure plate compresses the striker spring in the fuze until the striker-retaining ball escapes into a recess in the pressure cap, releasing the spring-loaded striker which detonates the mine. In appearance, the TM-46 is almost identical to the TMN-46, which has a fuze well in the bottom of the mine for booby trapping. Specifications are—

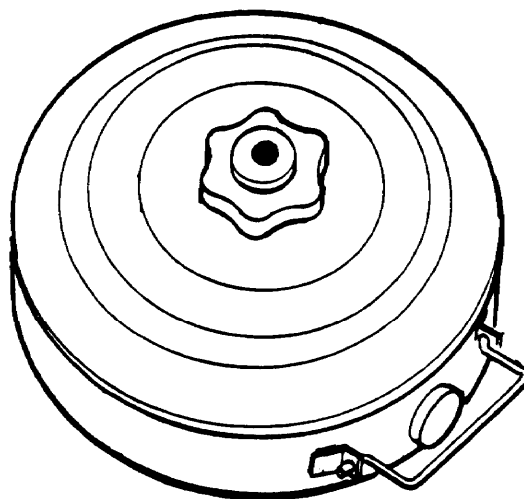
Weight: 8.7 kg

Diameter: 3.10 cm

Height: 7.4 cm

Main charge type: TNT

Main charge weight: 5.3 kg



Booster charge: TNT

Booster charge weight: 194.85 g

Operating force: 180 kg

Fuze model: MV-5 or MVM (angled tilt rod)
MVSH-46

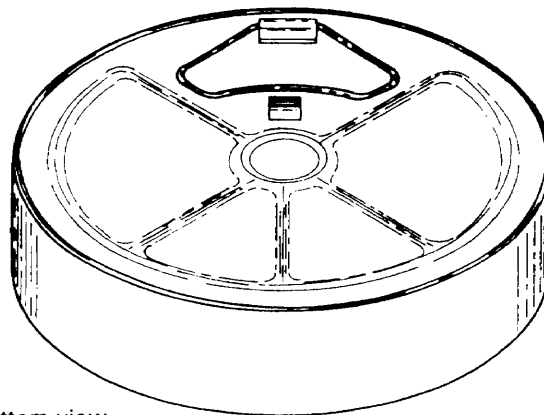
Figure A-29

TM-57 ANTITANK MINE

In appearance, the TM-57 metallic antitank mine is very similar to the TM-46 and TMN-46 antitank mine. The TM-57 has a larger charge and improved fuzing, and can be laid by hand or mechanically. It is easily recognized as it has no well in the bottom for an antihandling device (the TMV-46 has a well) and has seven ribs underneath (the TMN-46 has five ribs). Specifications are—

Weight: 9.5 kg

Dimension: 29.9 cm in diameter



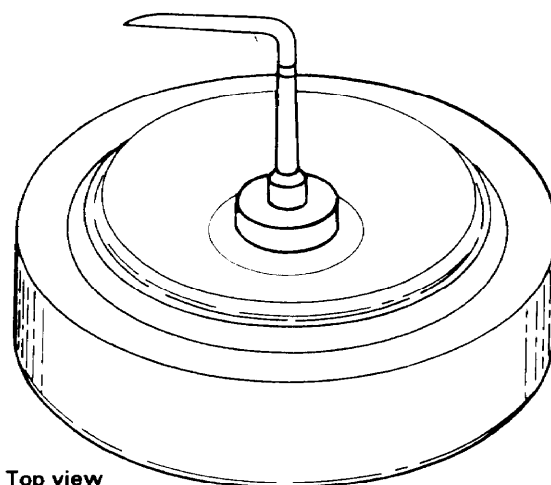
Bottom view

Main charge: 7 kg TNT

Activating force: pressure 200 to 700 kg

Height: 9.9 cm

Note: This mine may be fitted with a tilt rod or pressure fuze.

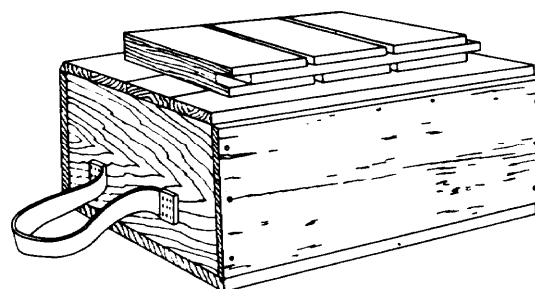


Top view

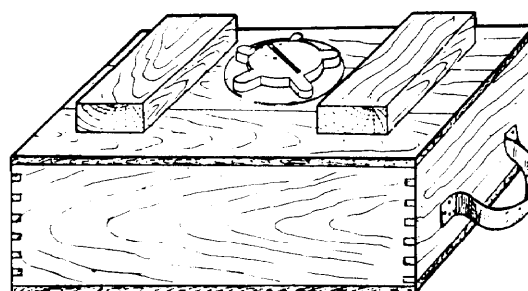
Figure A-30

TMD-B AND TMD-44 ANTITANK MINES

The wooden box is of simple construction with the boards either nailed together or fastened by tongue-and-groove joints. On the top of the mine are three pressure boards. The center board is hinged to allow the MV-5 fuze to be inserted. When armed, the pressure board is held in place by a wooden locking bar. The main charge normally consists of two waterproof paper-wrapped blocks of pressed amatol, ammonite, or dynammon. The mine operates as follows: when weight is applied, the top breaks down the cover at the sawed grooves and transmits pressure to the pressure block, which actuates the fuze and sets off the mine. The TMD-44 is similar to the TMD-B but has a centrally located plastic fuze well cover and only two pressure boards. Like the TMD-B, it uses the MV-5 pressure fuze.



TMD-B

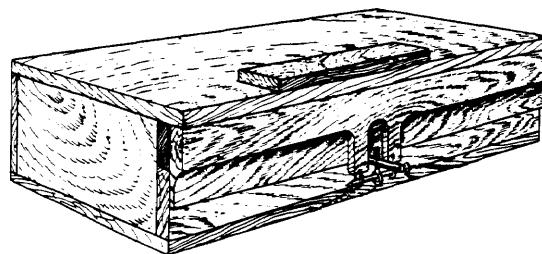


TMD-44

Figure A-31

YAM-5 AND YAM-10 ANTITANK MINES

The YAM-5 series of wooden antitank mines were widely used during World War II. The four models, which differ only in size, weight, and size of the pressure board on the mine lid, are designated the YAM-5, YAM-5K, YAM-5M, and the YAM-5U. They are easy to manufacture, and when constructed without nails, are difficult to detect. The mine consists of a wooden box with a hinged-lid lip which overlaps the box, recessed in the center to fit over the protruding end of the fuze striker. A staple is placed at each end of the recess which accommodates the pin, and then passes through the eye of the striker retaining pin. The pull fuze is actuated by pressure. Inside the box are the two explosive charges, booster charge, fuze holder block, and the fuze. The mine operates as follows: when



YAM-5

pressure is applied to the lid, it collapses, forcing the overlapping edge down. This removes the striker retaining pin and activates the fuze. To reduce the operating pressure, the underside of the lid may have sawed grooves. The YAM-10 is a postwar mine and is similar in construction to the YAM-5, but is larger and contains more explosive.

Figure A-32

LMG ANTITANK GRENADE MINE

The LMG (flying mine galitsky) was developed during World War II. The mine consists of a spigot-launched projectile with a HEAT warhead. The launcher and spigot launcher are attached to a wooden platform which is staked to the ground in a shallow trench and aimed at a probable tank approach. A wire is attached to the MUV pull fuze in the launcher spigot. The mine can be operated by a trip wire or an observer. The warhead of the projectile has a base-detonating fuze and detonates on impact. The mine is normally aimed to hit the side of an armored vehicle. Specifications are—

Weight: 9.98 kg
 (main charge) 3.2 kg
 (booster charge) 0.78 kg

Fuze: MUV pull and impact (warhead)

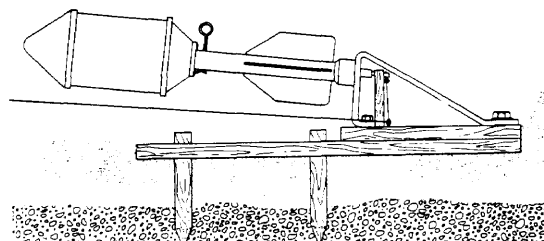


Figure A-33

TMK-2 ANTITANK MINE

This is a plate charge antitank mine that is equipped with a flash igniter fuze which operates on the tilt rod principle. The height of the rod is adjustable; therefore, this mine/fuze combination could be employed in deep snow, underwater, and as a triggering device for railway mines. This mine is believed capable of penetrating more than 250 millimeters of armor and is classed as a tank-killing mine that can destroy any armored vehicle. Specifications are—

Weight: 12.5 kg or 27.5 lb

Dimension: height - 350 mm,
diameter - 300 mm

Main charge: unknown

Activating force: tilt rod with booster charge

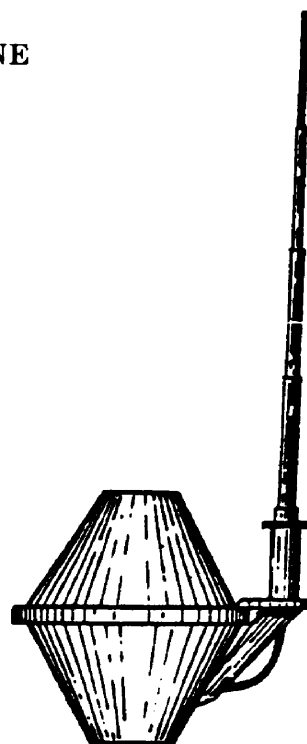


Figure A-34

PDM-6 (RIVER BOTTOM MINE)

The PDM-6 fluvial mine has a metal case and can be fuze by either a tilt rod or a command-detonated electric firing device. It was designed to be anchored in shallow water and was produced to counter fording and assault boat operations. It would produce a mobility kill of heavily armored vehicles but would probably destroy lightly armored vehicles. The PDM-2 comprises an estimated charge of from 15 kilograms of TNT and ammonite. Specifications are—

Weight: 47.5 kg

Dimension: 100-cm base x 55-105 cm

Main charge: 28 kg TNT and pentolite

Activation force: tilt rod

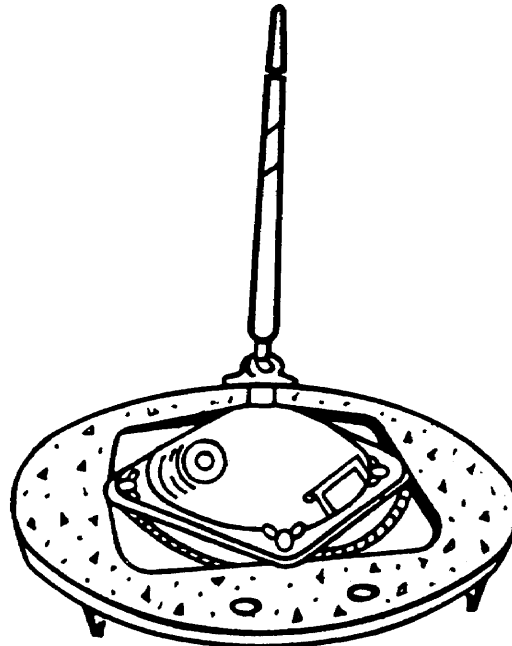


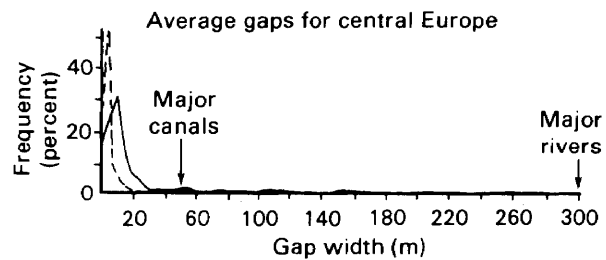
Figure A-35

OTHER ANTITANK OBSTACLES

There are many types of nonmine obstacles that can impede mobility (figures A-36 through A-46).

RIVERS/CANALS

Gaps caused by rivers and canals can be obstacles to the passage of tanks and wheeled vehicles. Even dry gaps can cause severe problems if the sides are steep or soil trafficability conditions are poor. Major obstacles like the Rhine River have been historic barriers in central Europe, but there are also many smaller streams and steep-sided canals which have delayed armies in the past.



Note:

20% of gaps are dry. 20% have water depth 1 m (TACGAP-75). Average height of bank is 2 m (TACGAP-75).

Figure A-36

CRATERS

Craters are spot obstacles generally circular or elliptical in shape. They are created by drilling a line of holes, filling with explosives, and blasting. The explosives can be prepared in advance and not set off unless needed. Craters can be formed rapidly. To be effective, they must be located in defiles or precise critical locations. Both ditches and craters should have steep sides and be of sufficient width so tanks cannot cross.

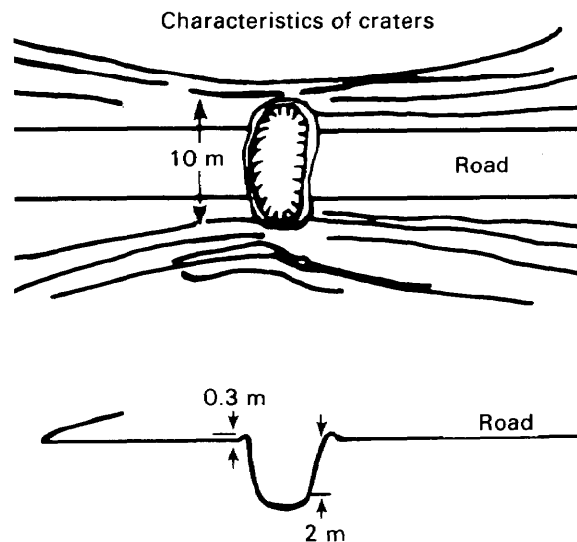
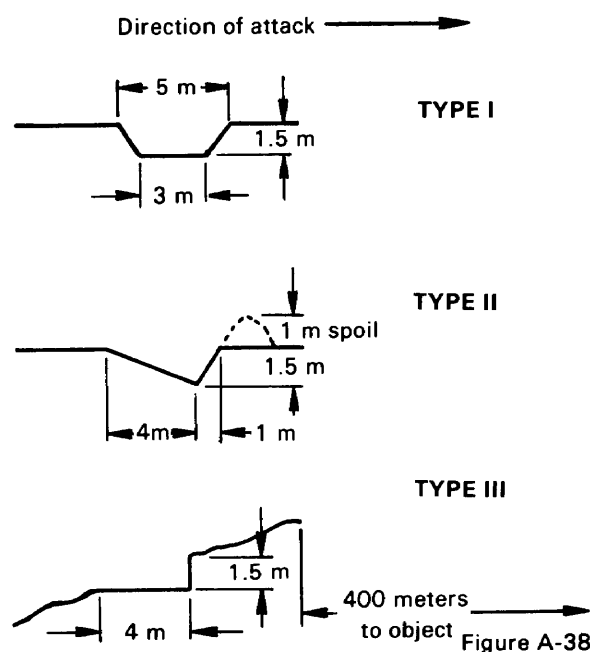


Figure A-37

DITCHES

Ditches are deliberate obstacles which an enemy may employ to deny use of high-speed road approaches. They can be used to reinforce natural defiles or to integrate with other obstacle systems such as minefields. Ditches are relatively long trenches which are dug, usually by machine, across an avenue of approach. However, Threat antitank ditches could probably be short segments placed in critical locations. To be effective, the ditch should be integrated with a minefield or anchored at each end by some other obstacle such as a forest, a minefield, or an unfordable river so that it cannot be easily bypassed.



ABATIS

An abatis is an obstacle formed by felling trees so that they fall across a road with branches interlocked and pointing toward the direction of enemy approach. The trees may be cut with power saws or with explosives. The obstacle is more effective if the tree trunks are left partially attached to the stumps.

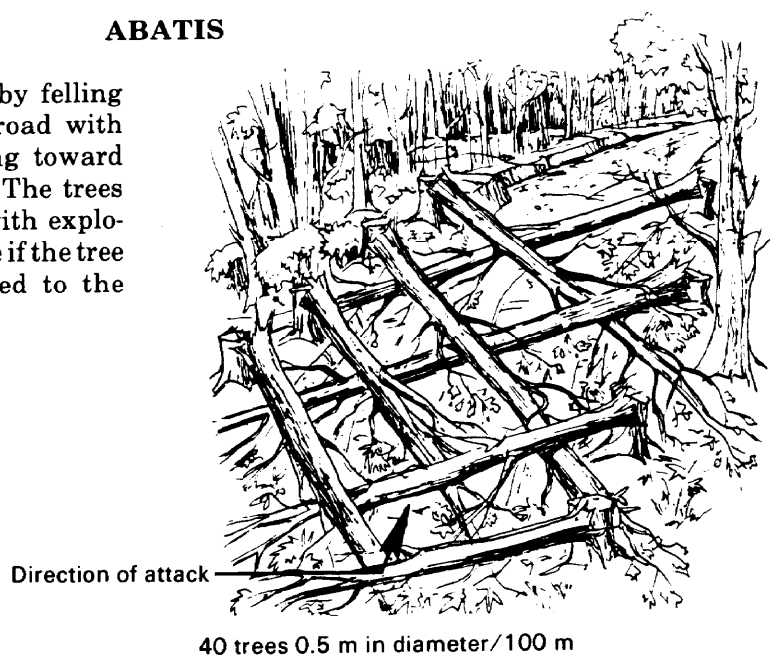


Figure A-39

TREE BLOWDOWN

Tree blowdown from a nuclear blast, in or near a forested area, would occur in a ring-shaped pattern approximately centered on ground zero out to a distance dependent on the overpressure. The resulting jumble of uprooted trees would block any existing roads or trails through the area. The effectiveness of such an obstacle would depend upon the density of the forest stand, the size of the trees, and the extent of the original forest.



Figure A-40

POSTS

Posts are wood or steel piles driven into the ground and braced against being pushed over. A post obstacle consists of several lines of posts across an avenue of approach.

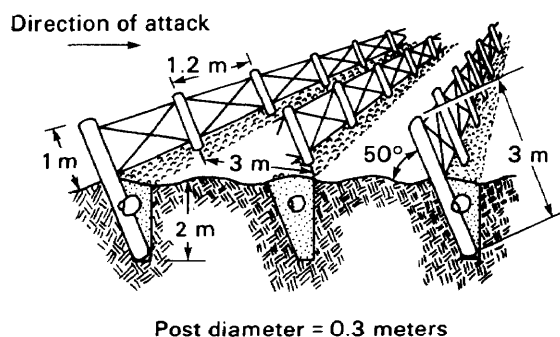


Figure A-41

DRAGON'S TEETH

Dragon's teeth are usually fabricated, concrete pyramids or truncated cones about 1-meter thick at the base. They are placed in multiple rows across an avenue of approach. Germany's Siegfried line in World War II was the main example of the extensive use of dragon's teeth, but similar obstacles can still be found on a more limited scale along some international borders today.

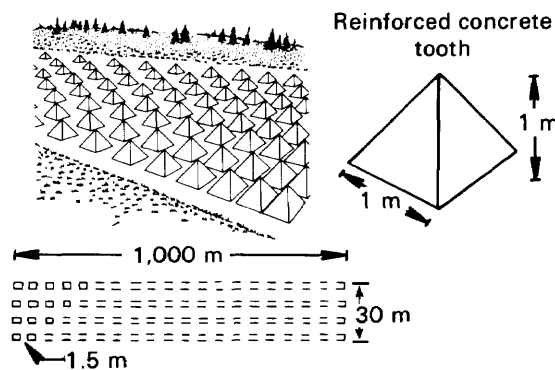
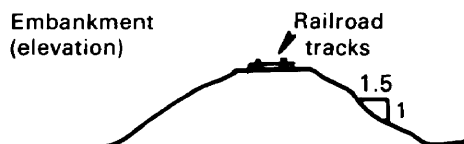


Figure A-42

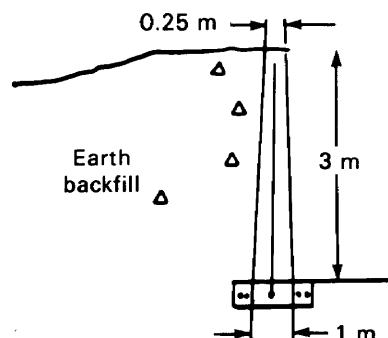
WALLS AND EMBANKMENTS

With the increasingly dense population of Europe and the proliferation of urban sprawl, constructed obstacles pose a sizeable threat to military mobility. Walls, railroad embankments, and the towns and cities themselves prevent free maneuver of forces.



Notes:
Slopes 1:2 will stop tanks.
Slopes 1:3 will stop trucks.
Slopes are vertical : horizontal.

Wall (elevation)



Note:
Typical materials include concrete, masonry, timber, and steel.

Figure A-43

CRIBS

Cribs are more like a point obstacle. They are formed by driving posts in a square or triangular pattern and then filling the enclosed space with rubble or earth. Cribs have been used to block roads, especially at constricted areas.

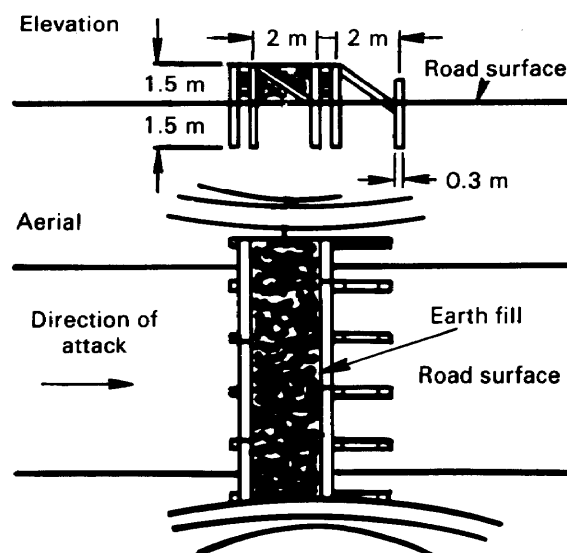


Figure A-44

FIELD/PERMANENT FORTIFICATIONS

Field/permanent fortifications include action to strengthen or fortify a unit position. Field fortifications may consist of log and earth bunkers, firing trenches, and dug-in positions for weapons. Permanent fortifications are more elaborate reinforced concrete structures.

Either type of fortification provides command posts, observation and fire direction centers, and covered protection for weapons to cover other obstacles such as minefield with direct or indirect fire. An example of this kind of fortification is covered in FM 5-103.

AREA WATER OBSTACLES

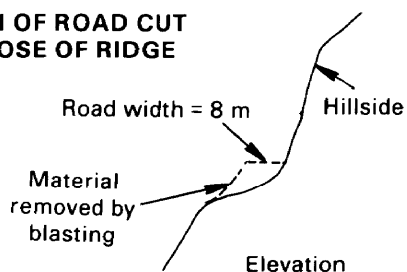
Inundated areas can be created deliberately by opening the floodgates of dams or dikes or by breaching with explosives. The area to be inundated is the natural floodplain. However, the exact boundaries will depend on the

quantity of water released and its rate of flow. A lesser quantity will produce a smaller inundated area, but the effect of the obstacle will be prolonged.

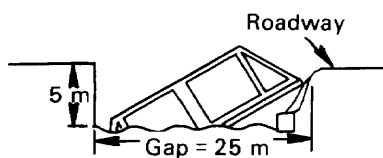
LINE OF COMMUNICATION (LOC) DEMOLITION

Demolitions of such structures as bridges, tunnels, culverts, and of the roadway itself at natural defiles can produce effective obstacles. Explosives have many apparent advantages in creating obstacles because they can be placed relatively quickly and the time of execution can be controlled. A large demolition project, however, is a major undertaking, and if not properly executed, can result in catastrophic failure such as the bungled German bridge demolition at Remagen in World War II. Properly handled, LOC demolitions can reinforce natural obstacles.

DEMOLITION OF ROAD CUT AROUND NOSE OF RIDGE



BRIDGE DEMOLITION



River/canal obstacle enhanced by bridge demolition mines emplaced around abutments.

TUNNEL DEMOLITION

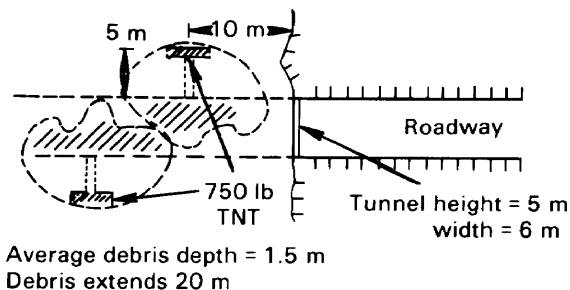


Figure A-45

URBAN RUBBLE

With the increased payloads of artillery, rockets and bombs, there would be a vast amount of damage and rubble created very quickly in areas with many artificial or constructed features. Nuclear weapons would be even more devastating. If nuclear weapons are employed against troop concentrations, there will be concurrent damage to the environment in the form of tree blowdown and the rubbing of buildings. This damage could



occur on a greater scale than damage caused by conventional artillery and bombs.

Figure A-46

NONEXPLOSIVE ANTIPERSONNEL OBSTACLES

Any obstacle that will stop a tank will also stop a wheeled vehicle. Special obstacles are required to slow down or stop personnel

(figures A-47 and A-48). On the other hand, antipersonnel obstacles are generally worthless against tanks. Therefore, a defender might use a combination of antitank and antipersonnel obstacles in order to prevent easy neutralization by anyone component of the team.

ENTANGLEMENTS

Aside from antipersonnel mines, the most common antipersonnel obstacle is some form of barbed wire or barbed tape. This may be strung along fence posts or pegged along the ground as foot snare. The barbs are designed to snag the soldier's clothing and equipment, making it impossible for the soldier to move through quickly. Thereby, the soldier becomes an easier target. Like all other obstacles, the value of barbed wire/tape diminishes greatly unless it is covered by fire.

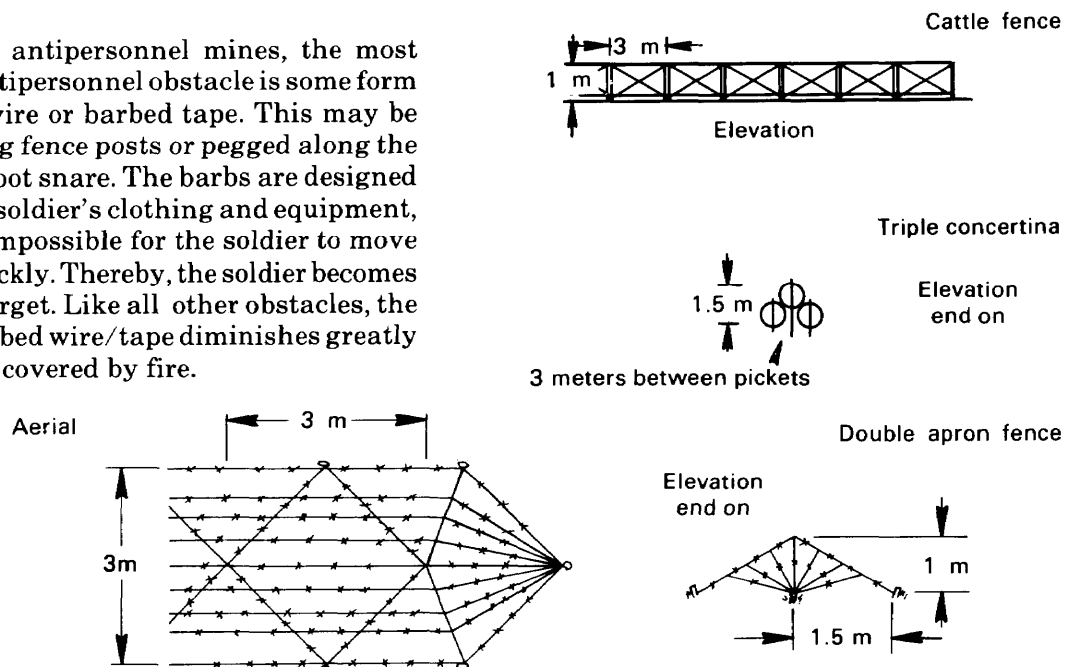
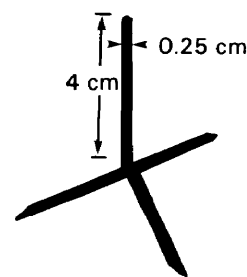


Figure A-47

CALTROPS

Caltrops are devices which consist of an arrangement of four sharpened metal prongs where one prong will always be vertical no matter how the caltrop lands. Caltrops can be dispensed by hand or from trucks or aircraft. Caltrops are designed to cause injury by penetrating the footgear of the person who steps on one. Serious injury will result if an individual quickly falls to the ground to avoid small arms or artillery fire.



Notes:
Caltrops can be employed with other obstacles or by themselves
With a density of 30-40/meter or front, caltrops are equivalent to triple concertina.

Figure A-48

