
CHAPTER 6

URBAN ENVIRONMENT

American and foreign doctrines reflect that military training must give more attention to urban combat. Urban areas are the power centers, and urban terrain is expected to be the most common type of area of operations for future American forces throughout the world. Recent deployments in Panama, Somalia, Kosovo, and Bosnia, as well as developments in Afghanistan, have shown the need for units to be proficient in warfighting in urban and complex terrain. The increasing focus on urban terrorism and civil disorder emphasizes that combat in built-up areas is unavoidable.

Expanding urban development affects military operations as the terrain is altered. Urban and complex close terrain pose significant problems for all types of military forces, but platoons and squads in the SBCT must be capable of leveraging combat power to achieve decisive results. The increased population and accelerated growth of cities have made the problems of combat in built-up areas an urgent requirement for the US Army. This chapter discusses the tools necessary for understanding the urban environment and for planning and executing missions, including reconnaissance, in the urban area.

Section I. UNDERSTANDING THE URBAN ENVIRONMENT

This section discusses the characteristics and definitions of urban operations. Throughout history, military planners have viewed cities as centers of gravity and sources of national strength. Cities are population centers; transportation and communication hubs; key nodes of industrial, financial, and information systems; seats of government; and repositories of wealth. Because the US has worldwide interests that directly relate to global security, deployments into urban environments are likely to become more frequent. These urban operations will serve a variety of tactical purposes--to neutralize or stabilize extremely volatile political situations, to defeat an enemy force that has sought protection afforded by urban terrain, and to provide assistance to allies in need of support. The reconnaissance platoon is an essential element in providing friendly forces with the real-time information and situational understanding they need to defeat the enemy in the urban environment. The commander must examine two key questions that affect the mission of the reconnaissance platoon and the battalion:

- Is it essential that maneuver forces be employed in the urban environment?
- How can forces apply combat power in the most efficient manner in an urban setting?

6-1. DEFINITIONS

Urban operations (UO) are defined as all military actions, combat and noncombat, conducted on terrain where manmade construction affects the tactical options. These operations may involve noncombatants, so the ROE and use of combat power are normally more restrictive than under other conditions of combat. Because of political change, advances in technology, and the Army's role in maintaining world order, UO

now takes on new dimensions. Infantrymen conduct urban combat operations under many varying conditions across the spectrum of conflict from major theater war through SSC to stability operations and support operations. These conditions range from large-scale, high-intensity combat through isolated actions against armed belligerents mixed with noncombatants to peace operations that resemble dangerous police work more than combat. The following terms and definitions provide clarity and focus for commanders conducting tactical planning for combat in an urban environment. They describe the US force's degree of sensitivity to political considerations during the operation being conducted.

a. **High-Intensity UO Conditions.** Under high-intensity UO conditions, combat actions are conducted against a determined enemy occupying prepared positions or conducting planned attacks. These conditions require the coordinated application of the full combat power of the SBCT. An infantry unit's mission is normally to seize, secure, clear, or defend urban terrain, engaging and defeating the enemy using any force necessary. High-intensity UO represents the high end of the combat spectrum. Units must be trained for it because high-intensity UO conditions can be casualty-intensive for both sides. Even though the full, integrated firepower of the SBCT is brought to bear on the enemy, leaders must still try to limit unnecessary destruction and casualties among noncombatants. A recent example of high-intensity UO conditions is the Russian experience in Grozny.

b. **Precision Small-Scale Contingency Operations in Urban Conditions.** Under precision SSC urban conditions, conventional forces conduct combat operations to defeat an enemy mixed with noncombatants. Units conduct combat operations carefully to limit noncombatant casualties and collateral damage while still achieving the military objectives.

(1) **Noncombatant and Political Considerations.** Under these conditions, either the enemy is mixed with the noncombatants or political considerations require the ROE to be more restrictive than under high-intensity UO conditions. It also requires specific tactics, techniques, and procedures for precise use of combat power (as in Operation Just Cause). Some of this combat can be quite violent for short periods.

(2) **Focus and Restraint.** Forces accepting the need to focus and restrain the combat power mark this type of operation. The platoon or section leader may bring overwhelming force to bear but only on specific portions of the urban area occupied by the enemy. He may choose different TTP to remain within the bounds of the more restrictive ROE. This is complicated by the fact that, due to an asymmetrical threat, a precision operation could occur while a high-intensity operation occurs in another part of the city. UO requires strict accountability of individual and unit actions through strict ROE. This requires soldiers to be disciplined and trained.

c. **Stability and Support Operations in UO Conditions.** Under these conditions, infantry units conduct stability and support operations that can easily turn into combat operations (for example, Somalia). Stability operations and support operations may include humanitarian assistance, evacuation of American nationals, or peacekeeping operations. Recent examples include the operations in Monrovia and Bosnia. (Stability operations and support operations are also covered in FM 7-98, FM 100-23, and FM 90-8. Lesson plans for many of these techniques are in TC 7-98-1.)

6-2. CHARACTERISTICS OF THE URBAN ENVIRONMENT

Although each operational environment encountered by the reconnaissance platoon has its own distinct characteristics, urban areas are the most complex. There are two primary factors that influence the complexity of urban operations. One is the manmade terrain and supporting infrastructure. These are covered later in this discussion. The other factor is the density of noncombatants in close proximity to combat forces. Of these two key urban factors, noncombatants and the human dimension are the most important and, potentially, the most confusing. HUMINT, which focuses on gaining an understanding of how the local populace feels toward friendly and enemy forces, is a major part of the reconnaissance platoon's effort. The following discussion describes characteristics unique to the urban environment and the enemy as well as considerations that the reconnaissance platoon must take into account during preparation and planning.

a. **Urban Considerations.** Urban terrain presents operational challenges in an extraordinary mix of horizontal, vertical, interior, exterior, and subterranean settings. Four aspects of this physical dimension merit special consideration.

(1) ***Airspace over the City.*** Airspace provides a rapid avenue of approach into the urbanized area. While aviation assets are unaffected by obstacles such as rubble, they must consider towers, signs, power lines, and other obstructions to flight. Soldiers can locate these obstructions, determine how they can serve as passive air defense measures, and provide a hazards overlay for unmanned aerial vehicle (UAV) units and other aviation assets. The reconnaissance platoon can also identify and mark potential pickup zones (PZs) and landing zones (LZs).

(2) ***Buildings.*** Buildings provide cover and concealment, limit or enhance fields of fire, and restrict or block movement of ground forces. Soldiers must identify buildings that serve as key terrain (for example, as communications nodes or dominant vantage points) throughout the urban area. They must consider rooftops a separate and unique threat. Whenever possible, UAV or aviation reconnaissance of rooftops can identify threats and help to preempt enemy action.

(3) ***Streets.*** Streets afford avenues of approach and are the primary means for rapid ground movement in an urban area. Forces traveling along streets, however, are often canalized by buildings and have little space for maneuver off the main thoroughfares. The reconnaissance platoon must identify trafficability of streets (lateral and parallel) within the area of operations. This includes determining the width and weight capabilities of streets throughout the urban area to assist follow-on forces in their planning.

(4) ***Subterranean Systems.*** Subterranean systems can easily be employed as avenues of approach and supply routes for dismounted elements. Friendly forces must identify subways, sewers, cellars, and utility systems in the urban area. They can then develop an understanding of how the enemy may use these systems to conduct ambushes, counterattacks, infiltration, and sustainment operations. Entrances and exits to subterranean areas should be mapped as part of an overlay.

b. **Types of Urban Terrain.** The urban area is classified into six types of urban terrain.

(1) ***Dense, Random Construction.*** Dense, random construction is typical of the old inner city pattern with narrow, winding streets radiating from a central area in an irregular manner. Buildings are located close together and frequently close to the edge of a roadway.

(2) ***Closed-Orderly Block Areas***. This type of city block typically has wider streets that form rectangular patterns. The buildings frequently form a continuous front along the blocks. Inner-block courtyards are common.

(3) ***Dispersed Residential Areas***. Normally adjacent to closed-orderly block areas in Europe, this pattern consists of row houses or single-family dwellings with yards, gardens, trees, and fences. Street patterns are normally rectangular or curving.

(4) ***High-Rise Areas***. High-rise areas are typical of modern construction in larger cities and towns. They consist of multistoried apartments, separated open areas, and single-story buildings. Wide streets are laid out in rectangular patterns. These areas are often adjacent to industrial-transportation areas or interspersed with closed-orderly block areas.

(5) ***Industrial-Transportation Areas***. These are generally located on or along major rail and highway routes in urban complexes. Older complexes may be located within dense, random construction or closed-orderly block areas. New construction normally consists of low, flat-roofed factory and warehouse buildings. High-rise areas providing worker housing are normally located adjacent to these areas throughout the Orient. Identification of transportation facilities within these areas is critical. These facilities, especially rail facilities, pose significant obstacles to military movement.

(6) ***Permanent or Fixed Fortifications and Other Military Installations***. Examples of permanent or fixed fortifications include the Hue Citadel and the Siegfried and Maginot Lines. While most of these types of fortifications are found in Western Europe, a number can be found in the Balkans, Middle East, Asia, Africa, and South America. Fortifications in the United States are mostly of the coast-defense type. Permanent-type fortifications can be made of earth, wood, rock, brick, concrete, steel-reinforced concrete, or any combination of these. Some of the latest variants have been built underground and employ heavy tank or warship armor, major caliber and other weapons, internal communications, service facilities, and NBC overpressure systems.

c. **The Enemy in the Urban Area**. Trends indicate increasing availability and integration of sophisticated technology and unorthodox operational approaches by potential opponents in urban operations. To offset their inherent weaknesses, enemy forces seek the advantage in urban and complex terrain by remaining dispersed and decentralized; they adapt their tactics to counter the response of US forces and their allies most effectively.

(1) ***Organizations and Capabilities***.

(a) ***Other Forces***. In addition to conventional forces, the enemy in urban areas may include the following:

- Unconventional forces.
- Paramilitary forces.
- Militia and special police organizations.
- Organized crime organizations.

(b) ***Enemy Force Employment***. Enemy forces employ the full range of military ordnance and organizations from small arms, mortars, machine guns, antiarmor weapons, and mines to very capable mechanized and armored forces equipped with current-generation equipment. The enemy uses these various approaches to counter the technological and numerical advantages of US and allied systems and forces. In addition, enemy forces seek to exploit constraints placed on US forces because of cultural bias,

media presence, ROE, ROI, and distance from the crisis location. Urban environments also provide many passive dangers such as disease from unsanitary conditions and psychological stresses.

(c) *Most Dangerous Opponent*. The most dangerous potential opponents remain those who have the capacity to execute full-scale combat actions escalating to a major theater of war. They employ weapons of mass destruction wherever possible. Such organizations as special operations forces (SOFs), state-controlled terrorist elements, paramilitary units, and guerilla forces are part of a strategy of simultaneous, distributed operations both inside and outside of the area of operations. They use mines and unexploded ordnance to demoralize and hamper US forces.

(2) *Enemy Tactics*. While the nature of active threats vary widely among specific urban areas, many principles and techniques are common to all such elements. This discussion examines several operational and tactical tenets that may be used against US forces in the urban environment.

(a) *Local Populace*. The populace of a given urban area represents an aspect of key terrain: the side that manages it best has a distinct advantage. Enemy forces use the population to provide camouflage, concealment, and deception for their operations. Guerilla and terrorist elements look no different from other members of the community. Even conventional and paramilitary forces often adopt a civilian look to confuse friendly forces. The civilian populace can also actively provide cover for enemy forces, enhancing their mobility in proximity to US positions.

(b) *Moral Responsibility*. Enemy forces take advantage of the moral responsibilities of US and ally units, attempting to make the civilian populace a burden on their logistical and force protection resources. Local residents also serve as a key intelligence source for enemy forces that attempt to use civilians with access to US bases or perimeters to gain information on friendly dispositions, readiness, and intent.

(c) *Information War*. Enemy forces take advantage of the media to turn the sentiments of the civilian populace of other countries against US forces. Print and broadcast reporters and photographers, video cameras, Internet web sites, and cellular telephones are examples of tools the enemy can use to influence popular opinion.

(d) *Key Facilities*. Enemy forces identify key facilities and then use them to shape the area of operations in their favor. Examples of facilities that the enemy may target to gain a position of advantage against US forces include telecommunication sites, water treatment plants, and power generation and transmission sites.

(e) *Physical Environment*. Enemy forces take advantage of every aspect of the urban environment to attack US forces. Rooftops and tall buildings afford vantage points and ambush positions that exceed the maximum elevation capability of many friendly weapon systems. Elevated attack positions allow the enemy to strike vehicles at their most vulnerable points and to use enfilading fire against exposed dismounted soldiers. Basements and other subterranean areas provide covered and concealed positions that allow movement and access throughout the area of operations. Many of these positions are below the minimum depression capability of friendly vehicles and weapons.

d. **Civilian Considerations**. Analyzing the information gained on the civilian populace is an important factor in determining courses of action for higher headquarters. The platoon leader analyzes the information collected and assesses what actions are necessary to control the impact of civilians. Options that the reconnaissance platoon

leader can recommend to higher headquarters include screening civilians, prohibiting unauthorized movement, diverting or controlling refugee movements, and evacuating civilians. Information requirements for the platoon consist of the following:

- Political affiliations and grievances.
- Ethnicity.
- Factions.
- Cultural distinctions.
- Living conditions.
- Religious beliefs.
- Attitude toward US forces (friendly, neutral, or hostile).

Section II. PLANNING

The planning phase for urban operations entails two key actions: collecting and analyzing existing intelligence and developing the plan.

6-3. COLLECT AND ANALYZE EXISTING INTELLIGENCE

During the planning phase, the reconnaissance platoon leader assesses his assigned reconnaissance objectives and conducts his urban IPB. To begin developing the situation, the platoon collects and analyzes existing intelligence, including map and aerial images (IMINT) and HUMINT. The platoon begins mapping the urban area as part of the planning phase.

a. Before entering an urban environment, reconnaissance elements should develop urban operations sketches. These reconnaissance products, usually created as overlays, serve several purposes. The sketches are an important supplement to existing maps which in most cases do not show the level of detail necessary for effective situational understanding. The sketches also allow the reconnaissance platoon leader to track his elements with greater accuracy and to give precise location updates to higher headquarters. The ultimate goal is to hand off the sketch to the battalion for use by leaders and soldiers at all levels of the operation.

b. In developing urban operations sketches and overlays, the reconnaissance platoon should attempt to gain access to city planner or civil engineer maps which provide detailed information on the urban area. The platoon then conducts initial map and aerial photograph reconnaissance to pinpoint key terrain and other important locations in the area of operations. Figure 6-1 shows an example of photoreconnaissance, which focuses on areas such as the following:

- (1) Sites that may serve as potential safe havens for enemy forces, including--
 - Hospitals.
 - Police stations.
 - Embassies.
 - Other facilities that are nominally friendly but that could harbor enemy elements.
- (2) Hazardous areas such as--
 - Construction sites.
 - Dangerous intersections.
 - Bridges.
 - Areas of criminal activity.

(3) Major terrain features, including--

- Bridges.
- Parks.
- Industrial complexes.
- Airports.

(4) Subterranean features such as--

- Sewers/utility systems.
- Subway systems.
- Underground water systems.

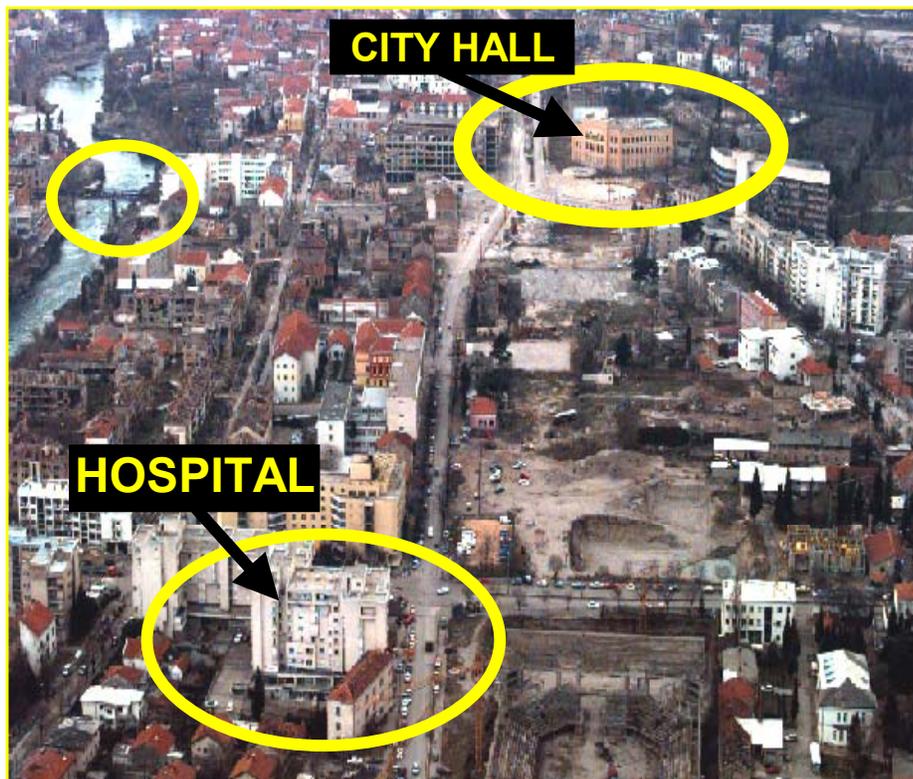


Figure 6-1. Initial photoreconnaissance in urban operations.

c. Once this basic reconnaissance is complete, the reconnaissance unit uses the available maps and photographs to refine the information and translate it into a form that can be transferred to the urban operations sketch. This process includes incorporating a reference system to identify buildings and streets. Naming and numbering conventions should be simple (for example, odd number buildings on left side of street, even numbers on right street) to allow for ease of navigation and orientation in the urban environment. Street names should not be used as references as the signs can be removed or changed to confuse friendly forces.

d. The reconnaissance elements add graphic control measures and identify sites of tactical and operational significance (Figure 6-2, page 6-8). The reconnaissance platoon leader can then use the accumulated information to develop a detailed urban operations

sketch (Figure 6-3). He must ensure that the sketches the platoon develops and uses are consistent with those used throughout the battalion.

e. The sketches are distributed both within the unit and to higher and adjacent elements. The platoon leader must ensure that every soldier has an understanding of the sketch and reference system since individual vehicles and sections may have to execute operations on their own. As the reconnaissance platoon conducts operations in the urban area, it confirms the accuracy of the sketch and adds more detail as necessary.



Figure 6-2. Refinement of urban operations photoreconnaissance.

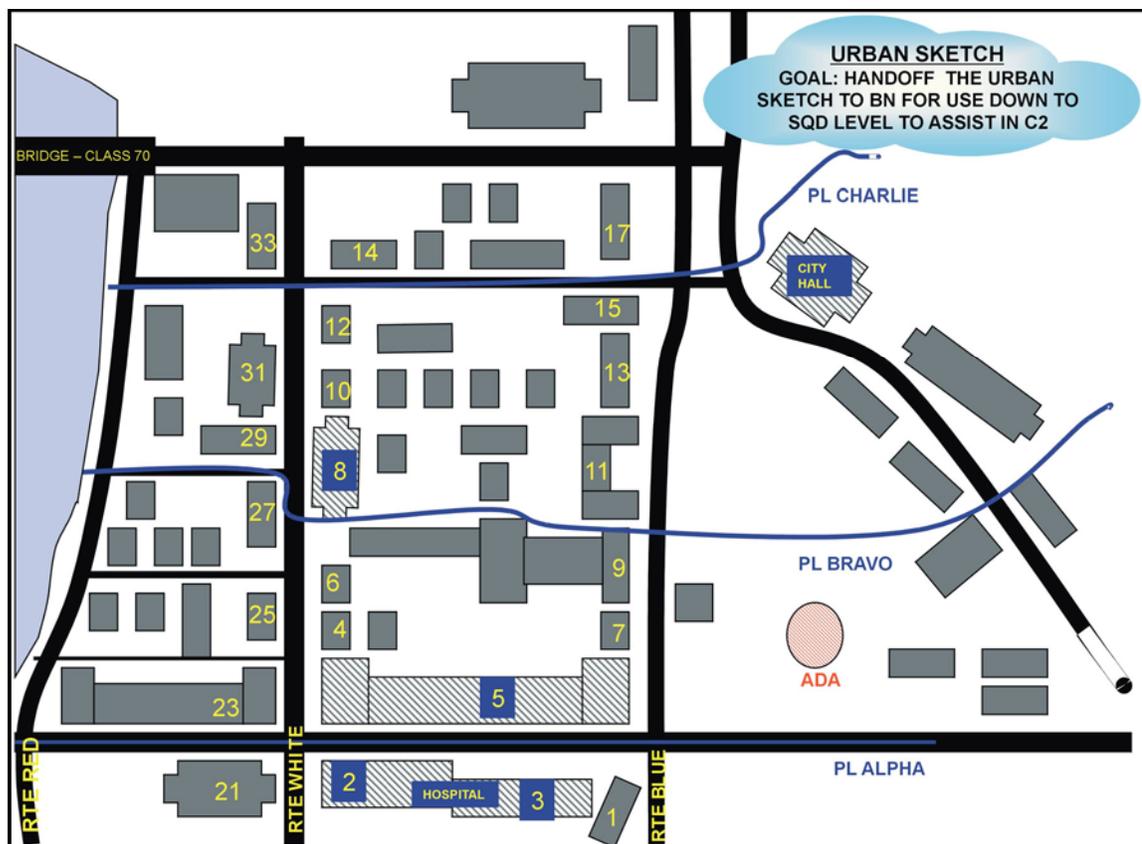


Figure 6-3. Urban operations sketch.

6-4. DEVELOP THE PLAN

Once the reconnaissance platoon leader has collected and analyzed existing intelligence, he and his subordinates then develop the plan for completing the reconnaissance.

a. **Intelligence Collection Plan.** The collection plan begins with the reconnaissance platoon obtaining all available information, including that from internal military forces and SOFs. In particular, the platoon gathers information on locations of reliable sources near the urban area that can be used to gain the most current situation within the area of operations. In diverse multiethnic areas, it is important for platoon soldiers to have an understanding of how the different segments of the local populace will react to them during the course of operations.

(1) **Approach Routes.** Based upon his current information, the platoon leader identifies the best approach route into the urban area, locations or obstacles to be avoided, sources within the urban area, and any other specific areas of interest. The use of tactical questioning is an invaluable skill in validating the information from HUMINT sources. Depending on the mission and the information gained initially, the reconnaissance platoon may have to conduct infiltration using surveillance teams to observe areas of interest or conduct target acquisition. It must develop thorough plans for the surveillance teams, covering security considerations such as exfiltration routes, immediate support (direct or indirect), and evasion corridors. Surveillance positions should be placed in low-activity areas and occupied during limited visibility to reduce the possibility of compromise. Sustainment considerations are also critical; these include the duration of

the surveillance mission and required logistical support (such as food, water, and batteries). The surveillance teams must have redundant communications for successful operations (refer to the following discussion of communications in the urban environment).

(2) **Gaining Information.** After analyzing the mission and the commander's intent, the reconnaissance platoon leader determines how to gain the information required within its AO. The information-gathering process is conducted progressively from outside the urban area to inside the urban area. As the platoon gains information from the outer ring of the area of operations, it updates the focus of the collection plan and refines the reconnaissance and surveillance objectives within the urban area. The urban situation can change quickly, leading to compromise or attack; it is essential that reconnaissance units continuously maintain a current COP. The platoon continues to collect and corroborate information as it approaches the urban area. The platoon leader then determines whether to use reconnaissance or surveillance to gather information on or in the objective areas.

b. **Reconnaissance.** The reconnaissance platoon leader must decide on the stealthy or aggressive method of reconnaissance. Mounted or dismounted patrols are used in conjunction with other surveillance assets to gain information required by the mission.

c. **Surveillance.** The reconnaissance platoon uses surveillance to collect information on or in objectives. Locating surveillance positions within the urban area requires thorough planning to ensure teams are not compromised and that the platoon can assist in extraction, if necessary. Communications are of vital importance to the surveillance team; therefore, redundancy must be incorporated into the collection plan. Security considerations for the team, such as exfiltration routes, immediate support (direct or indirect), and evasion corridors, are essential. Surveillance positions should be placed in low-activity areas and occupied during limited visibility to reduce possibility of compromise. The duration of the surveillance mission must also be considered for sustainment of the team (considering items such as food, water, and batteries). The selection of the hide site and surveillance site(s) depends on METT-TC. The following are considerations for site selection:

- Can the team place the designated surveillance target(s) under continuous and effective observation and within the range of surveillance devices to be used?
- Will the surveillance site have to move if weather and light conditions change?
- Does the area provide concealment and entrance and exit routes?
- Are there dominant or unusual terrain features nearby?
- Is the area wet, is there adequate drainage, or is the area prone to flooding?
- Is the area a place the enemy would want to occupy?
- Is the site silhouetted against the skyline or a contrasting background?
- Are there roads or trails nearby?
- Are there other natural lines of movement nearby (gullies, draws, or any other terrain for easy foot movement)?
- Could the team be easily trapped in the site?
- Are there any obstacles to prevent vehicle movement nearby (roadside ditch, fence, wall, stream, or river)?
- Are there any inhabited areas in the prevailing downwind area?
- Are there any suitable communication sites nearby?

- Is the site in the normal line of vision of enemy personnel in the area?
- Is there a source of water in the area?

d. **Infiltration.** Plans for infiltration are based on the requirement for conducting movement to the AO with the least risk of detection.

(1) Select concealed primary or alternate routes based on detailed map reconnaissance, aerial photographs, ground reconnaissance, and data on the enemy situation from other sources.

(2) Avoid obstacles, populated areas, silhouetting, enemy positions, main avenues of approach, and movement along heavily populated routes and trails.

(3) The time of infiltration should be during reduced visibility and reduced alertness. The time is especially important during critical phases such as moving through populated areas.

(4) Soldiers must know routes, rally points (and alternates), time schedules, danger areas, and the enemy situation. These are critical to speed and stealth.

(5) The team should have centralized coordination to ensure that all crewmen act in accordance with cover and deception plans. Infiltration by land is characterized by centralized planning and decentralized execution.

e. **Exfiltration.** The principles of route selection, movement formations, and movement security are observed during movement to the extraction site.

(1) The time that a team remains in the urban area of operations depends on its mission, composition, and equipment. The exfiltration is critical from a standpoint of morale and mission accomplishment. Plans for extraction are made before the operation, with alternate plans for contingencies such as the evacuation of sick or injured personnel. During the mission, the team leader may encounter an unforeseen situation that may demand the utmost flexibility, discipline, and leadership.

(2) Each team is given code words in the OPORD for use during exfiltration. For example, one code word may mean that the team is at its PZ. Another may mean that both the primary and alternate PZs are compromised and to abort the extraction.

(3) When a team has missed a certain number of required transmissions, the command assumes that the team has a communication problem, is in trouble, or both. At that time, a no-communication resupply and exfiltration plan is used.

(4) Exfiltration of the team may be by means other than linkup with their vehicles. The OPORD may specify dismounted exfiltration or linkup with friendly forces in an offensive operation. Any of these means may also be planned as alternatives in the event the team cannot be extracted by their vehicles or to avoid capture.

(5) Soldiers must be trained in exfiltration techniques so they can walk out either singly or in groups.

f. **Communications.** Communications in the urban environment requires detailed planning. Because of the effects of urban terrain, the reconnaissance platoon leader must plan for redundant communications that will allow the reconnaissance platoon freedom of movement. In simplest terms, to communicate effectively and continuously, he must minimize the limitations imposed by the urban environment and maximize the advantages of existing civil communications. The reconnaissance platoon should follow this general rule: if you cannot communicate where you are, move until you can.

(1) **Terrain.** The first step is to identify terrain along the approach route and in the urban area of operations that supports line of sight (LOS) communications. Manmade

structures can create problems for single-channel radios; they may inhibit LOS radio communications by absorbing or reflecting transmitted signals. One solution is to establish retrans sites on supporting terrain or structures to facilitate C2 during the reconnaissance platoon's initial entry into the urban area. The platoon continues to identify structures within the urban area that can support retrans sites as it moves within the area of operations. If retrans teams are not available, unit vehicles must position themselves to maintain communications with all elements. TUAV retrans capabilities should be requested and coordinated for redundancy. The battalion should also plan to request and coordinate use of aviation assets for C2 and retrans, if available.

(2) **Advantages.** The urban environment may have exploitable advantages such as the availability of electrical power and commercial telecommunications networks. Electrical power generation stations and other emergency power systems are normally found in protected structures and are often usable in UO. Enclosed areas offer excellent concealment and protection of communications and other C2 support equipment. Extensive commercial communications networks composed of miles of protected underground cable connecting central telephone exchanges are likely to be available, as are numerous types of public service radio nets (such as those used for police, fire, civil defense, and taxi radios). These systems have existing antennas and retransmission stations.

g. **Fire Support.** The reconnaissance platoon leader must plan for employment of indirect fires in the urban area of operations.

(1) **Mortar Fires.** Mortars are the most responsive indirect fires available to infantry commanders and leaders. Their mission is to provide close and immediate fire support to the maneuver units. Mortars are well suited for combat in urban areas because of their high rate of fire, steep angle of fall, and short minimum range. The platoon leader must plan mortar support with the fire support element (FSE) as part of the total fire support system. (See FM 7-90 for detailed information on the tactical employment of mortars.)

(a) **Role of Mortar Units.** The role of mortar units is to deliver suppressive fires to support maneuver, especially against dismounted infantry. Mortars can be used to obscure, neutralize, suppress, or illuminate during urban combat. Mortar fires inhibit enemy fires and movement, allowing friendly forces to maneuver to a position of advantage. The most common and valuable use for mortars is often harassment and interdiction fires. One of their greatest contributions is interdicting supplies, evacuation efforts, and reinforcement in the enemy rear just behind his forward defensive positions. During World War II and the recent Middle East conflicts, light mortar high explosive (HE) fires have been used extensively during urban combat to deny the use of streets, parks, and plazas to enemy personnel. Finally, mortars can be used, with some limitations, against light armor and structures. Effectively integrating mortar fires with dismounted maneuver is key to successful combat in an urban area.

(b) **Communications.** Initially, radio is the primary means of communication during urban combat, but an increased use of wire, messenger, and visual signals will be required. However, wire usually is the primary means of communication between the forward observers, fire support team, fire direction center, and mortars since these elements are close to each other. Also, FM radio transmissions in urban areas are likely to be erratic. Structures reduce radio ranges; however, remoting the antennas to upper floors or roofs may improve communications and enhance operator survivability. The use of

radio retransmissions is another technique that may apply. A practical solution is to use existing civilian systems to supplement the unit's capability, understanding that this is an unsecure method of communication.

(c) *Magnetic Interference*. In an urban environment, all magnetic instruments are affected by surrounding structural steel, electrical cables, and automobiles. Minimum distance guidelines for the use of the M2 aiming circle (FM 23-90) are difficult to apply. To overcome this problem, an azimuth is obtained to a distant aiming point. From this azimuth, the back azimuth of the direction of fire is subtracted. The difference is indexed on the red scale and the gun manipulated until the vertical cross hair of the sight is on the aiming point. Features such as the direction of a street may be used instead of a distant aiming point.

(d) *High-Explosive Ammunition*. During urban combat, mortar HE fires are used more than any other type of indirect fire weapon. Although mortar fires often are targeted against roads and other open areas, the natural dispersion of indirect fires will result in many hits on buildings. Leaders must use care when planning mortar fires during urban operations to minimize collateral damage.

- HE ammunition, especially the 120-mm projectile, gives good results when used against lightly built structures within cities. However, it does not perform well against reinforced concrete found in larger urban areas.
- When using HE ammunition in urban fighting, only point-detonating fuzes should be used. The use of proximity fuzes normally should be avoided because the nature of urban areas causes proximity fuzes to function prematurely. Proximity fuzes, however, are useful in attacking some targets such as OPs on tops of buildings.

(e) *Illumination*. In the offense, illuminating rounds are planned to burst above the objective. If the illumination were behind the objective, the enemy troops would be in the shadows rather than in the light. In the defense, illumination is planned to burst behind friendly troops to put them in the shadows and place the enemy troops in the light. Buildings reduce the effectiveness of the illumination by creating shadows. Continuous illumination requires close coordination between the observer and fire direction center (FDC) to produce the proper effect by bringing the illumination over the defensive positions as the enemy troops approach the buildings (Figure 6-4, page 6-14).

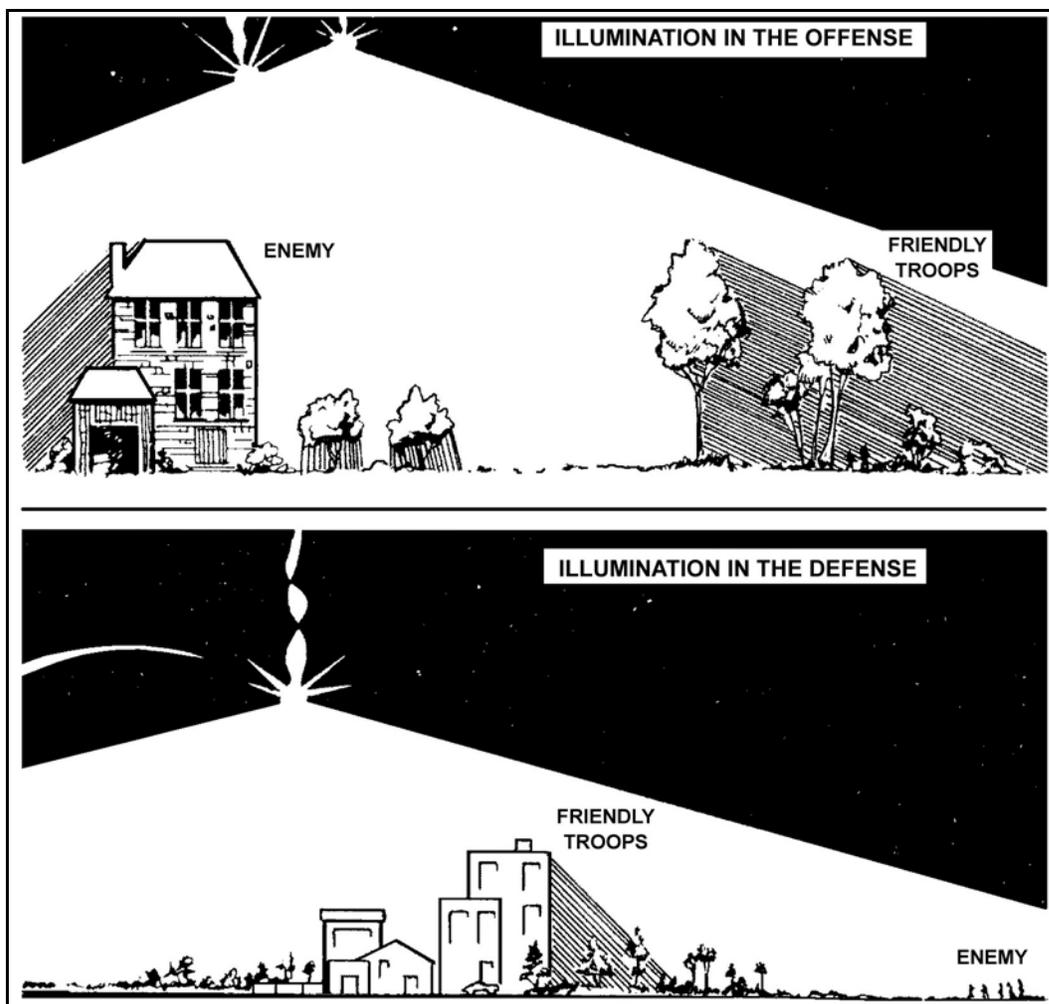


Figure 6-4. Illumination during urban operations.

(f) *Special Considerations.* When planning the use of mortars, the reconnaissance platoon leader must consider the following:

- Forward observers (FOs) should be positioned where they can get the maximum observation so target acquisition and adjustments in fire can be best accomplished. This is not necessarily on tops of buildings.
- The reconnaissance platoon leader must understand ammunition effects to correctly estimate the number of volleys needed for the specific target coverage. Also, the effects of using white phosphorus may create unwanted smoke screens or limited visibility conditions that could interfere with the tactical plan.
- Observers must be able to determine dead space in urban terrain. Dead space is the area in which indirect fires cannot reach the street level because of buildings. This area is a safe haven for the enemy. For mortars, the dead space is about one-half the height of the building.

(2) *Field Artillery.* During urban combat, field artillery (FA) provides direct support (DS), general support (GS), and general support-reinforcing (GS-R) to infantry units.

(For further discussion on the employment of field artillery in urban terrain, see FM 3-06.11.)

(a) When FA supports fighting in urban areas, fire support coordination measures necessary to provide adequate yet safe support must be considered carefully due to the close proximity of friendly forces to the enemy. When planning for fire support, leaders should consider the following:

- The increased cover and concealment afforded by the terrain.
- Ground observation is limited in urban areas.
- Adjusting fires is difficult since buildings block the view of adjusting rounds.
- Acquiring targets is difficult in urban terrain because the enemy has many covered and concealed positions and movement lanes.
- Forward observers must be able to determine where and how large the dead spaces are.
- The use of air burst fires is an effective means of clearing snipers from rooftops.

(b) Employing artillery in the direct-fire mode to destroy fortifications (Figure 6-5, page 6-16) should be considered, especially when assaulting well-prepared enemy positions. Also, restrictive fire support coordination measures, such as a restrictive fire area or no-fire area, may be imposed to protect civilians and critical installations.

- The 155-mm self-propelled howitzer is extremely effective in neutralizing concrete targets with direct fire.
- Concrete-piercing 155-mm rounds can penetrate 36 inches of concrete at ranges up to 2,200 meters.
- When employing artillery in the direct-fire mode and maneuvering the self-propelled howitzers within the urban area, it is important that the infantry secure them because they do not have any significant protection for their crews.

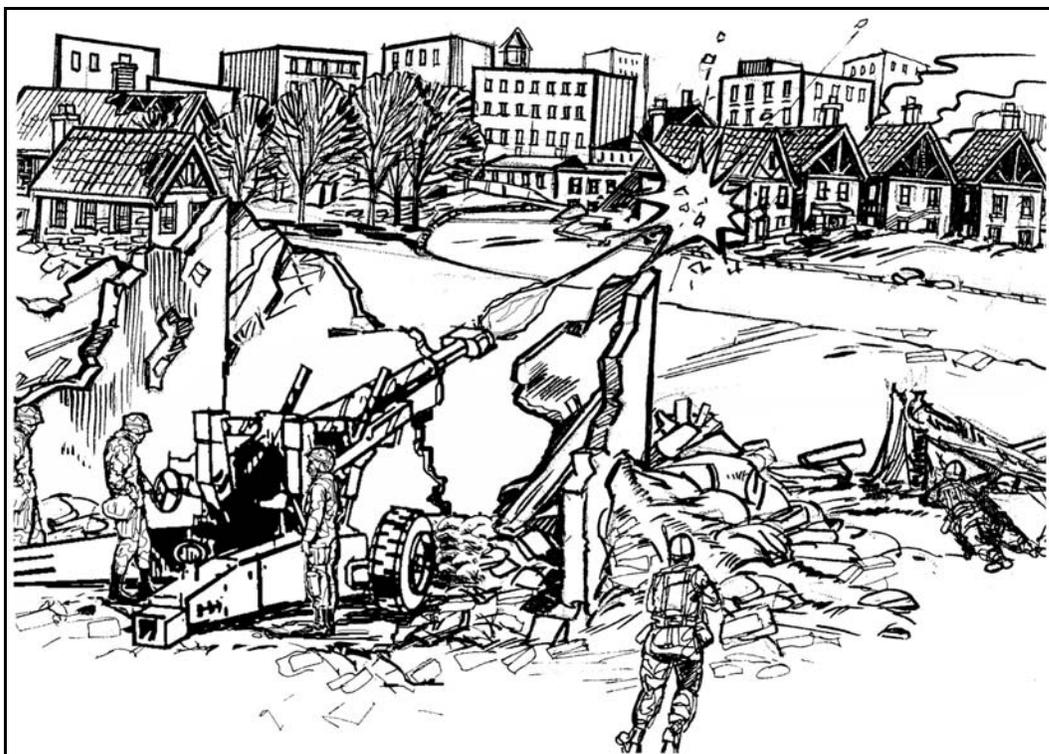


Figure 6-5. Artillery in direct fire role.

NOTE: When employing these weapon systems, leaders must be aware of the explosive effects and fragmentation fallout as well as the blast-over pressure and how these will affect the infantry on the ground. (For more specific information on the effects of weapons, see FM 3-06.11.)

(3) ***Precision-Guided Munitions.*** The reconnaissance platoon must also be prepared to employ precision-guided munitions from other sources, including Army artillery and joint and allied military services. This may entail use of laser or infrared (IR) designator equipment or use of special augmentation. The platoon leader must ensure that no-fire areas (NFAs) are placed on all surveillance positions and that critical friendly zones are coordinated along reconnaissance routes. The following are some fire support considerations for urban operations; they are by no means all-inclusive:

- Identify who controls each fire support asset.
- Exchange fire plans and observer plans with adjacent units.
- Develop observer plans to include OPs in buildings, location of laser designators, and overwatch of trigger points.
- Identify location of hazardous sites (both above and below ground), fuel and industrial storage tanks, gas distribution lines, and any other area where incendiary effects of detonating artillery and mortar rounds will start fires.
- Identify the general construction or composition of the buildings and road surfaces (these may impact the type of munitions used).
- Determine where building masking, overhead power lines, or towers degrade GPS and compass functioning.

- Determine if use of obscurants and illumination will favor friendly units or the enemy.
- Determine whether buildings or structures will require fire support personnel to carry or use equipment not normally carried (for example, field expedient antennas, climbing rope, wire gloves, axes, or sledgehammers).
- Identify the requirements for radar coverage.

h. **Combat Service Support.** To preclude compromise, surveillance teams carry required supplies into the area of operations on their vehicles. They avoid unnecessary movement in their area of operations. Some missions, however, may require additional supplies that cannot be carried on the vehicles. Resupply operations for deployed surveillance teams are planned and coordinated during the planning phase.

(1) **Resupply.** When resupply is required, a drop point is established. It should be well away from the hide site and the surveillance site, but in a position that is available to all teams. Caches should be used in these instances. Units should standardize the contents of caches so all teams understand what is available. Example items to be carried in the cache include the following:

- Emergency Class I items.
- Batteries (radio/night vision devices [NVDs]).
- Class VIII items.
- Nonsensitive mission-specific items.

(2) **Maintenance.** In the urban area of operations, self-recovery within the platoon will be necessary. Vehicles should have towing cables and shackles attached and be configured for immediate recovery. The platoon identifies a secured maintenance collection point outside the urban area during planning and coordinates with battalion for maintenance support. All vehicle crews must know this location.

(3) **Medical.** Organic medical support in the reconnaissance platoon is limited to self aid and buddy aid. Due to the remote deployment of teams, primary medical care is not readily available. All soldiers should receive combat lifesaver and emergency medical technician training.

(4) **Medical Evacuation.** Additional medical support is requested as needed. When possible, medical evacuation of team members is delayed until the whole team is evacuated from the area of operations. Wounded team members are sent directly to the nearest medical facility that can provide definitive care and treatment. Combat stress is another medical aspect with which reconnaissance teams must cope. Due to the nature of reconnaissance missions, the teams are subjected to stress in many ways. Some of these factors are listed below.

(a) *Limited Visibility* (darkness, smoke, fog, rain, snow, ice, and glare). This requires the extended use of night-vision devices.

(b) *Disrupted Sleep Cycles.* Performance suffers from the disruption of the normal sleep schedule.

(c) *Mental Fatigue.* This results from having to make decisions of serious consequences in too little time with too little information while exposed to danger.

(d) *Physical Fatigue.* This results from conducting physical activity excessive to current conditioning or at a strenuous level without rest.

(5) **Combat Stress.** Combat stress is not solely a medical problem. It is also a command problem in terms of reduced performance and personnel lost from duty. It is a

command responsibility to take actions to increase the individual team member's resistance to stress. This can be done through extensive training under simulated combat conditions and a high level of physical fitness. Proper nutrition is also a major factor in coping with stress. Soldiers should have a healthy, balanced diet not only during combat operations but also before the mission begins.

Section III. EXECUTION

The execution phase entails four key actions, which are examined in this section:

- Approach the urban AO .
- Employ dismounted surveillance teams.
- Conduct reconnaissance.
- Conduct assessment of the AO.

6-5. APPROACH THE URBAN AREA OF OPERATIONS

The platoon conducts information-gathering operations outside of the urban area to gain information on the objective. Depending on the time available, the reconnaissance platoon develops the urban situation progressively as it moves from the surrounding area toward the city. The battalion may refine objectives and routes as it gains and analyzes information. If available, UAVs conduct aerial reconnaissance of routes and objective areas. UAVs focus on unit entry points to determine the enemy situation, including obstacles in the urban area, ambush positions on rooftops, or movement of personnel and vehicles as reconnaissance units approach.

6-6. EMPLOY DISMOUNTED SURVEILLANCE TEAMS

The primary method of employing surveillance teams is in a hide or surveillance site. However, the terrain, mission, and location of the site may dictate that the teams establish a separate surveillance site (or sites) to effectively observe the area.

a. **Hasty Sites.** These are sites the team plans to occupy for a short period (generally less than six hours). This occurs most often during target-acquisition missions.

b. **Urban Surveillance Sites.** Surveillance teams can construct fixed urban hide sites in occupied and abandoned buildings, in water tanks, in shrubbery, on warehouse rooftops, or in attics of multistory buildings or other tall structures. If possible, teams should avoid wooden buildings and buildings in a significantly deteriorated condition because of the risk of injury from fire and structural failure.

c. **Hasty Subsurface Sites.** A hasty subsurface site is constructed when there is not enough time to construct a complete subsurface site. The site is especially useful when there is little natural cover and concealment. Considerations in the employment of hasty subsurface sites include the following:

- Lower profile than surface surveillance sites.
- Better protection against small-arms weapons and indirect fires.
- Excellent camouflage.
- Requirement to conceal soil.
- Greater time required to construct.
- Construction noise.

6-7. CONDUCT RECONNAISSANCE

The fundamentals of reconnaissance described in Chapter 4 are applicable in an urban environment, but the type of information and the method by which it is collected takes on a new form. The reconnaissance platoon develops an understanding of the regional, local, and neighborhood-level situation. The soldiers must learn how the urban area operates and who the sources of power or influence are. Examples include the following:

- The formal and informal political power structure.
- Police, secret police, and intelligence agencies.
- Criminal organizations.
- Military and paramilitary structures.
- Key terrain.
- Sensitivities of the populace.

6-8. ASSESS THE AREA OF OPERATIONS

The platoon leader receives and analyzes the information gathered by the reconnaissance and surveillance teams. He then assesses the AO according to the mission and intent of higher. The assessment includes, but is not limited to, these elements:

- Enemy composition and activity.
- Areas of vulnerability to friendly forces.
- Key terrain.
- Approach routes for mounted and dismounted forces.
- Entry points or points of penetration.
- Support positions for direct and indirect systems.
- Civilian disposition.
- Density and composition of urban area.
- Hazard areas (fuel storage, natural gas lines, chemical production sites).
- Communication facilities.
- Retrans sites.
- Intent of civilian populace (stay or flee).

6-9. END STATE

The efforts of the reconnaissance platoon can be a critical factor in shaping the urban area of operations and in maximizing the effectiveness of the battalion (and, therefore, the brigade).

a. **Reconnaissance Platoon Tasks.** A summary of the reconnaissance platoon's tasks in the urban environment includes the following:

- Develop and distribute UO sketches.
- Reconnoiter recommended entry points and routes.
- Maintain surveillance on key objectives.
- Conduct target acquisition.
- Assist in isolation of the AO by conducting screening operations (or establishing checkpoints) on the perimeter.
- Perform continuous information gathering during the operation. Especially vital to the battalion effort is information on personnel attempting to leave or enter the urban area.

b. **Mission Accomplishment.** The reconnaissance platoon achieves the end state of its reconnaissance effort when two critical questions are answered:

- Is it essential to conduct operations in the urban environment?
- If so, how can the battalion employ combat power in the most efficient manner?

Section IV. COMBAT MULTIPLIERS

The nature of urban operations makes it infantry-centric; however, the urban battle should never be exclusively an infantry fight. A powerful combined arms team properly employed in an urban area will enhance mission accomplishment. It is imperative that the leadership of the reconnaissance platoon have a full understanding of the capabilities of other supporting assets in order to successfully accomplish its reconnaissance mission in urban terrain. This section discusses the more common combat multipliers available to infantry units during the execution of UO.

6-10. ARMORED VEHICLES

Based on the considerations of the METT-TC analysis and the operational ROE, a situation may arise that requires the attachment of tanks in direct support of the SBCT infantry battalion mission. This paragraph discusses tactics and techniques used by infantry units when working with armored vehicles.

a. **Task Organization for Mechanized Operations.** Leaders must understand the principles of employing infantry and armor forces to maximize their capabilities and ensure mutual support. Support from the armored vehicles enhances maneuver by the infantry.

(1) The infantry assists the mechanized forces by infiltrating to clear obstacles or key enemy positions and to disrupt the enemy defense. It provides security for the armored vehicles by detecting and suppressing or destroying enemy antitank weapons. It designates targets and spots the impact of fires for tanks and Bradley fighting vehicles (BFVs).

(2) Mechanized forces support the infantry by moving with it along an axis of advance and providing a protected, fast moving assault weapons system. They suppress and destroy enemy weapons, bunkers, and tanks by fire and maneuver (Figure 6-6). They also provide transport when the enemy situation permits.

(3) Armored vehicles should never be maneuvered individually. The smallest maneuver level for armor is a section (two vehicles).

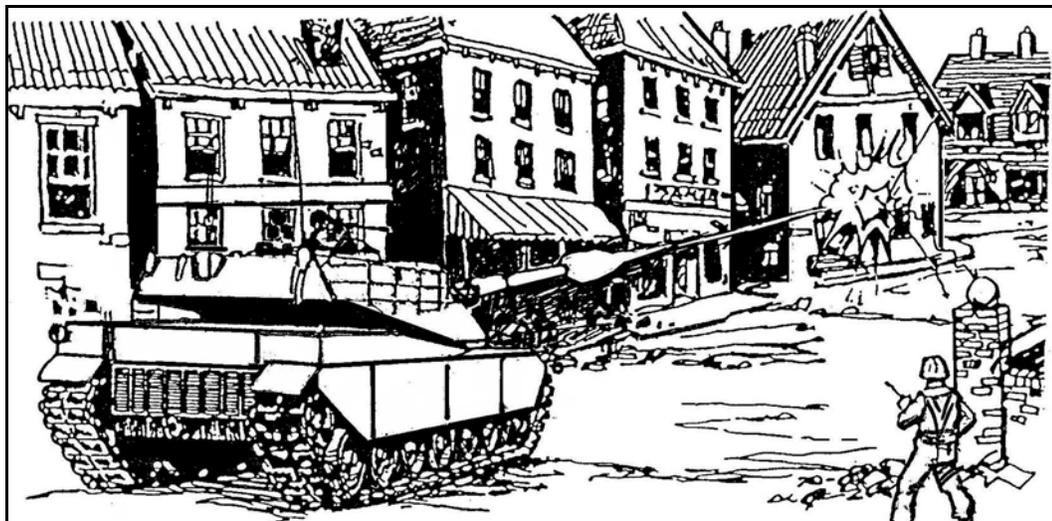


Figure 6-6. Tank in direct support of infantry.

NOTE: For further discussion concerning the strengths, limitations, and employment considerations of armor with the infantry, see FM 3-06.11.

b. **Weapon System Considerations.** While operating in concert with armored forces, the infantry leader must be knowledgeable of the capabilities, limitations, and effects of the armor weapon systems. He must understand the dangers these systems pose to his soldiers when operating together and ensure that his soldiers are briefed about these dangers. Figure 6-7, page 6-22, shows the difference in the capabilities of the BFV and the M1A1/A2 tank with regard to fields of fire on urban terrain. Note that the BFV can engage a target 9 to 10 stories high at 20 meters, whereas an M1A1/A2 tank requires 90 meters.

(1) ***Bradley Fighting Vehicles.***

(a) The primary role of the BFV in an urban environment is to provide suppressive fires and to breach exterior walls. The vehicle's armor-piercing rounds can be very useful in urban terrain. They can penetrate concrete up to 16 inches thick and can easily penetrate brick structures. They are highly effective against earthen- and sandbag-reinforced structures.

(b) The BFV can elevate its 25-mm gun to about +60 degrees and depress the gun to about -10 degrees.

(c) The crew has limited visibility to the sides and rear and no visibility to the top when buttoned up.

(d) The BFV can be outfitted with an external phone hookup for communications with accompanying infantry.

(e) The 25-mm gun, firing antipersonnel (AP), HE, and even target practice-tracer (TP-T) rounds, can be used effectively against enemy-occupied buildings and fortifications.

(2) ***M1-Series Tanks.***

(a) Normally, the primary ammunition for the main gun in the urban environment is the high explosive antitank (HEAT) round. It is the most effective round against masonry and will penetrate all but the thickest reinforced concrete. A HEAT round will create a

hole in masonry or concrete large enough for a man to fit through but will not cut the reinforcing steel bars. A HEAT round is also effective against earthen- and sandbag-reinforced strong points. A 120-mm HEAT round does not become armed until it is about 36 feet from the end of the gun tube.

(b) Multipurpose antitank (MPAT) rounds will penetrate masonry and concrete but are less effective than HEAT rounds against heavier structures.

(c) Sabot ammunition has limited use against non-vehicular targets, and its discarding petals endanger accompanying infantry. Sabot petals create a hazard area extending 70 meters on either side of the gun target line for a distance of one kilometer.

(d) The external M2 HB (cal. 50) machine gun can elevate to +36 degrees; however, to fire the cal. 50 on the M1A2 Abrams, the tank commander must be exposed to enemy fire.

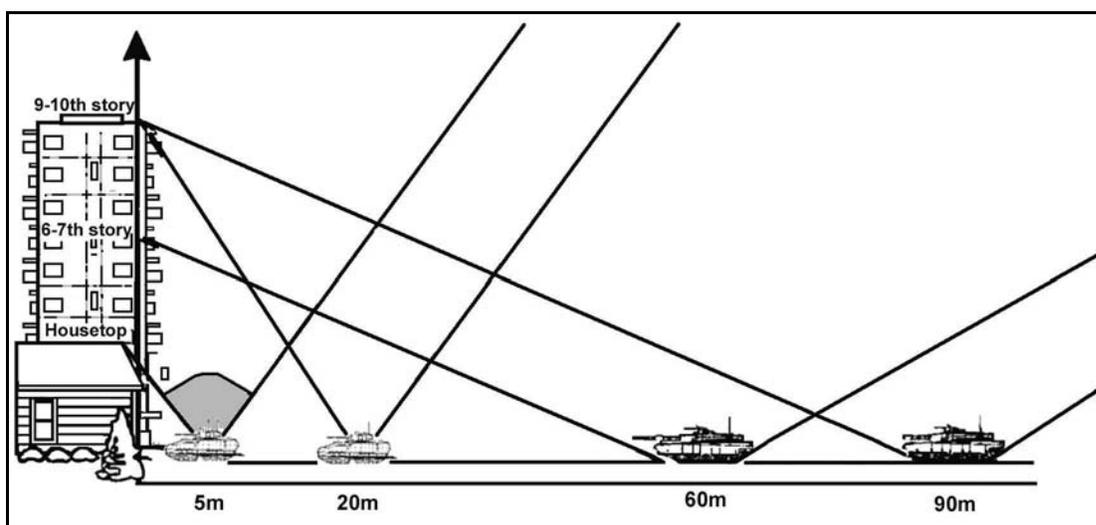


Figure 6-7. Fields of fire on urban terrain.

NOTE: When employing these weapon systems to support the infantry assault, leaders must be aware of the explosive effects and fragmentation fallout as well as the blast-over pressure and how these will affect the infantry on the ground. (For more specific information on the effects of weapons, see FM 3-06.11.)

6-11. ENGINEERS

Normally an engineer squad will be attached to an infantry company. Most engineer manual-labor tasks (for example, preparing fighting positions) will have to be completed by infantry units with reinforcing engineer heavy-equipment support and technical supervision. (For further discussion on the employment of engineers with the infantry, see FM 3-06.11.)

a. **Offensive Missions.** During offensive operations, an engineer sapper team may be attached to the reconnaissance platoon for specific missions. They may be required to conduct the following tasks in support of the platoon:

- Use explosives to destroy fortifications and strong points that cannot be reduced with the maneuver unit's organic assets.
- Locate and remove mines that may hamper the unit's movement.

- Conduct breaching operations.
- b. **Defensive Missions.** Engineers may perform the following tasks in support of the platoon during the defense of an urban area:
 - Construct complex obstacle systems.
 - Assist in the preparation of defensive positions and strong points.

NOTE: When employing demolitions along side the infantry assault, leaders must be aware of the explosive effects and fragmentation fallout as well as the blast-over pressure and how these will affect the infantry on the ground. (For more specific information on the effects of weapons, see FM 3-06.11.)

6-12. ATTACK HELICOPTERS

Infantry units may receive support by a variety of attack helicopters, including (but not limited to) the AH-64A, AH-64D, OH-58D, and MH-6. Attack helicopters can provide area fire to suppress targets and precision fire to destroy specific targets or breach structures. Attack helicopters provide real-time reconnaissance information through direct viewing of the area of operations. This facilitates the platoon leader's ability to effectively coordinate and integrate all aspects of the mission. Attack helicopters can also assist with ISR and close air support (CAS) integration and communications using their advanced suite of sensors and radios. Other supporting helicopters, such as the UH-60, CH-47, and MH-47, may also have weapons systems (7.62-mm machine gun, cal. 50 machine gun, 7.62-mm mini-gun) that aid in the suppression of enemy forces when operating in urban terrain. Operational control of attack helicopter units will remain at battalion level or higher; however, attack helicopters may conduct direct air-to-ground coordination with companies and platoons during combat operations. (For further discussion on the supporting role of the attack helicopter, see FM 1-114 and FM 3-06.11.)

6-13. ANTIARMOR WEAPONS

The tactical use of antiarmor weapons does not change in the urban environment but how they are employed does change. Some employment limitations include--

- Stand-off.
- Displacement after engagements.
- Ability to fire in-depth engagements.
- More obstacles that may interfere with the flight of the AT weapons (such as chicken wire in windows and or door ways, power lines.)
- Increased danger zones.
- All-round security.

For further discussion on the employment of antiarmor weapons in the urban environment, see FM 3-06.11.

a. Although antiarmor weapons are primarily designed to destroy armored vehicles, they also can be used to damage or destroy fortifications. Additionally, they can be used for ballistic breaching of doorways and the walls of lightly constructed buildings to create entry points. They also may be used for creating deceptions just before the assault element enters the actual initial breach (entry) point. The larger systems (tube-launched, optically tracked, wire-guided [TOW] missiles and Javelin) that have highly magnified

day and thermal sights can be used to detect snipers and to disrupt or kill them with long-range missiles.

b. Engaging targets from an enclosure creates unique hazards. Before positioning soldiers in enclosures (combat only), leaders must consider several factors that affect safety. Only in combat, and when no other tactical option exists, should antiarmor weapons be fired from an enclosure. If antiarmor weapons must be employed this way, the enclosure must meet the following minimum requirements:

- Construction of wood or stucco buildings must be sturdy to reduce the damage that will occur.
- All objects and debris must be removed from the rear of the weapon because the backblast will cause loose objects to fly around the enclosure, possibly injuring someone.

NOTE: When employing these weapon systems to support the infantry assault, leaders must be aware of the explosive effects and fragmentation fallout as well as the blast-over pressure and how these will affect the infantry on the ground. (For more specific information on the effects of weapons, see FM 3-06.11.)

6-14. SNIPER EMPLOYMENT CONSIDERATIONS

The characteristics of urban areas and the nature of urban warfare impact on both the effectiveness of the sniper weapons system and how the system may be employed. The sniper must consider the location of the target in relation to his position and whether he or the target is inside or outside the building. The sniper also must consider the structural configuration of the buildings in his area of operation. The basic classes of structures encountered in an urban area are concrete, masonry, and wood. However, any one building may include a combination of these materials. All buildings offer the sniper concealment, though the degree of protection varies with the materials used.

a. **Selecting Positions and Targets.** Leaders will provide the sniper with the general area of operation (building or group of buildings) in which to position, but the sniper selects the best position for his specific engagements. Sniper positions should cover--

- Obstacles.
- Roofs.
- Friendly routes.
- Likely avenues of approach.
- Gaps in the final protective fires.
- Dead space.
- Other areas that may provide the enemy an advantage.

The sniper also selects numerous alternate and supplementary positions to cover his areas of responsibility. The sniper should think three-dimensionally. Because the urban environment poses a three-dimensional battlespace, the sniper should anticipate the threat from any direction at any time.

b. **Offensive Missions.** Offensive operations carry the fight to the enemy to destroy his capability and will to fight. The sniper can prove to be a key combat multiplier by neutralizing enemy targets that threaten the success of the attack. During offensive operations snipers--

- Conduct countersniper operations.
- Overwatch movement of friendly forces and suppress enemy targets that threaten the moving forces.
- Place precision fire on enemy crew-served weapons teams and into exposed apertures of bunkers.
- Place precision fire on enemy leaders, armored vehicle drivers or commanders, FOs, radiotelephone operators (RATELOs), or other designated personnel.
- Place precision fire on small, isolated, bypassed elements.
- Place precision fire on enemy forces that are withdrawing or threatening a counterattack.
- Assist in screening a flank using supplemental fires.
- Dominate key terrain by controlling access with fires.

(1) To increase security and surprise, snipers must move covertly into position in an objective area long before the main attack forces arrive. Once the assault begins, snipers may need to reposition due to masking of fires by friendly forces. A detailed evaluation must be made when determining where and how the snipers would be most beneficial to the mission.

(2) Upon consolidation of forces on the objective area, the snipers may be displaced forward to new positions for security. These positions may not necessarily be on the objective. From these positions the snipers conduct observation and provide early warning to the friendly unit. They also will provide precision fire against bypassed enemy positions, enemy counterattacks, or other enemy positions that could impede the unit's ability to exploit the success of the mission.

c. **Defensive Operations.** When employed properly, snipers can effectively enhance a commander's defensive fire plan. After analyzing the terrain, snipers should provide the commander with recommendations for their employment. Snipers are capable of performing the following tasks during defensive operations:

- Cover obstacles, minefields, roadblocks, and pre-positioned demolitions.
- Perform counterreconnaissance (terminate enemy reconnaissance efforts).
- Engage enemy OPs, exposed armored vehicle commanders, and AT weapons teams.
- Engage enemy vehicles' optics to degrade vision and disrupt movement.
- Engage enemy crew-served weapons.
- Disrupt follow-on units with long-range precision fire.

(1) Snipers should be positioned to cover one or more avenues of approach into the defensive position. They can be used to enhance security, allowing the platoon leader to concentrate his combat power against the most likely enemy avenue of approach. Snipers, with their optics for target acquisition and their long-range engagement capability, will compliment the unit's machine guns. Snipers also may be used in an economy-of-force role to cover a dismounted enemy avenue of approach into positions the unit cannot cover.

(2) Multiple sniper teams can be positioned for surveillance and mutual support. If possible, they should establish positions in depth for continuous support during the fight. The sniper's rate of fire neither increases nor decreases as the enemy approaches.

Specific targets are systematically and deliberately engaged; accuracy is never sacrificed for speed.

(3) When supporting a strongpoint defense, the sniper teams should be positioned outside the defensive position to allow for freedom of movement. Their primary mission is to conduct observation tasks or independent harassing engagements against enemy reconnaissance elements or induce the enemy to move into a predetermined engagement area.