CHAPTER 7
EMPLOYMENT AND EFFECTS OF WEAPONS

This chapter supplements the technical manuals and field manuals that describe weapons capabilities and effects against generic targets. It focuses on specific employment considerations pertaining to combat in urban areas, and it addresses both organic infantry weapons and combat support weapons.

7-1. EFFECTIVENESS OF WEAPONS AND DEMOLITIONS

The characteristics and nature of combat in urban areas affect the employment of weapons and the results they can achieve. Leaders at all levels must consider the following factors in various combinations.

a. **Surfaces.** Hard, smooth, flat surfaces are characteristic of urban targets. Rarely do rounds impact perpendicular to these flat surfaces; rather, they impact at some angle of obliquity, which reduces the effect of a round and increases the threat of ricochets. The tendency of rounds to strike glancing blows against hard surfaces means up to 25 percent of impact-fuzed explosive rounds may not detonate when fired onto rubbled areas.

b. **Engagement Ranges.** Engagement ranges are close. Studies and historical analyses have shown that only 5 percent of all targets are more than 100 meters away. About 90 percent of all targets are located 50 meters or less from the identifying soldier. Few personnel targets will be visible beyond 50 meters and engagements usually occur at 35 meters or less. Minimum arming ranges and troop safety from backblast or fragmentation effects must be considered.

c. **Engagement Times.** Engagement times are short. Enemy personnel present only fleeting targets. Enemy-held buildings or structures are normally covered by fire and often cannot be engaged with deliberate, well-aimed shots.

d. **Depression and Elevation.** Depression and elevation limits for some weapons create dead space. Tall buildings form deep canyons that are often safe from indirect fires. Some weapons can fire rounds to ricochet behind cover and inflict casualties. Target engagement from oblique angles, both horizontal and vertical, demands superior marksmanship skills.

e. **Reduced Visibility.** Smoke from burning buildings, dust from explosions, shadows from tall buildings, and the lack of light penetrating inner rooms all combine to reduce visibility and to increase a sense of isolation. Added to this is the masking of fires caused by rubble and man-made structures. Targets, even those at close range, tend to be indistinct.

f. **Risks from Friendly Fire.** Urban fighting often becomes confused melees with several small units attacking on converging axes. The risks from friendly fires, ricochets, and fratricide must be considered during planning. Control measures must be continually adjusted to lower the risks. Soldiers and leaders must maintain a sense of situational awareness and clearly mark their progress IAW unit SOP to avoid fratricide.

g. **Close Combat.** Both the shooter and target may be inside or outside buildings and they may both be inside the same or separate buildings. The enclosed nature of combat in urban areas means the weapon's effects, such as muzzle blast and backblast, must be considered as well as the round's impact on the target.

h. **Attacking Man-made Structures.** Usually man-made structures must be attacked before enemy personnel inside are attacked. Weapons and demolitions can be chosen for employment based on their effects against masonry and concrete rather than against enemy personnel.

i. **Modern Buildings.** Modern engineering and design improvements mean that most large buildings constructed since World War II are resilient to the blast effects of bomb and artillery attack. They may burn easily, but usually retain their structural integrity and remain standing. Once high-rise buildings burn out, they are still useful to the military and are almost impossible to damage further. A large structure can take 24 to 48 hours to burn out and become cool enough for soldiers to enter.

j. **Building Types.** The most common worldwide building type is the 12- to 24-inch brick building. Table 7-1 lists the frequency of occurrence of building types worldwide.

TYPE OF BUILDING	FREQUENCY OF OCCURRENCE (PERCENTAGE)
30-inch Stone	1
8- to 10-inch Reinforced Concrete	6.9
12- to 24-inch Brick	63
6-inch Wood	16
14-inch Steel and Concrete (Heavy Clad)	2
7-inch Steel and Concrete (Light Clad)	12

Table 7-1. Types of buildings and frequency of occurrence.

k. **Definitions.** The following definitions were determined based on the analyses of various studies relating to the size of "man-sized" holes and experimentation analyses from the MOUT advanced concepts technology demonstration (ACTD).

(1) ***Loophole***. A loophole is a firing aperture (a minimum of 8 inches in diameter) made in a structure.

(2) ***Mousehole.*** A mousehole is an opening that is made to the interior or exterior of a structure (walls, floors, ceilings, roofs) to facilitate inter- and intra-building communications and movement. A mousehole is usually a minimum of 24 inches high by 30 inches wide in size.

(3) ***Breach Hole.*** A breach hole is an opening that is made in a structure using mechanical, ballistic, explosive, or thermal means to facilitate the entry of assault elements. A breach hole is normally 50 inches high by 30 inches wide in size. Breaches made through existing apertures, for example doors and windows, normally do not require additional size enhancement.

7-2. RIFLE, CARBINE, AND SQUAD AUTOMATIC WEAPON

The M16 rifle and the M4 carbine are the most common weapons fired in urban areas. These weapons, along with the M249 light machine gun, are used to kill enemy personnel, to suppress enemy fire and observation, and to penetrate light cover. Leaders can use tracer fire to designate targets for other weapons.

a. **Employment.** Close combat is the predominant characteristic of urban engagements. Riflemen must be able to hit small, fleeting targets from bunker apertures,

windows, and loopholes. This requires pinpoint accuracy with weapons fired in the semiautomatic mode. Killing an enemy through an 8-inch loophole at a range of 50 meters is a challenge, but one that may be common in urban combat.

(1) When fighting inside buildings, rapid semiautomatic fire is used. To suppress defenders while entering a room, a series of rapid three-round bursts is fired at all identified targets and likely enemy positions. This technique is more effective than firing long bursts into a room with fully automatic fire. Soldiers should fire aimed shots from an underarm or shoulder position, not unaimed fire from the hip.

(2) When targets reveal themselves at short range inside buildings, the most effective engagement is the quick-fire technique with the weapon up and both eyes open. (See FM 23-9 for more detailed information.) Accurate, quick fire not only kills enemy soldiers but also gives the attacker fire superiority.

(3) Within urban areas, burning debris, reduced ambient light, strong shadow patterns of varying density, and smoke all limit the effect of night vision and sighting devices. The use of aiming stakes in the defense and the pointing technique in the offense, both using three-round bursts, are night firing skills required of all infantrymen. The individual laser aiming light can sometimes be used effectively with night vision goggles (NVGs). Any soldier using NVGs should be teamed with at least one soldier not wearing them.

b. **Weapon Penetration.** The penetration that can be achieved with a 5.56-mm round depends on the range to the target and the type of material being fired against. The M16A2, M4, and M249 achieve greater penetration than the older M16A1, but only at longer ranges. At close range, the weapons perform the same. Single 5.56-mm rounds are not effective against structural materials (as opposed to partitions) when fired at close range—the closer the range, the less the penetration.

(1) ***5.56 mm Maximum Penetration.*** For the 5.56-mm round, maximum penetration occurs at 200 meters. At ranges less then 25 meters, penetration is greatly reduced. At 10 meters, penetration by the M16 round is poor due to the tremendous stress placed on this high-speed round, which causes it to yaw upon striking a target. Stress causes the projectile to break up, and the resulting fragments are often too small to penetrate.

(2) ***Reduced Penetration.*** Even with reduced penetration at short ranges, interior walls made of thin wood paneling, Sheetrock, or plaster are no protection against 5.56-mm ball ammunition rounds. Common office furniture, such as desks and chairs, cannot stop these rounds, but a layer of books 18 to 24 inches thick can.

(3) ***Wood and Cinder Blocks.*** Wooden frame buildings and single cinder block walls offer little protection from 5.56-mm rounds. When clearing such structures, soldiers must ensure friendly casualties do not result from rounds passing through walls, floors, or ceilings.

(4) ***Armor-Piercing Rounds.*** Armor-piercing rounds are slightly more effective than ball ammunition in penetrating urban targets at all ranges. They are more likely to ricochet than ball ammunition when the target presents a high degree of obliquity.

c. **Protection.** The following common barriers in urban areas stop a 5.56-mm round fired at less than 50 meters:

- One thickness of well-packed sandbags.
- A 2-inch concrete wall (nonreinforced).
- A 55-gallon drum filled with water or sand.
- A small ammunition can filled with sand.

- A cinder block filled with sand (block will probably shatter).
- A plate glass windowpane at a 45-degree angle (glass fragments may be thrown behind the glass).
- A brick veneer.
- A car body (5.56-mm rounds penetrate but may not always exit).

d. **Wall Penetration.** Although most structural materials repel single 5.56-mm rounds, continued and concentrated firing can breach some typical urban structures (see Table 7-2).

(1) ***Breaching Masonry Walls.*** The best method for breaching a masonry wall is by firing short bursts (three to five rounds) in a U-shaped pattern. The distance from the gunner to the wall should be minimized for best results—ranges as close as 25 meters are relatively safe from ricochet. Ballistic eye protection, protective vest, and helmet should be worn.

(2) ***Ball and Armor-Piercing Ammunition.*** Ball ammunition and armor-piercing rounds produce almost the same results, but armor-piercing rounds are more likely to fly back at the shooter. The 5.56-mm round can be used to create either a loophole (about 7 inches in diameter) or a breach hole (large enough for a man to enter). When used against reinforced concrete, 5.56-mm rounds cannot cut the reinforcing bars.

TYPE	PENETRATION	ROUNDS (REQUIRED)
8-inch reinforced concrete	Initial Loophole	35 250
14-inch triple brick	Initial Loophole	90 160
12-inch cinder block with single-brick veneer	Loophole Breach hole	60 250
9-inch double brick	Initial Loophole	70 120
16-inch tree trunk or log wall	Initial*	1 to 3
12-inch cinder block (filled with sand)	Loophole	35
24-inch double sandbag wall	Initial*	220
3/8-inch mild steel door	Initial*	1
*Penetration only, no loophole.		

Table 7-2. Structure penetration capabilities of the 5.56-mm round against typical urban targets (range 25 to 100 meters).

7-3. MEDIUM AND HEAVY MACHINE GUNS (7.62-MM AND CALIBER .50)

In the urban environment, the Browning caliber .50 machine gun and the 7.62-mm M60 and M240B machine guns provide high-volume, long-range, automatic fires for the suppression or destruction of targets. They provide final protective fire along fixed lines and can be used to penetrate light structures—the caliber .50 machine gun is most effective in this role. Tracers from both machine guns are likely to start fires.

a. **Employment.** The primary consideration that impacts the employment of machine guns within urban areas is the limited availability of long-range fields of fire.

Although machine guns should be emplaced at the lowest terrain level possible, grazing fire at ground level is often obstructed by rubble.

(1) ***M2, Caliber .50 Machine Gun.*** The caliber .50 machine gun is often employed on its vehicular mount during both offensive and defensive operations. If necessary, it can be mounted on the M3 tripod for use in the ground role or in the upper levels of buildings. When mounted on a tripod, the caliber .50 machine gun can be used as an accurate, long-range weapon and can supplement sniper fires.

(2) ***M60/M240 Machine Guns.*** Medium machine guns are cumbersome, making them difficult to use inside while clearing a building. They are useful outside to suppress and isolate enemy defenders. If the gunner is unable to engage targets from the prone position, he can fire the M240B and the M60 from either the shoulder or the hip to provide a high volume of assault and suppressive fires. The use of the long sling to support the weapon and ammunition is preferred.

(3) ***Comparison.*** Medium machine guns are less effective against masonry targets than caliber .50 machine guns because of their reduced penetration power. The gun's availability and its lighter weight make it well suited to augment heavy machine gun fire. They can be used in areas where the caliber .50 machine guns cannot be positioned, or they can be used as a substitute when heavy machine guns are not available. The M60/M240B machine gun can be employed on its tripod to deliver accurate fire along fixed lines and then can quickly be converted to bipod fire to cover alternate fields of fire.

b. **Weapon Penetration.** The ability of the 7.62-mm and caliber .50 rounds to penetrate is also affected by the range to the target and type of material fired against. The 7.62-mm round is affected less by close ranges than the 5.56-mm; the caliber .50 rounds penetration is reduced least of all.

(1) At 50 meters, the 7.62-mm ball round cannot reliably penetrate a single layer of well-packed sandbags. It can penetrate a single sandbag layer at 200 meters, but not a double layer. The armor-piercing round does only slightly better against sandbags. It cannot penetrate a double layer but can penetrate up to 10 inches at 600 meters.

(2) The penetration of the 7.62-mm round is best at 600 meters. Most urban targets are closer. The longest effective range is usually 200 meters or less. Table 7-3 explains the penetration capabilities of a single 7.62-mm (ball) round at closer ranges.

RANGE (meters)	PENETRATION (inches)			
	PINE BOARD	DRY LOOSE SAND	CINDER BLOCK	CONCRETE
25	13	5	8	2
100	18	4.5	10	2
200	41	7	8	2

Table 7-3. Penetration capabilities of a single7.62-mm (ball) round.

(3) The caliber .50 round is also optimized for penetration at long ranges (about 800 meters). For hard targets, obliquity and range affect caliber .50 penetration. Both armor-piercing and ball ammunition penetrate 14 inches of sand or 28 inches of packed

earth at 200 meters, if the rounds impact perpendicular to the flat face of the target. Table 7-4 explains the effect of a 25-degree obliquity on a caliber .50 penetration.

THICKNESS (feet)	100 METER (rounds)	200 METERS (rounds)
2	300	1,200
3	450	1,800
4	600	2,400

Table 7-4. Number of rounds needed to penetrate a reinforced concrete wall at a 25-degree obliquity.

c. **Protection.** Barriers that offer protection against 5.56-mm rounds are also effective against 7.62-mm rounds with some exceptions. The 7.62-mm round can penetrate a windowpane at a 45-degree obliquity, a hollow cinder block, or both sides of a car body. It can also easily penetrate wooden frame buildings. The caliber .50 round can penetrate all the commonly found urban barriers except a sand-filled 55-gallon drum.

d. **Wall Penetration.** Continued and concentrated machine gun fire can breach most typical urban walls. Such fire cannot breach thick reinforced concrete structures or dense natural stone walls. Internal walls, partitions, plaster, floors, ceilings, common office furniture, home appliances, and bedding can be easily penetrated by both 7.62-mm and caliber .50 rounds (Tables 7-5 and 7-6).

TYPE	THICKNESS (inches)	HOLE DIAMETER (inches)	ROUNDS REQUIRED
Reinforced concrete	8	7	100
Triple brick wall	14	7	170
Concrete block with single brick veneer	12	6 and 24	30 and 200
Cinder block (filled)	12	*	18
Double brick wall	9	*	45
Double sandbag wall	24	*	110
Log wall	16	*	1
Mild steel door	3/8	*	1
* Penetration only, no loophole.			

Table 7-5. Structure penetrating capabilities of 7.62-mm round (NATO ball) against typical urban targets (range 25 meters).

(1) The medium machine gun can be difficult to hold steady enough to repeatedly hit the same point on a wall. The dust created by the bullet strikes also makes precise aiming difficult. Firing from a tripod is usually more effective than without, especially if sandbags are used to steady the weapon. Short bursts of three to five rounds fired in a U-type pattern are best.

(2) Breaching a brick veneer presents a special problem for the medium machine gun. Rounds penetrate the cinder block but leave a net-like structure of unbroken block.

Excessive ammunition is required to destroy a net since most rounds only pass through a previously eroded hole. One or two minutes work with an E-tool, crowbar, or axe can remove this web and allow entry through the breach hole.

(3) The caliber .50 machine gun can be fired accurately from the tripod using the single-shot mode. This is the most efficient method for producing a loophole. Automatic fire in three- to five-round bursts, in a U-type pattern, is more effective in producing a breach.

TYPE	THICKNESS (inches)	HOLE DIAMETER (inches)	ROUNDS REQUIRED
Reinforced concrete	10	12	50
		24	100
	18	7	140
Triple brick wall	12	8	15
		26	50
Concrete block with single brick veneer	12	10	25
		33	45
Armor plate	1	*	1
Double sandbag wall	24	*	5
Log wall	16	*	1
* Penetration only, no loophole.			

Table 7-6. Structure penetrating capabilities of caliber .50 ball against typical urban targets (range 35 meters).

7-4. GRENADE LAUNCHERS, 40-MM (M203 AND MK 19)

Both the M203 dual-purpose weapon and the MK 19 grenade machine gun fire 40-mm high-explosive (HE) and high-explosive dual-purpose (HEDP) ammunition. Ammunition for these weapons is not interchangeable, but the grenade and fuze assembly hitting the target is identical. Both weapons provide point and area destructive fires as well as suppression. The MK 19 has a much higher rate of fire and a longer range; the M203 is much lighter and more maneuverable.

a. **Employment.** The main consideration affecting the employment of 40-mm grenades within urban areas is the typically short engagement range. The 40-mm grenade has a minimum arming range of 14 to 28 meters. If the round strikes an object before it is armed, it will not detonate. Both the HE and HEDP rounds have 5-meter burst radii against exposed troops, which means the minimum safe firing range for combat is 31 meters. The 40-mm grenades can be used to suppress the enemy in a building, or inflict casualties by firing through apertures or windows. The MK 19 can use its high rate of fire to concentrate rounds against light structures. This concentrated fire can create extensive damage. The 40-mm HEDP round can penetrate the armor on the flank, rear, and top of Soviet-made BMPs and BTRs. Troops can use the M203 from upper stories to deliver accurate fire against the top decks of armored vehicles. Multiple hits are normally required to achieve a kill.

b. **Weapon Penetration.** The 40-mm HEDP grenade has a small shaped charge that penetrates better than the HE round. It also has a thin wire wrapping that bursts into a dense fragmentation pattern, creating casualties out to 5 meters. Because they explode on

contact, 40-mm rounds achieve the same penetration regardless of range. Table 7-7 explains the penetration capabilities of the HEDP round.

TARGET	PENETRATION (inches)
Sandbags	20 (double layer)
Sand-filled cinder block	16
Pine logs	12
Armor plate	2

Table 7-7. Penetration capabilities of the HEDP round.

(1) If projected into an interior room, the 40-mm HEDP can penetrate all interior partition-type walls. It splinters plywood and plaster walls, making a hole large enough to fire a rifle through. It is better to have HEDP rounds pass into a room and explode on a far wall, even though much of the round's energy is wasted penetrating the back wall (Figure 7-1). The fragmentation produced in the room causes more casualties than the HE jet formed by the shaped charge.

(2) The fragments from the HEDP round do not reliably penetrate interior walls. Office furniture sandbags, helmets, and protective vests (flak jackets) also stop them. The M203 dual-purpose weapon has the inherent accuracy to place grenades into windows at 125 meters and bunker apertures at 50 meters. These ranges are significantly reduced as the angle of obliquity increases. Combat experience shows that M203 gunners cannot consistently hit windows at 50 meters when forced to aim and fire quickly.

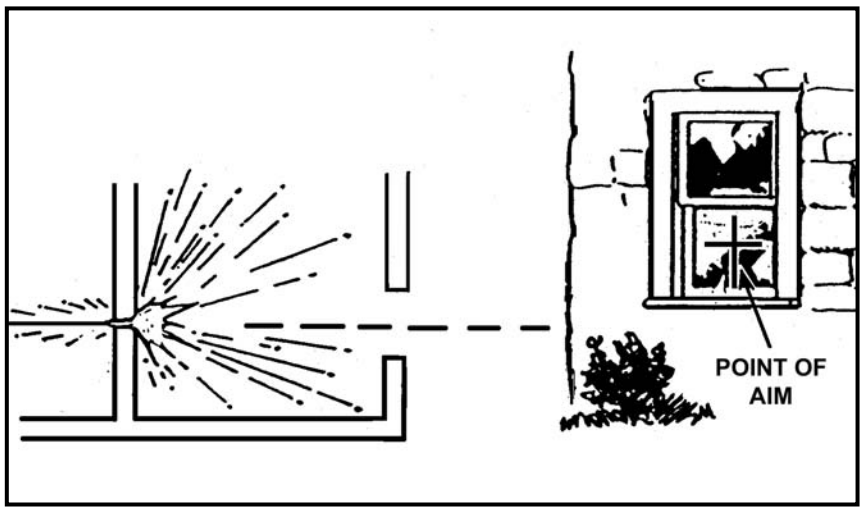

Figure 7-1. Aiming point for 40-mm HEDP.

c. **Wall Penetration.** The M203 cannot reasonably deliver the rounds needed to breach a typical exterior wall. The MK 19 can concentrate its fire and achieve wall penetration. Firing from a tripod, using a locked down traversing and elevating mechanism is best for this role. Brick, cinder block, and concrete can be breached using the MK 19 individual HEDP rounds, which can penetrate 6 to 8 inches of brick. The only material that has proven resistant to concentrated 40-mm fire is dense stone such as that used in some European building construction. No precise data exist as to the number of

rounds required to produce loopholes or breach holes with the MK 19; however, the rounds' explosive effects are dramatic and should exceed the performance of the caliber .50 machine gun.

7-5. LIGHT AND MEDIUM RECOILLESS WEAPONS

Light and medium recoilless weapons are used to attack enemy personnel, field fortifications, and light armored vehicles. They have limited capability against main battle tanks, especially those equipped with reactive armor (except when attacking from the top, flanks, or rear). The light category of recoilless weapons includes the AT4 M136 series; the 84-mm M3 Carl Gustaf recoilless rifle; and the shoulder-launched, multipurpose, assault weapon—disposable (SMAW-D) also known as the bunker defeat munitions (BDM). The medium recoilless weapons are the Javelin and Dragon.

a. **Employment.** Other than defeating light armored vehicles, the most common task for light recoilless weapons is to neutralize fortified firing positions. Due to the design of the warhead and the narrow blast effect, these weapons are not as effective in this role as heavier weapons such as a tank main gun round. They are lightweight, allowing soldiers to carry several AT4 rounds. Light recoilless weapons can be fired from the tops of buildings or from areas with proper ventilation.

(1) Light and medium recoilless weapons, with the exception of the SMAW-D, employ shaped-charge warheads. As a result, the hole they punch into walls is often too small to use as a loophole. The fragmentation and spall these weapons produce are limited. Normally, shaped-charge warheads do not neutralize enemy soldiers behind walls unless they are located directly in line with the point of impact.

(2) Against structures, shaped-charge weapons should be aimed about 6 inches below or to the side of a firing aperture (Figure 7-2), which enhances the probability of killing the enemy behind the wall. A round passing through a window wastes much of its energy on the back wall. Since these shaped-charge rounds lack the wire wrapping of the 40-mm HEDP, they burst into few fragments and are often ineffective casualty producers.

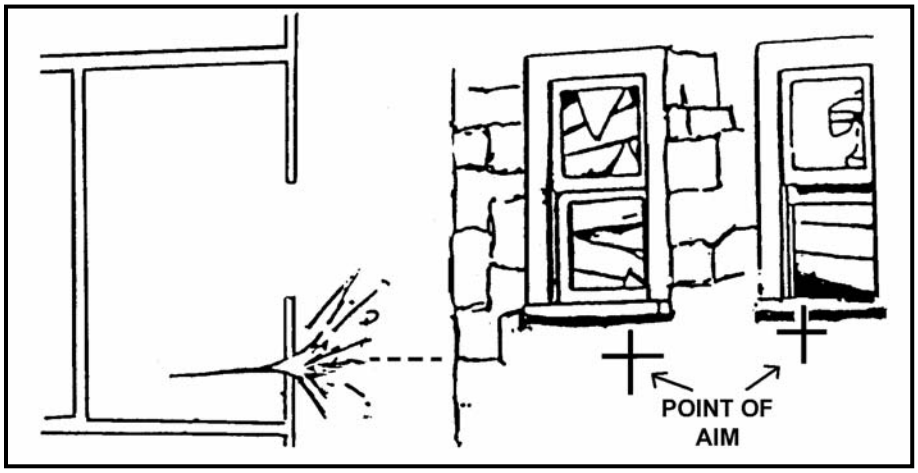

Figure 7-2. Point of aim for a shaped-charge weapon against a masonry structure.

(3) Sandbagged emplacements present a different problem (Figure 7-3). These positions may be encountered in urban areas that are adjacent to or contain natural terrain. Because sandbags absorb much of the energy from a shaped-charge, the rounds should be aimed at the center of the firing aperture. Even if the round misses the aperture, the bunker wall area near it is usually easier to penetrate.

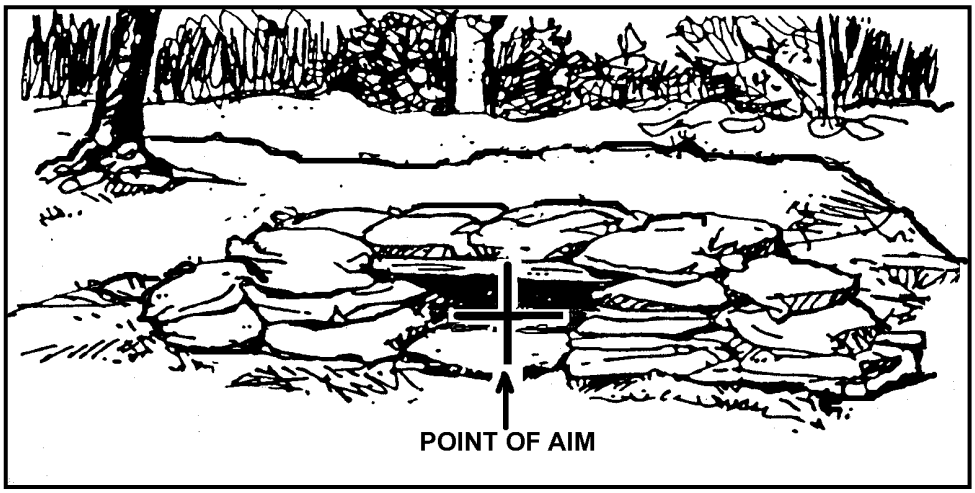

Figure 7-3. Point of aim for sandbagged emplacement.

(4) Light and medium recoilless weapons obtain their most effective short-range antiarmor shots by firing from upper stories, or from the flanks and rear. When firing at main battle tanks, these weapons should always be employed against weaker areas in volley or paired firing. They normally require multiple hits to achieve a kill on a tank. Flanks, top, and rear shots hit the most vulnerable parts of armored vehicles. Firing from upper stories protects the shooter from tank main gun and coaxial machine gun fire since tanks cannot sharply elevate their cannons. The BMP-2 can elevate its 30-mm cannon to engage targets in upper stories. The BTR-series armored vehicles can also fire into upper stories with their heavy machine gun.

(5) Modern threat infantry fighting vehicles, such as the BMP-2 and the BTR-80, have significantly improved frontal protection against shaped-charge weapons. Many main battle tanks have some form of reactive armor in addition to their thick armor plate. Head-on, ground-level shots against these vehicles have little probability of obtaining a kill. Even without reactive armor, modern main battle tanks are hard to destroy with a light antiarmor weapon.

(6) The most effective method of engagement for hitting and killing an armored vehicle is to fire from an elevated position. A 45-degree downward firing angle doubles the probability of a first-round hit as compared to a ground-level shot (Figure 7-4).

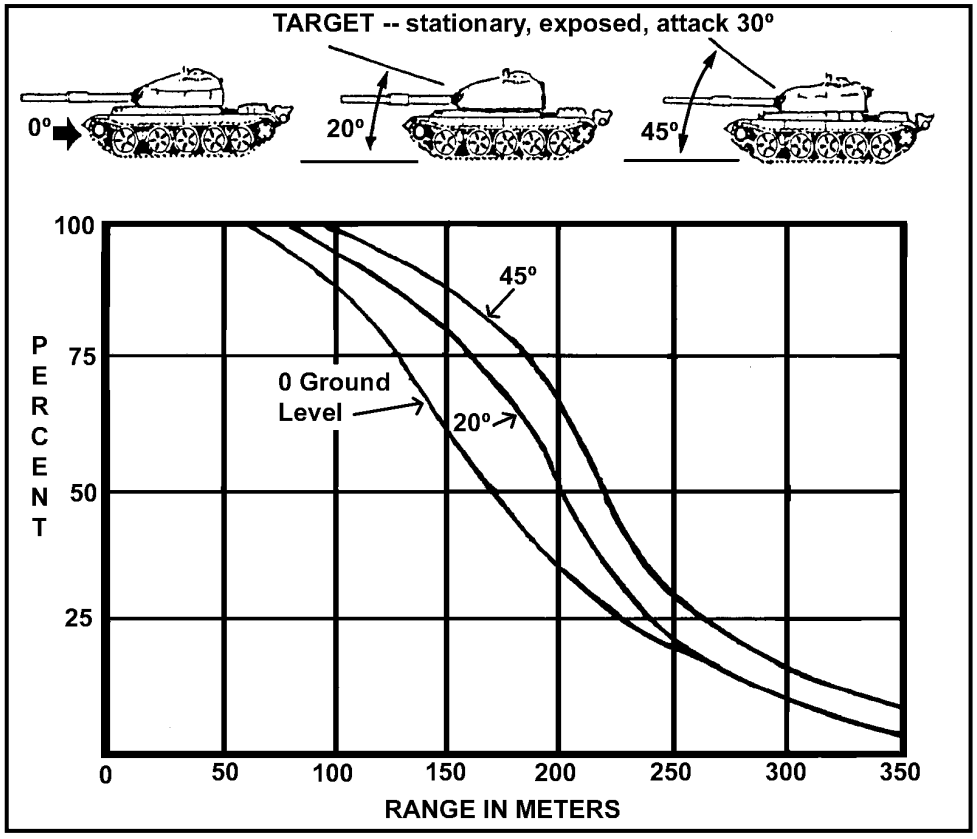

Figure 7-4. Probability of achieving a hit at different angles

b. **Backblast.** Backblast effects must be considered when employing recoilless weapons. During combat in urban areas, the backblast area in the open is more hazardous due to loose rubble and the channeling effect of the narrow streets and alleys.

(1) When firing recoilless weapons in the open, soldiers should protect themselves from blast and burn injuries caused by the backblast. All personnel should be out of the danger zone. Anyone not able to vacate the caution zone should be behind cover. Soldiers in the caution zone should wear helmets, protective vests, and eye protection. The shooter and all soldiers in the area should wear earplugs.

(2) Since the end of World War II, the US Army has conducted extensive testing on the effects of firing recoilless weapons from within enclosures. Beginning as early as 1948, tests have been conducted on every type of recoilless weapon available. In 1975, the US Army Human Engineering Laboratory at Aberdeen Proving Grounds, Maryland, conducted extensive firing of the LAW, Dragon, and TOW from masonry and frame buildings, and from sandbag bunkers. These tests showed the following:

(a) Firing these weapons from enclosures presented no serious hazards, even when the overpressure was enough to produce structural damage to the building.

(b) Little hazard exists to the gunnery or crew from any type of flying debris. Loose items were not hurled around the room.

(c) No substantial degradation occurs to the operator's tracking performance as a result of obscuration or blast overpressure.

(d) The most serious hazard that can be expected is hearing loss. This must be evaluated against the advantage gained in combat from firing from cover. To place this hazard in perspective, a gunner wearing earplugs and firing the loudest combination (the Dragon from within a masonry building) is exposed to less noise hazard than if he fired a LAW in the open without earplugs.

(e) The safest place for other soldiers in the room with the shooter is against the wall from which the weapon is fired.

(f) Firers should take advantage of all available sources of ventilation by opening doors and windows. Ventilation does not reduce the noise hazard, but it helps clear the room of smoke and dust, and reduces the effective duration of the overpressure.

(g) The only difference between firing these weapons from enclosures and firing them in the open is the duration of the pressure fluctuation.

(h) Frame buildings, especially small ones, can suffer structural damage to the rear walls, windows, and doors. Large rooms suffer slight damage, if any.

(3) Recoilless weapons fired from within enclosures create some obscuration inside the room, but almost none from the gunner's position looking out. Inside the room, obscuration can be intense, but the room remains inhabitable.

(4) The Dragon causes the most structural damage, but only in frame buildings. There does not seem to be any threat of injury to the gunner, since the damage is usually to the walls away from the gunner. The most damage and debris is from flying plaster chips and pieces of wood trim. Large chunks of plasterboard can be dislodged from ceilings. The backblast from the AT4, Dragon, or TOW rarely displaces furniture. Table 7-9 shows the test results of structural damage and debris.

NOTE: While the results of the tests may have shown that the threat of injury from debris is rare, commanders must ensure that proper safety precautions are followed prior to firing weapons inside a room.

BUILDING	WEAPON	STRUCTURE DAMAGE	WALL DAMAGE	DEBRIS MOVEMENT
Masonry	LAW Dragon	None None	Slight Slight	Slight Slight
Bunker	Dragon TOW	None None	None None	None Leaves & dust disturbed
Small Frame	LAW Dragon	None Severe	Slight Severe	None None
Medium Frame	LAW Dragon	None Slight	None Slight	Slight Lamps and chairs overturned
Large Frame	LAW Dragon TOW	None Slight Slight	Slight Moderate Severe	Slight None None

Table 7-9. Structural damage and debris movement.

(5) To fire an 84-mm Carl Gustaf recoilless rifle, the AT4, or SMAW-D from inside a room, the following safety precautions must be taken (Figure 7-5).

(a) The building should be of a sturdy construction.

(b) The ceiling should be at least 7 feet high with loose plaster or ceiling boards removed.

(c) The floor size should be at least 15 feet by 12 feet. (The larger the room, the better.)

(d) At least 20 square feet of ventilation (room openings) should exist to the rear or side of the weapon. An open 7- by 3-foot door would provide minimum ventilation.

(e) All glass should be removed from windows and small, loose objects removed from the room.

(f) Floors should be wet to prevent dust and dirt from blowing around and obscuring the gunner's vision.

(g) All personnel in the room should be forward of the rear of the weapon.

(h) All personnel in the room should wear helmets, body armor, ballistic eye protection, and earplugs.

(i) If the gunner is firing from the prone position, his lower body must be perpendicular to the bore of the weapon or the blast could cause injury to his legs.

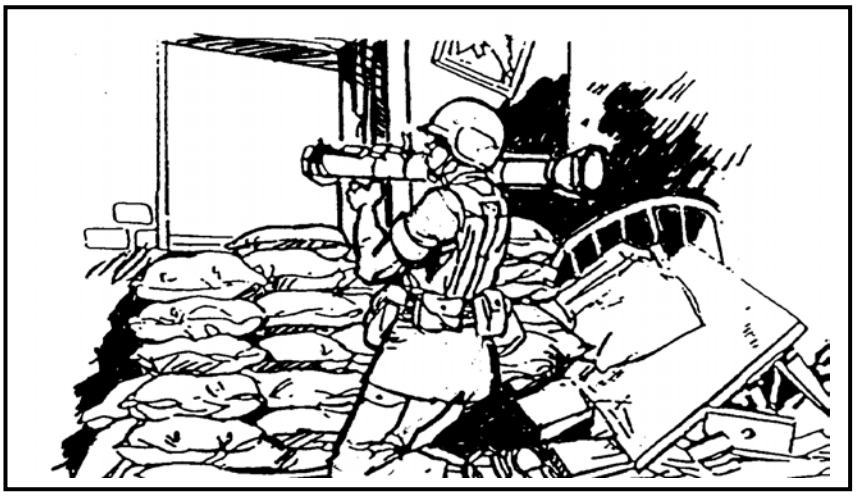

Figure 7-5. Firing an 84-mm Carl Gustaf recoilless rifle, an AT4, or SMAW-D from inside a building.

c. **Weapon Penetration.** The most important tasks to be performed against structures are the neutralization of fortified fighting positions, personnel, and weapons behind barriers. Recoilless weapons can be used in this role, but none of them are as effective as heavy direct-fire weapons or standard demolitions. Each recoilless weapon has different penetrating ability against various targets. Penetration does not always mean the destruction of the integrity of a position. Usually, only those enemy soldiers directly in the path of the spall from a HEAT round become casualties. Other soldiers inside a fortification could be deafened, dazed, or shocked but eventually return to action. (See Table 7-10, page 7-14.)

TARGET	EFFECT WHEN FIRED AT TARGET	RECOMMENDED AIMING POINT
Firing port or aperture	Rounds fired into firing ports or apertures may be wasted; rounds detonate inside on the rear of the position, causing little or no damage to the position or equipment and personnel unless hit directly.	Coordinate fire: fire light antiarmor weapons at a point 6 to 12 inches from the edge of the aperture or berm.
Berm	Firing at the berm causes the round to detonate outside the position or in the berm, producing only a small hole in the berm, but no damage to the position or equipment and personnel unless hit directly.	Coordinate fire: fire light antiarmor weapons at a point 6 to 12 inches from the edge of the aperture or berm.
Windows	The round may travel completely through the structure before detonating; if not, it causes dust, minor damage to the rear wall, but no damage to the position or equipment and personnel unless they are hit directly.	Fire 6 to 12 inches from the sides or bottom of a window. Light antiarmor rounds explode on contact with brick and concrete, creating an opening whose size is determining by the type of round used.
Wall	The round detonates on contact, creating dust, a small hole, and minor structural damage, but little or no damage to the position or equipment and personnel unless hit directly.	Fire 6 to 12 inches from the sides or bottom of a window. Light antiarmor rounds explode on contact with brick and concrete, creating an opening whose size is determining by the type of round used.
Corners	Corners are reinforced and thus harder to penetrate than other parts of the wall. Any light antiarmor round will detonate sooner on a corner than on less dense surfaces. Detonation should occur in the targeted room, creating dust and overpressure. The overpressure can temporarily incapacitate personnel inside the structure near the point of detonation.	Fire 6 to 12 inches from the sides or bottom of a window. Light antiarmor rounds explode on contact with brick and concrete, creating an opening whose size is determining by the type of round used.

Table 7-10. Light antiarmor weapons effects on urban targets.

(1) ***M136 84-mm Launcher (AT4)***. The AT4 is a lightweight, disposable, direct fire antiarmor weapon. The round has a diameter of 84 millimeters, which gives the warhead much greater penetration. The AT4 can penetrate more than 17.5 inches (450 millimeters) of armor plate. Its warhead produces highly destructive results behind the armor. The AT4 has a minimum arming distance of 10 meters, which allows it to be fired successfully against close targets. Firers should be well covered by protective equipment when firing at close targets.

(2) ***M3 84-mm Carl Gustav Recoilless Rifle.*** The 84-mm, M3 Carl Gustav recoilless rifle is lightweight and maneuverable with great penetrating power, making it a very

useful weapon during urban combat. The Carl Gustav can fire a variety of rounds against a variety of targets.

(a) The FFV HEAT 551 round, for use against armored targets, will penetrate more than 400 millimeters of armor. The HEAT round arms at 5 to 8 meters and may throw fragments back as far as 50 meters.

(b) The FFV HEDP 502 round with a dual mode fuze can be set to detonate on impact against nonreinforced structures, or delayed to detonate after penetrating 1 meter into an earthen bunker. It will penetrate more than 150 millimeters of armor. The HEDP round is probably the most useful during urban combat. It is effective against light-armored vehicles, thick concrete and brick walls, thin wood walls and field fortifications, and unprotected troops. The HEDP round arms at 15 to 40 meters and produces only slight fragmentation out to 50 meters.

(c) The FFV HE 441B is used primarily against personnel and light-skinned vehicles. The HE round can be set for either airburst or impact burst. It contains 800 steel balls that are distributed in a lethal pattern upon detonation. The HE round arms at 20 to 70 meters and may throw its steel balls back as far as 250 meters.

(d) The FFV Illumination 545 round produces 650,000 candlepower, illuminating a 400- to 500-meter area for 30 seconds.

(e) The FFV Smoke 469B round provides a screening and blinding smoke cloud. It is useful to cover friendly units crossing small open areas.

(3) ***Shoulder-Launched, Multipurpose, Assault Weapon—Disposable (SMAW-D)***. The SMAW-D is a lightweight, man-portable, assault weapon easily carried and placed into action by one man. It is used against fortified positions, but is also effective against light-armored vehicles. The SMAW-D has a rifle type sighting system with a three-post front and a peep rear sight. It fires an 83-mm HEDP rocket that is effective against walls, bunkers, and light-armored vehicles. The SMAW-D can destroy most bunkers with a single hit while multiple shots create breach holes even in reinforced concrete; it will not cut reinforcing steel bars.

(4) ***Javelin.*** The Javelin is a dual-mode (top attack or direct fire), man-portable antitank missile with an increased capability to engage and defeat tanks and other armored vehicles. The Javelin has a missile contained in a disposable launch tube-container and reusable tracker. The Javelin is a fire-and-forget weapon system, which significantly increases the gunner's survivability because the gunner is no longer required to track the target for the duration of the missile's flight. Additionally, compared to the Dragon, the Javelin has a soft launch that significantly reduces the visual and acoustical signature the missile makes. The minimum engagement range is 75 meters, and the Javelin can penetrate all urban targets. Penetration, however, does not mean destruction of the structural integrity of a position. Firing ATGMs is the least efficient means to defeat structural walls.

d. **Wall Breaching.** Wall breaching is a common combat task in urban areas for which light recoilless weapons can be used. Breaching operations improve mobility by providing access to building interiors without using existing doors or windows. Breaching techniques can also be used to create loopholes for weapons positions or to allow hand grenades to be thrown into defended structures. Breach holes for troop mobility should be about 50 inches high by 30 inches wide. Loopholes should be about 8 inches in diameter (Figure 7-6, page 7-16). None of the light recoilless weapons organic

to maneuver battalions (with the possible exception of the SMAW-D) provide a one-shot wall-breaching capability. To breach walls, a number of shots should be planned.

(1) Of all the common building materials, heavy stone is the most difficult to penetrate. The AT4 or the Carl Gustav usually will not penetrate a heavy European-style stone wall. Surface cratering is usually the only effect.

(2) Layered brick walls are also difficult to breach with light recoilless weapons. Some brick walls can be penetrated by multiple firings, especially if they are less than three bricks thick. Weapons such as the AT4 and the Carl Gustav may require 3 to 5 rounds in order to penetrate brick walls. The SMAW-D produces a hole in brick walls that is often large enough to be a breach hole.

(3) Wooden structural walls offer little resistance to light recoilless weapons. Even heavy timbered walls are penetrated and splintered. The AT8 and SMAW have a devastating effect against a wood-frame wall. A single round produces a breach hole as well as significant spall.

(4) Because of its high velocity, the AT4 may penetrate a soft target, such as a car body or frame building, before exploding.

(5) None of the light recoilless weapons are as effective against structural walls as demolitions or heavier weapons such as a tank main gun, or field artillery. Of all the light recoilless weapons, the SMAW-D is the most effective.

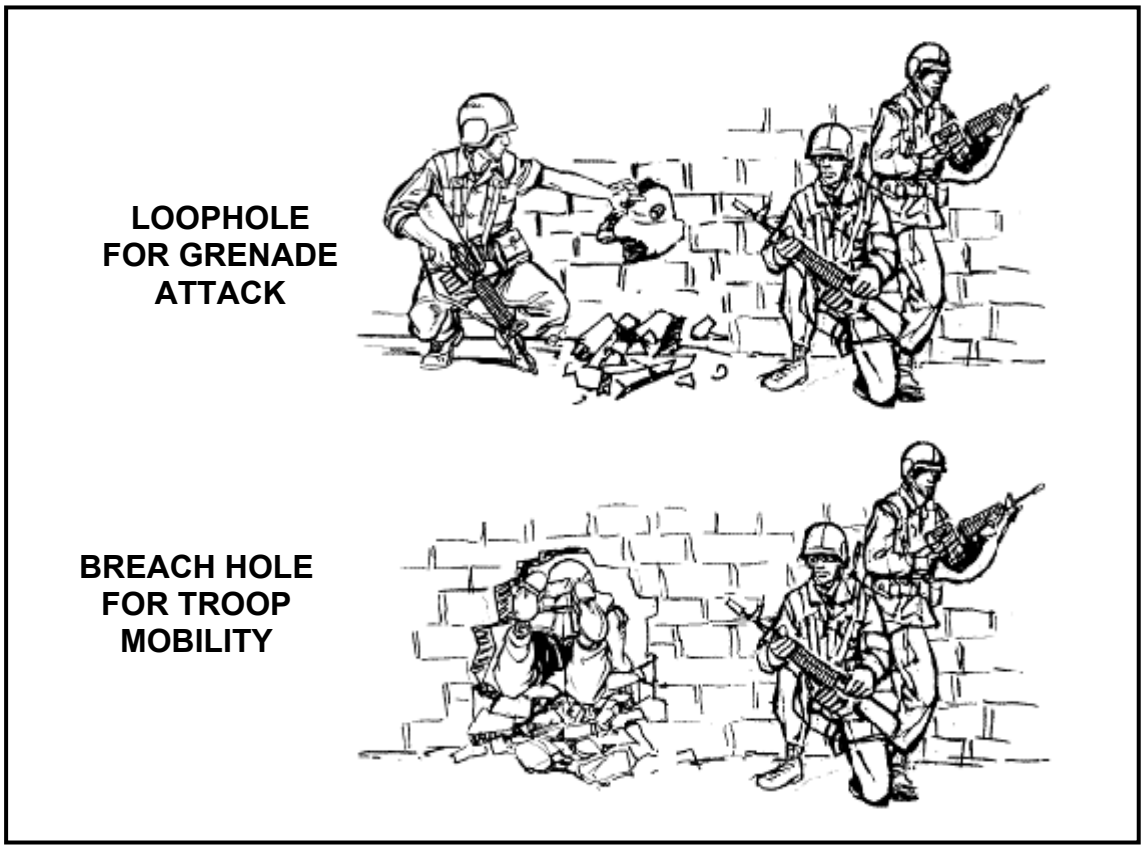

Figure 7-6. Tactical use of holes in masonry walls, after ballistic breaching.

7-6. ANTITANK GUIDED MISSILES

Antitank guided missiles (ATGMs) are used mainly to defeat main battle tanks and other armored combat vehicles. They have a moderate capability against bunkers, buildings, and other fortified targets commonly found during combat in urban areas. This category of weapons includes the TOW and Dragon missiles.

a. **Employment.** TOWs and Dragons provide overwatch antitank fires during the attack of an urban area and extended range capability for engaging armor during the defense. Within urban areas, they are best employed along major thoroughfares and from the upper stories of buildings to attain long-range fields of fire. Their minimum firing range of 65 meters could limit firing opportunities in the confines of densely urban areas.

(1) ***Obstacles***. When fired from street level, rubble or other obstacles could interfere with missile flight. At least 3.5 feet (1 meter) of vertical clearance over such obstacles must be maintained. Figure 7-7 shows the most common obstacles to ATGM flights in urban areas. Power lines are a special obstacle that presents a unique threat to ATGM gunners. If the power in the lines has not been interrupted, the ATGM guidance wires could create a short circuit. This would allow extremely high voltage to pass to the gunner in the brief period before the guidance wires melted. This voltage could either damage the sight and guidance system, or injure the gunner. Before any ATGM is fired over a power line, an attempt must be made to determine whether or not the power has been interrupted.

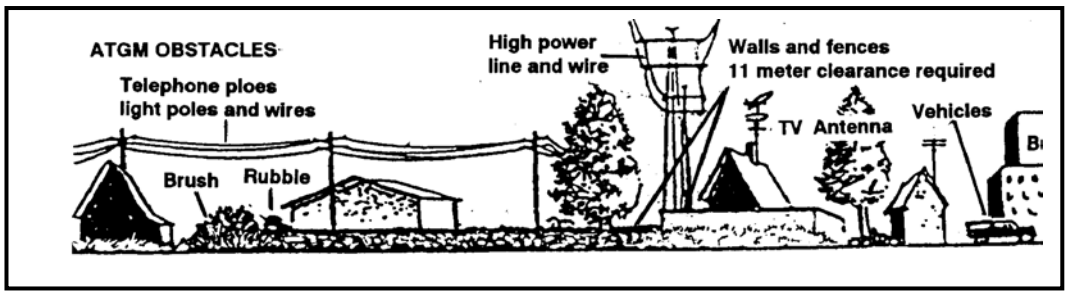

Figure 7-7. Common obstacles to ATGM flights.

(2) ***Dead Space***. Three aspects of dead space that affect ATGM fires are arming distance, maximum depression, and maximum elevation.

(a) Both the Dragon and TOW missiles have a minimum arming distance of 65 meters, which severely limits their use in urban areas. Few areas in the inner city permit fires much beyond the minimum arming distance—ground-level long-range fires down streets or rail lines and across parks or plazas are possible. ATGMs may be used effectively from upper stories or roofs of buildings to fire into other buildings.

(b) The TOW is limited much more than the Dragon by its maximum depression and elevation. The maximum depression and elevation limits of the TOW mount could result in dead space and preclude the engagements of close targets (Figure 7-8, page 7-18). A target located at the minimum arming range (65 meters) cannot be engaged by a TOW crew located any higher then the sixth floor of a building due to maximum depression limits. At 100 meters the TOW crew can be located as high as the ninth floor and still engage the target.

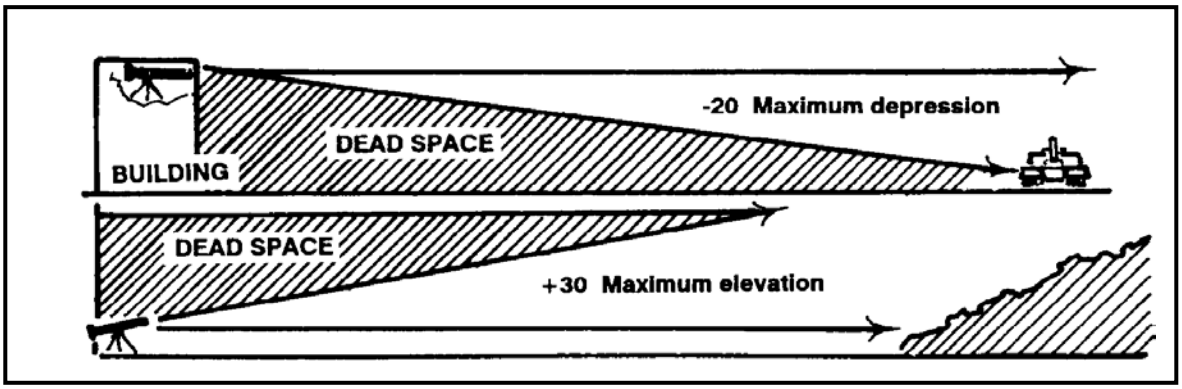

Figure 7-8. TOW maximum elevation and depression limitations.

(3) ***Backblast***. Backblast for ATGMs is more of a concern during combat in urban areas than in open country. Any loose rubble in the caution zone could be picked up and thrown by the backblast. The channeling effect of walls and narrow streets is even more pronounced due to the greater backblast. If the ATGM backblast strikes a wall at an angle, it can pick up debris, or be deflected and cause injury to unprotected personnel (Figure 7-9). Both ATGMs can be fired from inside some buildings. In addition to the helmet and body armor, all personnel in the room should wear eye protection and earplugs.

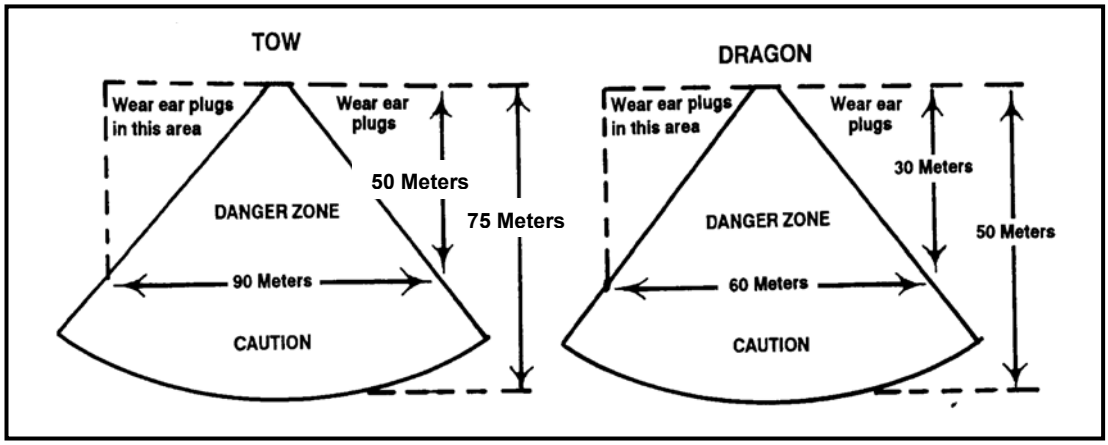

Figure 7-9. ATGM backblast in an open street.

(a) To fire a TOW from inside a room, the following safety precautions must be taken (Figure 7-10).

- The building must be of sturdy construction.
- The ceiling should be at least 7 feet high.
- The floor size of the room should be at least 15 by 15 feet; larger, if possible.
- At least 20 square feet of room ventilation should exist, preferably to the rear of the weapon. An open 7- by 3-foot door is sufficient. Removing sections of interior partitions can create additional ventilation.

- All glass must be removed from the windows, and all small loose objects removed from the room, the room should be cleaned.
- All personnel in the room should be forward of the rear of the TOW.
- All personnel in the room should wear ballistic eye protection and earplugs.
- A clearance of 9 inches (23 centimeters) must be between the launch tube and aperture from which it is fired. (See AR 385-62 and AR 385-63 for more detailed safety information.)

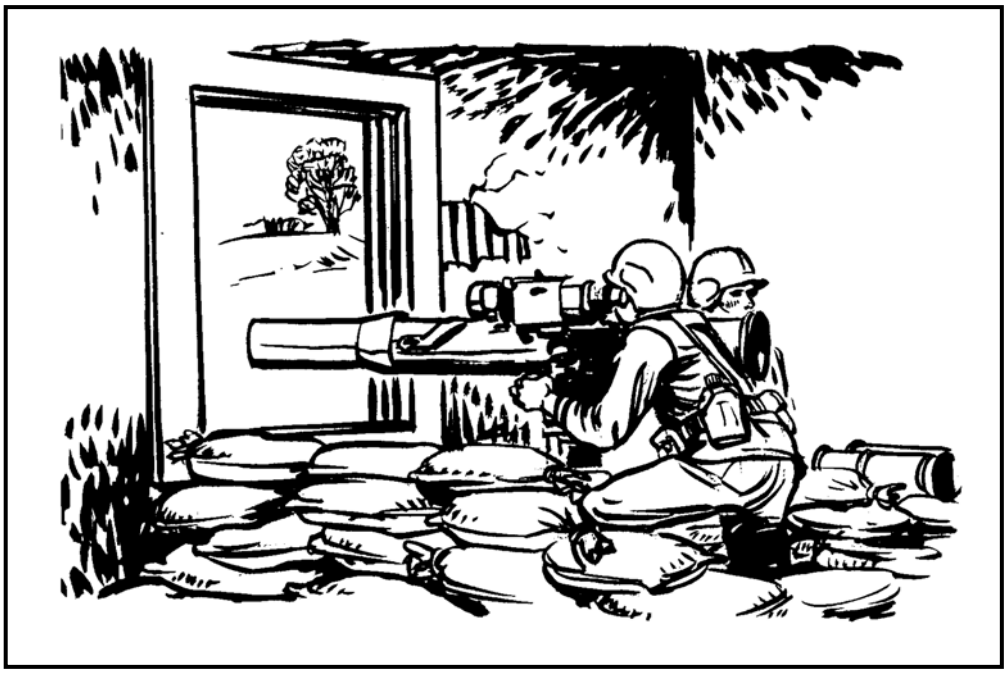

Figure 7-10. TOW fired from inside a room.

(b) To fire a Dragon from inside a room, the following safety precautions must be taken.

- The building must be of sturdy construction.
- The ceiling should be at least 7 feet high.
- The floor size should be at last 15 by 15 feet; larger, if possible.
- At least 20 square feet of ventilation should exist (room openings), preferably to the rear of the weapon. An open 7- by 3-foot door would provide minimum ventilation.
- All glass should be removed from windows, and small loose objects removed from the room.
- The room should be clean or the floors must be wet to prevent dust and dirt (kicked up by the backblast) from obscuring the vision of other soldiers in the room.
- All personnel in the room must be forward of the rear of the weapon.
- All personnel in the room must wear ballistic eye protection and earplugs.
- At least a 6-inch clearance must exist between the launch tube and aperture from which it is fired.

b. **Weapon Penetration.** ATGMs can penetrate and destroy heavily armored tanks. They have large warheads employing the shaped-charge principle. Because of their size, these warheads can achieve significant penetration against typical urban targets. Penetration does not mean concurrent destruction of the structural integrity of a position. The shaped-charge warhead produces relatively little spall. Enemy personnel not standing directly behind or near the point of impact of an ATGM may escape injury.

(1) ***Standard TOW missiles.*** The basic TOW missile can penetrate 8 feet of packed earth, 4 feet of reinforced concrete, or 16 inches of steel plate. The improved TOW (ITOW), the TOW 2, and the TOW 2A have been modified to improve their penetration and they penetrate better than the basic TOW. All TOW missiles can defeat triple sandbag walls, double layers of earth filled 55-gallon drums, and 18-inch log walls.

(2) ***TOW 2B***. The TOW 2B uses a different method of defeating enemy armor. It flies over the target and fires an explosively formed penetrator down onto the top of an armor vehicle, where the armor is thinner. Because of this design feature, the TOW 2B missile cannot be used to attack nonmetallic structural targets. When using the TOW 2B missile against enemy armor, gunners must avoid firing directly over other friendly vehicles, disabled vehicles, or large metal objects such as water or oil tanks.

(3) ***Dragon Missile***. The Dragon missile can penetrate 8 feet of packed earth, 4 feet of concrete, or 13 inches of steel plate. It can attain effective short-range fire from upper stories, or from the rear or flanks of a vehicle. These engagements are targeted against the most vulnerable parts of tanks, and can entrap tanks in situations where they are unable to counterfire. Elevated firing positions increase the first-round hit probability. Firing down at an angle of 20 degrees increases the chance of a hit by 67 percent at 200 meters. A 45-degree down angle doubles the first round hit probability, compared to a ground-level shot.

c. **Breaching Structural Walls**. Firing ATGMs is the least efficient means to breach structures. Because of their small basic load and high cost, ATGMs are better used against enemy tanks or fortified fighting positions. They can be effective against bunkers or other identified enemy fighting positions.

7-7. FLAME WEAPONS

The use of flame weapons, such as Fougasse, the M202A1 Flash, white phosphorous, thermobaric, and other incendiary agents, against targets is not a violation of current international law. They should not, however, be employed to just cause unnecessary suffering to individuals. The use of flame weapons should be addressed in the ROE. Flame weapons are characterized by both physical (flame and overpressure) and psychological casualty-producing abilities. Flame does not normally need to be applied with pinpoint accuracy to accomplish its mission. Efforts must be made to ensure that certain types of flame munitions effects do not spread to structures needed by friendly forces. Large fires in urban areas are catastrophic, and these fires can create an impenetrable barrier for hours. The most common US flame weapons currently employed are the M202A1 Flash, flame field expedients (Fougasse), and the M14 TH3 incendiary hand grenade. In the future, the M202A1 Flash may be replaced by a new shoulder-fired, thermobaric warhead, soft-launched rocket to support soldiers. (See Chapter 3, paragraphs 3-31 and 3-32 for more details.)

a. **Employment.** Flame weapons can be used against fortified positions, interior buildings, tunnels (to include subways and sewers), and open areas. They can also be used to control avenues of approach for personal and lightly armored vehicles. When employed properly, even if the round or burst misses, enough flaming material and overpressure enters the position or area to cause casualties and disrupt operations. Thermobaric munitions will provide a more effective and selective flame capability that is easier and safer to employ at all levels of tactical operations without the side effect of large area destruction due to uncontrolled fires.

b. **Capabilities.** Flame weapons have different effects against typical urban targets and complex terrain.

(1) ***M202A1 Flash Rocket Launcher.*** The M202A1 Flash is a lightweight, individual rocket launcher aimed and fired from the right shoulder using either the standing, the kneeling, or the prone positions. The launcher is loaded with a clip (M74), which contains four 66-mm rockets. It can fire one to four rockets semi-automatically at a rate of one rocket per second and can be reloaded with a new clip (Figure 7-11). The M202A1 can deliver area fire out to 500 meters. During urban combat, the range to targets is normally much less. Point targets, such as an alleyway or bunker, can usually be hit from 200 meters. Precision fire against a bunker aperture is possible at 50 meters.

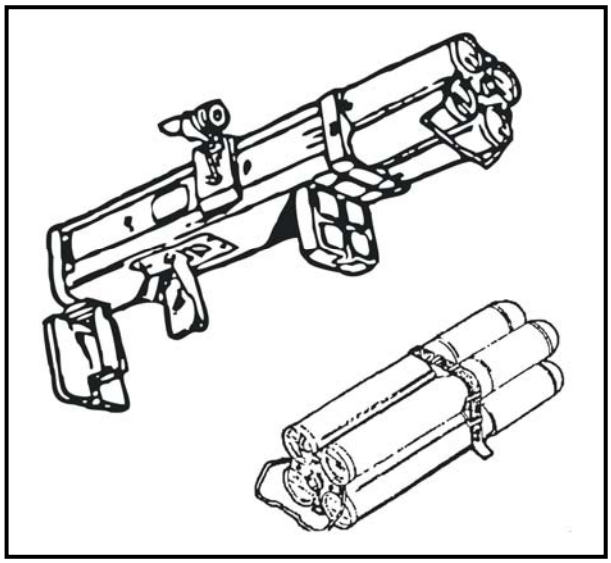

Figure 7-11. M202A1 Flash, 66-mm rocket launcher with M74 rocket clip.

(a) The rocket's warhead contains tri-ethyl aluminum (TEA), which ignites when exposed to air. The minimum safe combat range is 20 meters, which is the bursting radius of the rocket warhead due to splash back. If the projectile strikes a hard object along its flight path and breaks open, it will burst into flames even if the fuse has not armed. M202A1 rocket packs must be protected from small-arms fire and shell fragments that could ignite them. The M202A1 has a backblast that must be considered before firing (Figure 7-12, page 7-22).

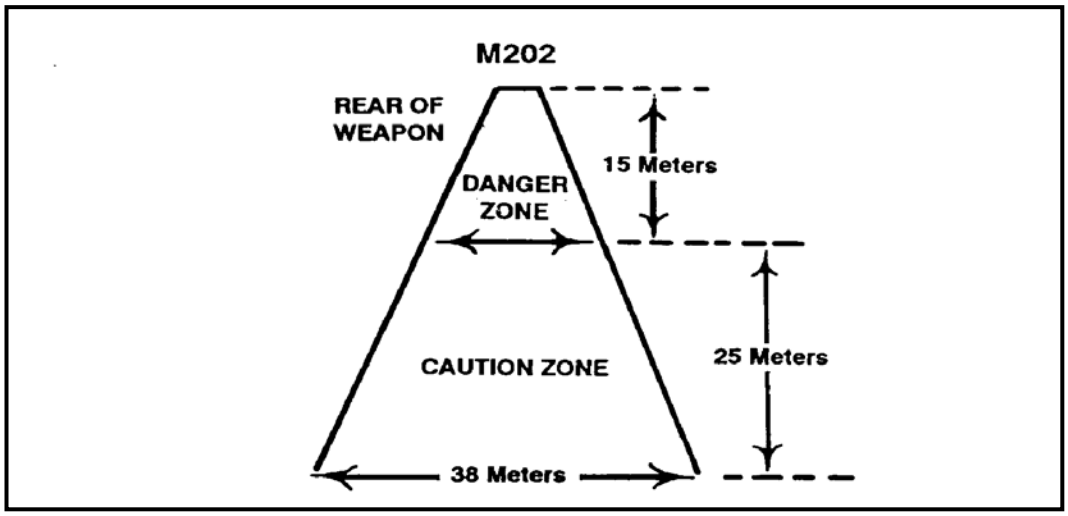

Figure 7-12. Backblast area of an M202A1 Flash.

(b) The M202A1 Flash is not effective in penetrating typical urban targets. It can penetrate up to 1 inch of plywood at 200 meters, and at close range it can penetrate some wooden doors. The rocket reliably penetrates window glass. The M202A1 is not effective against brick or cinder block construction. The flame agent splattered against the top, flanks, and rear of light armored vehicles can be effective. The psychological effect of hits by flame rockets on closed-in crewmen is significant.

(c) A round detonating near or on a vehicle's rear deck or engine compartment could set the vehicle on fire. A wheeled vehicle, such as the BTR, could have its tires severely damaged by the M202A1.

(2) ***M14 TH3 Incendiary Hand Grenade.*** The M14 is used to destroy equipment and start fires. It is used to damage, immobilize, or destroy vehicles, weapons systems, shelters, and ammunition. The M14 incendiary grenade is especially effective against flammable objects such as wooden structures. It is also used to create an immediate smoke cloud to conceal movement across a narrow open space such as a street. Its smoke is not toxic but can cause choking in heavy concentrations. A portion of thermate mixture (an improved version of thermite, the incendiary agent used in hand grenades during World War II) is converted to molten iron, which burns at 4,000 degrees Fahrenheit. The mixture fuses together the metallic parts of any object that it contacts. The thermate filler can burn through a 1/2-inch homogenous steel plate. It produces its own oxygen and burns under water.

(a) The grenade's intense light is hazardous to the retina and can cause permanent eye damage. The brilliant light, smoke, and molten iron particles all combine to make the M14 a very effective psychological weapon. Because it weighs 32 ounces, most infantrymen can throw this grenade only 25 meters.

(b) The M14 incendiary grenade is an effective weapon against enemy armored vehicles when used in the close confines of combat in urban areas. It can be thrown or dropped from upper stories onto enemy vehicles. The M14 can be combined with flammable liquids, detonating cords, blasting caps, and fuse igniters to create the eagle

fireball, a field-expedient antiarmor device. (See FM 21-75, Appendix H for more information.)

(3) ***Flame Field Expedients.*** Flame field expedients (Fougasse) are used chiefly in defensive operations; however, they may also be used in offensive operations to—

- Warn of enemy approach when used in a defilade area or during periods of limited visibility.
- Produce casualties by radiant heat or contact with the flaming materiel.
- Deter the enemy by psychological impact.
- Produce limited battlefield illumination to silhouette the opposing force and defeat their IR sensors.
- Restrict terrain to adversaries.
- Defeat underground tunnels and structures.
- Flame minefields that are controll-detonated.

(a) Exploding flame devices consist of a container, thickened fuel, and a firing system to scatter and ignite fuel. The size area to be covered depends on the size of the container and type of firing system. Normal containers will range from 1 to 55 gallons of thickened fuel.

(b) Flame illuminators give an initial flash and then burn for several hours. The normal size container is from 5 to 55 gallons and is filled with earth and then thickened fuel is poured in. The illuminator can be stored for long periods of time if sealed.

(4) ***Thermobarics.*** This type of munition has been used by many nations of the world and their proliferation is an indication of how effectively these weapons can be used in urban and complex terrain. The ability of thermobaric weapons to provide massed heat and pressure effects at a single point in time cannot be reproduced by conventional weapons without massive collateral destruction. Thermobaric weapon technologies provide the ground commander a new choice in protecting the force, and a new offensive weapon that can be used in a mounted or dismounted mode against complex environments. Currently, there are no thermobaric weapons in the US inventory.

7-8. HAND GRENADES

Hand grenades are used extensively during combat in urban areas. Smoke grenades are used for obscuration and signaling. Riot control grenades are used to control civil disturbances. Fragmentation, concussion and stun grenades are used to clear the enemy from rooms and basements. Hand grenades are the most used explosive munition during intense combat in urban areas. In World War II, it was common for a battalion fighting in a city to use over 500 fragmentation grenades each day. Stun grenades are used primarily during precision clearing of an urban structure when the presence of noncombatants is likely.

a. **Employment.** Smoke and riot control grenades have similar employment techniques. Fragmentation and concussion grenades are used to produce enemy casualties. The stun grenade is used as a distraction device.

(1) ***AN-M8 HC smoke grenade.*** The AN-M8 HC smoke grenade produces a dense white or gray smoke. It burns intensely and cannot be easily extinguished once it ignites. The smoke can be dangerous in heavy concentrations because it makes breathing difficult and causes choking. The M8 grenade is normally used for screening. It produces a slowly

building screen of longer duration than the obsolete M34 WP grenade without the problem of collateral damage caused by scattered burning particles.

(2) ***M18-Series Smoke Grenades.*** The M18-series smoke grenades produce several different colors of smoke, which are used for signaling. Yellow smoke is sometimes difficult to see in urban areas. Newer versions of yellow smoke grenades are more visible than the old type.

(3) ***Riot Control Grenade.*** The M7A3 CS riot control grenade can be used to control riots or disperse personnel. (See Appendix F.) Urban areas often create variable and shifting wind patterns. When using CS grenades, soldiers must prevent the irritating smoke from affecting friendly troops. The CS grenade burns intensely and can ignite flammable structures. Enemy troops wearing even rudimentary chemical protective masks can withstand intense concentrations of CS gas.

NOTE: National Command Authority (NCA) approval is required before using riot control agents (RCAs).

(4) ***Concussion Grenade.*** The MK3A2 offensive hand grenade, commonly referred to as the concussion grenade, produces casualties during close combat while minimizing the danger to friendly personnel. The grenade produces severe concussion effects in enclosed areas. For this reason, it is the preferred hand grenade during offensive operations in a MOUT environment. It can be used for light blasting and demolitions, and for creating breach holes in interior walls. The concussion produced by the MK3A2 is much greater than that of the fragmentation grenade. It is very effective against enemy soldiers in bunkers, buildings, and underground passages.

(5) ***Fragmentation Grenade.*** The M67 fragmentation grenade is the most commonly available grenade during combat in urban areas. It provides suppression during room-to-room or house-to-house fighting, and is used while clearing rooms of enemy personnel. When used at close ranges, it can be cooked off for two seconds to deny the enemy time to throw it back. The fragmentation grenade can be rolled, bounced, or ricocheted into areas that cannot be reached by 40-mm grenade launchers. Soldiers must be cautious when throwing grenades up stairs. This is not the most desired method of employment.

(6) ***Stun Grenade.*** The M84 stun hand grenade is the most recent addition to the Army inventory of grenades. Stun hand grenades are used as diversionary or distraction devices during building and room clearing operations when the presence of noncombatants is likely or expected and the assaulting element is attempting to achieve surprise. The following is a description of the M84 stun hand grenade and its components.

(a) *Body*. The body is a steel hexagon tube with holes along the sides to allow for the emission of intense light and sound when the grenade is ignited.

(b) *Fuze*. The fuze is the M201A1 modified with a secondary safety pin installed with a triangular pull ring attached.

(c) *Weight*. The grenade weighs 8.33 ounces.

(d) *Safety Clip*. The fuze has a secondary safety pin installed with a triangular pull ring attached.

(e) *Field-Expedient Use*. In combat, you may need to use the M84 stun hand grenade as an early warning device. Use the following procedures *in combat only*:

- Attach grenade to a secure object such as a tree, post, or picket.
- Attach tripwire to a secured object, extend across path, and attach wire to the pull ring of the grenade.
- Bend the end of the pull pin flat to allow for easy pulling.
- Remove the secondary safety pin.

b. **Effects.** Each type of hand grenade has its own specific effect during urban operations.

(1) The effects of smoke grenades in urban areas are nominal. Smoke grenades produce dense clouds of colored or white smoke that remain stationary in the surrounding area. They can cause fires if used indiscriminately. If trapped and concentrated within a small space, their smoke can suffocate soldiers.

(2) The fragmentation grenade has more varied effects during urban combat. It produces a large amount of small high-velocity fragments, which can penetrate plasterboard partitions and are lethal at short ranges (15 to 20 meters). Fragments lose their velocity quickly and are less effective beyond 25 meters. The fragments from a fragmentation grenade cannot penetrate a single layer of sandbags, a cinder block, or a brick building, but they can perforate wood frame and tin buildings if exploded close to their walls.

(3) Fragmentation barriers consisting of common office furniture, mattresses, doors, or books can be effective against the fragmentation grenade inside rooms. For this reason, a room should never be considered safe just because one or two grenades have been detonated inside. Fragmentation grenades detonated on the floor not only throw fragments laterally but also send fragments and spall downward to lower floors. Predicting how much spall will occur is difficult since flooring material varies, but wooden floors are usually affected the most.

(4) Some foreign grenades throw fragments much larger than those of the US-made M67. Light barriers and interior walls would probably be less effective against these grenades than against the M67. A major problem with the US-made fragmentation grenade is its tendency to bounce back off hard targets. Grenades are often directed at window openings on the ground floor or second floor. At ranges as close as 20 meters, a thrower's chances of missing a standard 1-meter by 1-meter window are high. The fragmentation grenade normally breaks through standard window glass and enters a room. If the grenade strikes at a sharp angle or the glass is thick plate, the grenade could be deflected without penetrating.

(5) The M84 stun hand grenade is designed to be thrown into a room (through an open door, a standard glass window, or other opening) to deliver a loud bang and bright flash sufficient enough to temporarily disorient personnel in the room.

(6) Hand grenades are difficult weapons to use. They involve a high risk of fratricide. Commanders should conduct precombat training with hand grenades as part of normal preparations. Soldiers must be very careful when throwing hand grenades.

(7) The pull pins of all these hand grenades can be replaced if the thrower decides not use the weapon. This pin replacement must be done carefully (see FM 23-30).

(8) The METT-TC and ROE dictates what type of grenade the soldier uses to clear each room. Because of the high expenditure of grenades, units should carry additional grenades of all types. Additional grenades can be carried in empty ammunition or canteen pouches.

7-9. MORTARS

The urban environment greatly restricts low-angle indirect fires because of overhead masking. While all indirect fire weapons are subject to overhead masking, mortars are less affected than field artillery weapons due to the mortar's higher trajectory. For low-angle artillery fire, dead space is about five times the height of the building behind which the target sits. For mortar fire, dead space is only about one-half the height of the building. Because of these advantages, mortars are even more important to the infantry during urban combat.

a. **Employment.** Not only can mortars fire into the deep defilade created by tall buildings, but they can also fire out of it. Mortars emplaced behind buildings are difficult for the enemy to locate accurately and even harder for him to hit with counterfire. Because of their lightweight, even heavy mortars can be hand carried to firing positions that may not be accessible to vehicles.

(1) Mortars can be fired through the roof of a ruined building if the ground-level flooring is solid enough to withstand the recoil. If there is only concrete in the mortar platoon's area, mortars can be fired using sandbags as a buffer under the baseplate and curbs as anchors and braces. (This is recommended only when time is not available to prepare better firing area.) Aiming posts can be placed in dirt-filled cans.

(2) The 60-mm and 81-mm mortars of the US Army have limited effect on structural targets. Even with delay fuzes they seldom penetrate more than the upper stories of light buildings. However, their wide area coverage and multioption fuzes make them useful against an enemy force advancing through streets, through other open areas, or over rubble. The 120-mm mortar is moderately effective against structural targets. With a delay fuze setting, it can penetrate deep into a building and create great destruction.

(3) Mortar platoons often operate as separate firing sections during urban combat. The lack of large open areas can preclude establishing a platoon firing position. Figure 7-13 shows how two mortar sections, which are separated by only one street, can be effective in massing fires and be protected from countermortar fire by employing defilade and dispersion.

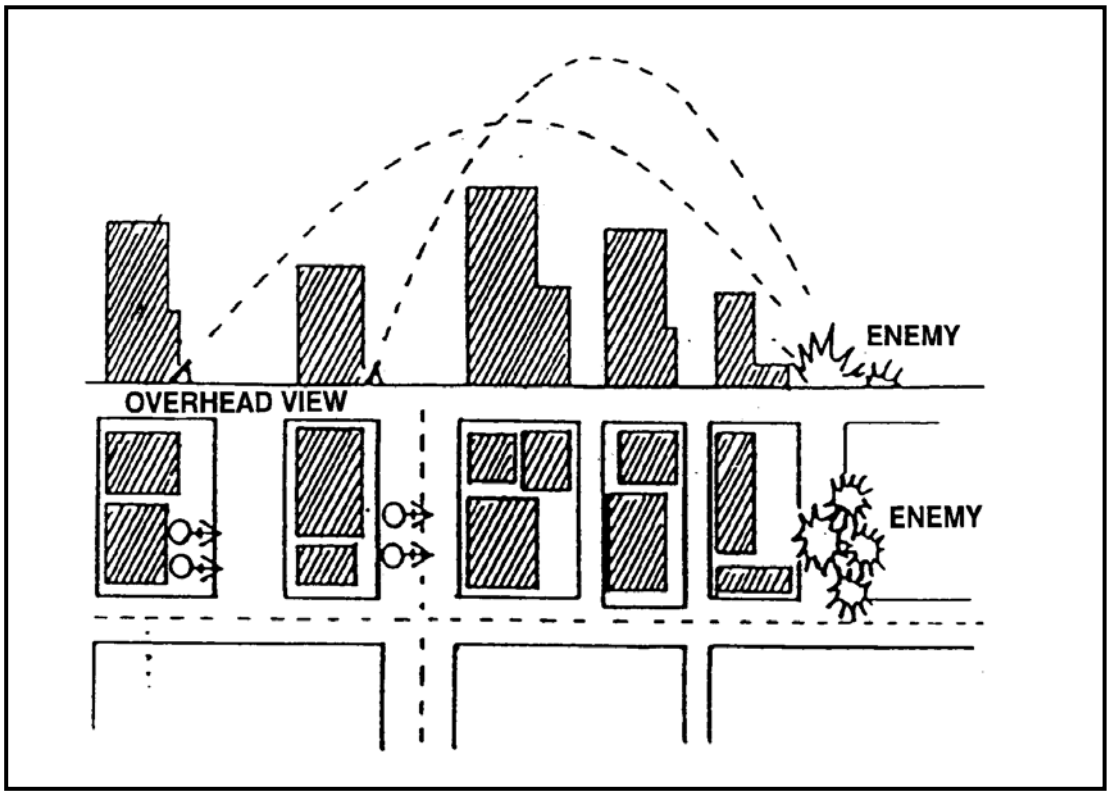

Figure 7-13. Split-section mortar operations on adjacent streets.

(4) All three of the standard mortar projectiles are useful during combat in urban areas. High-explosive fragmentation is the most commonly used round. WP is effective in starting fires in buildings and forcing the enemy out of cellars and light-frame buildings, and is the most effective mortar round against dug-in enemy tanks. Even near misses blind and suppress the tank crew, forcing them to button up.

(5) The artificial relief of urban terrain reduces wind speed and increases atmosphere mixing, so mortar smoke tends to persist longer and give greater coverage in urban areas than in open terrain.

(6) Urban masking impacts the use of illumination. In urban areas, it is often necessary to plan illumination behind friendly positions placing friendly troops in shadows and enemy troops in the light. Illumination rounds are difficult to adjust and are often of limited use because of the deep canyon nature of the urban area. Rapidly shifting wind currents in urban areas also affect mortar illumination, making it less effective.

b. **Effects of Mortar Fire.** The multioption fuze on newer US mortar rounds makes them effective weapons on urban terrain. Delay settings can increase penetration slightly, while proximity bursts can increase the lethal area covered by fragments. Tall buildings can cause proximity fuzed mortar rounds to detonate prematurely if they pass too closely.

(1) ***60-mm Mortar***. The 60-mm mortar round cannot penetrate most rooftops, even with a delay setting. Small explosive rounds are effective, however, in suppressing snipers on rooftops and preventing roofs from being used by enemy observers. The 60-mm WP round is not normally a good screening round due to its small area of

coverage. In urban combat, however, the tendency of smoke to linger and the small areas to be screened make it more effective. During the battle for Hue in South Vietnam, 60-mm WP rounds were used to create small, short-term, smoke screens to conceal movement across open areas such as parks, plazas, and bridges. Fragments from 60-mm HE rounds landing as close as 10 feet away cannot penetrate a single sandbag layer or a single-layer brick wall. The effect of a 60-mm mortar HE round that achieves a direct hit on a bunker or fighting position is equivalent to 1 or 2 pounds of TNT. Normally, the blast will not collapse a properly constructed bunker but can cause structural damage. The 60-mm mortar will not normally crater a hard-surfaced road.

(2) ***81-mm Mortar***. The 81-mm mortar has much the same effect against urban targets as the 60-mm mortar. It has a slightly greater lethal area and its smoke rounds (WP and RP) are more effective. A direct hit is equivalent to about 2 pounds of TNT. The 81-mm round cannot significantly crater a hard-surfaced road. With a delay setting, the 81-mm round can penetrate the roofs of light buildings.

(3) ***120-mm Mortar***. The 120-mm mortar is large enough to have a major effect on common urban targets. It can penetrate deep into a building, causing extensive damage because of its explosive power. A minimum of 18 inches of packed earth or sand is needed to stop the fragments from a 120-mm HE round impacting 10 feet away. The effect of a direct hit from a 120-mm round is equivalent to almost 10 pounds of TNT, which can crush fortifications built with commonly available materials. The 120-mm mortar round can create a large but shallow crater in a road surface, but it is not deep or steep-sided enough to block vehicular movement. However, craters could be deep enough to damage or destroy storm drain systems, water and gas pipes, and electrical or phone cables.

7-10. 25-MM AUTOMATIC GUN

The 25-mm automatic gun mounted on the M2/M3 Bradley fighting vehicle offers infantrymen an effective weapon for urban combat. The primary role of the BFVs during combat in urban areas is to provide suppressive fire and to breach exterior walls and fortifications. (See paragraph 7-3 for the suppression effects and penetration of the 7.62-mm coaxial machine gun.) The wall and fortification breaching effects of the 25-mm automatic gun are major assets to infantrymen fighting in urban areas.

a. **Obliquity.** The 25-mm gun produces its best urban target results when fired perpendicular to the hard surface (zero obliquity). During urban combat, however, finding a covered firing position that permits low obliquity firing is unlikely, unless the streets and gaps between buildings are wide. Most shots impact the target at an angle, which normally reduces penetration. With the APDS-T round, an angle of obliquity of up to 20 degrees can actually improve breaching. The rounds tend to dislodge more wall material for each shot but do not penetrate as deeply into the structure.

b. **Target Types.** The 25-mm gun has different effects when fired against different urban targets.

(1) ***Reinforced Concrete***. Reinforced concrete walls, which are 12 to 20 inches thick, present problems for the 25-mm gun when trying to create breach holes. It is relatively easy to penetrate, fracture, and clear away the concrete, but the reinforcing rods remain in place. These create a “jail window” effect by preventing entry but allowing grenades or rifle fire to be placed behind the wall. Steel reinforcing rods are normally 3/4 inch thick

and 6 to 8 inches apart—there is no quick way of cutting these rods. They can be cut with demolition charges, cutting torches, or special power saws. Firing with either APDS-T or HEI-T rounds from the 25-mm gun will not always cut these rods.

(2) ***Brick Walls***. The 25-mm gun more easily defeats brick walls, regardless of their thickness, and the rounds produce the most spall.

(3) ***Bunker Walls***. The 25-mm gun is devastating when fired against sandbag bunker walls. Obliquity has the least affect on the penetration of bunker walls. Bunkers with earth walls up to 36 inches thick are easily penetrated. At short ranges typical of combat in urban areas, defeating a bunker should be easy, especially if the 25-mm gun can fire at an aperture.

c. **Burst Fire.** The 25-mm gun's impact on typical urban targets seems magnified if the firing is in short bursts. At close ranges, the gunner might need to shift his point of aim in a spiral pattern to ensure that the second and third bursts enlarge the hole. Even without burst fire, sustained 25-mm gunfire can defeat almost all urban targets.

d. **Weapon Penetration.** Although the penetration achieved by the two combat rounds—armor-piercing, discarding sabot with tracer (APDS-T) and high explosive, incendiary with tracer (HEI-T)—differ slightly, both are eventually effective. However, the best target results are not achieved with either of the combat rounds. At close range against structural targets, the training round (TP-T) is significantly more effective. The TP-T round, however, has little utility when used against enemy armored vehicles.

(1) ***APDS-T***. The APDS-T round penetrates urban targets by retaining its kinetic energy and blasting a small hole deep into the target. The APDS-T round gives the best effects behind the wall, and the armor-piercing core often breaks into two or three fragments, which can create multiple enemy casualties. The APDS-T needs as few as four rounds to achieve lethal results behind walls. Table 7-11 explains the number of APDS-T rounds needed to create different size holes in common urban walls.

TARGET	LOOPHOLE	BREACH HOLE
3-inch brick wall at 0-degree obliquity.	22 rounds	75 rounds
3-inch brick wall at 45-degree obliquity.	22 rounds	35* rounds
5-inch brick wall at 0-degree obliquity.	32 rounds	50* rounds
8-inch reinforced concrete at 0-degree obliquity.	22 rounds	75 rounds(NOTE: Reinforcing rods still in place)
8-inch reinforced concrete at 45-degree obliquity.	22 rounds	40* rounds (NOTE: Reinforcing rods still in place)
*Obliquity and depth tend to increase the amount of wall material removed.		

Table 7-11. Breaching effects of APDS-T rounds.

(a) When firing single rounds, the APDS-T round provides the greatest capability for behind-the-wall incapacitation. The APDS-T round can penetrate over 16 inches of reinforced concrete with enough energy left to cause enemy casualties. It penetrates through both sides of a wood frame or brick veneer building. Field fortifications are

easily penetrated by APDS-T rounds. Table 7-12 explains the number of APDS-T rounds needed to create different-size holes in commonly found bunkers.

TYPE BUNKER	OBLIQUITY	PENETRATION	LOOPHOLE	SMALL BREACH HOLE
36-inch sand/timber	0 degree	1 round	25 rounds	40 rounds
36-inch sand/ 6-inch concrete	0 degree	6 rounds	6 rounds	20 rounds

Table 7-12. Number of APDS-T rounds needed to create different size holes in bunkers.

(b) The APDS-T round creates a hazardous situation for exposed personnel because of the pieces of sabot that are thrown off the round. Personnel not under cover forward of the 25-mm gun's muzzle and within the danger zone could be injured or killed by these sabots, even if the penetrator passes overhead to hit the target. The danger zone extends at an angle of about 10 degrees below the muzzle level, out to at least 100 meters and about 17 degrees left and right of the muzzle. Figure 7-14 shows the hazard area of the APDS-T round.

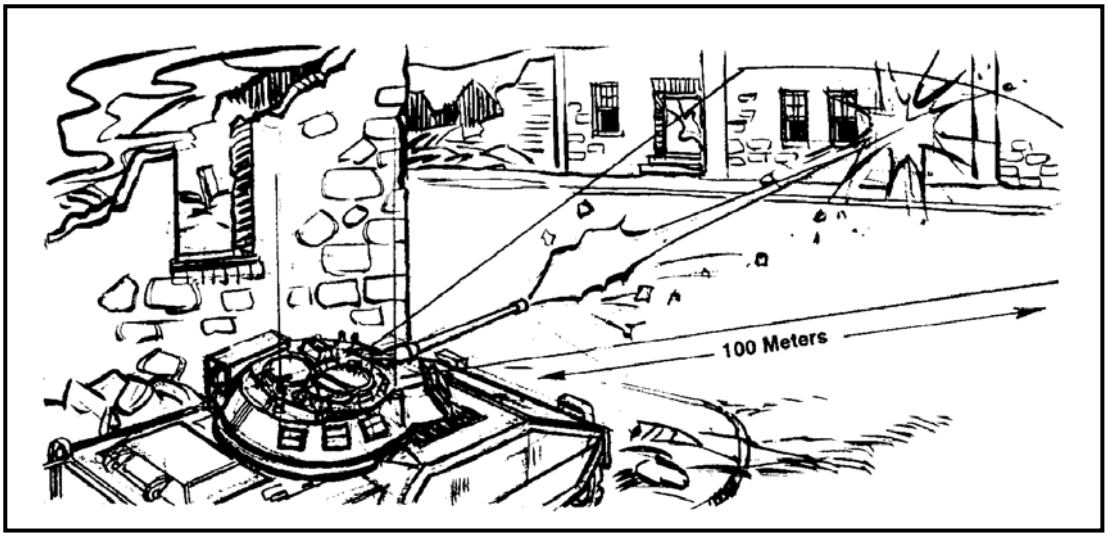

Figure 7-14. APDS-T danger zone.

(2) ***HEI-T.*** The HEI-T round penetrates urban targets by blasting away chunks of material.

(a) The HEI-T round does not penetrate an urban target as well as the APDS-T, but it creates the effect of stripping away a greater amount of material for each round. The HEI-T does more damage to an urban target when fired in multiple short bursts because the accumulative impact of multiple rounds is greater than the sum of individual rounds. Table 7-13 explains the number of HEI-T rounds needed to create different-size holes.

TARGET	LOOPHOLE	BREACH HOLE
3-inch brick wall at 0-degree obliquity.	10 rounds	20 rounds
3-inch brick wall at 45-degree obliquity.	20 rounds	25 rounds
5-inch brick wall at 0-degree obliquity.	30 rounds	60 rounds
8-inch reinforced concrete at 0-degree obliquity.	15 rounds	25 rounds
8-inch reinforced concrete at 45-degree obliquity.	15 rounds	30 rounds

Table 7-13. Number of HEI-T rounds needed to create different-size holes.

(b) The HEI-T round does not provide single-round perforation or incapacitating fragments on any external masonry structural wall. It can create first-round fragments behind wood frame and brick veneer walls. HEI-T rounds cannot penetrate a bunker as quickly as APDS-T, but they can create more damage inside the bunker once the external earth has been stripped away. Against a heavy bunker, about 40 rounds of HEI-T are needed to strip away the external earth shielding and breach the inner lining of concrete or timber. The HEI-T round is also used for suppression against known or suspected firing ports such as doors, windows, and loopholes.

7-11. TANK CANNON

The powerful, high-velocity cannon mounted on the M1-series tanks provides the infantryman heavy direct-fire support. Although the infantry assumes the lead role during combat in urban areas, tanks and infantry work as a close team. Tanks move down streets, after the infantry has cleared them of any suspected ATGM positions, and, in turn, support the infantry with fire. The tank is one of the most effective weapons for heavy fire against structures. The primary role of the tank cannon during urban combat is to provide heavy direct-fire against buildings and strongpoints that are identified as targets by the infantry. The wall and fortification breaching effects of the 105-mm and 120-mm tank cannon are major assets to infantrymen fighting in urban areas.

a. **Obliquity.** Tank cannons produce their best urban target effects when fired perpendicular to the hard surface (zero obliquity). During urban combat, however, finding a covered firing position that permits low-obliquity firing is unlikely. Most shots strike the target at an angle that would normally reduce penetration. With a tank cannon, a HEAT multipurpose round is the item of choice against urban targets; the size of the hole is reduced by approximately 1/3 when the firing angle is 45 degrees.

b. **Ammunition.** Armor-piercing, fin-stabilized, discarding sabot (APFSDS) rounds work best against armored vehicles. Other types of ammunition are carried that are more effective against masonry targets and other urban structures. The 105-mm cannon has HEAT, HEP, and WP rounds in addition to APFSDS. The 120-mm cannon has an effective high-explosive, antitank, multipurpose (HEAT-MP) round, which also has capability against helicopters. The 120-mm tank can also carry a high-explosive, concrete-obstacle reduction cartridge that has rubbling capability.

c. **Characteristics.** Both 105-mm and 120-mm tank cannons have two specific characteristics that affect their employment in urban areas: limited elevation and depression, and short arming ranges. In addition, the M1 and M1A1/M1A2 tanks have

another characteristic not involved with its cannon but affecting infantrymen working with it—extremely hot turbine exhaust.

(1) The M1 and M1A1/M1A2 tanks can elevate their cannon +20 degrees and depress it -10 degrees. The lower depression limit creates a 35-foot (10.8-meter) dead space around a tank. On a 16-meter-wide street (common in Europe) this dead space extends to the buildings on each side (Figure 7-15). Similarly, there is a zone overhead in which the tank cannot fire (Figure 7-16). This dead space offers ideal locations for short-range antiarmor weapons and allows hidden enemy gunners to fire at the tank when the tank cannot fire back. It also exposes the tank's most vulnerable areas: the flanks, rear, and top. Infantrymen must move ahead, alongside, and to the rear of tanks to provide close protection. The extreme heat produced immediately to the rear of the M1-series tanks prevents dismounted infantry from following closely, but protection from small-arms fire and fragments is still provided by the tank's bulk and armor. The M1-series tanks also have a blind spot caused by the 0-degree of depression available over part of the back deck. To engage any target in this area, the tank must pivot to convert the rear target to a flank target.

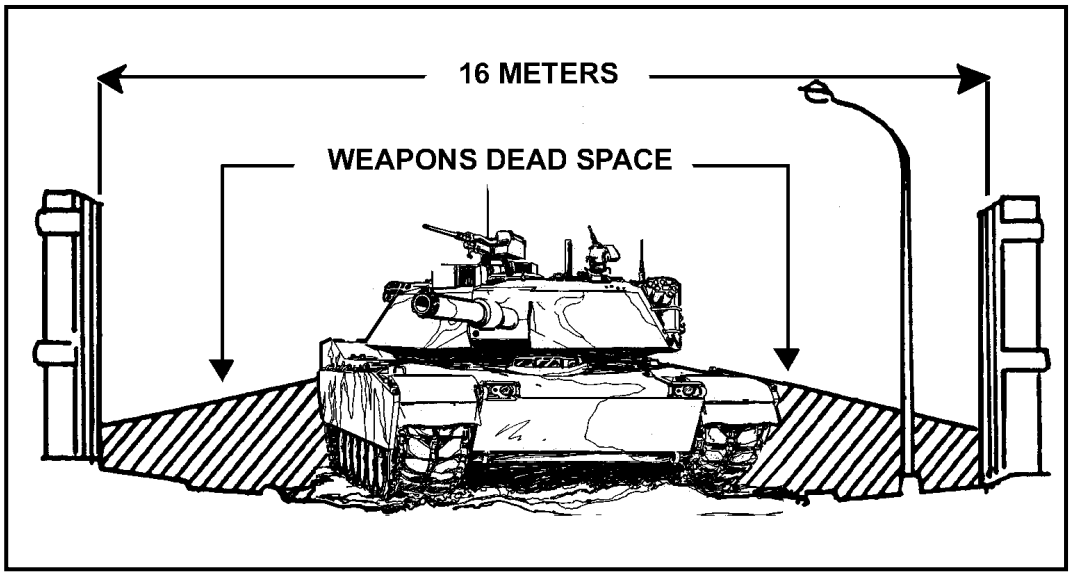

Figure 7-15. Tank cannon dead space at street level.

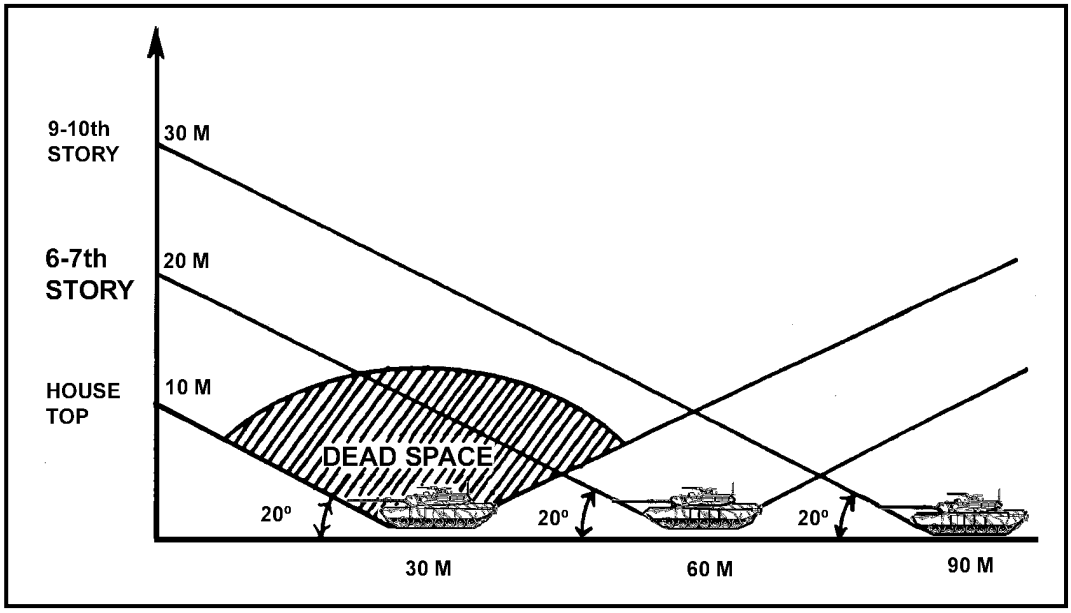

Figure 7-16. Tank cannon dead space above street level.

(2) HEAT type rounds arm within 15 to 30 meters from the gun muzzle. On a 16-meter-wide street, HEAT type ammunition does not arm quickly enough to engage a structure directly perpendicular to the direction of travel. HEAT type rounds fired at structures less than 30 meters from the muzzle will provide some of the desired effects, particularly if the desired effect is casualties inside the building. However, the effectiveness of unarmed HEAT type rounds will be unpredictable and highly variable. These arming distances allow the tank to engage targets from short ranges. The armor of the tank protects the crew from both the blowback effects of the round and enemy return fire. The APFSDS round does not need to arm and, therefore, can be fired at almost any range. The discarding portions of tank rounds can be lethal to exposed infantry forward and to the side of the tank. Additionally, HEAT rounds have an infrequent early burst occurrence. Therefore, exposed infantry should not be forward of a firing tank (60-degree frontal arc).

d. **Target Effects.** High-explosive, antitank rounds are most effective against masonry walls. The APFSDS round can penetrate deeply into a structure but does not create as large a hole or displace as much spall behind the target. In contrast to lighter HEAT rounds, tank HEAT rounds are large enough to displace enough spall to inflict casualties inside a building. One HEAT round normally creates a breach hole in all but the thickest masonry construction—a single round demolishes brick veneer and wood frame construction. Even the 120-mm HEAT round cannot cut all the reinforcing rods, which are usually left in place, often hindering entry through the breach hole (Figure 7-17, page 7-34). The 105-mm HEP round cuts the reinforcing rods and leaves a 20-inch hole.

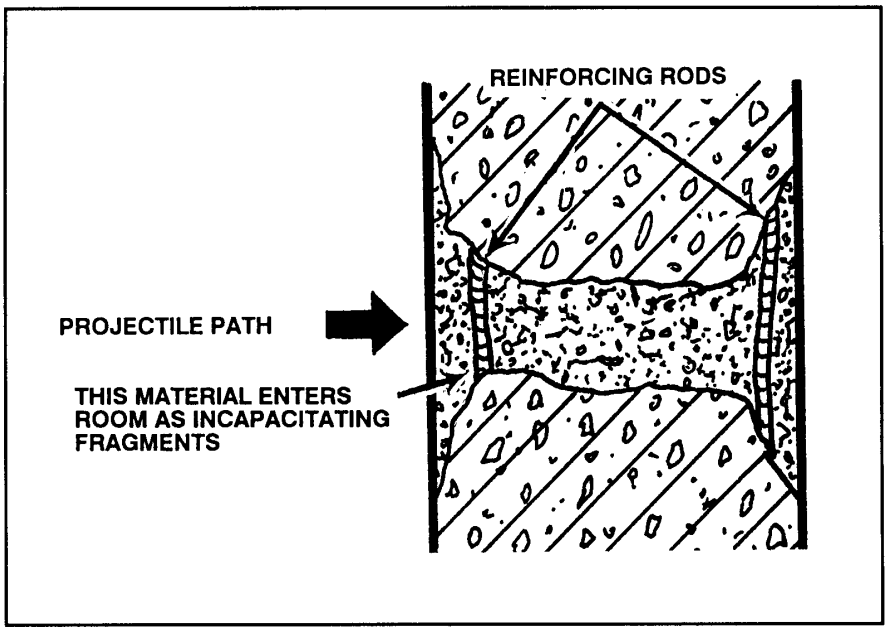

Figure 7-17. Tank HEAT round effects on reinforced concrete walls.

e. **Employment.** Tank-heavy forces could be at a severe disadvantage during urban combat, but a few tanks working with the infantry can be very effective, especially if they work well together at the small-unit level. Tank, infantry, and engineer task forces are normally formed to attack a fortified area. Individual tanks or pairs of tanks can work together with rifle squads or platoons.

(1) Tanks need infantry on the ground to provide security in urban areas and to designate targets. Against targets protected by structures, tanks should be escorted forward to the most covered location that provides a clear shot. On-the-spot instructions by the infantry unit leader ensure the tank's fire is accurate and its exposure is limited.

(2) When the tank main gun fires, it creates a large fireball and smoke cloud. In the confines of an urban area, dirt and masonry dust are also picked up and add to this cloud. The smoke and dust of the explosion further obscure the target. Depending on local conditions, this obscuration could last as long as two or three minutes. Infantry can use this period to reposition or advance unseen by the enemy. Caution must be exercised because the enemy might also move.

(3) Tank cannons create an overpressure and noise hazard to exposed infantrymen. All dismounted troops working near tanks should wear their Kevlar helmet and protective vest, as well as ballistic eye protection. If possible, they should also wear earplugs and avoid the tank's frontal 60-degree arc during firing.

(4) Tanks are equipped with powerful thermal sights that can be used to detect enemy personnel and weapons hidden in shadows and behind openings. Dust, fires, and thick smoke significantly degrade these sights.

(5) Tanks have turret-mounted grenade launchers that project screening smoke grenades. The grenades use a bursting charge and burning red phosphorous particles to create this screen. Burning particles can easily start uncontrolled fires and are hazardous to dismounted infantry near the tank. The tank commander and the infantry small-unit

leader must coordinate when and under what conditions these launchers can be used. Grenade launchers are a useful feature to protect the tank but can cause significant problems if unwisely employed.

(6) The tank's size and armor can provide dismounted infantry cover from direct-fire weapons and fragments. With coordination, tanks can provide moving cover for infantrymen as they advance across small open areas. However, enemy fire striking a tank but not penetrating is a major threat to nearby infantry. Fragmentation that is generated by antitank rounds and ricochets off tank armor have historically been a prime cause of infantry casualties while working with tanks in urban areas.

(7) Some tanks are equipped with dozer blades that can be used to remove rubble barriers, breach obstacles, or seal exits under fire.

f. **Multipurpose Antitank (MPAT) Round Target Effects.** The MPAT round can be very effective during UO. Different MPAT effects are described below.

(1) ***Heavy Armor.*** Because of a relatively small explosive warhead, MPAT effectiveness against heavy armor (tanks) is limited to attacks from the side and rear. Mobility kills of heavy armor can be achieved when fired at from these orientations (especially if tracks and or road wheels are struck); however, the vehicle armament is likely to remain operational.

(2) ***Light Armored Vehicles (LAVs).*** The heavy nose of the MPAT projectile makes it extremely effective against LAVs, such as the BMP. Vehicle kills can be achieved with an impact on varying locations on the hull or (if so equipped) the turret. Mobility kills can be achieved if the wheels or tracks are struck, and it is likely that a road wheel or track impact will also produce penetration of the hull structure. MPAT is effective when it impacts targets from perpendicular to highly oblique, but will function with a reduced reliability when striking excessively oblique surfaces (nearing that of a graze impact).

(3) ***Bunkers.*** The heavy nose of the MPAT projectile makes it extremely effective against earthen, timber, and or sandbag bunkers with the projectile "burying" itself into the bunker structure before warhead detonation. When this occurs, the projectile detonation produces not only lethal effects to personnel within, but a highly-destructive effect to the bunker structure itself.

(4) ***Buildings.*** MPAT is effective against buildings with wooden walls over 1 inch thick. Impact against a thinner wall structure (plywood sheathing without striking supporting members) may produce only a small hole as the projectile passes through the wall without detonating. Impact against a supporting structure (roof rafter, wall stud) causes detonation of the warhead and a subsequent hole and lethal fragmentation effects to personnel located inside. Impact against concrete walls yield holes of about 24 inches in diameter, but reinforcing bars embedded within the concrete are not likely to be cleared from the hole, unless struck directly.

(5) ***Helicopters.*** MPAT, when switched to the "A" or "air" mode, is effective against attack helicopters because of its proximity switch, which can produce mission abort kills without actually impacting the aircraft. The design of the proximity switch is such that if the projectile (set in the "A" mode) is fired against a helicopter, and is on a direct impact flight path, the projectile warhead will not function in the proximity mode, but will be detonated when the projectile strikes the target. If the projectile, however, strikes lightly armored parts of the structure (such as windows or the aluminum skin of the aircraft), it is likely to pass directly through the aircraft without detonating. Impact with heavier

structures, such as the engine or transmission components, will cause detonation of the warhead.

(6) ***Concrete Obstacles (XM908 OR-T Projectile).*** The OR-T projectile, because of its steel nose, is effective against large concrete obstacles. This effectiveness comes from the projectile's striking the face of the obstacle and penetrating several inches before the warhead is detonated. This penetration fractures the concrete obstacle from within, breaking it into smaller blocks, which can be cleared with an ACE. A concrete block 6 feet in diameter and 6 feet long is broken up into rubble, which can be cleared by a tank equipped with a bulldozer blade.

7-12. ARTILLERY AND NAVAL GUNFIRE

Field artillery and naval gunfire can both provide support to the infantry fighting in urban areas. The infantry must understand their capabilities and limitations to employ them effectively.

a. **Indirect Fire.** Indirect artillery fire is not effective for attacking targets within walls and masonry structures. It tends to impact on roofs or upper stories rather than structurally critical wall areas or pillars.

(1) Weapons of at least 155-mm are necessary against thick reinforced concrete, stone, or brick walls. Even with heavy artillery, large expenditures of ammunition are required to knock down buildings of any size. Tall buildings also create areas of indirect-fire dead space due to a combination of building height and angle of fall of the projectile (Figure 7-18). Usually the dead space for low-angle indirect fire is about five times the height of the highest building over which the rounds must pass.

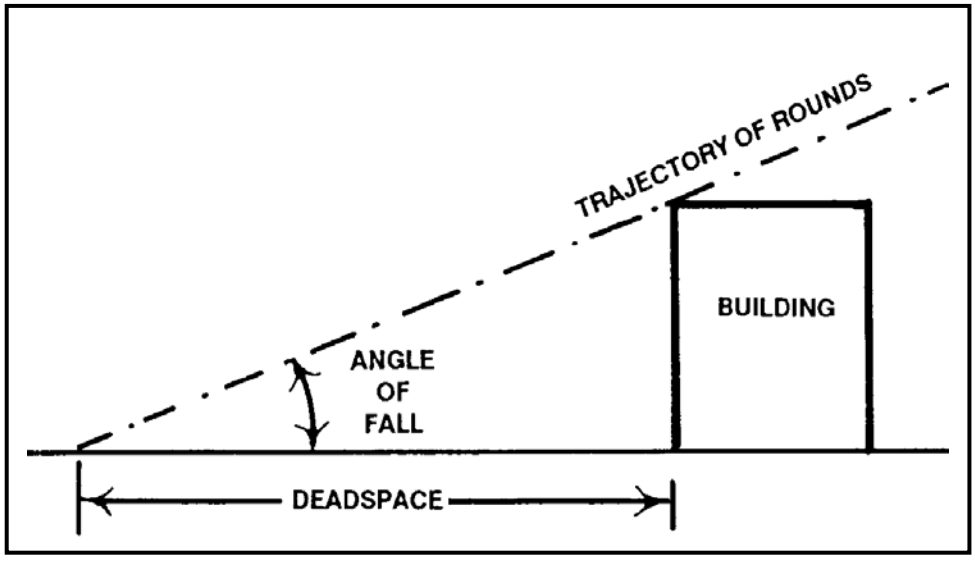

Figure 7-18. Indirect-fire dead space (low angle).

(2) Even when it is theoretically possible to hit a target in a street over a tall building, another problem arises because of range probable error (PE). Only 50 percent of the rounds fired on the same data can be expected to fall within one range PE of the target.

This means when firing indirect fire into urban areas with tall buildings, it is necessary to double the normal ammunition expenditure to overcome a reduced target area and range PE. Also, up to 25 percent of all HE rounds fail to detonate because they glance off hard surfaces.

(3) Naval gunfire, because of its flat trajectory, is even more affected by terrain masking. It is usually difficult to adjust onto the target, because the gun-target line is constantly changing.

b. **Direct Fire.** Self-propelled artillery pieces are not as heavily armored as tanks, but they can still be used during urban combat if adequately secured by infantry. The most likely use of US artillery in an urban direct-fire role is to reinforce tank fires against tough or important urban targets. Because of their availability and habitual relationship with infantry, tanks remain a more common direct-fire support means than self-propelled artillery. Self-propelled artillery should be used in this role only after an analysis of the need for heavy direct fire and the tradeoff involved in the extreme decentralization of artillery firepower. It has the same need for close security and target designation as tanks.

c. **Target Effects.** 155-mm direct fire has a devastating effect against masonry construction and field fortifications. Smaller artillery pieces (105-mm) are normally towed and, therefore, are difficult to employ in the direct-fire mode. Their target effects are much less destructive than the larger caliber weapons.

(1) ***155-mm howitzers***. The 155-mm self-propelled howitzer offers its crew mobility and limited protection in urban areas. It is effective due to its rate of fire and penetration. HE rounds can penetrate up to 38 inches of brick and nonreinforced concrete. Projectiles can penetrate up to 28 inches of reinforced concrete with considerable damage beyond the wall. HE rounds fuzed with concrete-piercing fuzes provide an excellent means of penetrating strong reinforced concrete structures. One round can penetrate up to 46 inches. Five rounds are needed to create a 1.5-meter breach in a 1-meter thick wall. About 10 rounds are needed to create such a breach in a wall 1.5 meters thick. Superquick fuzing causes the rubble to be blown into the building, whereas delay fuzing tends to blow the rubble outward into the street.

(2) ***Naval Cannon.*** The most common naval cannon used to support ground troops is the 5-inch 54-caliber gun. In either single or double mounts, this weapon has a high rate of fire and is roughly equivalent to the 155-mm howitzer in target effect.

7-13. AERIAL WEAPONS

Both rotary- and fixed-wing aircraft can quickly deliver large volumes of firepower over large urban areas. Specific targets are often hard to distinguish from the air. Good ground-to-air communications are vital to successfully employ aerial firepower.

a. **Rotary-Winged Aircraft.** Armed attack helicopters can be used to engage targets in urban areas. Enemy armored vehicles in small parks, boulevards, or other open areas are good targets for attack helicopters.

NOTE: The target effects of TOW missiles and 40-mm grenades carried by attack helicopters have already been discussed

(1) The HELLFIRE missile has a larger warhead and greater range than the TOW. It has a shaped-charge warhead and is not specifically designed for use against masonry

targets. Laser target designation for the HELLFIRE sometimes may not be possible due to laser reflections off glass and shiny metal surfaces. The use of attack helicopters to deliver ATGMs against targets in the upper stories of high buildings is sometimes desirable.

(2) The 2.75-inch folding fin aerial rocket and the 20-mm cannon common to some attack helicopters are good area weapons to use against enemy forces in the open or under light cover. They are usually ineffective against a large masonry target. The 20-mm cannon produces many ricochets, especially if AP ammunition is fired into urban areas.

(3) The 30-mm cannon carried by the Apache helicopter is an accurate weapon. It penetrates masonry better than the 20-mm cannon.

b. **Fixed-Wing Aircraft.** Close air support to ground forces fighting in urban areas is a difficult mission for fixed-wing aircraft. Targets are hard to locate and identify, enemy and friendly forces may be intermingled, and enemy short-range air defense weapons are hard to suppress.

(1) Because only one building can separate enemy and friendly forces, accurate delivery of ordnance is required. Marking panels, lights, electronic beacons, smoke, or some other positive identification of friendly forces is needed.

(2) General-purpose bombs from 500 to 2,000 pounds are moderately effective in creating casualties among enemy troops located in large buildings. High-dive angle bomb runs increase accuracy and penetration but also increase the aircraft's exposure to antiaircraft weapons. Low-dive angle bomb runs using high drag (retarded) bombs can be used to get bombs into upper stories. Penetration is not good with high-drag bombs. Sometimes aerial bombs pass completely through light-clad buildings and explode on the outside.

(3) Aerial rockets and 20-mm cannons are only moderately effective against enemy soldiers in urban areas since rockets lack the accuracy to concentrate their effects. The 20-mm cannon rounds penetrate only slightly better than the caliber .50 round; 20-mm AP rounds can ricochet badly; and tracers can start fires.

(4) The 30-mm cannon fired from the A-10 aircraft is an accurate weapon. It is moderately effective against targets in urban areas, penetrating masonry better than the 20-mm cannon.

(5) The AC-130 aircraft has weapons that can be most effective during combat in urban areas. This aircraft can deliver accurate fire from a 20-mm Vulcan cannon, 40-mm rapid-fire cannon, and 105-mm howitzer. The 105-mm howitzer round is effective against the roof and upper floors of buildings. The AC-130 is accurate enough to concentrate its 40-mm cannon and 105-mm howitzer fire onto a single spot to create a rooftop breach, which allows fire to be directed deep into the building.

(6) Laser and optically-guided munitions can be effective against high-value targets. The US Air Force has developed special, heavy, laser-guided bombs to penetrate hardened weapons emplacements. Problems associated with dense smoke and dust clouds hanging over the urban area and laser scatter can restrict their use. If the launching aircraft can achieve a successful laser designation and lock-on, these weapons have devastating effects, penetrating deep into reinforced concrete before exploding with great force. If launched without a lock-on, or if the laser spot is lost, these weapons are unpredictable.

7-14. DEMOLITIONS

Combat in urban areas requires the extensive use of demolitions, which requires all soldiers, not only engineers, to be trained in demolition employment. (See FM 5-25 for specific information on the safe use of demolitions.)

a. **Bulk Demolitions.** Bulk demolitions come in two types: TNT and C4 (see Chapter 8).

(1) TNT comes in 1/4-, 1/2-, and 1-pound blocks. About 5 pounds of TNT are needed to breach a nonreinforced concrete wall 12 inches thick if the explosives are laid next to the wall and are not tamped. If the explosives are tamped, about 2 pounds are sufficient.

(2) C4 comes in many different sized blocks. About 10 pounds of C4 placed between waist and chest high will blow a hole in the average masonry wall large enough for a man to walk through.

b. **Shaped Charges.** The two sizes of US Army shaped charges are a 15-pound M2A3 and a 40-pound M3A3. The M3A3 is the most likely shaped charge to be used in urban areas. It can penetrate 5 feet of reinforced concrete. The hole tapers from 5 inches down to 2 inches. The amount of spall thrown behind the target wall is considerable. There is also a large safety hazard area for friendly soldiers.

c. **Satchel Charges.** Satchel charges are very powerful. The two standard US Army satchel charges are the M183 and the M37. Both come in their own carrying satchel with detonators and blasting cords. Each weighs 20 pounds. The M183 has 16 individual 1 1/4-pound blocks that can be used separately. When used untamped, a satchel breaches a 3-foot thick concrete wall. Debris is thrown great distances. Friendly troops must move away and take cover before detonation.

d. **Cratering Charges.** The standard US Army cratering charge is a 43-pound cylinder of ammonium nitrate. This explosive does not have the shattering effect of bulk TNT or C4, and it is more useful in deliberate demolitions than in hasty ones.

7-15. COMMON EFFECTS OF URBAN COMBAT

Regardless of what weapons are used, there are several common effects during urban combat. Leaders must take them into account and use them or avoid them, as the situation demands.

a. **Penetration and Damage to Structures.** Most tactical situations call for penetration of buildings and walls. No one can be sure of how much penetration a round will achieve against a specific target until it has been tried. Some situations require units to limit penetration to the minimum obtainable. Generally, the smaller the round, the less penetration. High-explosive rounds normally penetrate less than armor-piercing rounds. High-explosive rounds and aerial bombs can cause extensive damage to buildings surrounding the target area (Figure 7-19, page 7-40).

Figure 7-19. Examples of penetration and damage to buildings.

b. **Rubble.** Combat experience has shown that after an urban area is reduced to rubble by weapons fire, it often becomes more of an obstacle to advancing troops, and a stronger position for defending troops, than it was before. (See Figure 7-20.)

Figure 7-20. Examples of rubble.

c. **Fire.** The risk of fire during urban combat is very high. Once a large fire starts, it is nearly impossible to put out. Damage to gas lines and water mains, the scarcity of fire fighting equipment and trained firemen, the general lack of access caused by rubble blocking the streets, and the danger posed by the combat itself make containing fires very difficult. Fires that rage out of control can cause more damage to the urban area than any other factor (Figure 7-21).

Figure 7-21. Examples of urban fires.

d. **Smoke and Haze.** Limited visibility is a common factor during urban combat. Fires produce large clouds of often toxic or irritating, choking smoke (Figure 7-22). Explosions add significant amounts of dust to the atmosphere. Even the effort to rescue personnel trapped within collapsed buildings creates dust.

Figure 7-22. Example of smoke as a result of fires.

e. **Trapped and Injured Survivors.** Intense urban combat will inevitably result in large-scale destruction to buildings. Survivors, both military and civilian, may be trapped in the rubble and must be extracted (Figure 7-23, page 7-42). This extraction effort may be impossible without heavy construction equipment. Unless specially trained personnel are available, the rescue effort itself can result in more casualties as the rubble shifts and collapses on would-be rescuers. Once they are located, casualties must be evacuated quickly and safely. This is often difficult to do without causing additional injury.

Figure 7-23. Examples of personnel trapped under rubble.

f. **Damaged and Destroyed Transportation Systems.** Urban areas are transportation hubs. Road, rail, barge, air, and ship traffic rely on functioning systems for the movement, loading, unloading, and distribution of supplies and goods. Battles in urban areas disrupt the normal flow of traffic destroying or damaging roads, ports, bridges, and rail lines (Figure 7-24). Large numbers of civilian inhabitants can be fed and cared for only if these are intact.

Figure 7-24. Example of a damaged rail transportation system.

g. **Displaced Civilian Occupants.** Although many civilian inhabitants of a town will flee the fighting, experience has shown that many others will remain behind. They may be trying to protect their property, or they may feel that they have no other place to go. For whatever reason, they will be in the immediate area of the fighting and in danger. These civilians must be considered in all military planning, and commanders must make provisions for their protection and evacuation. (See Figure 7-25.)

Figure 7-25. Example of displaced persons.