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Breaching Walls in Urban Warfare

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Final report 6 June 1975



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A thesis presented to the faculty of the U.S. Army Command and General Staff College, Fort Leavenworth, Kansas 66027

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Breaching Walls in Urban Warfare		5. TYPE OF REPORT & PERIOD COVERED Final report 6 Jun 75
7. AUTHOR(s) Hartle, Anthony E., MAJ, USA		6. PERFORMING ORG. REPORT NUMBER
9. PERFORMING ORGANIZATION NAME AND ADDRESS Student at the U.S. Army Command and General Staff College, Fort Leavenworth, Kansas 66027		8. CONTRACT OR GRANT NUMBER(s)
11. CONTROLLING OFFICE NAME AND ADDRESS US Army Command and General Staff College ATTN: ATSW-DD Fort Leavenworth, Kansas 66027		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		12. REPORT DATE 6 Jun 75
		13. NUMBER OF PAGES 87
		15. SECURITY CLASS. (of this report) Unclassified
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
16. DISTRIBUTION STATEMENT (of this Report) Distribution limited to U.S. Government agencies only: Proprietary Information. Other requests for this document must be referred to U.S. Army Command and General Staff College, Fort Leavenworth, Kansas 66027.		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES Master of Military Art and Science (MMAS) Thesis prepared at CGSC in partial fulfillment of the Masters Program requirements, U.S. Army Command and General Staff College, Fort Leavenworth, Kansas 66027		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number)		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) See reverse.		

29 SEP 1975

Unclassified

SECURITY CLASSIFICATION OF THIS PAGE(When Data Entered)

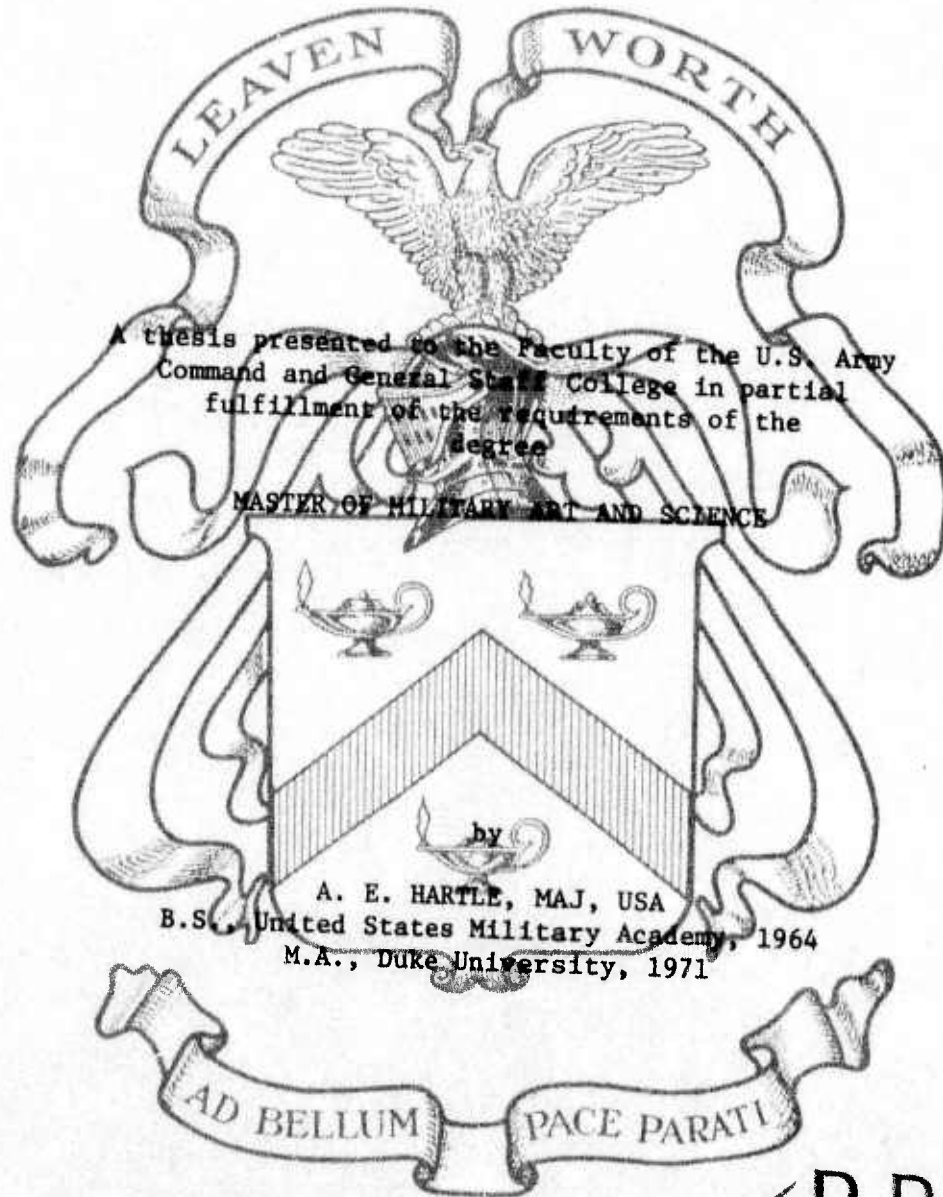
This study attempts to determine if there is a need for a wall-breaching capability in infantry units today. The investigation is focused on an analysis of historical experience, contemporary urban areas, and the capabilities of U.S. Army weapons.

Investigation reveals that a distinct need for a wall-breaching capability in infantry units does exist, and that current weapons and equipment readily available to the infantry rifle company are inadequate for this purpose. Further examination reveals that the means of satisfying the requirement are within the capability of current technology.

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BREACHING WALLS IN
URBAN WARFARE



Fort Leavenworth, Kansas
1975

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ABSTRACT

The process of urbanization throughout the world is making urban warfare a major aspect of future military conflicts. Past experience in such combat indicates that wall breaching is an important capability in facilitating the movement of ground units. Maneuver in strongly defended built-up areas is sometimes possible only if units move through buildings.

This study attempts to determine if there is a need for a wall-breaching capability in infantry units today. The investigation is focused on an analysis of historical experience, contemporary urban areas, and the capabilities of U.S. Army weapons.

Investigation reveals that a distinct need for a wall-breaching capability in infantry units does exist, and that current weapons and equipment readily available to the infantry rifle company are inadequate for this purpose. Further examination reveals that the means of satisfying the requirement are within the capability of current technology.

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CHAPTER I

PRESENTATION OF THE PROBLEM

"The worst policy is to attack cities. Attack cities only when there is no alternative." --Sun Tzu: The Art of War

This study is an analysis of the capability of the infantry rifle company to breach walls in urban combat, primarily for the purpose of facilitating maneuver. At first glance such a subject appears relatively inconsequential, but combat in built-up areas is a subject of mounting concern to ground combat forces because of the continually increasing likelihood of urban warfare. This concern is clear in the Quadripartite discussions of the American, British, Canadian, and Australian armies in 1972:

We cannot escape from the basic fact . . . that sooner or later . . . open space will become more and more at a premium. Whether we or the Warsaw Pact countries like it or not, we will eventually be forced by the spread of urbanization to take it more into account and to organize ourselves with forces more suited to urban warfare, namely, more infantry and less armour.¹

The Soviet Army joins this consensus in some of its authoritative publications: "In a modern war, should the imperialists unleash one, combat action in a city will be inevitable."²

As the world population increases geometrically, a larger and larger proportion of that population lives in expanding metropolitan areas. A recent study of built-up area conflict recognized the significance of such development for the military: "The current urbanization of Europe and the projected growth rate indicate that the [U.S.]

Army must be prepared to fight in built-up areas."³

Urban areas in the underdeveloped countries are growing even faster than those in the rest of the world.⁴ In 1920, Great Britain was the only nation in the world with a predominantly urban population. Today, about one third of the people on earth live in cities, and, if present trends continue, by the year 2000 over half of the expected world population of seven billion will live in vast metropolitan complexes.⁵

These facts, when related to historical data concerning city combat, present the U.S. Army with a broad array of problems. As subsequent discussion will show, current U.S. Army doctrine concerning combat in built-up areas is limited or inadequate in various respects. A recent study prepared at the U.S. Army Infantry School concerning combat in cities states, "Almost without exception, the development of weapons and materiel since World War II has proceeded with little regard to the applicability . . . to urban fighting."⁶ Another special study report observed, "It has also been implicitly assumed that the organization and equipment used for operations in open country will be just as effective for operations in cities."⁷ These facts are particularly significant when one turns to wall breaching, a seldom discussed but nonetheless significant military capability. This study presents the importance of wall breaching in planning for future operations and future weapons development.

In any built-up area, movement of military forces is restricted. During combat, readily available avenues of approach are limited and largely predetermined by the pattern of construction, enabling a defending force to place extremely effective fire on all such avenues.

This fact presents a problem for assaulting elements. The restriction affects defenders as well in that aggressive patrolling and the limited counterattacks necessary for a viable defense will also be constrained. Past experience in urban warfare has developed various means of preserving maneuver capability in cities. Forces may move underground, in tunnels and sewer systems; they can move across rooftops and thus avoid the streets; or they can go through the outer and the interior walls of buildings. The last possibility is the one that can be employed most consistently. There may be no accessible tunnels. If there are, information about the tunnels may not be available or the tunnels may be difficult to follow, a circumstance which would result in confusion. Rooftops may not provide an avenue if buildings are separated or if building heights vary widely. Thus the capability to breach walls solely for the purpose of enhancing mobility is, in itself, a significant consideration in urban warfare.

The focus of this study is threefold: first, to analyze the need for a wall-breaching capability in units committed to urban combat; second, to examine the wall-breaching capability of weapons now available to infantry units; and, third, to recommend a solution to remedy any shortcomings identified.

Statement of the Problem

Does the infantry rifle company in urban combat need a wall-breaching capability to facilitate movement and maneuver? The remainder of this study is devoted to answering this question, primarily through analysis of combat experience during and since World War II in relation to the capabilities of current infantry weapons.

The study of the problems encountered in urban warfare has intensified in the U.S. Army in recent years. Our experience in Hue and Saigon during the Tet Offensive of 1968 focused attention on tactics and weapons in city fighting. The Advanced Research Projects Agency of the Department of Defense in the last six years has supported various studies of military operations in built-up areas. One of these, by Ketrion, Incorporated, included the following conclusions:

The Army currently has no weapon system especially designed for wall breaching.⁸

Current weapons systems are not adequate for wall breaching
.....⁹

S. L. A. Marshall reports that at a recent Army symposium on the problems of urban warfare, commanders "accented the need for a projectile that from one or several hits would blast a hole in a stone wall, quite a few inches of concrete or a reinforced house of brick so that men may move through the hole and neutralize defense within the structure."¹⁰ Interestingly, Marshall himself rejects this conclusion, saying, "Blowing down walls when buildings are designed so that they might be entered and used is going at it the hard way."¹¹ This observation by the usually astute historian is rather surprising, for it appears he is overlooking the historically (and logically) supported fact that those entrances and the approaches to them are covered by boobytraps or intense fire.

The problem of wall breaching has been exacerbated by recently approved changes in tables of organization and equipment. The 106-mm recoilless rifle (M40A1) and the 90-mm recoilless rifle (M67) have been deleted from the standard inventory and replaced by the tube-launched, optically-guided, wire-command link (TOW) guided missile and the DRAGON missile (M47). The characteristics of these weapons, which will be

discussed in Chapter V, make them largely unsuitable for close combat in cities. Experience with the recoilless rifles and data concerning the performance of these weapons show them to be useful for wall breaching, though they have serious limitations because of backblast characteristics. Their absence leaves a definite gap in the range of weapons effects available to the infantry, a gap that becomes acutely significant in urban warfare.

History of Wall Breaching

If an enemy force conducts a stubborn defense in a city complex today, the time required to reduce strongpoints and the casualties suffered will be major factors in determining whether the assaulting force succeeds or fails. The capability to breach walls quickly and efficiently is thus revealed as an important consideration in the development of forces which will conduct operations in built-up areas. When other avenues of approach are too difficult or simply unavailable, "mouse-holing" (tunneling through walls) may often prove to be a critical capability. A large number of breaching requirements will consume excessive time, a factor of great importance to commanders, if the assault units are not properly equipped. The pressure applied by General MacArthur's Far East Command for a speedy conclusion to the fight to seize Seoul in 1950 is a particular case in point. There the political considerations demanding speed overrode the tactical considerations counseling caution. Often in the history of warfare, combat in cities has been conducted under urgent time constraints.

In our modern environment, the search for a rapid means to enter a structure by other than the expected route or to move through "interior obstacles" in a building is intriguingly analogous to the

ancient problem of wall breaching. As Phillip H. Stevens notes in his study of the history of artillery,

Wasting either time or good troops does not fit into the plan of any would-be conqueror. To be a successful military leader, one must overcome obstacles in the minimum possible time and with the least possible loss of manpower. Siege warfare, the art of quickly reducing a fortified town, gave the major impetus to the development of what we call artillery.

Early artillery devices were known as siege engines and their almost exclusive purpose was to knock things down--walls, gates, anything that stood between the attacker and his objective.¹²

Consider the campaign to unify Greece conducted by Phillip of Macedon, father of Alexander the Great. According to W. A. Windas, "He saw at once that without artillery, the task bordered on the impossible, for each of the independent city states was surrounded by strong walls. Therefore, his first thought was to develop efficient siege engines."¹³ The artillery referred to here undoubtedly consisted of catapults which hurled stones or similar projectiles, and their function was primarily to cause destruction and casualties inside the walls, but this reference illustrates the problem that walls have presented throughout history.

The Middle Ages also reveal the same preoccupation with the problem of overcoming walls. The eminent medieval war scholar, C. W. C. Oman, emphasized the significance of this problem:

In the whole history of the medieval period the most striking features are undoubtedly the importance of fortified places and the ascendance assumed by the defensive in poliorcetics A Norman keep, solid and tall, with no woodwork to be set on fire and no openings near the ground to be battered in, had an almost endless capacity for passive resistance.¹⁴

Because the problem of overcoming walled defenses was so vital, human ingenuity was intensively applied to a solution. The wide variety of siege engines of the Roman Empire and the later medieval period

reveal this. The Roman Legions used huge battering rams to gain access to walled cities, but the casualties incurred in working directly under the walls were heavy. The catapult and the ballista, along with a host of related inventions, were designed to achieve a stand-off capability, but something more efficient was needed. A satisfactory solution to the problem was achieved in Europe only with the advent of gunpowder and cannon during the Hundred Years War between France and England, 1339 to 1453.

The Battle of Crecy between the French and the English in 1346 is often cited as the beginning of a new era in Western civilization. A. V. B. Norman, a specialist in arms and armor, grants that Edward III had guns at the time of Crecy and that Italian writers of the time excused the failure of the Genoese contingent during the battle by saying they were dismayed by the English guns, but he finds no clear evidence that guns were actually used.¹⁵ Another scholar points out that Edward III actually used the "crakys of war," essentially a vase-shaped pot propelling a heavy lance or battering projectile, as early as 1327, but that it "was good for limited purposes only--perhaps to batter down the sallyport in the outer wall of a fortress . . . smash a city gate, or cave in wooden barriers."¹⁶ The bombard, a piece with a conical barrel which would accept a variety of projectile sizes, was soon developed. It and similar weapons proved to be devastating replacements for the battering ram. Some were quite large, firing stones weighing several hundred pounds. The massive stone castle was no longer a secure refuge, nor the most effective means of defending against an invader. Artillery played the leading role in the conquest of Constantinople in 1453, and in the centuries that followed, artillery proved to be a decisive

factor that often dominated the battlefield, obviating the requirement to close with the enemy in a town or city.¹⁷

Military forces now obviously have the capability of destroying buildings by using air power and artillery. But while buildings can be collapsed, experience from World War II to the present has repeatedly revealed that damaged buildings provide very effective cover and make the advance even more difficult for the attacker. In addition, U.S. Army forces in recent years have operated under restrictions which often precluded wholesale destruction. Such was the case in Santo Domingo in 1965. It is reasonable to expect such restrictions to continue, particularly in view of the ever-increasing problem of the civilian population. For example, the CONAF III study notes that in Europe, the initial NATO defense will be conducted in the least densely settled areas, but that current planning envisions the Allies will be pushed west from D-Day to D + 180. "Therefore, in the D-Day to D + 180 period, it is inevitable that fighting will increasingly occur in the built-up areas."¹⁸ In such areas, where the civilian population will remain if the official "stay-at-home" policy of the Federal Republic of Germany is obeyed, weapons of wholesale destruction, particularly nuclear weapons, could reasonably be employed in only the most desperate situations.

In sum, we must expect to have to fight with foot soldiers, in which case, if any offensive action is contemplated, we must overcome obstacles in the "minimum possible time and with the least possible loss of manpower." Ground forces in urban warfare now and in the future need a rapid and efficient way to breach the interior and exterior walls of a wide variety of structures, in much the same sense armies of Europe centuries ago had to overcome the walled cities and castles of their

enemies in order to move safely through an area or to destroy the opposing forces.

The problem of walls in city fighting became prominent in World War II and subsequent conflicts. Objectives often involved major population centers, normally the location of industrial capability and political institutions. S. L. A. Marshall notes that, "From the opening of World War I, the importance of the city as a pivotal conquest in war, due to what it signified as a communications plus or minus, was more heavily dramatized than ever before."¹⁹ Nonetheless, it was not until World War II that urban combat began to be recognized as a separate and distinct tactical environment, and current weapons development programs indicate that we are still somewhat reluctant to recognize the import of the burgeoning urbanization of the areas where U.S. Army forces are likely to be committed.

Commitment of U.S. Forces

The likelihood of U.S. Army participation in urban warfare is a function of several factors, the most significant of which is the area where we expect to fight. The United States today has formal commitments to seventeen nations or multi-national treaty organizations, each of which could cause this country to commit forces overseas.²⁰ Obligations of membership in the United Nations, the North Atlantic Treaty Organization, the ANZUS Pact, the Southeast Asia Treaty Organization, and the Rio Pact, as well as numerous bilateral agreements, make it clear that the United States has global responsibilities. On the other hand, hearings before the Senate Foreign Relations Committee in 1967 revealed that formal treaty obligations have not in the past been, nor are expected in the future to be, the determining factor in the commitment of American

forces.²¹ One must look more broadly at United States interests and our perceptions of major threats to national security. Such analyses are prepared annually by various government agencies such as the Joint Chiefs of Staff. Without involving the classified sources which fundamentally drive force development and weapons acquisition, such as the Joint Strategic Objectives Plan, it is clear that Europe is considered both vital to United States interests and highly probable among likely areas for commitment of United States forces. One need only examine the location of our forces abroad and the thrust of our research and development to confirm this statement.

Europe also represents significant problems in terms of urban warfare. The vast urban areas pose unique problems for military operations because of their high population density and their physical structure. The structural materials found in cities throughout the world vary widely, but all major population centers consist of buildings grouped closely together with streets and thoroughfares of varying widths, thereby presenting the same type of problem to an attacking force. Multi-storied, high-rise buildings complicate that problem tremendously, but it is of the same nature nonetheless. Many cities in Europe today are characterized by a central city dominated by old, thick-walled structures surrounded by large, postwar, modern industrial and residential areas. These characteristics are those that committed forces are likely to face today. Accordingly, this study will analyze wall-breaching capability in this type of environment.

The Infantry School's Combat in Cities Study describes the old central cities as consisting of old factories, warehouses, small industrial complexes, and compact brick and wood residential areas. The newer

outlying areas are largely modern, high-rise apartment buildings and separate family dwellings. The study notes that populations and city complexes have expanded significantly while rural areas have decreased in size since 1945.²² Another recent study presents the following structural composition of a model of a typical modern city where American forces might be committed:²³

<u>Structural Type</u>	<u>Percentage</u>
Wood framed	13
Brick	37
Reinforced concrete	48
Steel frame	3

The percentage cited for each type is significant because steel and concrete buildings and brick or stone buildings are most suitable for defense. There is a definite trend in modern construction toward what the military considers the most defensible type of structure. Combined with the urbanization of Europe, this fact is of great importance in planning for military operations in the future. The following figures document the trend toward urbanization:²⁴

<u>Country</u>	<u>Population in Urban Areas (1973)</u>	<u>Population Increase (1962-72)</u>	<u>Population Increase, Selected Cities, 1962-72</u> ²⁵
West Germany	46%	9.2%	24.2%
Netherlands	46%	12.7%	64.5%
France	52%	9.8%	14.9%

Assumptions and Delimitations

The preceding paragraphs have presented the following factors, each of which contributes to the significance of the problem being

examined in this study:

1. There is a definite trend toward urban growth throughout the world, including underdeveloped nations.
2. This trend is particularly significant in Europe because it is one of the most likely areas for commitment of United States forces.
3. U.S. Army forces can expect to be involved in urban warfare in the future.
4. In combat involving cities, breaching walls has long been a major problem.
5. There may be a deficiency in wall-breaching capability in the infantry rifle company, the basic unit normally assigned to urban combat.

These factors suggest questions which must be addressed in order to determine whether the infantry rifle company needs an additional capability to breach walls. These questions are:

1. Does historical analysis support the contention that the ability to breach walls is significant in urban warfare? Chapter IV is an analysis of representative combat experiences in urban warfare since 1942.
2. Does current U.S. Army doctrine recognize or imply a need for a wall-breaching capability? Doctrine, ultimately derived from experience, is an important reinforcement of historical analysis in this study.
3. What wall-breaching capability does the infantry rifle company now have? The answer to this question, in conjunction with the answers to the first two, will establish whether there is a requirement for a wall-breaching capability in the infantry rifle company which current weapons and equipment do not satisfy.

Certain assumptions are reasonable and necessary in the conduct of a preliminary investigation of this nature. The following are assumed in this analysis:

1. Urban warfare is both possible and likely in the future.

The obvious possibility of continuing low-level conflicts in major population centers throughout the world and the pattern of conflict in the last two decades make this a reasonable assumption. Consider Hungary, 1956; the Dominican Republic, 1965; Czechoslovakia, 1968; and Saigon and Hue, 1968, to mention only a few of the areas experiencing urban warfare in recent years.

2. The analysis of requirements for urban warfare in Europe is more meaningful than an analysis focused on some other part of the world.

Europe presents one of the most difficult problems in urban warfare because of population density and structural characteristics. Further, current trends indicate that many other areas of the world are developing toward the type of environment found in Europe insofar as population density and structures are concerned.

3. Recent historical experience in urban warfare is a major factor to consider in arming contemporary forces. S. L. A. Marshall stated the necessity for such an assumption: "In looking at the problem of urban warfare in the future, there is no choice other than to guide on the past."²⁶

This study is deliberately limited in an attempt to present only key factors concerning the need for a wall-breaching capability. Undoubtedly, there are numerous oversights and oversimplifications. The following delimitations, which apply throughout the study, are observed in an attempt to minimize such shortcomings:

1. Only the infantry rifle company with its authorized Table of Organization and Equipment is considered. Historically, this is the type of force most often given the mission of fighting in the cities.

2. Only the need for a wall-breaching capability in units involved in assaulting positions in urban areas is considered. There are additional applications in other situations, but these possibilities will not be developed.

3. The detailed technical questions involved in developing a multi-purpose weapon or item of equipment which has a collateral capability to breach walls have been left to later, more comprehensive research. Beyond establishing need, the objective in this study is limited to identifying the characteristics desired in a wall-breaching device.

To avoid confusion, in this study the term built-up area is considered to include both urban areas and suburban areas. The term urban warfare, which will be used most often in the following discussion, refers to combat in built-up areas.

CHAPTER II

REVIEW OF RELATED LITERATURE

The purpose of this chapter is to identify literature which is related to the subject of combat in built-up areas in general and to the subject of wall breaching in particular. Information concerning these subjects is not organized and readily available. Research to obtain relevant data must range widely to gather sources of needed information. The following survey may be of assistance to others involved in similar research.

There appears to be a general reluctance in the U.S. Army to deal with the problems of urban warfare in depth. This can be attributed to a number of factors, all of which indicate that we should try to avoid urban warfare: the costs in time and casualties are high, the civilian population inevitably suffers great hardship, large numbers of refugees complicate operations, and there are major command and control problems inherent in the decentralized operations of urban warfare. This reluctance has resulted in less than adequate consideration of the problems. For anyone dealing with the subject, the first step in developing an understanding of the problems is to identify the sources of information available. In the case of urban warfare and the breaching of walls, literature can be organized under these headings: (1) integrative studies which present principles or synthesize research to produce conclusions or recommendations, (2) historical data which reveals actual experience that can be analyzed and evaluated for its

meaning and value to future operations, and (3) technical data which can be analyzed in the context of the characteristics of modern urban areas in order to judge the suitability of current weapons, munitions capabilities, and tactical concepts. The remainder of this chapter is devoted to summarizing the more significant literature in these three areas, most of which provides support for answers to the research questions cited in Chapter I.

Integrative Studies

Of prime importance to our military forces are the doctrinal statements of the U.S. Army, generally accepted to be the content of current field manuals. There are, in addition, various integrative studies, most of them recent, undertaken by specific agencies at the direction of the Department of Defense.

Doctrine concerning "combat in built-up areas," the term usually employed in U.S. Army literature, is found primarily in FM 31-50, Combat in Built-up and Fortified Areas. This manual is only sixty pages long, with thirty-four pages devoted to combat in built-up areas. The guidance provided is general in nature and does not come to grips with the staggering problem of fighting in built-up areas such as the Rhine-Ruhr and Rhine-Main complexes in the Federal Republic of Germany. The "preference" of the U.S. Army is clearly to avoid urban areas and choose nonurban combat. This preference has in turn been translated into an emphasis on the development of weapons and weapons systems best suited for employment in open country. The TOW and the DRAGON are obvious examples of this emphasis.

FM 31-50 notes the following considerations concerning urban areas:

1. Movement is restricted.
2. Buildings provide degrees of cover and concealment.
3. Fighting tends to be small-unit actions in both offense and defense due to problems of communication and control.
4. Operations will be decentralized, requiring emphasis on common doctrine and careful planning.
5. The control and evacuation of civilians will be a major consideration in planning and executing operations. All these points appear appropriate, but they need to be expanded and applied to the massive metropolitan complexes of today and the future.

Doctrinal material is also found in other field manuals, including FM 7-20, The Infantry Battalions; FM 7-30, The Infantry Brigades; FM 17-1, Armor Operations; FM 61-100, The Division; and FM 100-5, Operations of Army Forces in the Field. The seven pages in Armor Operations provide the most detailed discussion other than FM 31-50, despite the fact that the infantry rifle company is the basic unit committed in urban warfare. The other manuals cited devote approximately one-half page to the subject, and each manual presents essentially the same brief generalizations, none of which can be related to the problem of breaching walls. Additional manuals contain references to combat in built-up areas, but they simply repeat very briefly the same information noted here.

FM 31-50 deals with the subject of wall breaching in terms such as the following:

Streets and alleys invite movement but constitute readymade fire lanes and killing zones. For this reason, dismounted troops frequently are forced to breach walls, move through buildings, or move through open areas under cover of smoke or darkness.¹

Indeed, the field manual notes, "Often the best avenue of approach, in

terms of concealment and cover, is through existing buildings."²
"Streets, alleys, vacant lots, and other open areas offer the best fields of fire to the enemy and are avoided whenever possible."³ These observations clearly indicate that forces fighting in cities should have the capability to breach walls. The field manual also notes that recoilless rifles and anti-tank weapons "may be used to blast holes in walls and knock out enemy strongpoints. They are well adapted to combat in built-up areas because of their light weight, versatility, and penetrating power."⁴

Little additional guidance concerning wall breaching is to be found in FM 31-50, though there are definite implications which will be explored in Chapter V. The information available in U.S. Army field manuals, the source of officially recognized doctrine, is limited and out of date in some respects.

Combat in built-up areas has received increased attention in recent years, resulting in studies of greater depth than had been previously available. One such effort was undertaken at Fort Benning in 1972 in order to "validate and expand existing combat in cities doctrine for the promulgation of doctrinal changes applicable throughout the spectrum of urban warfare."⁵ The study group researched all known and available sources of information. Accordingly, the bibliography listed is useful in any further research effort. The Fort Benning study also recognizes the fact that urban warfare is a subject requiring immediate attention:

The rapid growth of urban areas makes it reasonably certain that combat in built-up areas will provide at least one facet of the future battlefield--a facet totally different in concept from the fast moving mechanized attack or the swift airmobile assault envisioned for the plains of Europe.

A very real specter emerges in considering combat in cities. Although many of the techniques developed during World War II and now being rediscovered are applicable to the lower end of the combat in cities spectrum, our objective will most assuredly change. Rather than the destruction of the enemy, our objective will be preservation [of the population and the urban area] Even as the nature of the conflict changes, the size of modern cities makes all the more real the possibility of winning Pyrrhic victories Current doctrine is at best a guide to combat in a country town. A 'dorf' is an obstacle; the modern conurbation is a new environment.⁶

The Combat in Cities Study addresses tactics, communications, NBC operations, and other areas in considerable detail. It also includes a lengthy section on training and a 196-page annex dealing with weapons effects and techniques of employment.

The Combat in Cities Study reports that "little actual testing or studies have been conducted with weapons employed against materials found in cities."⁷ The study also reveals a telling fact: "Most Army Materiel Command (AMC) research and testing agencies are interested in the problems but have no requirement to perform this type work."⁸ That this was the case in 1972, when plans were well under way to replace the 90-mm and the 106-mm recoilless rifles with the DRAGON and the TOW, reveals much about our concern with urban warfare almost up to the present. This is particularly disturbing when one finds that the Combat in Cities Study, produced at one of the important centers of U.S. Army doctrinal development, stated that "Current potential enemy avenues of approach into Central Europe dictate his having to conduct combat in cities."⁹ The study indicates a concern with the problem of wall breaching, but it devotes little discussion to the subject, generally indicating that additional demolitions training and specialized charges are the most reasonable answer. Though specific discussion of the problems of wall breaching is lacking, pertinent data and a

description of the environment of city combat are presented, providing information important to the ideas being examined in this thesis.

In 1972 Ketron, Incorporated, in Arlington, VA, was contracted to conduct a thorough study of firepower in urban warfare. This effort was the result of the increasing interest of the Department of Defense, as the Ketron study notes:

It was recognized several years ago that U.S. military doctrine and materiel (especially ground combat) remained largely based on the "field environment." Yet experience showed increasing frequency, complexity, and criticality of combat in urban, or built-up areas. Demographic, political, and military studies clearly emphasize this trend toward city fighting for future military operations. The Office of the Secretary of Defense (OSD) recognized this trend and the makeshift nature of the adaptation of field material and tactics to the urban environment.¹⁰

Among other studies, the Department of Defense initiated a major investigation of "Military Operations in Built-up Areas" (MOBA) in 1972. GTE Sylvania was contracted to perform the project coordination role with the following organizations providing specific contributory studies:

1. Ketron, Incorporated--firepower.
2. Calspan Corporation--mobility.
3. GTE Sylvania--surveillance and communications.
4. Batelle Columbus Laboratories--civil interaction.

These investigations produced a wealth of information and imaginative concepts that have yet to be adequately digested by developmental agencies. The bibliography provided in the Ketron report is as useful as any available, though it does not adequately cover sources of weapons effects data.

The product of the research headed by George Schecter of Ketron, Advanced Firepower Concepts for Military Operations in Built-up Areas, 28 September 1973, focuses on four areas:

1. Analysis of current firepower capabilities.
2. Interface with communication, surveillance, mobility, and civil interaction.
3. Development of new system candidates.
4. System recommendations.

The objective of the Ketron study was "to identify the needs and evaluate system alternatives for improved firepower capabilities"¹¹ in urban combat overseas. The methodology employed in the first volume of the two-volume report is that of historical analysis of past military operations in built-up areas ranging from Riga in 1917 to An Loc in 1972. The report contains only the results of the historical analysis and discussion of data. Wall breaching is addressed in the study, though not in great detail, and Ketron concludes that "current US weapons systems are not adequate for wall-breaching."¹² They recommend that special emphasis be placed on man-portable wall-breaching systems both for building entry and room-to-room movement.

Volume Two of the report presents Technical Problem Resumes which employ six specific urban warfare scenarios as analytical vehicles for firepower evaluation. The scenarios represent types of built-up areas in the following parts of the world: Western Europe, Eastern Europe, Central Africa, North Africa/Mideast, South America, and the Far East. Each of twenty-five situations in the various scenarios is analyzed for conclusions and recommendations concerning firepower. Firepower problem number twelve deals specifically with wall breaching.

The Ketron study provides interesting and useful information and provocative ideas, but it is only a starting point. Theoretical analysis must always be supported by actual testing and evaluation by

combat units. Considerable study and analysis is necessary before the subjects raised by the Ketron study can be translated into battlefield improvements.

The study that preceded the GTE coordinated investigation, to which Ketron was a contributor, was prepared by the Science and Technology Division of the Institute for Defense Analysis, an agency within the Department of Defense. The major portion of that study is classified (see Annex A, Promising Areas of Research and Development for Tactical Operations in an Overseas Urban Environment) but a supplement to the study titled Suggested Areas for Modification or Development of Vehicles and Equipment for Urban Military Operations Overseas is not. It discusses urban models against which equipment for use in such areas could be evaluated, some seventeen "levels of intensity of conflict" in which military forces may be involved, and specific areas in which there are requirements which suggest changes in current equipment. These areas include the following: road clearance and maintenance, locomotion, demolition, reconnaissance, sanitation, detection of underground passageways and utility lines, and surveillance by lighter-than-air craft.

In the realm of wall breaching, this study notes that "in many instances improved demolition systems would be desirable. Such instances range from the breaching of a stone, masonry, or concrete wall to the breaching of a low-density barricade. . . ."13 The study also concludes that "Barreled weapons specially designed for city fighting would be preferable to the conventional fieldpieces currently used for demolition in urban conflict."14

Another supplement to Promising Areas of Research and Development for Tactical Operations in an Overseas Urban Environment entitled Fighting in Cities Overseas provides historical data which is still classified. This document is certainly a useful one, and it suggests that our involvement in urban operations is likely to continue. In the future, however, the authors believe that U.S. Army forces will often be prohibited from using heavy fire support and will thus be restricted to infantry weapons. In Santo Domingo, for example, the 106mm recoilless rifle was the largest caliber weapon which could be employed.

The U.S. Army Advanced Materiel Concepts Agency presented a number of ideas for the development of materiel specifically designed for use in urban warfare in a report issued in 1968. The concepts included such innovative ideas as "area denying foams" and a "remote control expendable ground reconnaissance vehicle." Of particular interest to anyone concerned with the environment of urban combat are Appendix B to this report, "Analytical Approaches Used in the Study of Future Armed Urban Warfare," and Appendix D, "Extracts, Summary, and Discussion of the Nature of War in Urban Areas." They provide much general information and reveal the complexity of the problems encountered in city fighting. This document does not deal specifically with the problem of wall breaching.

S. L. A. Marshall's review of urban combat, Notes on Urban Warfare, which was referred to in the preceding chapter, is not a systematic study, but it provides a useful perspective on the subject. The author discusses city fighting in World War I and World War II, tracing its increasing frequency and importance. Perceptive and well founded as his comments on tactics are--and that is his principal

concern in his rather brief paper--his closing comment on the subject of wall breaching suggests that this is one area where the general might more specifically consider the world as it is today. He quotes General Scharnhorst of the eighteenth century: "In attacking a town, the infantryman should carry along an axe in case he may have to break down a door."¹⁵

The U.S. Army Concepts Analysis Agency provides a continuing review of matters which may be useful to Army planners in future force design. This review is accomplished through the Conceptual Design for the Army in the Field (CONAF) Study Reports. A particularly useful study concerning urban warfare was published in 1973, CONAF III Special Study Report: Built-up Area Conflict. This brief but highly informative and well researched classified study deals with urban warfare in the context of today's large metropolitan areas.

The manuals, studies, and documents noted are the major sources of integrative material found in this research effort. There are numerous other sources of information, such as military school instructional material and periodical literature, whose value and significance are a matter of judgment.

Historical Data

Historical data comes in various forms. Documents produced by military headquarters and agencies are the most valuable sources of evidence. Reports of actual combat experience by participants, those with first-hand knowledge of events, is most compelling. Such evidence is found in unit after-action reports and bulletins such as Battle Experiences, Tactical and Technical Trends, the Intelligence Bulletin--all forms of "lessons learned"--and other reports prepared by

Army units in World War II. Unit histories in some instances also provide information. Historical works and summaries provide some data, though seldom in the detail necessary to constitute firm evidence for a particular theory. Nonetheless, because authors such as Cornelius Ryan, author of The Last Battle (Berlin) and A Bridge Too Far (Operation Market-Garden, World War II), conducted many personal interviews with participants, such works provide some information available nowhere else. Periodical literature is quite often the product of individuals who fought the battle and provides valuable testimony, so this source of data must be carefully examined.

Unquestionably, this variety of information is difficult to collate meaningfully. Conclusive historical analysis requires extensive data among which key variables can be identified and quantified so that meaningful statistical patterns can be developed. Because combat in cities is decentralized in nature, ultimately dealing with small units or individuals, such data is not available despite the frequency of urban warfare experience throughout the world since 1939. This scarcity of specific data makes the feasibility of employing statistical analytic techniques questionable, but sufficient information can be found in available historical data to make military evaluation both possible and determinative.

Because Chapter IV is itself a detailed discussion of literature pertinent to the problem of wall breaching, the various sources of historical data will not be discussed in depth in this chapter. There is no question about the amount of experience amassed during World War II. S. L. A. Marshall claims that "every water-borne tactical unit in the Normandy attack had as its primary object, either

the capture of a village or town inland."¹⁶ On the Eastern front, as all who have a rudimentary knowledge of World War II know, some of the bitterest, most difficult fighting took place in built-up areas. It is claimed that in the early months of 1945, Soviet forces attacked more than 300 cities of various size.¹⁷ The great battles of Stalingrad and Berlin offer classic examples of urban warfare. Information from the Korean War about the seizure of Inchon and Seoul is not as complete as one would expect, and, surprisingly, the same is true of Vietnam, where Army and Marine experience in Saigon and Hue involved some intense city combat. Pertinent information is analyzed and evaluated in Chapter IV.

Technical Data

Technical data concerning weapons performance and weapons effects would seem to be a readily available source of data in view of the extensive test and evaluation procedures involved in weapons development and acquisition, but there is a definite paucity of information concerning weapons effects in wall breaching. Only very limited tests have been conducted specifically to determine the penetrative and destructive capability against structural materials found in modern cities of weapons organic or available to the infantry company. Information pertinent to the question of wall breaching is summarized in tables and discussed in Chapter V. This information is found in Army field manuals in some cases, such as that concerning demolitions in FM 5-34, Engineer Field Data. The Combat in Cities Study, Volume III, previously discussed, presents a compilation of unclassified data on infantry weapons available in 1972. Ketrion added information in its report titled Analysis of Munitions Effectiveness in Built-up Areas Overseas.

Various research reports from the Naval Research Laboratory, Picatinny Arsenal, and the Ballistics Research Laboratories provide data, and of course there is significant information in the engineering tests on the now-standard infantry weapons (for example, Engineering Test of XM47 (Dragon) Weapons Systems, 3 September 1972).

In order to evaluate the capabilities of U.S. Army weapons in urban warfare, one must recognize the characteristics of the modern cities in which and against which the weapons will be used. Most of the integrative studies previously cited provide some information concerning population and structural characteristics, and there are Corps of Engineer studies describing the major cities of Europe, though types of construction are not analyzed in most cases. These are usually referred to as City Information Packets or Urban Area Studies. Specific population figures can of course be found in various almanacs and publications such as the United Nations' Demographic Yearbook.

In summary, considerable data concerning urban warfare is available. An in-depth analysis of the historical data has not yet been made. Little has been done to categorize and identify available information. Urban warfare and specific subjects such as wall breaching remain a fertile field for military thought, and there can be no question that this tactical subject will become more and more important in the future.

CHAPTER III

METHODOLOGY

The purpose of this chapter is to present the concept of research in this paper so that the question of thoroughness in methodology can be clearly examined. The method of research in this thesis is straightforward and specific, but simplification is achieved only through selectivity, so it is necessary to ask if all aspects of the problem have been adequately explored.

The problem of wall breaching is prominent today because of the environment in which the U.S. Army must fight now and in the future. The problem requires consideration because two of the means of breaching walls available to the infantryman, the 106-mm recoilless rifle and the 90-mm recoilless rifle, are being replaced by weapons less suitable for that purpose. Such trends in weapons development appear to discount the requirement for a wall-breaching capability, so the need for such a weapon or system must first be established.

Experience coupled with rational analysis is the best guide for action in warfare, so one must turn to history to determine the probable requirements for the future, though the nature of urban warfare and the urban environment today limits how far into the past we can reach to find relevant experience. Large-scale urban warfare with modern weapons in densely populated and highly developed metropolitan areas largely began in World War II. Accordingly, prominent combat examples from World War II and later conflicts have been selected for analysis. The battles

analyzed in the next chapter represent a broad spectrum of experience in urban warfare. Choices are limited by the fact that in many of the urban battles of World War II and later, even some in which American forces were involved, information is simply not readily available in sufficient detail to support conclusions.

After establishing the requirement for a wall-breaching capability, the next logical step is to determine a feasible means of fulfilling the need. The historical analysis that establishes the need should also reveal the general characteristics desirable in a wall-breaching system. The parameters of the problem today can be further clarified by identifying the salient characteristics of a "modern city" and by identifying how the Army intends, according to present doctrine, to conduct operations in that environment. Both of these factors contribute to delineating the means necessary to fulfill the need for a wall-breaching system.

One must also examine the present capability of U.S. Army weapons and equipment. Do available means satisfy the needs identified? The answer to this question is somewhat obscured by the lack of test data concerning weapons effects against the structural materials found in modern cities, but each weapon or system with a wall-breaching capability must be carefully considered in order to reach valid conclusions. In areas where objective data is not available, rational evaluation must be used as the basis for analysis. While this may not be conclusive statistical evidence, it is often the best available.

The discussion of current capabilities must deal specifically with whether the weapons and equipment organic to the infantry company will make a hole in a wall large enough for a man to enter (about two

feet in diameter). This question must be answered through the analysis of technical data concerning weapons effects or at least by examining reports of actual experience in using the weapons and equipment. Of the means available, which can feasibly be employed in a combat situation?

Establishing the need for a wall-breaching capability and determining whether present weapons and equipment organic to the infantry rifle company are adequate constitute the primary objectives of this study, but it is also important to determine what specific operational capabilities are needed in infantry units and what possibilities exist for meeting that need. Current and future possibilities are examined in Chapters V and VI.

A straightforward, step-by-step method of analysis is the basis of the following chapters. Chapter IV presents extracts from records of urban warfare during and since World War II, up to the battle in Hue in 1968. Each battle is discussed in three subdivisions: first, the time, place, and the situation will be established; second, aspects relevant to the problem of wall breaching will be discussed; and, third, the experience of the forces involved will be evaluated to determine effective means of wall breaching employed or wall-breaching capabilities needed to accomplish specific missions. The first two subdivisions will present data; only the last will include analysis and evaluation of data.

Chapter V delineates the parameters of the problem being considered. The characteristics of an urban area are established in general terms in order to present a model that can be used to determine what wall-breaching weapons or equipment must be able to do. The U.S.

Army's tactical doctrine is analyzed to determine the way in which wall-breaching means will be employed and how frequently such a capability will be needed.

Analysis from Chapter IV and the beginning of Chapter V will be the basis of establishing the desirable characteristics of a wall-breaching system, against which the capabilities of current U.S. Army weapons and equipment can be compared. The data concerning capabilities constitutes the remainder of Chapter V. Chapter VI summarizes the information presented in the study and makes the comparisons upon which the conclusions are based.

CHAPTER IV

HISTORICAL ANALYSIS

The material presented in this chapter illustrates the role of wall breaching in urban warfare of the last forty years. The examples cited are not intended to be a catalog of urban warfare during the period considered; rather, the material presented is representative historical data which reveals how important wall breaching has been in major urban conflicts.

Much of the fighting in World War II took place in built-up areas; indeed, it has been claimed that such was the case in forty percent of all combat actions in Europe during the war.¹ Given the pattern of urbanization discussed in Chapter I, it appears certain that any future warfare in Europe will involve major actions in urban areas.

The following discussion focuses on combat in seven specific cities. Each case is divided into three sections: Section 1 describes the circumstances and the urban environment, Section 2 presents factual details pertaining to wall breaching, and Section 3 is a subjective evaluation of the significance of that data. General findings emerging from this historical analysis will be summarized in Chapter VI.

A. Stalingrad (1942)

1. In the summer of 1942, the armies of Nazi Germany drove deep into the Russian steppes. In that offensive, Stalingrad became the focal point of the assault by Army Group B. Colonel General Friedrich Paulus' elite Sixth Army rapidly seized much of the city. Stalingrad,

third industrial city of the USSR, stretched thirty miles along the west bank of the Volga, a city of modern factories and high-rise buildings housing half a million civilians.² It became a death trap for nearly 300,000 Germans when the Sixth Army was encircled and destroyed. From September, 1942, until 2 February, 1943, the largest urban battle in history raged bitterly. Stalingrad was totally destroyed under the fires of thousands of tanks and artillery pieces by December, but the struggle in the ruins continued until February.

One historian states that, "After Stalingrad, all modern military academies and special training schools could teach city fighting as they once had taught artillery placement and tank deployment."³ The intense, extended period of combat within the city provided a wealth of experience.

2. The totally unrestrained firepower directed by the Luftwaffe in thousands of missions and by the opposing armies rendered most structures piles of rubble or at best shells with empty, staring windows and gaping holes. In many instances, if a wall had to be breached, artillery or tanks were employed at extremely short ranges.

Fires were so effective that open spaces were avoided completely, and "To move on the streets or in the open across parks or squares meant instant death."⁴ General Vasili I. Chuikov, commander of the Soviet forces in Stalingrad, confirms this point:

It would be wrong to imagine that city fighting is the same as street fighting. When the enemy has established himself strongly in the city, it is houses, buildings, blocks that are being fought for. The fighting takes place . . . in rooms, in attics, in cellars, in ruins--and least of all in streets and squares.⁵

General Chuikov also contends that city combat is necessarily centered around small infantry units which make swift, violent attacks on

fortified houses and buildings.⁶ The capability to breach walls is essential in his view: "In order to be able to make breaches in walls, overcome obstacles and smoke the enemy out of strongpoints, small infantry groups had sappers and chemical warfare specialists attached to them."⁷ With equal stress, however, General Chuikov emphasizes the importance of combined arms operations, noting that, whenever possible, tanks operated together with the infantry and sappers.⁸

Progress through October was slow and costly, apparently too much so for the Fuhrer. In November, five specially trained engineer battalions were flown into the battle. Key objectives for the Germans, the Cannon Factory, the "Dispensary," and the "Red House," were strongly defended; and the Sixth Army decided they could be taken only by a frontal attack on the walls themselves, "which they breached with explosive charges and armour-piercing shells."⁹ The engineers took their objectives but were decimated in the process.

In the face of the unrelenting German assaults, the Russians adopted a highly aggressive defensive policy, one characterized by constant small attacks and counterattacks which kept the Germans off balance. General Chuikov contends that urban defense against a superior enemy must be "offensive-minded" if it is to be successful.¹⁰

The Germans' initial drive into the city carried them to a large U-shaped building near the river in the center sector. Captain Gerhard Maunch occupied the building with the remnants of his battalion and held it for over a week until Russians of the 13th Guards Division blew a hole in the cellar wall and attacked from below.¹¹

Sergeant Jacob Pavlov, a Russian soldier, had better fortune in holding a four-story house in the central part of the city. With

about sixty men,¹² he defended his position against repeated attacks from 20 October till 19 November, when the Russian counter-offensive began. Sergeant Pavlov placed mines around the building and covered foot approaches with interlocking fires. Tanks could not fire from a distance because of surrounding structures, and when they were close enough, the guns could not elevate enough to hit the top story, nor could they depress far enough to hit the basement. Antitank weapons in the basement and automatic weapons on the upper stories were a deadly combination. Pavlov's House was never taken.¹³

3. Hundreds of battles took place in Stalingrad between small groups of men, most of them unrecorded. The ones that are remarked upon by various participants were remarkable in some aspects, but appear to be fairly typical of the form of combat in the city. The opinions expressed by figures such as General Chuikov as well as various German analysts support the examples.

It seems clear that infantry units were the critical factor in Stalingrad. They needed all support available, but they were the central actors. Wall breaching was a necessity in their operations. It was most frequently accomplished by either demolitions or direct-fire weapons of tanks and artillery. Both tanks and artillery were limited by restrictions on mobility and by their vulnerability to enemy fire. Hundreds of German tanks were destroyed or damaged by infantry weapons at close quarters.

Russian artillery pieces were numerous in the latter stages of the battle--eight to twelve guns per mile with as many as 250 guns massed in three-fourths of a mile for preparatory files.¹⁴ Even with this density, however, not every squad or platoon that needed a wall

breached was supported by a direct-fire artillery piece. In any major battle, the U.S. Army, with far fewer artillery pieces, will not be able to provide full support.

In Stalingrad, the Germans and Russians both used artillery and tanks in direct fire primarily to destroy positions or to suppress defenders in order to allow attacking elements to gain access to buildings. Demolitions played the major role in wall breaching.

B. Ortona (1943)

1. Allied forces were struggling northward up the Italian peninsula in the winter of 1943. On the eastern coast, the First Division of the Canadian Army faced determined, well prepared Germans in the town of Ortona as Christmas approached. Ortona was built against a high cliff which jutted out to sea, presenting only one possible direction of approach. The Old Town consisted of tall, narrow houses looming over ancient, winding streets too narrow for tanks. The southern portion of the town, where the Germans established their main defenses, was newer, consisting of wider streets, numerous squares, and well built houses with adjoining walls. Most buildings were about four stories high.¹⁵

The Germans carefully positioned antitank guns to cover approaches suitable for tanks. Light machine guns, heavy machine guns, and snipers provided all-around defense.¹⁶ The Germans had constructed barriers and demolished selected buildings, spilling the rubble into the streets in an attempt to force the Canadians into "kill zones."¹⁷ Interlocking fires made the positions unapproachable on the streets.

2. The Canadian attack began on 21 December, 1944, against stiff opposition. Not until 27 December was the town cleared, largely

because of the procedures noted below:

The necessity for getting from a captured house to the next one forward without becoming exposed to enemy fire along the open street produced an improved method of 'mouse-holing'--the technique, taught in battle drill schools from 1942 on, of breaching a dividing wall with pick or crowbar. Unit pioneers set a 'Beehive' demolition charge in position against the wall on the top floor, and exploded it while the attacking section sheltered at ground level. Before the smoke and dust had subsided the infantry were up the stairs and through the gap to oust the enemy from the adjoining building. In this manner the Canadians cleared whole rows of houses without once appearing in the street¹⁸

3. Ortona is typical of smaller urban areas in Europe today.

The Canadian experience also applies in two ways to the large urban areas now growing so rapidly in Europe. First, it indicates the difficulty and time involved in securing a relatively small urban area. A large area would involve many weeks of urban warfare if it were strongly defended. Second, defense is enhanced by the patterned construction and long fields of fire along streets found in cities. To avoid channelization, an attacking force must rely on movement off the streets. As the Canadian experience in Ortona clearly shows, this involves the breaching of exterior and, particularly, interior walls. Their experience also demonstrates the feasibility of employing demolition charges to breach interior walls. It should be noted, however, that the Canadians found it necessary to use specialists ("unit pioneers") to emplace and detonate the charges.

C. Brest (1944)

1. A deep water port, Brest was being used as a German naval base threatening Allied sea lanes. General Middleton's VIII Corps was assigned the mission of securing the fortress city, which by August was three hundred miles behind the front lines. The Germans defended Brest with approximately 30,000 soldiers.¹⁹

Extensive defensive works had been constructed around the city, which was a formidable objective in itself. A series of massive French forts dating from the Franco-Prussian War supplemented the inner fortress built by Vauban.²⁰ Most of the civilian population of 80,000 had been evacuated.

A limited amount of artillery ammunition had been allocated for the operation. Priority understandably went to the rapidly advancing Third Army. Bad weather limited air support during August. Under these conditions, the assault began on 29 August. Progress was slow, and the city proper was not reached until troops of the Second Infantry Division advanced into the streets of Brest on 8 September. The house-to-house, street-to-street battle did not end until 18 September. The three assaulting divisions took nearly 10,000 casualties, and the combat, supported by intense bombing in September, resulted in a totally destroyed city.²¹

2. Reports concerning combat action in Brest are more detailed than in many other urban battles. With respect to wall breaching, Major General Walter M. Robertson, commander of the Second Infantry Division, made the following comment:

The term 'street fighting' is a misnomer, for the street was the one place we could not go. Streets were completely covered by pillboxes and rapid-fire 40mm guns, with each street corner swept by at least four pillboxes. Our procedure was to go from house to house blasting holes through the walls with satchel charges.²²

Streets were used as boundaries between units, contrary to common doctrine, because "Many felt that responsibility for the street was immaterial, since no one dared use it."²³

Advancing infantry gained entry to buildings by blowing a hole in a covered side and then advanced through entire blocks by blowing

holes and crawling through. This technique of movement, however, had its perils, too. "Pole and satchel charges generally were used but care was necessary in determining the amount of charge since it was difficult to estimate the thickness of the walls."²⁴ In some cases, entire buildings were collapsed through misjudgment in the use of explosives, thereby creating a major obstacle to further movement. The after-action report qualifies this negative note by adding, "Our men were not injured in these cases, because they would always be two or three buildings back at the time of the explosion."²⁵

Another report reiterated the point made by Major General Robertson:

Because the streets were so heavily defended, the buildings provided the routes of advance Ammunition and pioneer men were at a premium as advance was limited by the number of demolition teams available.²⁶

A common technique used was to blast holes during the night in initial objectives for the following day.²⁷ Tank destroyers and self-propelled 155mm guns were often used to blast walls of buildings.²⁸

3. One point is clear in reviewing U.S. Army experience in the streets of Brest: wall breaching was essential to the success of offensive operations in the city itself. The German defense in most cases precluded movement through the streets.

The mishaps which occurred, such as collapsing an entire building when simply trying to blow a hole in a wall, indicate the dangers inherent in having infantry soldiers employ explosives. When demolition specialists were not available, units employed charges prepared by the engineers if they could be obtained.

The statement that the advance was limited by the number of demolition teams available is particularly significant. In a protracted

battle in a large urban area today, such a restriction would greatly slow an offensive operation. The fact that the infantry would move two or three buildings away while attempting to blow a wall suggests they were quite cautious in the use of demolitions. The time lost operating in this fashion could be critical in most urban operations.

D. Manila (1945)

1. Greater Manila in 1945, with a civilian population of 1,100,000, covered almost 110 square miles, the city proper covering over 14 square miles. Shabby residential areas of light material, houses of frame and brick, centuries-old Spanish churches, and modern, reinforced concrete business buildings contributed to the wide variety of structures within the city. The government buildings in central Manila were massive, built to be earthquake proof.²⁹

In this setting, the Japanese placed 10,000 troops who had the mission of defending to the death. The force was heavily armed with a variety of automatic weapons, and they were prepared to fight:

The Japanese fortified building entrances with sandbags; they set up barricades along corridors and stairways; they chopped firing slits for rifles and machine guns through outside walls While the defenders constructed many bunkers and pillboxes throughout the city, they depended principally on the buildings³⁰

Against this force, XIV Corps of the U.S. Sixth Army sent the 1st Cavalry Division and the 37th Infantry Division. When the units reached the city on 3 February, they were under severe restrictions concerning the use of firepower. General MacArthur forbade air attacks and confined artillery support to observed fire on confirmed point targets.³¹ He hoped to spare the city and the civilian population. The restriction of artillery fire was lifted after the first few days because

of the high number of casualties incurred by the unsupported attacking units, and tanks and 4.2-inch mortars joined the conflict.

2. The fighting in the buildings of Manila was protracted and deadly. "Although XIV Corps placed heavy dependence upon artillery, tank, tank destroyer, mortar, and bazooka fire for all advances, cleaning out individual buildings fell to individual riflemen."³² In this effort, small units fought from building to building, attempting to secure them from the top down.

In many cases . . . the American troops found it necessary to chop or blow holes through walls and floors. Under such circumstances, hand grenades, flame throwers, and demolitions usually proved requisites to progress.³³

After-action reports note that explosives "were used freely" in room-to-room fighting within the buildings.³⁴ The reports further note:

Streets were used as boundaries and units advanced through the interior of the city blocks by means of alleys or breaches through the walls. Platoon leaders organized assault teams equipped with bazookas and demolitions³⁵

Tanks and artillery were prominent in the battle, but the cavalry division pointed out that tanks are "seriously exposed to short-range antitank weapons," that they should be used in a support role, and that "in all cases [tanks] must be protected by infantry."³⁶ Artillery was used extensively to destroy enemy positions, playing a major role because of the unusually strong, heavy construction in central Manila, but units reported that artillery close enough to fire point blank in the city was highly vulnerable to enemy small arms fire.³⁷ Some buildings had to be reduced to rubble, burying the defenders, before resistance could be overcome.

Despite such fire support, the last battle belonged to the infantry as they mopped up. In the fighting in the buildings, a common

technique used in gaining access to well-defended rooms involved cutting or blowing a hole in the ceiling of the room, through which grenades or a flamethrower could be directed.³⁸

3. The intense combat in Manila produced one stark result beyond victory: massive destruction. The city was a smoking shambles and nearly 100,000 civilians lost their lives.³⁹ Historically, desolation has proved inevitable in major urban warfare. An attempt to limit destruction in future operations seems quite likely nonetheless. Any such attempt will increase the burden on the infantry.

In Manila, foot soldiers performed well with the extensive support available, once restrictions on the use of firepower were lifted. Tanks, antitank guns, and self-propelled artillery operated with relative freedom, largely unopposed by tanks or significant numbers of antitank weapons. The availability of tanks and artillery assisted greatly in wall breaching. Nonetheless, when fighting inside the buildings, the infantry often used demolitions to gain access to barricaded Japanese positions. Breaching walls was significant in this battle.

After fighting through the city, one infantry lieutenant felt that American forces were inadequately prepared for that type of combat. He reported, "Various techniques for entering, search and 'mouse-holing' should be developed."⁴⁰ Though the official after-action report states the opposite, he and others felt doctrine was inadequate for this form of battle. The infantry soldiers had difficulty employing demolitions.

F. Jerusalem (1948)

1. In 1948 the ancient city of Jerusalem became a battleground for contending Arab and Jewish forces, each struggling for dominance

as the British relinquished control of Palestine. Jewish forces battled military elements of five Arab nations throughout Palestine, but the fighting in Jerusalem, Holy City for Arabs, Jews, and Christians alike, was particularly desperate.

The population of the city in 1948 was 170,000, a majority being Jewish.⁴¹ The Old City was described as,

A walled town, a citadel, some of the world's most holy places, a forest of stone cut by narrow winding streets and topped with domes, minarets, church steeples and the roofs of synagogues.⁴²

Photographs show that buildings were densely concentrated, most of them two or more stories high.

On 19 May, with the British gone, the Arab Legion, a highly trained, well disciplined unit, attacked into Jerusalem to relieve the unorganized groups of armed Arabs battling Jewish forces spearheaded by elements of the Palmach and Hagana, Jewish irregular military organizations. Elements of two regiments of the Arab Legion took part in the battle. These lightly armored units were designed to be highly mobile strike forces. The commander, General Sir John Glubb, moved into the crowded city with great reluctance.⁴³

2. The Arab Legion moved into the walled city on 19 May, but could not subdue Jewish opposition until 28 May. The fighting was difficult and costly:

Most of the time the fighting consisted of slow progress from house to house Sometimes explosives were laid against a dividing wall and detonated. The Arab Legion in those days was still armed with Piats (an abbreviation for Projectors, Infantry, Anti-tank). The original role of this weapon was to incapacitate a tank at short range, but it was equally effective against masonry, and for breaching walls from one room or house into another.⁴⁴

The Jewish version of the battle noted the use of demolitions by the Arabs, particularly bags of explosives slung by centrifugal force at

the end of a short rope.⁴⁵

3. Though trained and equipped for mobile warfare in open areas, the Arab Legion units employed in Jerusalem were adequately armed for combat in the city, except for a lack of artillery. They were well supplied with grenades and explosives, and they were armed with the Piat and many automatic weapons. This force proved to be too strong for the poorly armed Jews.

The Arab and Jewish versions of the battle, as told by the Arab commander and the Jewish Military Governor, differ considerably, each attributing numerical superiority to the other, each extolling the courage and resourcefulness of his own forces while castigating the murderous duplicity of the other, but they agree on the nature of the battle. It is clear that covered avenues were essential to movement, and that wall breaching was often necessary to create them. The Arabs used explosives, and sometimes found it necessary to throw the explosives to emplace them. This requirement made the Piat particularly useful because it could be used to breach walls from a distance.

F. Santo Domingo (1965)

1. At the request of the Provisional Government of the Dominican Republic, American forces were dispatched to Santo Domingo on 30 April 1965. Communist-influenced rebel forces held much of the city and threatened to topple the government. The stated mission of the initial elements deployed, the U.S. Army's Eighty-second Airborne Division, was to protect American lives and property, and to evacuate Americans and other foreign nationals. U.S. Army elements were later reinforced by other services and by the forces of other Latin American countries.⁴⁶

2. The mission of the forces in Santo Domingo was an extremely delicate one. They had to meet rebel forces in combat and yet preserve "peace" in the city, avoiding civilian loss of life and minimizing destruction. Policy limited the largest caliber weapon to the 106-mm recoilless rifle, and no mortars or artillery could be used.⁴⁷

Wall breaching was an important factor even in this limited action, as the following quotation reveals:

When attacking, the soldiers avoided the streets like the plague. The middle-of-the-block approach was the answer with the troops advancing over and through the buildings. Engineers were used to blow holes through walls of the buildings, or if the Engineers were unavailable, holes were made with a 3.5" rocket launcher, a LAW, or a 106mm recoilless rifle.⁴⁸

A lesson learned emphasized the idea of "creating" access to structures: "Beware of doors, windows, and holes in buildings made by the enemy. Make your own entranceways with Engineer assistance or with your own Infantry weapons."⁴⁹

3. The significant points in this historical example are (1) that in this type of operation, which is quite likely to occur again in some part of the world, restriction upon the use of tanks and artillery may be severe, and (2) that even when the enemy possesses only small arms, wall breaching is necessary to avoid casualties and to overcome a determined defender. Note that when engineers were not available, some means of wall breaching other than demolitions was sought.

G. Hue (1968)

1. Viet Cong and North Vietnamese Army forces attacked the ancient imperial capital of Vietnam at 0330, 31 January. The unforeseen assault was part of the Tet Offensive of 1968 that had such a tremendous impact on the American view of the war. Nearly fifty coordinated

attacks on cities and installations took place throughout South Vietnam. The massive walled Citadel in Hue was penetrated by elements of the division-size North Vietnamese force, and the U.S. Advisory Compound was under fire. For twenty-five days South Vietnamese units and U.S. Marines battled the determined enemy forces. On 24 February, 1968, the city was cleared in what was then the longest battle of the war in Vietnam.⁵⁰

2. Merciless house-to-house fighting characterized much of the battle. Counterattacking Marine forces reached the U.S. Advisory Compound, then spent five days moving four blocks west to the province hospital.⁵¹ In the intense fighting, key actions were often dominated by the U.S. Marines' 3.5-inch rocket launcher and the RPG series rocket launchers of the enemy.⁵²

Two U.S. Marine Corps battalion commanders⁵³ were interviewed as part of the Ketrion study. The following points were made emphatically by these two officers who fought in Hue:⁵⁴

1. The M-70 grenade launcher is not effective in the city for house-to-house fighting. The round has insufficient blast effect and the weapon is inaccurate. The Communist RPG-2 was much more effective.
2. The M-72 LAW did not achieve enough penetration in walls to be effective. M-72's were turned in and replaced with 3.5-inch rocket launchers.
3. The 3.5-inch rocket launcher was highly effective, so much so that the danger of backblast inside a room was accepted in order to use it.
4. Both officers stated the 106-mm recoilless rifle was effective against defended buildings. More were desired though the weapon was awkward to use in the city.
5. LTC Cheatham: "What I want for cities is a short range, heavy-punch weapon, light and small, to hit and breach a wall. Would prefer that to

a 106mm RR or 3.5" RL."⁵⁵

A company commander who participated in the battle made the following observation:

We found the 3.5 was invaluable, and in most cases, better than the LAAW. It packed a much greater punch which enabled us to breach the many stone walls of the city. We didn't have this success with the LAAW.⁵⁶

The intense combat in the city made it a shambles. Initial policy guidance precluded bombing and shelling, but this policy was abandoned as the battle progressed slowly with significant casualties.⁵⁷

3. These reports obviously cast doubt on the adequacy of the LAW in urban warfare. In actual use, the LAW apparently lacked penetrating capability and did not have enough explosive power. The 3.5-inch rocket launcher, on the other hand, was apparently well suited for use in the city except for the problem of backblast.

The M-70 grenade launcher (and this comment would apply to the M-203 attachment) did not add significantly to the firepower of the infantry company, let alone contribute to the capability to breach walls.

H. Urban Warfare Notes

The following material departs from the situation, data, and evaluation format used thus far in this chapter. It is a collection of references to wall breaching in urban warfare taken from reports, articles, and books which deal with the subject to some degree. In each lettered section, the first paragraph presents the historical observation, and the second paragraph is an evaluative comment relating the observation to the problem of wall breaching.

1. Frequency of Urban Warfare

a. Observation. The following is a statement from the Intelligence Bulletin, a monthly War Department publication in World War II:

Now that United Nations forces are fighting energetically on the soil of continental Europe, it must be expected that we shall engage the enemy in towns and cities with ever-increasing frequency.⁵⁸

b. Evaluation. This statement is an indication that the Military Intelligence Service, which made the statement, fully expected many of the battles on the continent of Europe to take place in urban areas, as in fact they did. It is not reasonable to expect that we can avoid urban warfare in the future.

2. Use of Prepared Charges

a. Observation. The British Army amassed considerable experience in urban warfare in World War II. In 1944, they were teaching their soldiers the importance of prepared charges in urban fighting. The British Army had found that demolitions figured prominently, particularly in penetrating walls that tanks and other vehicles could not reach. Prepared charges had proved quite useful in clearing passages from one building to another.⁵⁹

b. Evaluation. The British recognized the importance of having specially prepared charges available to minimize the time required to breach a wall and to insure that the demolition was done effectively. A packaged charge could be used by anyone, not just a demolitions specialist.

3. Wall Breaching

a. Observation. The Intelligence Bulletin reported that the British Army in World War II advocated attacking a building from the top down. Their experience in Italy, where most houses were

adjoining, indicated that once a house had been cleared, soldiers should "mousehole" their way into the next house on the top story. Such a tactic often required demolition packages.⁶⁰

b. Evaluation. This report parallels the experience of Canadian troops in Ortona. The process of moving through houses and buildings was apparently used by all forces participating in urban warfare, as the reports in this chapter indicate. While pick and axe may be adequate for breaching walls in some cases, the construction in most large European towns and cities today dictates the need for explosives or some equally effective weapon.

a. Observation.

(1) In 1951 General Niessel of France, after reviewing available information from World War II concerning urban warfare, made the following statement: "Explosives often were used to make passageways through walls and buildings in order to have better routes of approach."⁶¹

(2) After the abortive Warsaw uprising in 1945, the Germans analyzed their experience and circulated the results in "Notes for Panzer Troops." These reports took the form of identifying "wrong" actions and "right" actions. One such comparison noted that German troops mainly used streets—a wrong action. The corrective states that walls of adjoining houses are to be blasted and troops moved forward through the houses.⁶²

b. Evaluation. These two examples reinforce the point made previously concerning the importance and prevalence of wall breaching using demolitions in World War II.

a. Observation. The executive officer, G Company, 119th

Infantry Regiment, after fighting across France in 1944, reported the following:

A bazooka fired into the wall of a building makes a hole large enough for a man to enter. Using this system when fighting from house to house overcomes the necessity for inexperienced men to use dynamite charges.⁶³

b. Evaluation. This implies that difficulty was experienced in the use of explosives, arguing for special training, engineer assistance, or a demolition set specifically designed for wall breaching. A weapon system with an adequate wall-breaching capability would also solve the problem.

4. Use of Tanks

a. Observation. A report from the Soviet Army to the United States Military Intelligence Department concerning the use of tanks in built-up areas was noted in an issue of the Intelligence Bulletin in 1946:

The Soviets do not recommend that tanks be sent into the city, where movement is usually restricted and channelized, barricades and obstacles easily prepared, and every building becomes a potential strongpoint and direct-fire gun emplacement⁶⁴

b. Evaluation. In view of the extensive Soviet experience in urban warfare, from Stalingrad to Berlin, this opinion has great credibility. The reference here is to the use of tank formations, and it should be noted that Soviet forces did nonetheless use tanks extensively in combined arms operations in cities. The vulnerability of tanks parallels that of self-propelled artillery, and towed artillery is even more vulnerable when used in a direct-fire role in urban areas. The support capability of tanks and artillery is needed and must be used, in spite of these problems, but the restrictions imposed by the urban environment must be recognized. Tanks and artillery must be

protected by infantry well to the front and on the flanks, and tanks and artillery do not operate inside buildings.

CHAPTER V

PARAMETERS OF THE PROBLEM

This chapter delineates the major aspects of the problem of wall breaching as it stands today. The data discussed here are the basis for the findings presented in Chapter VI.

The characteristics of urban areas in Europe today were referred to in Chapter I, but for the purposes of this study it is helpful to establish a model of a typical urban area. Current capabilities can then be measured against such a model as well as evaluated on the basis of past experience.

Characteristics of U.S. Army weapons and equipment found in the infantry rifle company constitute current capabilities. This information is summarized in this chapter.

A discussion of U.S. Army doctrine is significant in that it becomes clear that the Army does expect to be able to breach walls when involved in urban warfare.

Historical experience, the urban model, and the requirements of U.S. Army doctrine provide a basis for identifying the nature of the wall-breaching system needed to effectively conduct urban warfare.

Characteristics of Urban Areas

The general characteristics of warfare in urban areas are widely recognized:

1. Movement is restricted and canalized, particularly for vehicles.

2. Observation and fields of fire are severely limited.
3. It is difficult to locate enemy positions and the origin of enemy fire.
4. Communication is restricted.
5. Command and control are quite difficult, leading to isolated engagements between platoon and smaller elements.
6. Engagements take place at very close ranges, the majority at 50 meters or a lesser distance.

Some sources say most engagements take place at less than 30 meters.¹ The Ketron study noted that only 5% of urban combat engagements take place at less than 35 meters.²

These general characteristics of urban warfare are specifically defined by the actual urban environment in which combat takes place. Recent studies (Ketron, GTE Sylvania, CONAF III) have determined that there has been a significant increase in the use of reinforced concrete in urban construction since World War II. Where wood was customarily used in the past, concrete and steel are used today.

Urban areas are as unique as human beings, each being different from all others in some aspects. The terrain of the area in which the city is located may vary from flat to mountainous, from a coastal area to an inland plateau. Some large urban areas will have extensive underground systems such as subways and sewers. The density and height of construction varies widely. Notwithstanding these differences, cities in Europe generally have some common characteristics. These can be structured into a model which is useful in considering wall breaching.

The various integrative studies referred to in Chapter II generally agree on the following urban model for modern Europe. In most

cities there is an older, inner area where construction is largely wood and masonry. Row housing of several stories is the most common type of structure. Business and small industry structures are mixed with the residential structures. Streets are winding and relatively narrow, often too narrow for tanks and other combat vehicles. Population is dense throughout. The older core area is dominated by encircling industrial and residential areas that are much more modern, largely postwar construction. Streets are wider and laid out in a pattern. Many residential areas are high-rise, and most buildings are spaced some distance apart. Steel frame and reinforced concrete are the predominant building materials in business and industrial structures.

In an urban area such as the one just described, what wall thickness must be breached? Investigation by the Army Materiel Command into wall breaching and anti-bunker munitions has established a standard that has been applied in various research projects and ordnance testing. The breach required is a hole two feet in diameter in a brick and masonry wall eight inches thick backed by four feet of sandbags.³ This is the standard for measuring wall-breaching capability which will be applied in the environment of the urban model just presented.

Urban Combat Doctrine

The U.S. Army Infantry School contends, "Tactical doctrine expressed in current official publications for battalion, brigade, and higher is basically sound but too vague to be of substantial value."⁴ The basic source for U.S. Army doctrine, FM 31-50, is considered lacking in necessary detail and somewhat out of context with respect to the vast metropolitan development in many areas of Europe

today. Paragraph 67 (p. 39) states that large built-up areas should be cleared block by block. Such a process in a large metropolitan area in Europe today could take months if determined enemy resistance were encountered. In addition, no distinction is made between the tactics and techniques appropriate in an area of high-rise, reinforced concrete and glass office buildings and those appropriate in a residential area of one- and two-story homes. It is difficult to accept that the tactics and techniques should be the same in both areas. Other considerations, such as the tailoring of forces and below-ground operations, also need more attention. Be that as it may, the point of concern here is whether current U.S. Army doctrine for urban warfare states or implies a requirement for a wall-breaching capability.

FM 31-50 notes that recoilless rifles and antitank weapons "provide antitank protection and may be used to blast holes in walls"5 Such weapons are described as particularly useful because of their "light weight, versatility, and penetrating power."⁶ Since the U.S. Army no longer employs recoilless rifles in the infantry company, this emphasis must now be placed solely on antitank weapons. The same paragraph also states that antitank guided missiles can be used to blast holes in very thick walls. The field manual deals with methods of entry and techniques of movement, stating as doctrine that buildings should be cleared from the top down when possible, but if ground level entry is required, "it is preferable to use demolitions, artillery, tank fire, or other weapons to blast a new entrance."⁷ Only demolitions and "other weapons" are consistently available to infantry elements.

It is clear that the field manual does assume the capability to breach walls. The following passage confirms this point:

At times it may be desirable or necessary to create openings in walls to permit movement from one room or building to another. 'Mouseholing,' or creating these openings, can be done with hand-tools, explosives, or weapons.⁸

The danger of open areas so often emphasized in the historical material in Chapter IV is repeated in FM 31-50: "Streets, alleys, vacant lots, and other open areas offer the best fields of fire to the enemy and are avoided whenever possible."⁹ The most obvious means of avoiding such open areas is to move along covered routes, primarily through buildings. Such movement requires the capability to breach walls.

Current Wall Breaching Capability

TOE 7-45H for the infantry battalion (mechanized) shows that the combat elements are armed with the following weapons:

Launcher grenade M203 for M16 rifle
 Launcher tubular guided missile (TOW) M220A1
 DRAGON M47 (tracker)
 Machinegun cal .50
 Machinegun cal 7.62-mm
 Mortar 4.2-inch
 Mortar 81-mm
 Rifle 5.56-mm
 Submachinegun cal .45
 Pistol cal .45

The pistol, rifle, and machineguns obviously have no significant penetrating capability in terms of wall breaching. The 4.2-inch and 81-mm mortars are indirect fire weapons almost totally ineffective against specifically targeted vertical surfaces when employed in any practical firing mode. The M203 40-mm armor-piercing round will penetrate only light armor and creates a very small hole (1/2 inch or less). The only weapons remaining are the TOW and the DRAGON, though the infantry also has available the M72 LAW, technically a munition. These weapons have penetrating capabilities in excess of the data noted below:¹⁰

<u>WEAPON</u>	<u>EARTH</u>	<u>REINFORCED CONCRETE</u>	<u>STEEL</u>	<u>ARMING DISTANCE</u>
M72A2 ¹¹	6 ft	2 ft	8 in	49.21 ft.
DRAGON ¹²	8 ft	4 ft	12 in	213.25 ft
TOW ¹²	8 ft	4 ft	16 in	213.25 ft
90-mm (HEAT) ¹³	3.5 ft	2.5 ft	10 in	35-50 ft
106-mm (HEAT) ¹⁴	3 ft	2 ft	12 in	14-18 ft

The data concerning the LAW appears promising, but the object in wall breaching is to create a hole through which men can pass--one at least two feet in diameter. A test was conducted at Picatinny Arsenal in 1972 to determine the wall-breaching capability of several weapons, including the M72A2. Using the two-foot diameter circle as a criterion for adequacy and an eight-inch-thick brick wall backed by four feet of sandbags as the target to be penetrated, the test engineers concluded that the LAW "will not produce the desired 2-foot-minimum diameter hole in the fortified brick masonry target."¹⁵ The 66-mm M72A2 LAW warhead (M18A1) weighs only 1.5 pounds, of which 0.67 pounds is 70/30 Octol explosive. This antitank round simply has insufficient explosive power. Five consecutive rounds fired at the same spot on the target at zero degrees obliquity in the Picatinny Arsenal test produced a hole on the inside of the target wall only fifteen inches in diameter.¹⁶ When five rounds were fired at angles to the target wall rather than at zero degrees obliquity, a larger hole was obtained, but sandbag movement was not sufficient to allow entry.

The test results noted here reinforce comments made by U.S. Marine officers in Hue concerning the ineffectiveness of the LAW in a wall-breaching role. Current development of the Improved LAW is intended to increase the range of the LAW and produce a higher muzzle

velocity.¹⁷ Neither characteristic will significantly improve the effectiveness of the LAW in urban warfare.

One other available weapon which should be noted is the M202 multi-shot portable flame weapon system. It is a shoulder-fired, four-shot launcher weighing eleven and a half pounds. Ammunition is supplied in rocket clips preloaded with four rockets which can be fired simultaneously or semiautomatically at a rate of one per second. Two types of rockets are available for the launcher; the M74 incendiary rocket and the M96 CS2 rocket. The weapon has a maximum range of 750 meters, and a maximum effective range of 200 meters against point targets. Unfortunately, the weapon has negligible penetrative effect against a concrete target,¹⁸ so it appears to be of little value in wall breaching.¹⁹

The TOW is clearly intended for use in open terrain. A thirteen-power optical sight is standard for the weapon. The TOW is most effective at ranges beyond 1,000 meters. Mounted on the M151 1/4-ton truck or the Mule, the TOW system has no protection against small arms fire. Mounted on the M113A1, the TOW has only limited protection and its mobility in urban warfare is restricted, as is the case with all large combat vehicles. Including the TOW missile, the dismounted TOW system weighs 227 pounds, rather heavy for back-packing and rapid displacement, though it does break down into four components roughly equal in weight. Most significantly, while the arming distance is 65 meters, a severely limiting factor in itself in urban warfare, the range at which a gunner can effectively acquire a target is significantly greater because of the delayed activation of the flight rocket and the wire guidance system. The TOW is also limited by the requirement for

three-foot clearance along the flight path, necessary if the wire-guided missile is to function properly.

The same limitations apply to the DRAGON, making both weapons generally impractical for use in urban warfare within cities except in unusual circumstances. Rather than being a standard weapon for U.S. Army forces involved in urban warfare, the TOW and DRAGON are in effect special purpose weapons for situations that do not recur frequently. Only in the defense of approaches to the city will these weapons be important. A further consideration is the expense of these sophisticated missile systems. It hardly seems cost effective to use large numbers of electronic guided missiles costing several thousand dollars each to blow holes in walls. Experience is the basis of the statement in FM 31-50 that warns of increased ammunition expenditure in urban warfare. If this generalization were to apply to the TOW, which has an unusually large bulk-to-weight ratio (7 cubic feet, 83 pounds per round, shipping configuration), ammunition resupply would indeed be a problem.

The preceding analysis of organic capability leaves only one alternative for today's infantryman--the use of explosives, long a standard means of breaching walls. Standard U.S. Army demolitions are available to infantry units. These include 1/4-, 1/2-, and 1-pound blocks of TNT, 1 1/4-pound (M112) and 2 1/2-pound (M5A1) blocks of Flex-ex (M118 sheet explosive). Also available are standard shaped charges (15-pound M2A3 and 40-pound M3A1) and the 43-pound ammonium nitrate demolition charge.

The most obvious method of blasting a hole in a wall is to place a charge at the foot of the wall without tamping. If one assumes outside walls of buildings to be two feet or less in thickness, the problem

is not too difficult, though the size and shape of the charge, the placement, and the tamping all combine to determine the effect of the blast. The most common solution is to use excessive amounts of explosive.

Interior walls require more precision. Too large a charge may collapse the floor or even the building, creating a major obstacle to movement. FM 5-34, Engineer Field Data, presents this breaching formula: $P=R^3KC$, where P=pounds of TNT required, R=breaching radius, K=material factor, and C=tamping factor. Thus, to breach an estimated 12-inch thick concrete wall (no reinforcing), the calculation is as follows:¹⁹

$$P = \underset{(R^3)}{1^3} \times \underset{(K)}{1.14} \times \underset{(C)}{3.6} = 4.104 \text{ (lbs. of TNT)}$$

Values of K and C are found in appropriate tables in FM 5-34. Pounds of TNT can be converted to pounds of other types of explosive, the conversion factors also being found in a table in FM 5-34. The field manual also notes that the minimum safe distance from the explosion in this case is 900 feet for personnel in the open, 300 feet for personnel in a missile-proof shelter.²⁰

The point of this discussion is that individual infantrymen not trained in the use of explosives may find the proper use of various types of demolitions difficult.

Though shaped charges are relatively easy to use, they make small holes. The 40-pound shaped charge can penetrate 60 inches of reinforced concrete, but it creates a hole which averages only 3 1/2 inches in diameter.²¹

The U.S. Army does have two charges specifically designed for breaching, the M183 and M37 "satchel charges." The M37 was replaced by

the M183 but is still used as a substitute for the newer configuration. The M183 demolition charge assembly is intended for use in the demolition of large structures and the breaching of obstacles such as dragon's teeth. It consists of sixteen M112 demolition blocks and four priming assemblies packed in a canvas carrying case (M85). The twenty pounds of explosive can be detonated by using the priming assembly with electrical or non-electrical blasting caps, or by using detonating cord ring main. The M37, also composition C-4, has four M5A1 demolition blocks packed in each of two bags that are placed inside the M85 canvas case. The charge assembly is detonated in the same manner as the M183.²²

Each of these assemblies weighs over twenty pounds, and they obviously are very powerful charges. Used in the least efficient form of charge placement, this charge will breach nearly three feet of concrete, according to data in FM 5-34. Both the weight and the effect of the satchel charges are excessive for the standard breaching requirement established by the Army Materiel Command.

Available information supports the conclusion presented in the Infantry School's Combat in Cities Study:

Current military explosives will accomplish breaching mission [sic] ; however, an explosive device is needed that can be easily attached to a wall to avoid 'Rube Goldberg' or 'dangerous field expedient' devices.²³

Desirable Characteristics for a Wall-Breaching System

Historical experience establishes the requirement for the capability to breach walls in urban warfare. The requirement to breach walls has most often been satisfied by the use of demolitions or direct fire from a weapon such as an artillery piece or a tank. The cases analyzed in Chapter IV indicate that many situations arise in which

the infantryman cannot depend on tanks or direct fire artillery, thus establishing the need for a capability immediately available.

Analysis of the difficulties in command, control, and communications in urban warfare makes centralized, on-call systems such as the combat engineer vehicle (CEV), which has a highly effective 165-mm demolition gun capable of penetrating seven feet of concrete,²⁴ impractical as solutions to the problem. Besides the time factor involved in requesting and receiving such assistance, the CEV and other tracked vehicles are dangerously vulnerable in built-up areas, and there are simply not enough available. There are only eight CEV's in the infantry division.²⁵

U.S. Army doctrine requires the capability to breach walls in "combat in built-up areas." If assault units are to perform in accordance with the doctrinal guidance provided in FM 31-50, they must be capable of breaching interior and exterior walls.

The desirable characteristics of a wall-breaching system, based upon the discussion presented in this study, include the following:

1. Available to small units.

As indicated, this feature must be satisfied by having an organic capability.

2. Man-portable.

Historical experience clearly shows that wall-breaching means are often needed inside buildings or in other areas inaccessible to vehicles.

3. Rapidly employable.

Preparation beyond a few minutes will seriously slow the advance of the elements attacking through buildings.

4. Suitable for employment in confined areas.

5. Capable of blasting holes two feet in diameter in selected types of walls.

The Army Materiel Command requirement is specific: eight inches of brick and masonry backed by four feet of sandbags.

6. Effective at ranges up to the expected range of engagement by small arms--fifty meters.

This will provide a capability to breach walls covered by enemy fire, and such a stand-off capability will allow the breaching of building walls across streets and most other open areas found in cities.

CHAPTER VI

FINDINGS AND CONCLUSIONS

The object of the analysis in this study is to determine whether the infantry rifle company has an adequate capability to breach walls in urban warfare. The material presented in the preceding chapters makes it possible to provide answers to the three questions asked in Chapter I.

1. Does historical analysis support the contention that wall-breaching capabilities are significant in urban warfare?
2. Does current U.S. Army doctrine recognize or imply a need for a wall-breaching capability?
3. What wall-breaching capability does the infantry rifle company now have?

In addition, this final chapter will examine currently available technology that applies to the task of wall breaching. Also included are possible future developments that appear feasible. Recommendations based on this investigation conclude the study.

Findings

The requirement for a wall-breaching capability at the small-unit level cannot be taken for granted. Obviously, if the need were generally accepted by the agencies responsible for determining what weapons and equipment are required by infantry units, considerable attention and effort would already have been devoted to providing such items. This has not been the case. The analysis of historical

experience indicates that the failure to develop such items overlooks established facts. This conclusion is supported by other similar efforts, such as those referred to in the review of related literature in Chapter II. Moreover, it is not contradicted by any study reviewed during the research for this paper. These factors provide an answer to the first question asked in Chapter I:

1. Analysis of historical experience in urban warfare during and since World War II indicates that infantry units should have the capability to breach exterior and interior building walls.

The significance of this finding is based upon two conclusions only partially established in this study:

a. The nature of current conflict environments throughout the world and the definite worldwide trend toward urbanization make U.S. Army participation in urban warfare in the future highly probable.

b. Historical experience since World War II indicates that the infantry is the type of unit most likely to be committed in urban warfare.

The answer to the second question in Chapter I is clearly established by a review of doctrinal material such as FM 31-50.

2. The capability to breach walls in the conduct of urban warfare is required in order to employ U.S. Army doctrine concerning "combat in built-up areas."

The third question posed in Chapter I asked what breaching capability the infantry rifle company now has. The brief discussion of weapons and equipment in Chapter V showed that, in fact, we have a lesser capability today than in World War II or Korea, primarily because of the loss of recoilless weapons. The 3.5-inch rocket launcher was

more effective for wall-breaching purposes than the LAW now found in infantry units.¹ The LAW is inadequate for efficient wall breaching, and the new antitank weapons, the TOW and the DRAGON, are specialized antiarmor weapons generally inappropriate for the purpose of wall breaching.

The only effective means of wall breaching available within the infantry company is the use of demolitions. Unquestionably, they have improved since World War II insofar as explosive characteristics are concerned, but the problems that made demolitions a marginally satisfactory solution in World War II remain. There is no demolition charge specifically designed for the purpose of breaching building walls in urban warfare to allow entry or exit for the maneuver of ground forces. Individual infantrymen must assume the task of preparing and emplacing demolition charges unless engineer assistance is available. The number of combat engineers available was not sufficient in most cases in World War II. Today, engineer support is, at best, no more readily available than in the past. The trend in force development is toward a general reduction of all combat support elements. The dangers of "jerry-rigged" demolitions and the use of demolitions by untrained soldiers remains a significant shortcoming. These facts are the basis for the answer to the third question:

3. The infantry rifle company does not have an adequate wall-breaching capability for use in urban warfare.

Currently Available Technology

U.S. Army demolitions are highly effective for many of the tasks in which they are employed, but the Army does not have a specialized controlled-charge explosive that is designed for use in wall

breaching. Such an explosive, however, is readily available within the realm of current technology. A prime example was noted in a front-page article in The Wall Street Journal in early 1975 which discussed new fire-fighting techniques:

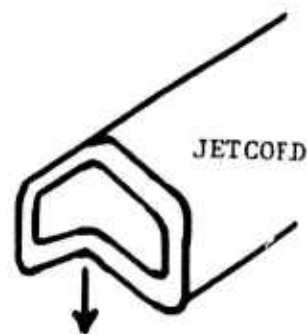
Crestwood, Mo., fire chief William J. Kramer credits Jet-Axe, an explosive developed by a subsidiary of OEA Inc., with curtailing the spread of a shopping-center blaze in neighboring Warson Woods not long ago. Fire fighters blasted through a four-inch-thick concrete-and-steel floor in seconds and headed off the rapidly spreading flames.²

Jet-Axe was developed by Explosive Technology, a firm in Fairfield, California. The technology applied in producing their products was developed in the aerospace program where the firm provided precision cutting, separation, and ejection capabilities with specially designed controlled explosives. Jet-Axe is a commercial product whose purpose is forcible entry and ventilation.³

Explosive Technology (ET) claims that the Jet-Axe packaged charge can be readied, positioned, and fired in forty-five seconds or less. It is marketed at present in five models, each tailored to provide a different cut configuration, and each tailored for a particular application. The JA-I, for example, is designed for use against steel roll-up doors. It cuts a square hole twenty-four inches on a side. Of particular interest is the JA-IV, which cuts a round hole in reinforced concrete or masonry walls up to eight inches thick. Capabilities of the Jet-Axe models are summarized in the following table:⁴

<u>MODEL</u>	<u>WT(lbs.)</u>	<u>CUT PROFILE</u>	<u>APPLICATION</u>
JA-I	18.75	square, 24"	steel roll-up doors
JA-II	8.5	round, 12" dia.	metal-clad doors
JA-III	27.0	rectangle, 24"x	wooden wall or roof
JA-IV	25.5	round, 17" dia.	reinforced concrete
JA-V	11.0	round, 10" dia.	steel (to 5/8")

The commercially available Jet-Axe is limited in size by federal specifications. The point of interest is the principle employed in the explosive design used in the Jet-Axe. ET has named the explosive Jetcord. It is a metal-clad, flexible, linear shaped charge whose end cross section is the shape of an inverted "V" or chevron. The open end of the chevron is placed toward the material to be penetrated. When the charge is detonated, a phenomenon known as the Munroe Effect occurs. The interaction of the detonation products and the metal cavity liner produces a jet of gases under pressures of several million pounds per square inch. Within a millionth of a second, shock waves cause a cutting jet of extreme pressure concentration along the plane of convergence bisecting the angle of the "V". The cutting action is extremely effective.⁵



The significant point of the figures provided in the table concerning Jet-Axe models is that the largest uses a relatively small type of Jetcord having a coreload of 500 grains of explosive per foot. Jetcord is available having as much as 4,000 grains per foot. The cross section dimensions of this much more powerful explosive charge are only 1.36 inches high by 1.63 inches wide. Military applications would probably involve somewhat larger pre-packaged Jetcord arrangements than those found in the federally limited, commercial Jet-Axe models.

The linear shaped charge appears to be a readily available, proven means of wall-breaching. The explosive can be tailored in pre-packaged form for specific purposes, depending on the type of buildings found in an area or on the specific wall to be breached. An efficient

and effective means of breaching walls with demolitions is certainly within the capability of current technology.

Another area of currently available technology which applies to wall breaching is that of chemical torches. Two examples of these were tested by government agencies recently.

The U.S. Army Land Warfare Laboratory evaluated the UTCTM Rocket Torch in 1973. It is a portable cutting torch employed with one hand. A 17.5-inch cylinder 2.5 inches in diameter, mounted on a pistol grip handle, contains a replaceable solid cartridge made up of two sections. One section is plexiglass fuel, and the other is a substance that produces oxygen-rich gas when burned. The torch weighs only 6.75 pounds, and each cartridge will provide a cutting flame for 2.5 minutes. In that time, the torch can cut 30 inches of 1/4-inch steel plate. Unfortunately, the Rocket Torch will not cut concrete or masonry.⁶

The Modern Army Selected Systems, Test, Evaluation, and Review organization at Ft. Hood, Texas, tested another promising device in 1974 called the "miniature thermal bar torch" (MTBT). The following excerpt from the MASSTER report on that test describes the system:

The MTBT is made of low-carbon steel tube housing and has an outside diameter (OD) of either 5/8 or 5/16 inch. The full length of the tube is packed with a quantity of low-carbon steel rods and one aluminum-magnesium alloy rod. . . . The thermal bar is ignited and consumes itself as it cuts or penetrates the target material. The basic MTBT system consists of an oxygen cylinder (any size), a regulator output valve, an oxygen supply hose, an on-off valve, an extension-handle holder, extension handles and couplings, thermal bars, and igniters. The MTBT is designed to concentrate a flame of very high temperature (6,000° Fahrenheit) on one spot to rapidly cut or burn through most known materials.⁷

The steel tubes used as fuel are about ten feet long, but they can be cut to any desired length. The MTBT can be operated by one man, works underwater, and will cut almost eight times as fast as an oxacetylene

torch.⁸ In the tests at Ft. Hood, the MTBT was effective in cutting metals and concrete. It can rapidly melt, cut, or burn almost any thickness, "approaching laser beam burning capabilities."⁹ The weight of the system varies from thirty to sixty pounds, depending on the amount of oxygen carried.¹⁰

The major drawbacks of the MTBT system are the size (three cubic feet) and the time required to cut a hole in a thick wall. A six-inch concrete wall can be penetrated in about one minute, producing a hole about two inches in diameter, but several holes must be made, and then the material between the holes must be cut. This makes the task of creating a two-foot diameter hole undesirably time-consuming if the wall is thick. To cut such a hole in an eight-inch reinforced concrete wall would take nearly half an hour.¹¹

In summary, the chemical torches available offer definite promise of future application in wall breaching, and they will certainly be valuable tools in a variety of other military applications, but they have characteristics which severely limit their usefulness at the present time as a means of breaching a building wall in combat.

There appear to be means available which could partially satisfy the need for a wall-breaching capability in infantry units. Several special plastic high explosive (HEP) rounds were produced at Picatinny Arsenal in 1971. Three were shortened rounds, 66-mm, and the others were standard-sized rounds for the LAW. The standard rockets were fabricated from components found in the 66-mm M72A2 rocket and the M74 incendiary rocket. The warhead, a slightly modified M235 incendiary warhead casing assembly, was loaded with 3.3 pounds of cast HTA-3 high explosive. The warhead weighed 4.2 pounds. The total weight of the

rocket was 4.9 pounds. The report on the subsequent tests emphasized that the component design was not considered optimum. The purpose was to demonstrate quickly the feasibility of such a concept in breaching brick masonry targets. The shortened HEP rocket was even less satisfactory from a design aspect, for a cylindrical section was simply cut from the warhead, shortening the warhead case from 11.75 inches to 7.25 inches.¹²

In testing, two shortened rockets fired at a range of 48 feet produced a 34-inch diameter hole in an 8-inch brick and masonry wall. Two standard HEP rockets, also fired at a range of 48 feet, zero degrees obliquity, demolished a 4-foot-square brick wall. Three rounds fired at a 10-foot-square target produced a hole 6 feet by 4 feet.¹³ The test indicated brick and steel fragments would be a potential danger to an unprotected firer less than 100 feet from the target.

The results of this test are particularly significant in view of the fact that the shortened rounds were fabricated from the M54 rocket motor and the M235 incendiary warhead. The M54 rocket motor is common to the M72A2 LAW and the M74 incendiary rocket, and the M235 incendiary warhead is used in the M74 rocket for the M202 rocket launcher. An obvious possibility with wall-breaching potential is a third round for the M202 rocket launcher, a HEP round to join the M74 incendiary rocket and the M96 CS2 rocket (noted in Chapter V). The multi-shot portable rocket launcher appears particularly appropriate because of the need for two or three rockets to breach a thick wall. Further, the M202 launcher requires only five meters clearance to the rear of the weapon when firing.

The Picatinny tests, using far from optimally designed warheads, demonstrate that the technology to construct an effective stand-off weapon for use in wall breaching is readily available. Such a munition could be short, lightweight, and man-portable, similar to the M72A2 LAW, or it could be a new round for the M202 rocket launcher. It could be designed with a low muzzle velocity and minimal backblast for use at the reduced ranges of urban warfare. A HEP rocket similar to the M72A2 antitank weapon would not be a replacement for the M72A2 now in use, but it is worthy of consideration as a supplementary munition for use against buildings and fortified positions.

Future Development

If present trends continue, the U.S. Army will probably be faced with the requirement to prepare for urban warfare, however undesirable that type of conflict may be. In that case, a topic which should receive much more attention than it does now is the problem of wall breaching. The Ketron study, after concluding that the need for "significantly improved wall-breaching capability warrants high priority," recommends that primary emphasis be placed on "man-portable wall breaching systems both for building entry and room-to-room movement."¹⁴

Other reports have suggested more specific lines of development. Herbert L. Goda described a vehicle-mounted telescoping arm that can be operated from behind armor protection to place a charge which could be detonated remotely. He also suggested a "remotely controlled, telescoping nozzle that can dispense liquid or jellied explosives at selected points or along a contour."¹⁵

Another concept receiving attention now is the use of air-gas explosives. One of several heavier-than-air explosive gases could be disseminated by various means and then remotely detonated. Such a capability would be quite useful in city combat for a variety of purposes. Refinements in controlling dissemination and distribution could make wall-breaching applications feasible, though directing the force of the blast is a problem yet to be solved.

The laser research in progress today extends in many directions: range-finding, microdrilling, pressure welding, fusion welding, microsurgery, holography, laser communications systems, and others. One recent development, hard-rock tunneling, which is predicted to cut by half the cost of the best methods in use today, suggests the possibility of application in wall breaching. Unfortunately, laser research is costly, and serious limitations seem to apply to most high-energy, destructive weapons. Dust, fog, and all reflective surfaces greatly affect laser beams. Atmospheric effects, target phenomena, and energy requirements make high-powered laser weapons appear to be developments of the distant future. The Air Force and Space Digest stated that "only aircraft with large payloads represent candidates for laser weapons, because of the need to transport a substantial power source aboard."¹⁶ Industrial users can accept a large, expensive power source weighing hundreds of pounds. The infantry unit in urban warfare could not.

Conclusions

Information presented in this study is general in nature, but it is sufficient to establish that there is a definite need in the

military today for a means to breach walls in urban warfare. The capability in infantry units is inadequate.

The means to satisfy the need for a wall-breaching capability are available. The two steps presented below are feasible approaches to providing infantry rifle companies with the capability they require.

1. The U.S. Army should more fully evaluate and subsequently develop a limited series of pre-packaged linear shaped charges designed to cut holes at least two feet in diameter in various types of building walls, doors, and other such obstacles to foot movement in urban areas.

2. The U.S. Army should establish a Required Operational Capability for a man-portable, recoilless weapon capable of breaching walls and fortified positions at ranges appropriate for urban warfare. Exact specifications should be established by initial research, but it appears a weapon similar to the M72A2 LAW with a HEP warhead or a new HEP round for the M202 rocket launcher could be developed rapidly at little cost.

Acceptance of these recommendations will be a major contribution to solving the problem of wall breaching in the infantry rifle company, and it will upgrade the readiness of our forces to operate successfully in urban warfare.

ENDNOTES

ENDNOTES

CHAPTER I

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