APPENDIX K
TACTICS, TECHNIQUES, AND PROCEDURES FOR THE EMPLOYMENT OF MORTARS ON URBAN TERRAIN

The following information was extracted from the Berlin Brigade, USCOB/USAB Pamphlet 350-1, Combat in Cities Procedures, dated 13 July 1984. The information contained herein was updated and reviewed by subject matter experts (SMEs). This appendix is provided as additional TTP for the employment of mortars during urban combat.

K-1. TARGET ENGAGEMENT

This paragraph describes the high angle fire, range and deflection probable errors, shapes of targets, limitations on the use of mortars, round adjustment, and effective use of mortars.

a. **High Angle.** The masking caused by the buildings necessitates the use of high angle fires to attack targets in the streets or behind buildings. Firing, at high angles, decreases the range, but this is often offset by the fact that proximity to the enemy generally will be close. In urban terrain, all mortar sections should be firing at the highest elevation possible. Use of high angle fires increases the probability of acquisition of the firing unit by enemy counterfire radar and therefore increases the frequency and accuracy of counter-mortar fires. This increased threat will be reduced by careful positioning of the mortars, avoiding fire missions which would not be effective, and moving mortar systems into covered hide positions or to alternate positions.

b. **Range and Deflection Probable Error.** The mortar is an area weapon. The single-mortar, firing multiple rounds, lands dispersed even if the gun is laid identical each time it is fired. One range probable error is the distance which, when added to and subtracted from range to the planned point of impact, will include 50 percent of the rounds fired at the planned point of impact. One deflection probable error is the distance which when added left and right of the gun target line will include 50 percent of the rounds fired at the planned point of impact. When the target lies between buildings, the variance might cause the rounds to land on top of a building or on the other side of a building even if the mortar was adjusted correctly. This may even cause the round to be unobserved. For example, a 60-mm mortar firing at a range of 3,000 meters at a high elevation of fire has a range probable error of 20 meters. This means 25 percent of the rounds fired could land more than 20 meters beyond the target and 25 percent could land less than 20 meters short of the target. The expected result is that only 50 percent of the rounds fired could land in an oval area that is 40 meters long. Human error will decrease the number of rounds that land close to the target. Deflection probable errors are much smaller and not as much concern for the 60-mm and the 81-mm mortar.

c. **Shapes of Targets.**

(1) ***Point Targets***. Point targets are the most common type of target that mortars will engage due to restricted sight lines, numerous street intersections used as adjustment points, and kill zones as wide as a street. Point targets can be engaged by a single gun, a section, or platoon with a converged sheaf. Using a high rate of fire from a single tube

will put a higher percentage of rounds in a small target area as opposed to using the same number of rounds from multiple tubes.

(2) ***Linear Targets***. Linear targets occur along streets. The streets may be perpendicular to the gun-target lines such as an FPF directly in front of a battle position or parallel or at some other angle to the gun-target line, such as a street which approaches the objective. For linear targets, the FO includes the attitude of the target with the call for fire. The FDC may have to issue separate gun data to each mortar to orient the sheaf correctly to bring effective fire on the targets.

(3) ***Area Targets***. Area targets are not as common in urban combat as point or linear targets. However, area targets may occur in parks which may be used as staging areas, or behind friendly lines during enemy air assault operations, or during an attempt to mass forces such as in an assembly area or an assault position.

d. **Limitations on the Use of Mortars.**

(1) ***Dead Space***. Enemy targets close to the base of buildings on the side away from the firing mortars cannot be effectively engaged. When firing at the maximum elevation possible, the dead space behind the building is greatly reduced. However, while firing at high angles decreases the amount of dead space, it cannot be eliminated.

(2) ***Observation***. Observation is severely restricted. Enemy targets are often only visible when they are within one block of the observer or on the same street as the observer. Positions in tall buildings can provide long range observation, but normally only from the tops of buildings. To engage the enemy, the FO should be positioned forward. Many fire missions will either be on streets that lead up to friendly positions or will be called in on targets that are within one block of the observer or friendly positions. Probable errors associated with mortars necessitate friendly positions be chosen and constructed to withstand an occasional mortar round striking the top or rear of the building in which they are constructed

(3) ***Penetration***. Mortar rounds are not effective in penetrating buildings. Rounds with delay fuzes sometimes penetrate the top floor, but damage is limited by interior walls, and the rounds do not normally penetrate to lower floors. Mortar rounds that do not impact directly against mass construction walls with the fuze may not cause much damage to personnel in the interior and in many cases will fail to explode. Mortar rounds will penetrate light walls on frame construction buildings but the damage is usually confined to one or two floors because of the heavy floor construction normally found in high rise frame buildings. For deeper penetration, HE delay can be used. HE quick is effective in lightly built structures found in some suburban areas. HE quick would also be effective in the flimsy construction usually found in shantytowns.

(4) ***Proximity Fuzes***. Proximity fuzes function erratically when used in the vicinity of buildings. They are still effective if used in large open areas (for example, parks, parking lots, and so forth).

(5) ***White Phosphorous***. White phosphorous (WP) smoke rounds will often start fires. This may interfere with the tactical plan and may cause civilian casualties. Note that all mortar rounds currently in the inventory are WP.

e. **Round Adjustment.** Adjustment of rounds will be very difficult because of the large percentage of the urban area that probably cannot be observed. If an adjustment round is 50 meters off, it may land a full block away. The FO would hear echoes, but have no indication where the round landed and what corrections are necessary. Using

time fuzes to cause adjusting rounds to burst just above the height of the buildings will ensure the FO can observe the rounds. Time fuzes will be used until the rounds are adjusted above the target.

f. **Effective Use of Mortars**. Mortar rounds must be carefully used and not wasted. Resupply of mortar ammunition may not be immediately available. Unnecessary firing will increase the likelihood of being engaged with accurate counter-mortar fire. Ineffective mortar fires may cause collateral damage and civilian casualties.

(1) ***Armored Vehicles***. Mortar fire normally will not disable armored vehicles, but it can be a combat multiplier when used with direct fire weapons. Indirect fire is effective in forcing the enemy to button up during movement, will slow his advance, make it hard for him to determine his exact location, decrease the probability he will see our mines, and assist friendly light antiarmor weapons fire before the enemy can return accurate fire. The enemy can take casualties from mortar fire during Infantry assaults against our positions or if he exposes himself.

(2) ***Smoke Missions***. Smoke missions are vital in urban combat in order to provide obscuration for assaulting or withdrawing forces. When planning fire support, careful analysis needs to be given to the length of required missions and the amount of rounds needed to support the coverage requested. Planners must also account for the duration the smoke lasts when planning for WP smoke, which is much longer in an urban area than in open terrain. In some cases, smoke mission requests may have to be modified based on the amount of rounds available for the mission. It is important to remember that when requesting smoke missions from mortars, WP rounds are used. These rounds burn until all the oxygen in the immediate area or the white phosphorous is exhausted.

(3) ***Obstacles and Minefields***. Covering obstacles and minefields with mortar fire will decrease the enemy's ability to view the extent of the barrier, slow his breaching efforts, and cause casualties if he tries to use Infantry to bypass or clear the obstacle. consistent with the ROE. Airbursts should be employed if the obstacle includes mines or concertina wire. Ground burst rounds would destroy much of the barbed wire and detonate many of the mines. Massed fires of mixed point detonating fuzes and time fuzes are effective if the enemy is breaching existing obstacles.

(4) ***Tops of Buildings***. Enemy soldiers can be forced off building tops by using HE rounds with time or proximity fuzes. When firing at the top or upper stories of buildings, it is most important the FO provide the vertical interval.

(5) ***Attics***. Targets located in an attic or on the floor immediately below the location of the enemy in mass construction buildings can be engaged with delay fuzes. Mass construction buildings have weak roofs and attic floors. Because these are point targets, only one gun should be used.

(6) ***Fronts of Buildings***. Enemy hasty positions or observers in the front side of buildings, or in a large open area in front of the building, can be engaged using proximity fuzes. Effectiveness will depend on the amount of window surface. Shrapnel normally will not penetrate walls and most casualties will be caused by the secondary shrapnel hazard of flying glass. For this use, the trajectory of the rounds should be the lowest point possible which clears the buildings along the gun target line, and which enables the rounds to reach down the building far enough to hit the target. If the goal is to blow glass into the street to cause casualties, delay fuzes should be used. (The 60-mm mortar in the handheld mode can be very effective against this type of target.)

(7) ***Enemy Air Assaults***. Enemy air assaults or raids behind friendly lines can be broken up and affected if immediately engaged with massed indirect fires using HE with PD and proximity fuzes

(8) ***Final Protective Fires***. Final protective fires planned immediately in front of friendly positions will cause casualties if the enemy attempts to move dismounted across the final gap before reaching friendly positions. Proximity fuses should be used to avoid destroying obstacle belts. The same fires are necessary if the enemy gains a foothold. Mortar fires will aid in sealing the breach to prevent reinforcement.

(9) ***Counterattacks***. If the enemy counterattacks, the commander may call for mortar fire on his own position. Friendly soldiers will be exposed to this fire and protection should be sought inside buildings. Smoke rounds should not be used because of the fire hazard

(10) ***Use of WP or Illumination***. WP or illumination rounds ignite fires that may burn or smoke enemy out of buildings. Because of heat, the building may be unusable to the enemy for days. Effects to be considered before using this technique are the possibility of friendly casualties from stray rounds and large fires, the possibility that burning buildings or heavy smoke will interfere with planned operations, the possibility of collateral damage and civilian casualties, and whether use is permitted by the ROE. Illumination is greatly influenced by the presence of buildings. Deep canyons formed by buildings severely limit the effect and duration of illumination on the target even if properly placed. Illumination rounds should be planned to place friendly soldiers in the shadows and place enemy troops in the light (Figure K-1). Because of the shadows produced by the buildings and the drift of the illumination round, effective illumination may be for a short duration. The FDC needs to calculate where the illumination shell casings will impact and inform friendly units in their path.

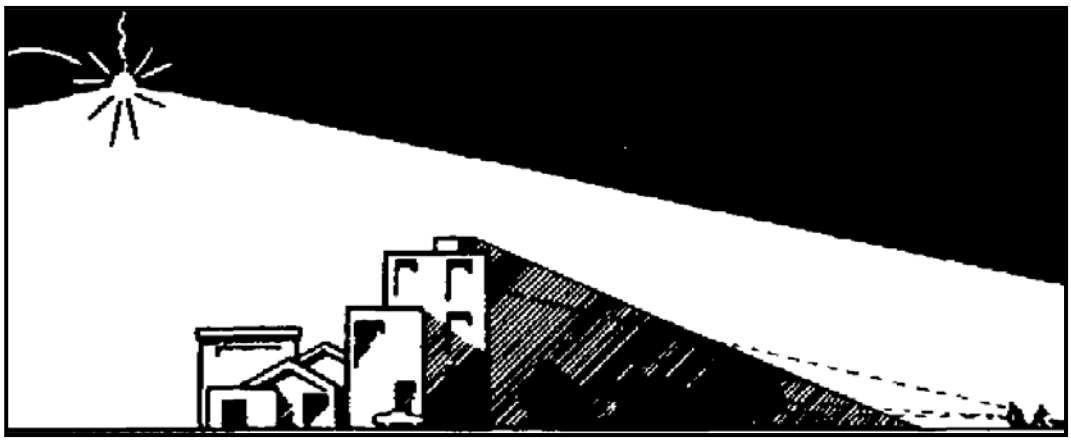

Figure K-1. Mortar illumination.

K-2. CONTROL

Mortars are responsive to calls for fire from platoon FOs and are capable of massing fires to have a decisive effect at key points in the battle. Control of the 60-mm section is normally retained at company level. It may be consolidated at battalion if the commander determines the primary use of mortars in his sector is to support the effort of an assaulting

company, or to defeat breaching efforts by the enemy at a major obstacle. Most of time the massing of fire can be achieved without having to consolidate the individual mortar sections by having the mortars fire under the battalion FSO's control from company positions. In these special cases, the loss of responsiveness to the company commander may be outweighed by the need for the battalion commander to be able to immediately mass the battalion's mortar fires. Frontages covered by companies are small enough that there is no advantage to be gained by attaching individual 60-mm mortar tubes to individual rifle platoons.

a. **Communications and Fire Missions.** The mortar section maintains communications with its company commander and with the FIST chief on the company command net. When a wire line has been run from the company to the mortar section, the radio can be placed on an alternate frequency which can provide a dedicated fire support net or it can be used as redundant communications. This provides a radio net for the FO or units to use in order to make calls for fire if the wire line to the company becomes overloaded. Each company commander has a dedicated indirect fire system. The company FIST chief will plan and coordinate the company's calls for fire. Most needs are met by the company mortar section. If additional support is needed, it will be requested through the battalion FSCOORD. The battalion commander, through the FSCOORD, can take direct control of indirect fire assets to meet an urgent tactical situation.

b. **Displacements.** The company mortars can displace with authorization from the company commander, but coordination with the battalion FSO should also be made. The battalion FSO will ensure mortars from more than one company are not displacing at the same time and will coordinate availability of additional fire support, if needed, while some mortars are out of action during movement. This support may be provided by the battalion mortar platoon or an adjacent company's mortars.

c. **Preplanned Targets.** Targets should be preplanned prior to any operation. Target lists and overlays of the entire battalion sector will be prepared for each mortar FDC, to aid sections providing temporary support for adjacent companies and responding to situations that require immediate massed fires from all the battalion's mortars. This is especially helpful if a company has been given the mission to support by fire and isolate an urban objective. Having accurate information at each FDC will decrease the likelihood of causing friendly mortar casualties and enhance situational awareness.

K-3. MORTAR POSITIONS

The distance that mortars are kept behind friendly positions depends on the observation available to the FO and how far forward the FO is located in the offense, or how far forward the LP/OP and or FO are located in the defense. The maximum range of the platoon is reduced if it needs to fire at high angles to engage targets. Mortars should not be so close to friendly positions that they will be overrun or forced to displace if the enemy achieves a minor breakthrough in the defense or counterattacks in the offense. The position should enable fire to be brought on friendly positions to counter enemy breaches. Logistical support of the 60-mm mortar section and wire communications is less difficult if the section is located relatively close to the company trains and CP.

a. **Use of Buildings for Protection.**

(1) ***Choosing Positions.*** By properly choosing mortar positions, protection can be obtained from enemy counter-mortar fires without restricting the ability to engage targets

with indirect fire. Mass construction buildings to the front and buildings to the sides and rear of positions can limit the mortars' exposure. If friendly mortars are close to a tall mass construction building and firing at near maximum elevation, they will be fairly well protected from counterbattery fires. Friendly mortars should move as close to the buildings as possible while maintaining clearance to fire over the building. The laid gun should be checked to ensure the rounds will clear the frontal mask. This positioning puts the weapon systems well within the enemy's dead space, if he is using flatter firing trajectories. Mortars should not be positioned close to buildings with a large percentage of surface area made of glass, because of the secondary shrapnel hazard of glass.

(2) ***Low Buildings.*** Low buildings close to the mortars on any side do not provide much dead space in which to position mortars, however, they will offer some protection from shrapnel from that side. If the area from which the mortar is firing is relatively small and the adjacent walls are fortified or strong enough to stop shrapnel, then the incoming rounds have to be almost a direct hit in order to damage the mortars or crew.

(3) ***Hide Positions.*** Hide positions (for example, large garages, store fronts, underpasses) can be used to protect the mortars before firing.

(4) ***FDC Location.*** The FDC can be placed in a parking garage, ground floor garage in a larger building, or covered vehicle passageway to protect it.

(5) ***Buildings Near Mortar Positions.*** Buildings near mortar positions obstruct the view of the mortars, making the position less likely to be discovered by the enemy.

b. **Ground Mounting Mortars.** There are only limited patches of soil available to ground mount mortars. These patches are rarely in the optimum location to ensure the mortar is protected by surrounding buildings and not masked. If mortars must be fired on a paved surface, baseplates should be supported with sandbags or any other non-skid surface that may be available.

c. **Positions.** Possible positions for 60-mm section and 81-mm mortar platoons are shown in Figures K-2 and K-3 on pages K-7 and K-8 respectively.

(1) ***Courtyard Positions.*** Positions in courtyards in the center of city blocks provide excellent protection from indirect fire. They aid local security by concealing the mortars (unless an observer is on the same block). By shielding the sound of firing, the surrounding buildings make it difficult to locate the guns by listening to fire. The primary concern with this position is ensuring adequate access routes. A single small passage through a building that could be blocked by minor rubbling is unacceptable. There should be at least two access routes not susceptible to blockage from minor rubbling.

(2) ***Gun Positions.*** Because many targets will be on streets, linear fire missions will be routinely planned. Consideration should be given to emplacing mortars at street intersections, so linear targets can be engaged quickly without the FDC having to adjust the sheaf. The shapes shown in Figure K-2 on page K-7, and Figure K-3 on page K-8, can assist in decreasing ammunition waste, provide adequate access routes, and simplify local security. Positions should be chosen away from likely enemy avenues of approach.

(3) ***Local Security.*** Local security is necessary to guard against destruction by the enemy and to protect supplies from pilferage and vandalism by local personnel. If an LP/OP is positioned to observe approaches to the section’s positions, it must be close enough to return to the guns rapidly and conduct fire missions. Section members will have assigned sectors of fire and a position defense plan will be prepared. Claymores are set out to cover possible Infantry approaches. It is preferable for the mortar section to

displace rather then stay in position and fight a decisive battle. Underground approaches are identified and either blocked or kept under observation.

(4) ***Vehicles.*** If vehicles are used, they should be parked under cover and camouflaged against ground and aerial observation. Debris, cars, trucks, and other items found in the vicinity can be used to break up the outline of friendly vehicles without causing the position to attract attention by not matching the surroundings.

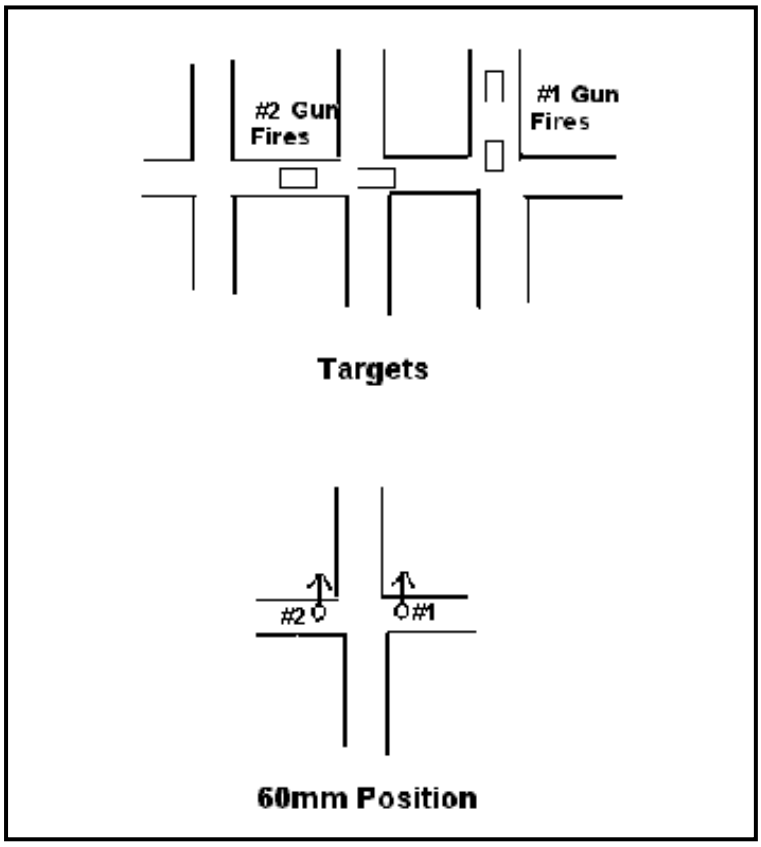

Figure K-2. Possible 60-mm mortar position.

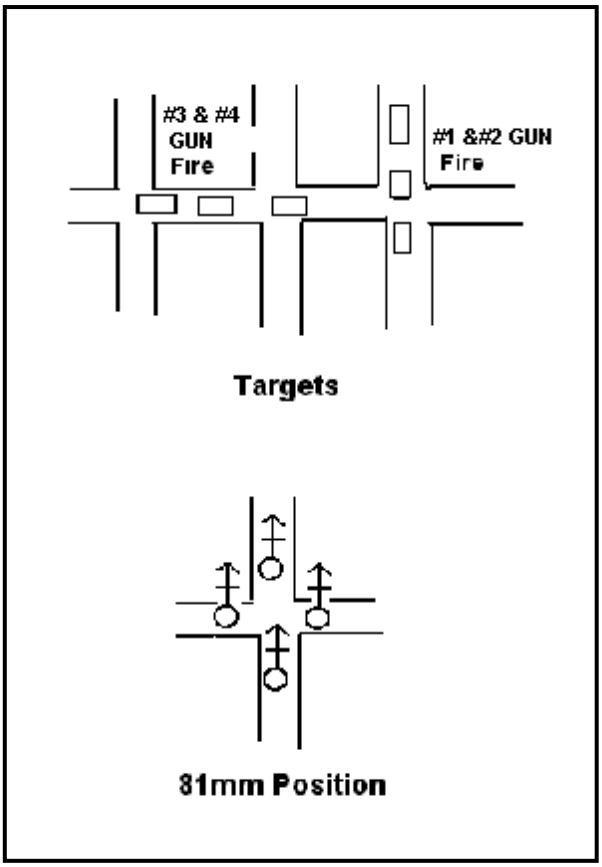

**Figure K-3. Possible 81-mm mortar position.
(Gun positions would be offset to prevent firing overhead
of the crew to the front)**

d. **Roving Guns.** Many targets will be point targets; therefore, it is possible for 60-mm mortar sections to employ a roving gun. One gun can be located in a firing position with the FDC and the other gun can be located either forward or rearward with wire communications to the FDC. (For an 81-mm platoon, two guns would he located in a firing position with the FDC and the remaining gun(s) may be 400 meters away, with wire communications to the FDC.) The other gun(s) would engage point targets without drawing counter-mortar fire on the rest of the section or platoon. If a linear fire mission or higher rate of fire were required, the two-gun section would fire that mission. Because it would fire more missions, the single gun would be expending the most ammunition and would be the most probable target for counter-mortar fire. When it ran low on ammunition or had to displace due to incoming indirect fire, it would displace back to the position near the FDC and the other gun would assume the role of roving gun. This method provides the section the most survivability from counter-mortar fire and ensures continuous fire support will be available, but it increases the difficulty of maintaining local security because the section or platoon is in two locations.

e. **Laying the Section.** Magnetic instruments, for example, compasses, are affected by the presence of massive amounts of structural steel and electrical cables usually found

in urban terrain. During one test in Berlin conducted in the 1980's, the variation in deflection on an aiming circle was more than 70 mils.

(1) ***Orienting Line Method.*** Use of the orienting line method with the aiming circle avoids reliance on magnetic azimuths. The steps are:

- Set up the aiming circle on a point that can be located to 8-digit accuracy on a map.
- Locate a point several hundred meters away (a minimum of 200 meters away, but the farther the better) that can be seen from the aiming circle and located to 8-digit accuracy on a map.
- Determine the grid azimuth on the map from the aiming circle location to the distant point.
- Index the grid azimuth on the aiming circle.
- Use the non-recording motion to place the vertical crosshair on the distant point.
- Index zero on the aiming circle and place an aiming stake to serve as a north reference point.
- Subtract the mounting azimuth from 6400 and place the remainder on the aiming circle. Use the non-recording motion to place the vertical crosshair on the left edge of the north reference stake.
- Lay the section using the aiming circle.

(2) ***Laying the Mortar Without a Compass.*** If an aiming circle is not available, the mortar can be laid without using a compass by a similar procedure.

- Set up the mortar on a point that can be located to 8-digit accuracy on a map.
- Locate a point several hundred meters away (a minimum of 200 meters, the farther the better) that can be seen from the mortar sight and located to 8-digit accuracy on a map.
- Determine the grid azimuth on the map from the mortar location to the distant aiming point. The direction of a street may be used instead of a distant aiming point, if necessary.
- Subtract the back azimuth of the direction of fire from the grid azimuth.
- Index the difference on the red scale and the mortar sight and manipulate the gun until the vertical crosshair of the sight is on the aiming point. The gun is now laid.
- Use the sight of this mortar to lay other mortars in the same position.

(3) ***Aiming Stakes.*** It is usually impossible to drive in aiming stakes because of the limited amount of open soil. Two ammunition cans filled with sand can be used on each gun. The stakes stand in the open can supported by the sand. If soil is used instead of sand, the stake will fall when it rains. Distant aiming points can be used instead of aiming stakes, but the distant point may not be consistently visible during the battle because of the large amount of smoke.

(4) ***Identification of Key Locations.*** During planning and identification of mortar positions, the exact location of the aiming circle or mortar and the distant aiming point must be identified. These identified locations and the grid azimuth can be calculated and included in prepared orders, this should assist in position occupation.

f. **Continuing Preparation.** After the position has been occupied, communications established, and the initial fire coordination conducted with the company FIST and the

battalion FSO, the section leader can conduct reconnaissance of alternate and supplementary positions. Alternate positions are used to avoid destruction by counter-mortar fires. Supplementary positions are used if the section is forced to withdraw from its battle positions or sector. This reconnaissance is to review the sites and confirm there have been no major changes since the section's plans were last updated.