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Ground Forces Battle Casualty Rate Patterns

Suggested Planning Considerations

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13. ABSTRACT ***(Maximum 200 words)***

A 4-year study of modern conventional ground operations (reported in 3 volumes: LMI FP703TR1/-TR2/-TR3) reveals patterns of personnel battle casualty rates strongly associated with patterns of operations. The third volume focuses on providing tables of rate data, and related techniques and considerations, to be used in evaluating or constructing rate estimates. Overall, the research combines insights from military theory, history, and operations research to investigate a new and large body of empirical data (from WWII, Korea, Middle East, and National Training Center -- much of it included in the first volume) on battle casualty rate behavior in modern conventional operations. Findings include detailed and general rate characteristics associated qualitatively and quantitatively with major forms of operations. Qualitative indicators include critical operational parameters for rate assessment, and fundamental operational scenario characteristics. Quantitative indicators -- provided in rate tables in this volume -- include probable ranges of average (mean) rates for army and corps-size forces for varying time periods and scenarios, distributions (max, 75, median, 25, min) of 1-day rates given those averages (for 5- and 10-day periods), measures of rate variability, rate frequencies, varying proportions of wounded casualties out of total, etc. Findings suggest that current U.S. and Allied casualty estimation methodologies and contemporary simulations fail to represent significant empirically-indicated rate patterns, and further suggest the character and degree of the misrepresentation. Improved approaches are described both to casualty estimation (to evaluate estimates made by whatever method or to construct estimates) and to help validate simulation output of casualties. [Note: a separate paper by the author summarizes and elaborates on the research (including discussion of how to use the data and patterns to critique simulation output), and discusses Operation Desert Storm results in light of the study's prior insights into rate patterns. See "Ground Forces Battle Casualty Rate Patterns: Uses in Casualty Estimation and Simulation Evaluation," prepared for the Military Operations Research Society, October 1992. Also in DTIC.]

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PREFACE

This report concludes a three-part series on battle casualty rates for modern conventional ground forces. The first report examined the nature of rates as revealed by empirical evidence from the 1940s through the 1980s. The second compared current major U.S. and allied rate projections for Europe to the empirically established character of rates. The present report (1) provides ranges and associated distributions of rates that are empirically supportable given certain force sizes and echelons, time periods, and general scenarios and (2) presents these data, and supporting commentary, in a form adaptable to two of the major current U.S. rate projection methodologies.

The data in this report are taken directly from actual operations – after research to ascertain both the patterns of relevant modern conventional operations and the rate patterns evident in them. The focus is on data reflecting the pulse and pause rate behavior so fundamental to actual combat. The framework is necessarily the critical set of operational parameters – force size/echelon, time, and scenario/sector. As the values of these parameters change, the rate data relevant to planning change. The data are structured to be useful for planners: those who construct rate projections, those who use them, or those who evaluate them or their use.

We encourage readers to communicate their comments and any questions or suggestions. Reader response will help identify issues or points that may need clarification or elaboration or, of course, further consideration.

Executive Summary

GROUND FORCES BATTLE CASUALTY RATE PATTERNS: SUGGESTED PLANNING CONSIDERATIONS

This report, the third in a series, provides planners a set of battle casualty rate data and characteristics for use in constructing and in critiquing battle casualty estimates. It suggests empirically supportable ranges and distributions of rates reflecting various combinations of the three critical operational parameters associated with casualty rate experience: force size and echelon, time period, scenario and sector.

Personnel casualty rates drive planning requirements for medical force structure, for replacements, and for the training base. They also play a primary role in assessing a force's potential effectiveness in various scenarios and hence its likelihood of success in pursuing national policy.

The report's data and methodological considerations are structured to help planners who develop or evaluate casualty estimates for confrontations between major conventional forces – in Europe, in Southwest Asia (e.g., a Desert Shield, Desert Storm, or more traditional scenario), in Northeast Asia, or in reasonably comparable settings. As such, the report will primarily assist those planners responsible for theater command estimates directly supporting operations plans or for other (Service) estimates of theater contingencies, and other planners who oversee such estimates. The report also suggests how the data and quantitative techniques provided in the three-report series may be used to validate major mathematical simulations – at least as regards personnel casualty rate output – that contribute to budget, force structure, and related planning.

Two previous reports in this series described patterns of casualty rates for modern conventional ground force operations. The first focused on the empirical evidence of those patterns, while the second further developed the evidence and also evaluated the reasonableness of various current battle casualty rate projections in light of that evidence.

Our research has shown that rate projections often fall outside ranges of rates that would be plausible for the combinations of the three operational parameters planners intend to represent. The typical misrepresentation appears to be (1) a projected rate curve showing only a single period of intense combat (rather than the multiple periods of intensity manifested in the empirical evidence) and (2) an average rate for the period that is too high for the full force and scenario represented and yet, at the same time, contains rates for the force's "hot spots" that are considerably too low. Projections also typically fail to show the dramatic reduction (clearly demonstrated empirically) in wounded-in-action casualties as a proportion of total battle casualties that is associated with certain common planning scenarios.

The only way to avoid such difficulties in projecting casualty rates is to ensure that projections reasonably reflect the kinds of patterns casualty rates exhibit in various situations. The ranges and distributions of rates that may be reasonable for a situation will vary with changes in the three operational parameters. This report quantifies rate ranges and distributions that the empirical evidence suggests accord with various values for those parameters.

We offer both near-term and longer term recommendations. The first near-term recommendation urges that those responsible for casualty rate planning be far more closely associated with the military operations planning community than is now usually the case. Casualty rate projections not grounded in plausible operational scenarios are almost inevitably misleading.

However, even knowledge of the details of a plausible operational contingency will not result in a reasonable representation of that contingency's casualty rates without access to reliable definitions of the reasonable ranges of rate possibilities. The second near-term recommendation, therefore, is that the data in this report be considered for incorporation into current casualty planning processes. Incorporating the data will make available to planners a framework of casualty rate data that they can use to produce empirically supportable rate projections or, at the least, to critique the reasonableness of projections in terms of the empirical evidence.

The report has been prepared as a casualty rate planning guide, in the form of a relatively detailed reference to rate patterns associated with patterns of operations. The data are structured to be compatible with two current planning methodologies – the Medical Planning Module (MPM) and the Patient Flow Model (PFM) – given

amendments to those methodologies. Accordingly, the last near-term recommendation is that the MPM and the PFM be amended somewhat so planners can make full use of the data. In particular, current efforts to amend the MPM to Version 2.0 should be fully supported: the amendments will permit planners to use the data in this report easily under the current official casualty planning procedures.

Longer term recommendations concern broader improvements that are possible in casualty rate planning. Efforts to build mathematical simulations that adequately describe casualty-producing combat phenomena should continue – especially further research in the mathematics appropriate to those phenomena and in the empirical character of the phenomena. Until more adequate modeling is possible, an interim measure is to find ways to incorporate empirical data, such as those in this report, into current simulations.

At the same time, the widely used U.S. Army Field Manual 101-10-1/2, which offers casualty rate planning data, should be amended to incorporate the perspectives afforded in this report (and its two predecessors) on the patterns of casualty rates associated with modern conventional operations. The manual's most often cited rate data reflect an outdated structure of operations. The rest of the data are for all practical purposes, given current planning processes, incapable of representing a multiple-unit force in a dynamic operational setting for any significant period of time.

Finally, we suggest that study of the relationships between casualty rate patterns and patterns of modern conventional operations is of such fundamental importance to planning generally that it ought to be instituted for military officers, and for anyone responsible for rate projections in the planning sphere, in the curricula at certain Service schools. The phenomena that give rise to casualty rates have associated implications across broad areas of planning requirements. Formal attention to the empirically demonstrated character of patterns of rates and operations seems amply justified.

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CHAPTER 1

INTRODUCTION

REPORT PURPOSE

This report (1) suggests empirically supportable ranges and distributions of battle casualty rates for combat between modern conventional ground forces and (2) discusses key considerations for understanding the meaning and applicability of those rates. The report aims to provide rates and methodological insights that may be used to help construct rate projections, to critique the projections of current or proposed rate methodologies, and to help guide construction of possible future methodologies.

The heart of the report is a series of tables and figures describing both rates and rate distributions for forces of different sizes and echelons, over different periods of time, in different scenarios and sectors. These rates and distributions are structured to fit – with at most a minor amount of change to existing planning tools – into current methods of projecting casualty rates by assignment.[1]

REPORT AUDIENCE

The report is intended for use by two sets of readers. The first and principal group for which the work has been prepared is the set of planners directly concerned with potential battle casualty rates for modern conventional ground force operations. The second is the broader community of defense analysts responsible for supporting those who plan for operational contingencies and their support requirements.

The planning group includes both (1) personnel and medical planners responsible for gauging possible requirements for personnel and medical support and (2) operations planners responsible for gauging the desirability of different possible

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[1]In our second report (May 1990, p. 7-1), we note two basic approaches to projecting possible casualty rates. "Assignment" occurs when planners take rates already identified as reasonable for certain forces and scenarios and assign them to the planning force and scenario. "Calculation" occurs when planners employ some instrument (usually a mathematical simulation) to determine rates unique to the planning force/scenario – based on the particulars of the planning force and scenario set into the structure, rules, and rate values of the calculator.

approaches to potential operations. Also, planners in both the operations and support communities include those who actually prepare and use casualty rate projections for planning and those who evaluate the adequacy of those projections and their use.

Perhaps the salient portion of the broader analytic community supporting planners is the operations research community that prepares analyses and analytic tools to assist planners in their responsibilities. These analyses and tools include casualty rate projection methodologies and the projections themselves.

NATURE AND APPLICABILITY OF DATA PRESENTED

The data and related observations in this report are drawn from real-world events. The empirical record is comprised of both actual (historical) combat operations and simulated combat operations in major field exercises. Our aim throughout the research has been to learn about the character of battle casualty rates directly from real-world experiences of them. Data from actual combat have constituted the only true source of insights; data from relatively realistic (and properly qualified) exercises were used only as checks against combat data. Data from imagined – especially modeled – representations were deemed unacceptable.

The rates and observations in this report stand squarely on the research detailed in the two previous reports in this series.[2] Those reports describe an extensive study of casualty rates for conventional ground forces both in actual combat from World War II through the Korean War (1950 to 1953) to two Middle East wars (1967 and 1973) and in a 3-year set of recent field exercises (late 1980s at the U.S. Army National Training Center).

Our previous research may perhaps best be summarized in three main points. First, casualty rates for modern combined arms forces are keyed to the operational parameters of force size (and echelon), time period, and general scenario (which subsumes types of operations and sectors). Second, rates occur in general rate patterns that, in turn, are associated – in terms of the three just-mentioned parameters – with patterns of operations. The rate patterns are generally measurable quantitatively in ranges and distributions of rate magnitudes and in

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[2]We do not revisit here – but do rely on – the detailed presentations made in the first two reports in this series. See LMI Report FP703TR1. *Ground Forces Casualty Rate Patterns: The Empirical Evidence.* Kuhn, George W. S. September 1989; and LMI Report FP703TR2. *Ground Forces Battle Casualty Rate Patterns: Current Rate Projections Compared to the Empirical Evidence.* Kuhn, George W. S. May 1990.

other respects (e.g., rate variability). The patterns of operations that give rise to the various rate patterns fall into two broad categories: continuous- and disrupted-front scenarios. Third, the patterns of rates and of operations learned from the empirical record continue to be relevant for contemporary conventional forces. That is, rates for comparable force sizes, time periods, and general scenarios are no higher today than in the mid-1940s, and the general patterns of operations fundamental to rate experience have not changed appreciably.

The data in this report are drawn from our analysis of the entire set of data collected. The great majority represent modern mobile operations [including rates experienced when attempting (with little or no success) to effect such operations]. The data address both defensive and offensive operations. The operations include those in which the front line of own troops (FLOT) moves only slowly, those in which it moves significantly but without a major disruption of the defender's line occurring, and those in which attacking forces break open major portions of the defender's front and successfully race deep, often encircling large groups of defenders.

The range of the operational practices and force structures underlying the data and analysis is broad. The casualty rates are taken from operations ranging in scale from strictly tactical-level operations to classic confrontations at the operational level of war (which, of course, includes tactical rates). The operations studied rest on U.S. and British doctrines and practices (including those based on AirLand Battle approaches in the late 1980s), German Blitzkrieg approaches, Soviet Deep Operations methods (and their derivatives), and Israeli practices. Our analytic focus is on operations for corps- and army-size forces – especially the divisional force. The data are most representative of division rates in those organizational groupings.[3]

The data are taken from an equally diverse range of combat environments (terrain, climate, etc.). These span the entirety of Europe from the hedgerows of Normandy and the rough Italian terrains, to the forested and rolling terrain in

[3]Extensive data collected for brigades/regiments and battalions were not ultimately included in this final analysis (with the exception of Figure A-1 in Appendix A). The critical issue concerning rates at these levels is not so much the range of rates possible – which is extremely wide, as illustrated for battalions in our first report – as it is the relationship of these rates' distribution to the rates of the higher echelon forces (notably the division) with which they are associated. Figure A-1 suggests something of the nature of this relationship at the battalion level. However, far more data collection and analysis would be necessary to address such relationships conclusively.

Central Europe, to the nearly treeless plains of the Soviet Union. They include desert experiences in North Africa, the Middle East, and the Mohave Desert.[4]

The research indicates that the data presented provide a comprehensive representation of the patterns of battle casualty rates and distributions associated with the major patterns of operations to be anticipated – especially for the combat zone's divisional force – in modern conventional ground operations.

[4]The data do not address unconventional operations or rates sustained by conventional forces operating against unconventional forces. Rates from Vietnam were reviewed but are not considered relevant, because of the substantially different character of the operations conducted there. In any case, the Vietnam rates appeared generally to be significantly lower, in terms of divisional force sizes and times, than rates seen in conventional operations.

CHAPTER 2

RATE RANGES AND DISTRIBUTIONS

GENERAL

This chapter outlines what the empirical evidence suggests are plausible ranges of rate magnitudes – given three major operational parameters: force size/echelon, time period, and scenario/sector – and different distributions of rates associated with those magnitudes.

No given point value rate may be considered to be "correct" for a given force in a given situation. Any of a number of rates could be perfectly reasonable. However, there are bounds beyond which a rate would be improbable, even highly improbable. The most reliable determinants of such boundaries are the three operational parameters – when combined. As values within one or more of the parameters change, the ranges and distributions of rates that are reasonable change.

Before turning to the data, we first offer some general thoughts on the kinds of perspectives the data afford and then define a series of terms used in the tables and figures. The definitions are followed by a description of the general organization of the data presentation and finally by the data themselves.

A brief comment on how to relate the data found in the various tables and figures is provided early in the next chapter.

NOTE ON PERSPECTIVES IN THE DATA

The data afford a series of linked perspectives. The intent is to provide a comprehensive look at rates and their distributions in terms taken directly from the "anatomies" of different versions of mobile operations – those in continuous-front settings and those involved in disrupted fronts.

Each perspective is in a sense a "snapshot" of rate experience. One may, for example, look at an overall army's rate during a continuous-front or a disrupted-front offensive or defensive, or at corps rates (for example, in a breakthrough sector) within that army. One may look, that is, at an overall operation or at a portion of that operation and retain perspective on the differences.

The data on continuous-front operations are presented to show the rates first from the point of view of rates experienced over time (single-day rate possibilities or average rates over longer periods) and laterally across a front, and then from the point of view of the distributions of rates experienced during intense (pulse) periods viewed in 10- and 5-day measures. Data on disrupted-front operations are necessarily less precise but suggest the rate character of these operations in some detail.

It must be remembered that the data are taken from actual events. Our research suggests that the data displayed are representative for planning purposes of the kinds of operations (and parts of operations) described. We have used actual data so as not to impose extraneous judgments about rates and their distributions for phenomena so complex as those represented.

DEFINITIONS

Thinking clearly about casualty rate phenomena and about using the data presented requires keeping in mind definitions and qualifications concerning certain basic parameters and terms.

The three key operational parameters are force size/echelon, time, and scenario/sector. A key term is the rate measure used to describe a rate for a given combination of the three parameters. We begin, however, with the pulses and pauses that have been at the center of this study's focus from the first report.

Pulses and Pauses

Combat occurs in pulses of intense activity separated by pauses of distinctly lower intensity. This report refers to a casualty rate pulse primarily as a one- or several-day period during which casualty rates are relatively high. Even during a

multiday pulse period, rates may vary dramatically when viewed on a day-to-day basis.[1] Without question, rates will vary dramatically when the pulse period is compared to the pause period that inevitably follows.[2]

The occurrence of casualty rate pulses is potentially critical for planning. The magnitude of a pulse will entail a sudden drop in personnel strength and a sudden rise in medical support burden. If the pulse is sufficiently high, the combat capability of the unit in question may suddenly decline dangerously. A flow of replacement personnel that is planned for even high numbers of replacements at a relatively steady state could easily be unable to meet a sudden, severe, localized need. Likewise, a medical support structure planned to accommodate a number of casualties that is quite high when measured over a many-day period could nevertheless be overwhelmed by the sudden, sharp magnitude of a combat pulse.

Pulses are also critical for planners because the nature of a rate pulse is to be both short in duration and highly localized. The pulse may well be accommodated within the overall personnel or medical structure. However, its severity in a particular locale may overwhelm available (notably lower echelon) resources, despite what may be an overall adequacy of resources in the theater. Particularly in regard to combat power, such localization of pulse rates has repeatedly been shown to be of potentially fundamental importance to the overall success of operations. Most of the great instances of disrupted fronts began with relatively small gaps – rapidly exploited and enlarged.

A pause in high casualty rates may be due to many factors. Among the more common in combat are what we will term *command and control pauses* (during which the command must reorient itself, following either failure or success, so as to recover or maintain direction and coherence of effort); *maneuver pauses* (when a force maneuvers rapidly against only scattered or ineffective enemy resistance – e.g., in a flanking movement or having pierced enemy defenses – or when a force has itself been flanked or otherwise placed in an operationally tenuous situation by enemy or

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[1] A more technically accurate definition of a "pulse" was offered in our first report: a pulse of casualties is a 1-day rate that is relatively high. Such 1-day events tend to occur in clusters – though the several rates in such clusters may vary considerably. For planning purposes, however, the larger interest is in the clusters, which we will therefore now refer to as pulses.

[2] As noted in our earlier reports, rates for Pacific island operations (e.g., by Marine Corps forces) often varied less dramatically over time – especially when excluding the initial landing date in those cases where it was high – than do rates in mobile operations.

even friendly maneuver and must curtail or cease current major efforts so as to reorient itself and respond); *intensity pauses* (where, for a multitude of possible reasons, the level of combat activity in the immediate vicinity simply drops – as when the principal areas of combat action flow elsewhere); *logistics pauses* (during which materiel or personnel shortages are being made up); and perhaps *exhaustion pauses* (where one or both opponents are humanly overextended).

Rate Measures

Evaluating whether rates are reasonable must be done not only in terms of the three key parameters – force size/echelon, time, and scenario/sector, discussed below – but also in terms of the measure of the rate within that framework. The basic alternative measures are what we will term the "divisional force" and the "full echelon force." The divisional force is often referred to as the "combat" force. The full echelon force includes the divisional force plus personnel assigned to the echelons-above-division organization(s) of interest – in this report, we address forces up to corps and army size.[3]

The main focus of the rates is the set of divisional force rates, which includes both line and reserve divisions of the force.[4] Rates for line versus reserve divisions are not distinguished individually in these data. Such units interact and will exchange postures relatively easily in mobile operations. The planner is instead provided with both rate ranges and distributions for the full set of division 1-day experiences in the divisional force.

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[3]A common approach among planners is to separate a force into its "combat" (meaning only fighters) and "support" elements. However, our research indicates the combat force should refer to the divisional force – which includes support personnel within divisions and ought to include all combat personnel closely connected to the conduct of the divisional force's scheme of maneuver and located in its vicinity (e.g., armored cavalry cover forces).

The "full echelon force" (termed in the rate distribution tables "full army" or "full corps") would encompass all combat and support personnel assigned to the combatant commands in what today is termed the combat zone (forward and rear areas) – the zone area depending on the overall force size.

Full echelon rates, thus defined, would not include personnel assigned to communications zone or theater support organizations (even though some of those personnel perform their functions in the combat zone). Rates in the latter section were traditionally extraordinarily low. Increasing the historical rates for such personnel several times over would still place them as a distinct minority of the overall force rate in a theater of operations.

[4]As discussed in footnote 3 and later in this chapter, rates across the full army- or corps-size force (including both their divisional and support personnel) are provided in the rate distribution tables for continuous-front scenarios.

The divisional force may be further characterized by focus either on "division-day" rates or "corps-day" or "army-day" rates.[5] A corps divisional force could be measured by either division-day rates or corps-day rates. An army-size divisional force experience could be viewed in terms of division days, corps days, or army days.

Division-day rates take the set of separate single-division rate experiences during the period in question as the measure of interest. For example, a corps with four divisions over a 10-day pulse period will have 40 division-day rates. Corps-day rates take the set of divisions in a corps for each day and average their rates (using the mean) to arrive at the set of corps-day rates for the divisional force. There would be 10 corps-day rates in the same example. Thus, the same overall force casualty experience for this hypothetical corps over the 10 days can be characterized either in terms of 40 division-day rates or 10 corps-day rates.

The same logic holds for an army-size force. The divisional force may be viewed in terms of army-day rates. These would be the set of 10 daily mean rates for all divisions assigned to the army on each of the 10 days. Extending our example, this army might have four corps, each with four divisions, over the 10-day period. Thus, the divisional force could be characterized in terms of either 160 division-day rates, 40 corps-day rates, or 10 army-day rates.[6]

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[5]We use the older term "army" to stand for a set of two or more corps. Standard NATO practice refers to such force groupings instead as "army groups." The term used is a matter of preference, but the force size represented must not be confused merely because of changed descriptors. The older usage of the term "army group" would encompass the full NATO force.

[6]The mean rate for each of the three measures over the full 10 days would be virtually identical to the other two measures' means. However, the spreads of the three measures of rates, from maximum to minimum, would probably be significantly different See the rate distribution tables for army- or corps-size forces.

Force Size/Echelon

A planner must be aware, first, of the size and echelon of the force for which the rate is being gauged.[7]

Two common errors should be avoided. The first is assigning a rate to a force only on the basis of that force's nominal echelon – e.g., using a division rate for a force of 5,000 (or of 30,000) commanded by a division headquarters. We suggest looking first at force size and thinking in terms of rates for the echelon suggested by that size. A force of 5,000 is more a brigade-size than a division-size force, regardless of the acting command headquarters.

The comparable error is to use rates based only on force size. A force of a certain size may well not be structured in a manner consistent with the force structures that underlie rate data usually applicable for that size force. For example, a force of 13,000 may easily qualify for a division rate, but circumstances of a particular deployment might argue for a brigade (or even battalion) rate measure instead – for example, where the total number involves only the combat elements of brigades or regiments (or battalions) and not the supporting structure associated with a division.[8] In such cases, the rates are likely to be higher than a division rate: the at-risk force is only a set of brigades or regiments (or battalions). It may be useful in these cases to use a rate measure that addresses the echelon that represents the personnel principally active and at risk.

Table 2-1 provides a rough idea of the relationships between force sizes and echelons. We have attempted to cover the many possible interpretations in a liberal

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[7]The kind of force – specifically, whether it is heavy or light, highly or less highly mobile, etc. – is, of course, also significant to casualty rates. The empirical evidence is clear that armored forces have traditionally taken significantly lower personnel casualty rates than lighter (foot infantry) forces. The empirical rates that serve as the basis for our data are mainly infantry-based rates. (They do include armored force rates, the proportion of armor depending on army or corps makeup for selected pulse periods – as a rule, some 20 to 40 percent of the divisional force.) Given that rates over the past half-century for comparable force sizes, times, and settings have been similar – a problem addressed at length in our first report – our data are inherently conservative: the infantry-weighted rates are highly likely to encompass rates of today's forces. Contemporary combined arms forces for conventional combat are generally considerably heavier, more dispersed, and more mobile (and larger, for example, at the division level) than those our data are based upon.

An added element of conservatism in the rate data is the fact they are based on assigned strengths, rather than on the higher authorized strengths so often used in planning.

[8]Such is probably the case with the initial day(s) of action in special operations of airborne or amphibious character.

fashion – providing broad definitions intended to accord with traditional Western force structure practice.[9]

TABLE 2-1

RANGES OF PROBABLE FORCE SIZE/ECHELON
(Divisional Force)

	Number of corps			Number of divisions			Number of personnel		
	Low	Average	High	Low	Average	High	Low	Average	High
Army	2	3–4	5	8	10–15	18[a]	120,000	140–250,000	300,000
Corps				2	3–4	6	35,000	45–80,000	100,000
Division							9,000	11–18,000	22,000

[a] Some army-size forces have comprised as many as 22 divisions for short periods during an operation.

Time

Any time period may, of course, be used to determine a rate for a given force. The time measure used has profound effect on the rates that are plausible for a force in a given scenario and sector. Whatever period is chosen, the rate must be judged in terms of what is operationally feasible over that full period – longer periods will definitely include pauses as well as pulses, and may include changed sector types (e.g., postures) as well.

Scenario/Sector

Scenario and sector types are clearly intimately related. Starting with either one, the character of the other may be suggested.

A *scenario* is the general operational setting suggested by the composition of fundamental operational factors that will likely produce operations of one of two major forms: continuous or disrupted fronts. These fundamentals include such factors as the opposing sides' policy and military objectives, the general character

[9]Traditional Soviet structures (and those of current or prior clients of Soviet approaches) use different terminology and force sizes. Comparability for echelons-above-division is usually established by finding the organization that most closely resembles, in terms of number of divisions, those listed in Table 2-1.

(e.g., in their doctrines and practices) of their respective approaches to conducting military operations, their available combat power and its deployment structure,[10] and the set of their respective particular advantages and constraints (e.g., terrain or intelligence advantages).[11]

A *sector* may be considered the spatial area where two attributes of operations overlap: type or posture (e.g., offensive or defensive) and function (e.g., a main attack versus a secondary attack). We generally reference four sorts of operational sector: main attack sectors (main attack sector – defense and offense), secondary attack sectors (secondary attack sector – defense and offense), fixed sectors, and quiet sectors.[12]

Some sectors' likely experience may suggest results that characterize a major scenario type. For example, a defender deployed in a probable main attack sector may be likely (given the threat facing it) to witness a major enemy breakthrough: a disrupted front. The breakthrough force may be of such combat power as to threaten envelopment of a major portion of the overall defender divisional force: a higher order (Level II or greater) of disrupted front.[13]

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[10]Deployment structure refers to the arrangement of combat power so as to bring force to bear advantageously. Some analysts have bandied about a so-called "3-to-1 rule," which holds that only such a ratio of forces or combat power is sufficient to conduct successful offensives. The counter examples of significantly lower ratios for successful attackers are too many to support any such rule. The critical matter is whether the attacker is able to arrange his combat power in such a way as to operate decisively against critical defender weaknesses. The Soviets, for example, managed their forces on the Eastern Front so as to achieve often enormous ratios (e.g., of 8-10 to 1) at the decisive tactical points of focus when, across the strategic front, their advantage averaged just below 2-to-1. Different operational "styles" may also result in decisive focused advantage even when an attacker's overall force ratio is well short of 3-to-1.

[11]The Soviets have attempted to raise such considerations to the level of general theory and a set of practical measurements in their famous "correlation of forces" approach. Great difficulty arises when such an approach becomes a series of inflexible dicta rather than a matter for closely reasoned but robust operational judgment. On the other hand, equal or even greater difficulties arise if such considerations are ignored or only superficially assessed.

[12]A counterattack sector designation was considered but rejected. A distinctive counterattack posture is usually quite short-lived and quickly subsumed into offensive or defensive postures. Also, the counterattacking force may be drawn from the sector principally attacked or from another, nearby defender sector

[13]We distinguished four levels (I to IV) of disrupted fronts in our second report (see Chapter 5 of the May 1990 report, especially pp. 5-4 to 5-12). The levels are based on severity of defender casualty rates: Level I is the least severe, since it involves no major encirclements of defender forces; Levels II through IV are characterized by catastrophic encirclement of increasingly larger portions of the defender force

Alternatively, certain broad operational features of an overall situation – probable policy and military objectives and certain doctrines for the conduct of forces – will suggest certain scenarios, which will in turn suggest distinctive types of probable sector experiences as component parts. For example, the attacker's objective may require that an enemy force be disrupted, but evaluation of available means may suggest that disruption is not achievable until after one or two major offensive pulses; in this event, the main attack sector rates will probably have a continuous-front character first and only later a disrupted-front character.

The conclusion of these considerations is that, ultimately, scenarios cannot be fully determined without reference to sector prospects,[14] and sectors cannot be determined without reference to the factors comprising the broader operational scenario. The definition of the scenario/sector character of a situation is thus a fully iterative undertaking.

Whether a front is continuous or disrupted is viewed in our analysis from the defender's perspective. A sector, on the other hand, is termed a main or secondary attack sector, or a fixed sector, by virtue of the role it plays in the attacker's operational scheme – regardless of whether the attacker is the enemy or friendly force. Finally, the force posture in attack sectors is then stated as either defense or offense, depending on the friendly planning perspective.

Continuous Front

A continuous-front setting is one in which a defender front retains its essential defensive cohesion and does not permit significant attacker forces to penetrate to rear areas without major defender opposition. Such a front may, in worst cases, experience significant attacker penetrations and a significant withdrawal of defender forces (probably with some confusion); but the attacker is unable to push operational-level forces (say, corps size or larger) through to defender rear areas before the defender is able to reestablish his defensive scheme or perimeter.

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[14]To extend the remark in footnote 10, a Soviet-approach judgment on whether the correlation of forces is advantageous or not will rest on whether the probability is high that disruption(s) can be achieved – a determination that requires attention to sectors in at least a broad sense. Of course, the details of operational planning, including the more precise allocation of force among the various sectors, will follow the broader judgment about the correlation of forces.

Disrupted Front

A disrupted-front setting is one in which a defender front has been broken, permitting significant attacker forces (at the operational level, corps size or larger) to penetrate to rear areas and engage in exploitation: deep operations, including catastrophic encirclement of major portions of the defender force.[15]

In terms of casualty rate results, disrupted fronts are distinguished particularly by the occurrence of catastrophic encirclements. Data from both the Eastern and Western Fronts strongly indicate that a *catastrophic encirclement* of a substantial divisional force – from a division or corps-size force to a multicorps force – may entail the loss of anywhere from 45 to 90 percent (or more) of the force within a given 10-day period. We use the 10-day measure since such losses may occur either immediately (as when the encircled defender force quickly surrenders) or over a period of days (when the encircled defender attempts breakout – often with remnants succeeding but the majority being lost). The 10 days appears to be a proper time measure to incorporate both the attacker's time spent enveloping the force after breakthrough and the defender's attempts to resist. If an envelopment is especially large – say, of an army-size force – the encirclement is more probable in the second 10-day period following the initial breakthrough, although the first 10 days may well witness smaller encirclements.[16]

Main Attack Sector

The attacker's operational plan will specify one or more sectors for principal emphasis – where the greatest gains, especially breakthroughs, are judged possible

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[15]Disrupted fronts have characterized most major decisive operations since 1940. These include the early German successes in campaigns in Poland, France, and the Soviet Union; most successful Soviet operations, especially after early 1943; the U.S./U.K. breakout from the Normandy area resulting in the Falaise encirclement and the race across France; the Communist advances in Korea both in June and July and again in November and December 1950; the U.N./U.S. Inchon-based counteroffensive; and the Israeli victories in the 1956 and 1967 conflicts, and again at the conclusion of the 1973 war (when the 3d Egyptian Army was disrupted and may have been saved from encirclement only by the cease fire). Of course, continuous-front operations are also critical, probably more common, and certainly the more common object of plans when on the defensive.

[16]Two examples would be the Soviet encirclement and destruction of the German 4th Army during the second 10 days of the Belorussian Campaign in 1944 – in the last of a series of cascading encirclements – and the Allied encirclement and capture of the German force in the Falaise Pocket in August 1944, again in the second 10 days following the U.S. disruption of the German front near Avranches.

and useful. The combat power in such a sector is disproportionately large given the spread of combat power across the front.

The attacker force in a main attack sector under continuous-front conditions will experience higher casualty rates than one that succeeds in disrupting the defender front. Similarly, the attacker rate in the continuous-front setting will be significantly higher when the defender front holds or withdraws only slowly, as compared to cases in which the defender is forced to withdraw more rapidly and deeply.

Defender rates will be high in main attack sectors. We have identified two versions of defender experience in continuous-front settings. *Type I* defensives occur when the defender is forced to withdraw rapidly (probably with significant confusion) and, in particular, experiences the encirclement or overrun of a major portion of up to a division-size force. *Type II* defensives may also show significant withdrawal, or they may succeed in posting only limited withdrawal; in neither case, however, do they witness the same kind of focused encirclement or overrun at the attacker's point of attempted breakthrough.[17]

A defender whose front is disrupted may or may not experience exceptionally high rates at the point(s) of breakthrough, but the especially high rates associated with disrupted-front defensives – i.e., when measured across the fuller front and force – will occur only if the attacker succeeds during exploitation in encircling significant portions of the defender's overall force. We have previously identified four levels of the disrupted-front experience, which differ depending on the extent of encirclement. The defender rate at the point(s) of breakthrough may or may not exceed the rates for defenders in main attack sectors of continuous-front situations. The disrupted defender's forces on either side of a breakthrough will tend to curl away in withdrawal or redeployment and will thus experience high rates themselves only to the extent that they are included in any subsequent encirclement. Of course, that subsequent encirclement will show increasingly greater success as it includes

[17]The data cited in this chapter for Type II defensive conditions occurred when the defender was forced to withdraw rapidly. The evidence suggests that rapid FLOT movement results in increased proportions of missing-in-action (MIA)/captured casualties out of the total battle casualty count. These increased ratios appear to occur both for defenders and attackers, although a defender's total casualty rate will be relatively high and the attacker's relatively low for such operations. We speculate, therefore, that defender rates in Type II defensives *without* significant FLOT withdrawal would show a higher proportion of wounded in action (WIA) out of the total battle casualty count – because of the markedly lower proportion of those missing and captured.

greater portions of the defender's force, whether or not they were originally close to the breakthrough(s).

Secondary Attack Sector

A secondary attack sector supports the effort of the main sector. The secondary sector witnesses a serious offensive effort but one well short of the combat power of the main effort.[18]

Fixed Sector

An attacker will attempt to occupy as much of the defender force as possible with concerted offensive pressure in sectors other than the main and secondary attack sectors. The attacker force applied here may be equivalent to or less than that in a secondary attack sector.

Quiet Sector

These sectors may exist during even the most aggressive campaigns, where the attacker cannot allocate sufficient force to occupy them actively. Quiet sectors appear more often across longer operational frontages – probably where each of the opposing overall forces includes multiple corps or armies – or in longer campaigns.

ORGANIZATION OF DATA PRESENTATION

The general organization of the presentation of rate data is important to understanding what they represent, and since it may appear complex, we will first describe its conceptual and then its graphic structure.

In the most general sense, we have constructed a series of tables and figures to provide a series of perspectives on rates. The presented data are intended to form a coherent collection of perspectives. Each table and figure represents a certain arrangement of the three operational parameters (force size/echelon, time, scenario/sector). The series of tables and figures thus presents perspectives that

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[18]The upper limit of the amount of attacker force applied in a secondary attack sector may be that amount deemed sufficient, should conditions warrant, to take over the main attack effort – at least with some shifts of combat power from the main effort or the reserve. More likely, the secondary effort will be calibrated such that the secondary attack force may maintain a threatening pressure on the defender even should the main effort pause; that is, the two attacker efforts will be gauged to operate interactively.

differ in accordance with changes in the parameters. The various tables and figures of data may be used individually, but they also relate to one another.

Tables 2-2 and 2-3 outline the structure and basic relationships of the data presented in the tables and figures that follow them.

The tables and figures are structured, first, to fall within the two major general scenario types – continuous and disrupted fronts. Given a broad scenario, the data are presented in tables and figures to illustrate either ranges of rates or the distributions of rates associated with those ranges. The data are provided for forces of different sizes and echelons, in different operational sectors and postures, over varying periods of time.

Within each of the two broad scenarios – continuous and disrupted fronts – the various sets of data are nested. For example, corps data may be taken at face value and viewed independently in the several sector/posture categories, as appropriate to the planner's requirements. However, the corps data also are consistent with army-level data. That is, data for a corps in a certain sector type and posture – which suggests in turn a certain overall operational scenario – will relate to data for other corps in other postures, and for an army as a whole. Corps experiences thus should be viewed as parts of a whole that is expressed in the army data for the same overall operational setting and time period.

Conceptual Structure

We first present rate data for continuous-front scenarios and then for disrupted-front scenarios. Within that broad scenario framework, we present data by force size and echelon – especially for both army- and corps-size forces. The principal focus is on rates for divisional forces within those echelons. (The comparable rates across the full echelon are also provided for continuous-front scenarios in rate distribution tables.) Next, each force size/echelon is presented, as appropriate, in terms of sectors (e.g., main attack/offense or secondary attack/defense, etc.) that comprise the broader scenario. Finally, within each matrix so defined (scenario/force size-echelon/sector), we present the data in terms of varied time periods.

TABLE 2-2

STRUCTURE OF DATA PRESENTATION: CONTINUOUS-FRONT SCENARIOS

Subject addressed	Tables	Figures
Army-size force • Rate ranges (by sector and posture)	Ranges of daily rates during pulses and pauses **[Table 2-4]**	Ranges of rates during pulses (1-, 5-, 10-, 20-, and 30-day measures) **[Figures 2-1 through 2-7]**
• Rate curves (by sector and posture)	**[N/A]**	Illustrative pulses and pauses (daily, plus 5- and 10-day moving averages) **[Figures 2-8 and 2-9]**
• Lateral rate ratios (by sector and posture)	**[None]**	Illustrative relative rates (lateral army-size forces) **[Figure 2-10]**
• Rate distributions (by sector and posture)	Rate spreads during pulses (10-day periods and their 5-day peaks) • Divisional force (division-days, corps-days, and army-days) • Full force (divisional plus support) Percent of force and rate averages by rate class Rates by casualty category total battle casualties (TBC), killed/captured/missing in action (KCMIA), wounded in action (WIA), WIA/TBC ratio **[Tables 2-5 and 2-6]**	**[None]**
• Variability of daily rates during pulses	**[None]**	Relationship of daily rates to army 10-day mean rate during pulses **[Figure 2-11]**

TABLE 2-2

STRUCTURE OF DATA PRESENTATION: CONTINUOUS-FRONT SCENARIOS (Continued)

Subject addressed	Tables	Figures
Corps-size force • Rate ranges (by sector and posture)	Ranges of daily rates during pulses and pauses **[Table 2-7]**	Ranges of rates during pulses (1-, 5-, 10-, 20-, and 30-day measures) **[Figures 2-12 through 2-21]**
• Rate curves (by sector and posture)	**[N/A]**	Illustrative pulses and pauses (daily, plus 5- and 10-day moving averages) **[Figures 2-22 through 2-28]**
• Lateral rate ratios (by sector and posture)	**[None]**	Illustrative relative rates (lateral corps-size forces) **[Figures 2-29 through 2-31]**
• Rate distributions (by sector and posture)	Rate spreads during pulses (10-day periods and their 5-day peaks) • Divisional force (division-days, corps-days, and army-days) • Full force (divisional plus support) Percent of force and rate averages by rate class Rates by casualty category TBC, KCMIA, WIA, WIA/TBC ratio **[Tables 2-8 through 2-11]**	**[None]**
• Variability of daily rates during pulses	**[None]**	Relationship of daily rates to corps 10-day mean rate during pulses **[Figure 2-32]**

TABLE 2-3

STRUCTURE OF DATA PRESENTATION: DISRUPTED-FRONT SCENARIOS

Single table (no figures) depicting Levels I, II, III, and IV defender experiences
• TBC rate ranges by force size (battalion to army) and sector (breakthrough and exploitation sectors; other sectors)
• Rate proportions (KCMIA and WIA) for corps- and army-size forces [Table 2-12]
Single table (no figures) depicting attacker rates during disruption of defender's front [Table 2-13]

Graphic Structure

The graphic structure of the data in tables and figures is based on the conceptual structure just described.

The rates depicted are total battle casualty rates. Breakdowns into the standard categories of battle casualties – total, KCMIA, and WIA – are covered under rate distributions.

Continuous-Front Data

Turning first to continuous-front phenomena, the rate data are presented by army and then corps.[19] Under each heading, a set of tables and figures addresses rate magnitudes first and then the associated distributions of rates.

Rate Ranges. Under rate ranges, a table of the ranges of 1-day rates for the various sector types is first presented. The table is followed by figures that graphically translate the rate data for the various operational phenomena (e.g., a corps on the offensive in a main attack sector) into rate ranges based on different time measures (1-day, 5-day, 10-day, etc.).

Illustrative Rate Curves. Rates are next shown in figures that visually illustrate particular cases of pulses and pauses over time (using daily, 5-day, and 10-day measures) as linear curves.

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[19]A special figure suggesting battalion rates, and the proportion of the division's battalions experiencing those rates, has been prepared that links those rate data to the division's rate(s). See Appendix A.

Illustrative Lateral Rates. A sense of the relative proportions of rates viewed laterally (across a front – e.g., for different armies on line or for their several corps) is provided by depicting particular cases of relative 10-day rates.[20]

Rate Distributions. Three measures are presented for each major force and sector experience previously shown.

First, the set of daily rates during a rate pulse – as seen over a 10-day period – for the force in question (say, a corps on the offensive in a main attack sector) are shown as spread highest to lowest. The pulse experience is shown both during the full 10-day period and for the 5-day peak during that period. The rate spreads include both the divisional force (the division-level combat force without the echelons-above-division support force included) and the full echelon force (the full population at risk including both the divisional force and support personnel).

Second, the same experience is shown by distributing the set of daily division rates for the divisional force as they fall into one or another of three classes of rates. Both the percentage of the division-day observations and the average (mean) rate for those observations falling into each rate class are shown – again, for both the full 10-day pulse period and its 5-day peak.

Finally, the same experience is again shown by distributing the casualties into the major casualty categories: the TBC (total battle casualty) rate, the rate within that total for KCMIA (killed/captured/missing in action), the rate for WIA (wounded in action), and the proportion of the WIA casualties out of the TBC whole.[21] As before, the distribution of rates by casualty category is shown for both the full 10-day pulse period and for its 5-day peak.

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[20]See our discussion of lateral rates in our first report (September 1989, pp. 6-5 to 6-8) and second report (May 1990, pp. 4-28 to 4-36). It is critical to note that "lateral rates" may also describe the relative rates experienced in different functional sectors (e.g., main attack versus fixed) that are not, in fact, located adjacent to one another (as along a front). For example, modern fluid operations conducted in large areas (e.g., central Europe) between low-density forces [e.g., post-Conventional Forces, Europe (CFE)] forces] could well witness whole corps performing their related main attack and fixing missions as relatively isolated islands of activity.

[21]As discussed in our two previous reports, these WIA figures include both all "admissions" and those "carded for record only" casualties that do not return to their unit's control the day of their wounding

Rate Variability. A graph is provided that displays the relationship of a 10-day average (mean) rate during a pulse period to the variability of daily rates during that period.

Disrupted-Front Data

Disrupted-front scenario data are shown both for the defensive force whose front has been disrupted and for the attacking force. As explained in our second report, the distinctive features of these scenarios as regards casualty rates are, first and mainly, the catastrophic encirclement of significant portions of the defender force and, second, the experience of the breakthrough sector(s).

Two tables present data from the defender and attacker perspectives.

Defender Experience. The data for the defender force is the more complex presentation. A single table suggests the ranges of rates of the defender force at several echelons in each of the four levels of disrupted front identified in the second report. The table displays rate data for the two distinctive sector experiences (breakthrough and encirclement) in disruption sectors, as well as rates for other sectors and for the larger (army-size) force.

Attacker Experience. A single table focuses mainly on rates for corps-size forces performing the breakthrough and exploration missions.

CONTINUOUS-FRONT SCENARIOS
ARMY-SIZE FORCES

• Rate Ranges:	Table 2-4 Figures 2-1 through 2-7
• Illustrative Rate Curves:	Figures 2-8 and 2-9
• Illustrative Lateral Rates:	Figure 2-10
• Rate Distributions:	Tables 2-5 and 2-6
• Rate Variability:	Figure 2-11

RATE RANGES

The following table and figures show the ranges of rates that may be expected for an army-size force in defensive and offensive operations for various time periods. (Rates are army-day rates for the divisional force.)

It is important to recognize that the longer time frames (e.g., 20 or 30 days) cite rate ranges that include as many pulses for such periods as have been witnessed empirically. That is, these longer time perspectives are not merely a single pulse experience seen over a longer time period, but show ranges of rates for the force over the time cited, which usually includes multiple pulses and their pauses.

In every case, the rates cited are averages (means) experienced over the cited period. The distributions of 1-day rates that comprise certain of these averages – rate pulses in particular types or phases of operations – are shown under Rate Distributions.

We exhibit ranges for various multiday measures of pulse periods – up to 30 days, for three main reasons. First, a planner will find 30 days to be a period that probably encompasses most, if not all, of the foreseeable events in an operations plan. Second, to the extent the planner is able or required to envision operations beyond 30 days, it will be found that 30 days (probably fewer) fully encompass at least one major phase of the operation; follow-on phases may then be planned using the data provided for various time intervals. Third, to assist in the latter planning cases, we have provided in our accompanying section, Illustrative Rate Curves, time line views of events in the most active sets of 60-day periods witnessed for continuous-front operations. The planner may wish to orient himself on the numbers of pulses and pauses, and their relationships, within those extended time lines.[22] Of course, operations do not neatly divide into recurring time blocks, so the planner may use the various time perspectives on ranges of pulse period rates (and the table's set of pause rates and durations) to describe an operation's phases. Thus, the range data may be used for planning periods of essentially any length.

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[22]A comparison to disrupted-front operations is useful. We are unaware of any cases of a front being disrupted in a period outside the first 10 days of that concerted effort's planned beginning; that is, fronts are disrupted or not within the first 10 days of such an operation's commencement. Operations that have begun with disruptions have lasted anywhere from 10 to 60 days – a very few have endured for as many as 70 to 80 days. However, in all cases, the disruption and any subsequent major encirclements have occurred in phases lasting 30 days or less. The longer time lines were comprised of various combinations of offensive or defensive continuous-front operations – or, simply, force movement until defenses were restored and such operations resumed.

TABLE 2-4

RANGES OF 1-DAY PULSE AND PAUSE RATES, ARMY-SIZE FORCES
(Assuming continuous front)

Army	TBC rates (per 1000/day)	WIA rates (per 1000/day)	Duration (days)
On defensive			
Type I	24–42 [a] / 4–14	9–13 / 2–6	1 [a] / ≤ 10–12
Type II	24 [a] / 4–14	9 [b] – 14 [c] / 2–6 – 3–10	1 [a] / ≤ 10–12
Pause	1–5	<1–4	≥ 7–8

[a] General note: Daily rates during pulses sometimes occur in what appear to be identifiably separate rate ranges. For example, a pulse may show rates in one range for nearly its full duration with occasional 1-day rates *during that period* in a significantly higher range. The latter events are indicated both in the TBC and WIA columns and under Duration (by a "V" placing them within the overall longer period).

[b] Wounded rates in the event the army's main attack sector force withdraws rapidly.

[c] Wounded rates in the event the army's main attack sector force holds or experiences only minor withdrawal.

Remarks: Rates for an army-size force on the defensive will be driven primarily by experience in the main attack sector. Two forms of rate experience have been observed: a Type I experience – a rapid withdrawal in the main attack sector with heavy casualties and with encirclement/overrun of major portions of up to one division on the breakthrough axis; and a Type II experience – either a rapid withdrawal in the main attack sector or only a minor withdrawal, with heavy casualties but no significant encirclements. Type I events will have a very high incidence of missing and captured and thus a lower proportion of wounded out of TBCs. Type II events will also experience high levels of missing and captured in cases of rapid withdrawal; where withdrawal is minor, their incidence will be much closer to that seen in offensive operations.

On offensive			
Low FLOT movement	6–18	5–14	≤ 10–15
Higher FLOT movement in main attack sector (breakthrough sector)	6–12	5–10	≤ 7–20
Pause	1–5	<1–4	5–6[d], 15–20[e]

[d] Pauses of 5 to 6 days between pulses when circumstances and resources permit "continuous operations" – up to probable maximum of 60 days.

[e] Longer pauses of 15 to 20 days (even 30 to 40) indicated between operations when resources are diminished or each pulse's operational circumstances demand special preparation or caution.

Remarks: Offensive pulses may last somewhat longer than defensive pulses. Also, the daily TBC rates during the offensive pulse may be somewhat higher than most daily defensive pulse rates – with the distinct exception of 1-day rates at the peak of those defensive pulses. Offensive rates tend strongly to a proportion of wounded that is around 75 percent of TBC. The proportion appears to reach 80 percent as a breakthrough is achieved in the main attack sector (continuous defender front maintained). Interestingly, the proportion seems to fall to the 60- to 70-percent range when disruption is achieved – it appears that rapid FLOT movement will result in increased proportions of missing/captured for the attacker as well as the defender (see above).

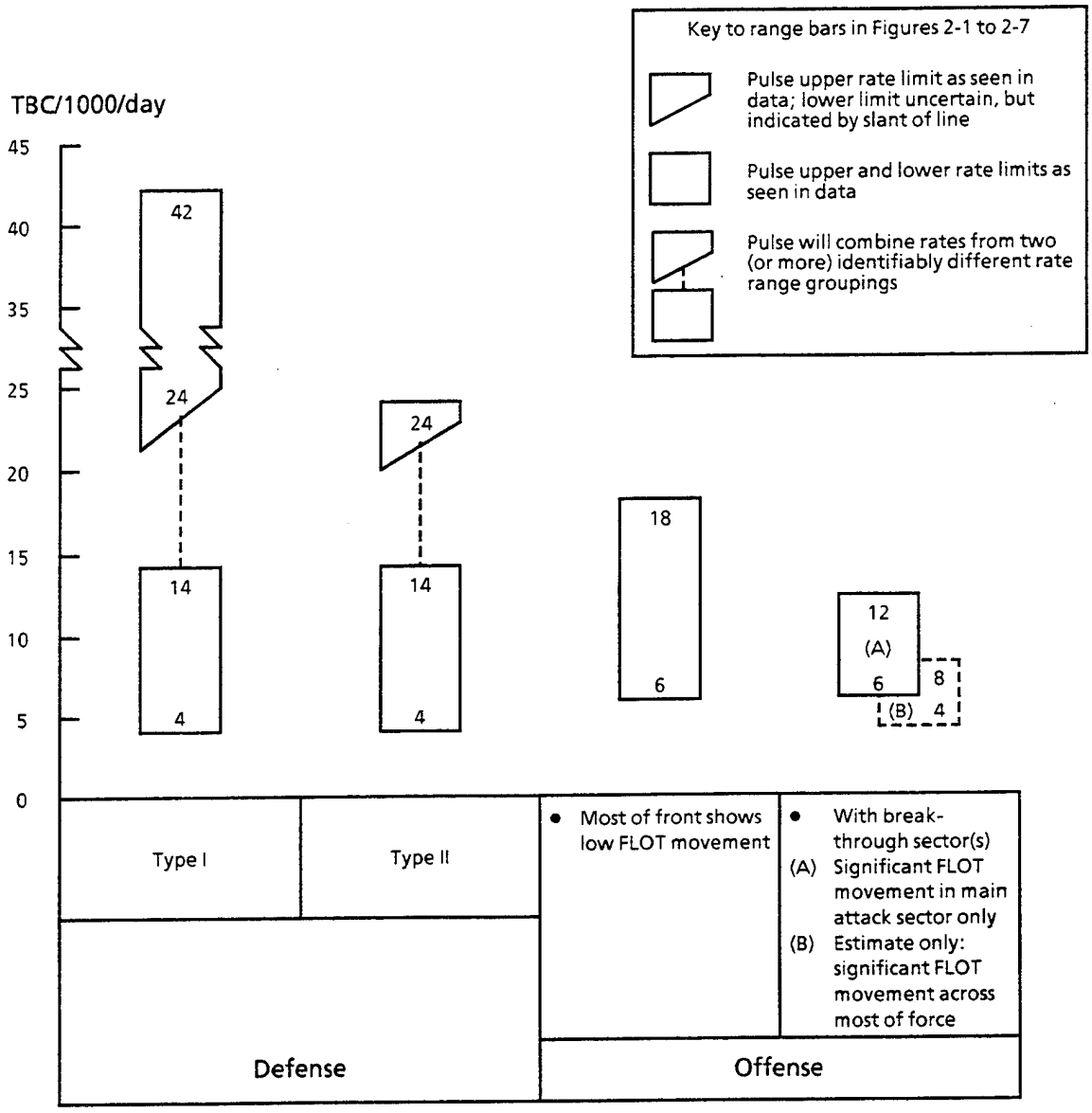


FIG. 2-1. RANGES OF 1-DAY PULSE RATES, ARMY-SIZE FORCE (Assuming continuous front)

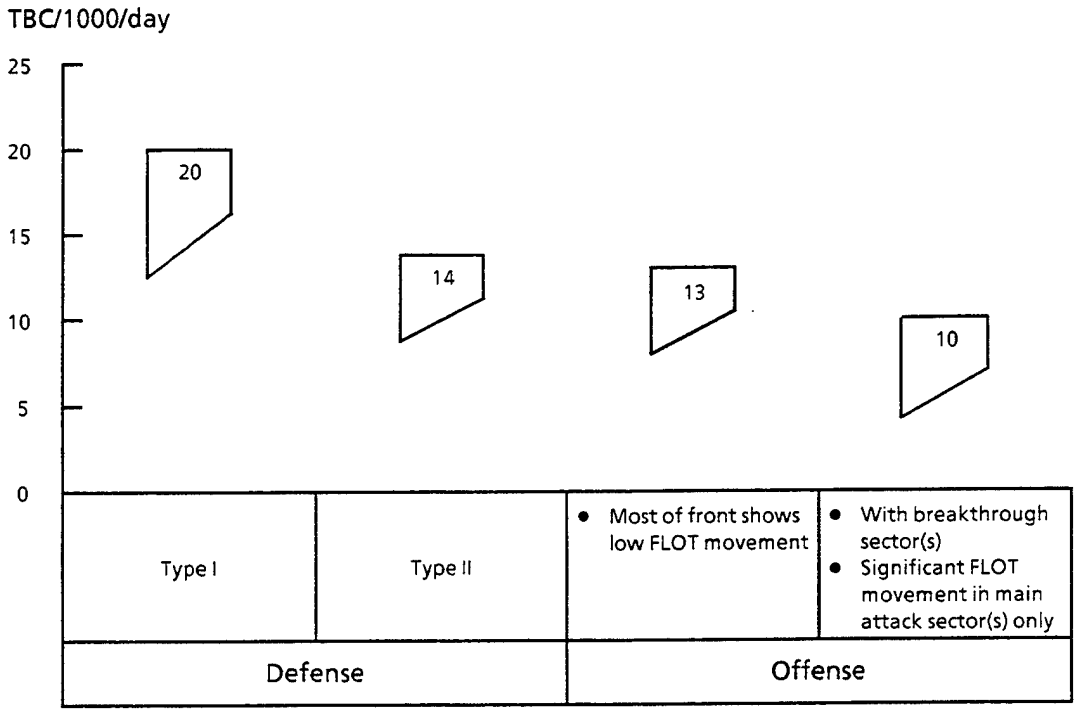


FIG. 2-2. RANGES OF 5-DAY PULSE RATES, ARMY-SIZE FORCE (Assuming continuous front)

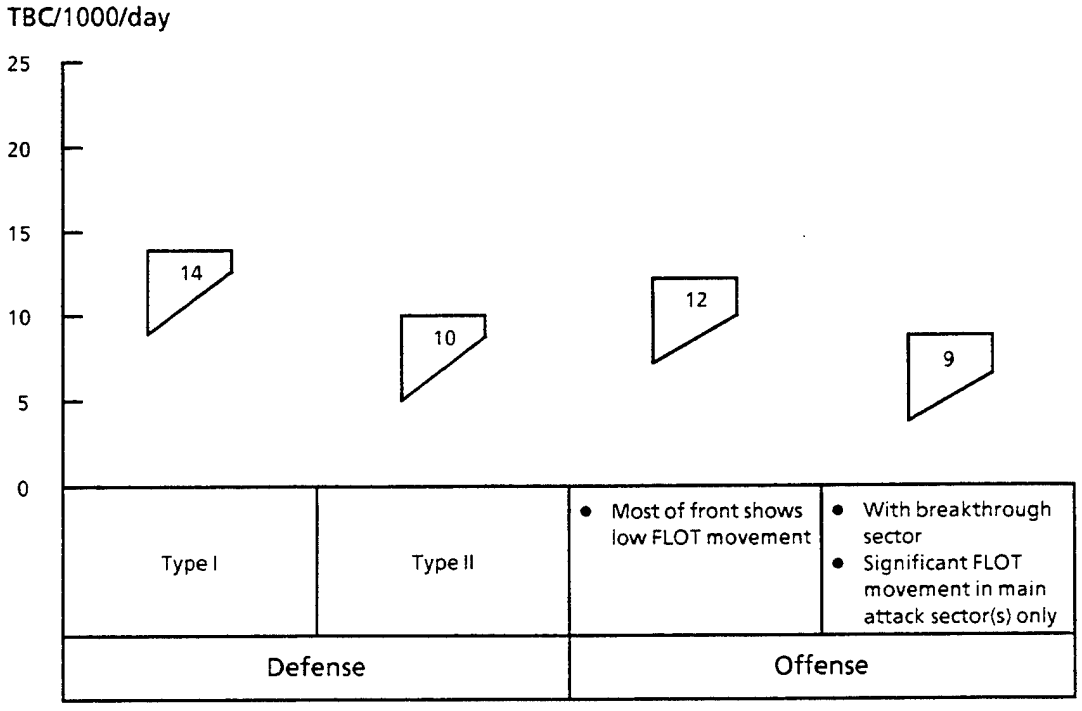
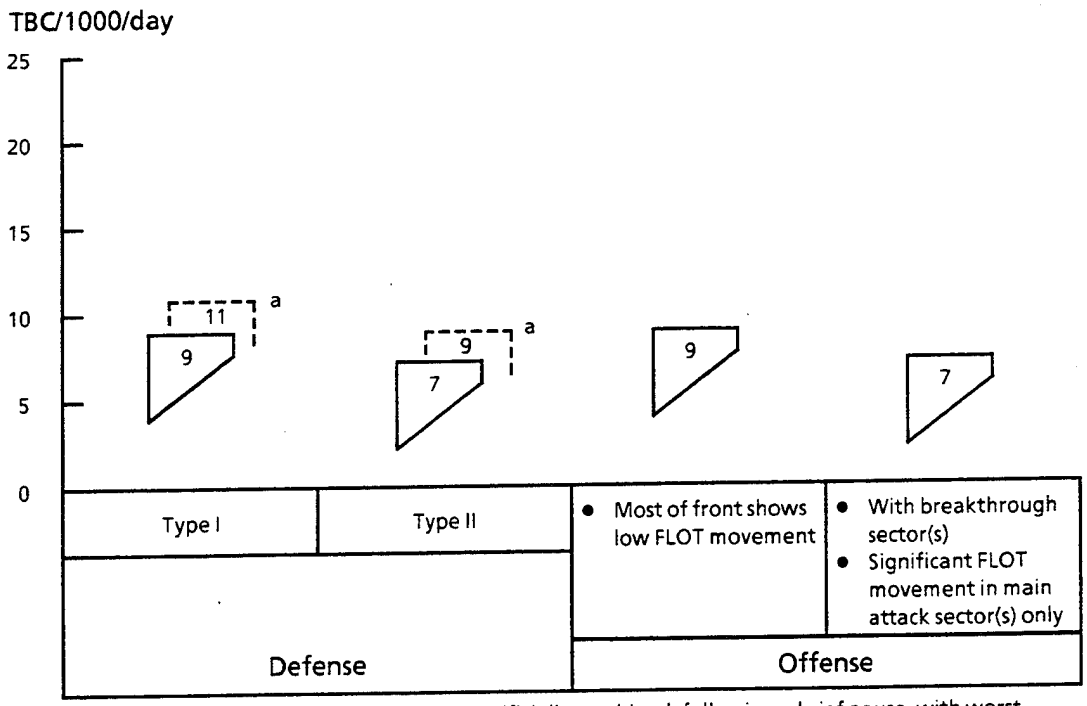
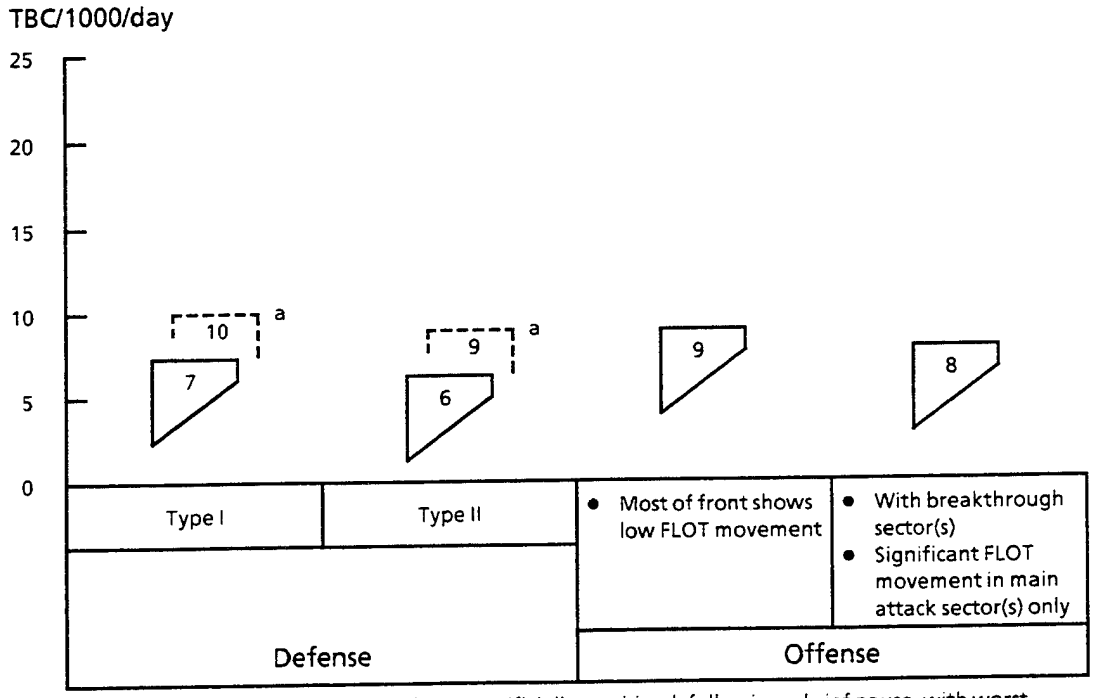


FIG. 2-3. RANGES OF 10-DAY PULSE RATES, ARMY-SIZE FORCE (Assuming continuous front)



[a] Rate limit if defensive pulse period were artificially combined, following a brief pause, with worst-case offensive pulse.

FIG. 2-4. RANGES OF 20-DAY PULSE RATES, ARMY-SIZE FORCE (Assuming continuous front)



[a] Rate limit if defensive pulse period were artificially combined, following a brief pause, with worst-case offensive pulse.

FIG. 2-5. RANGES OF 30-DAY PULSE RATES, ARMY-SIZE FORCE (Assuming continuous front)

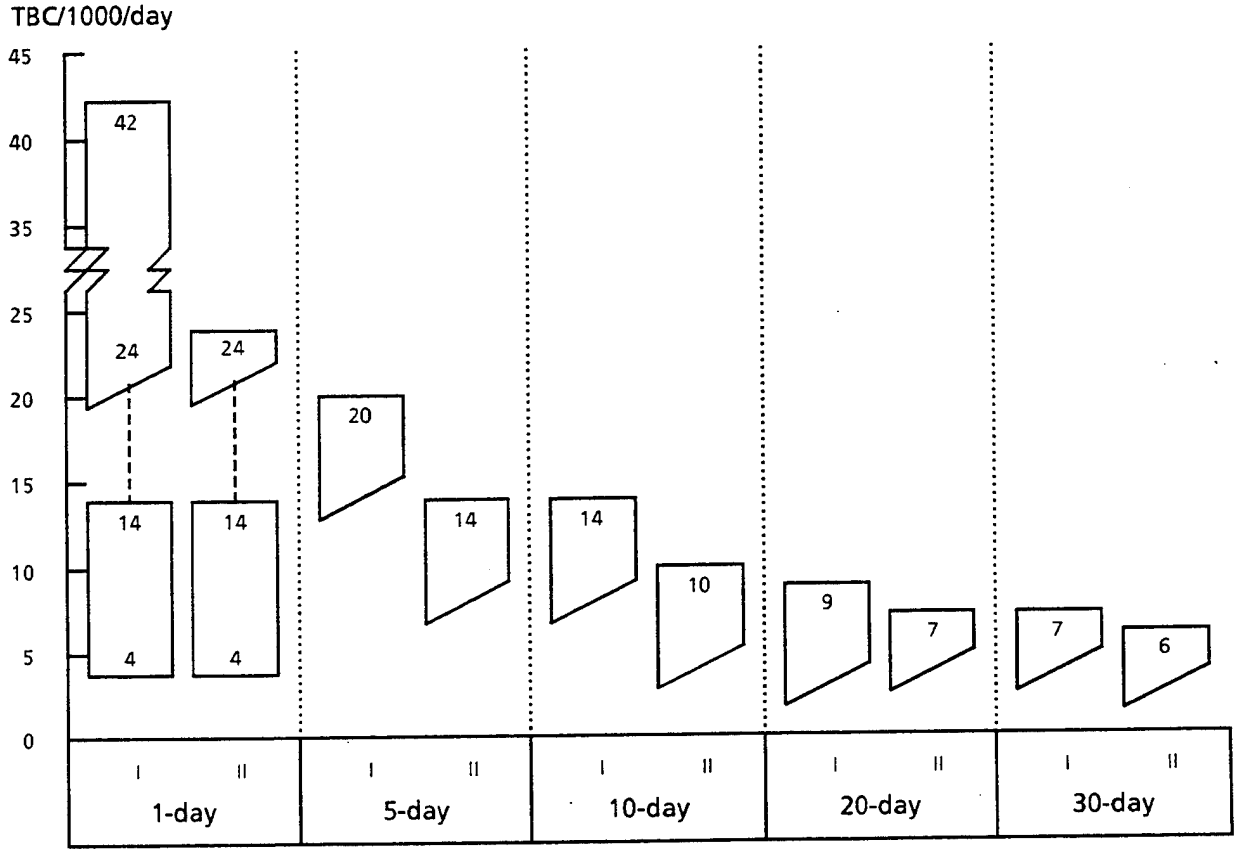


FIG. 2-6. SUMMARY TIME PERSPECTIVES ON ARMY PULSE RATES – DEFENSE, TYPES I AND II (Continuous front)

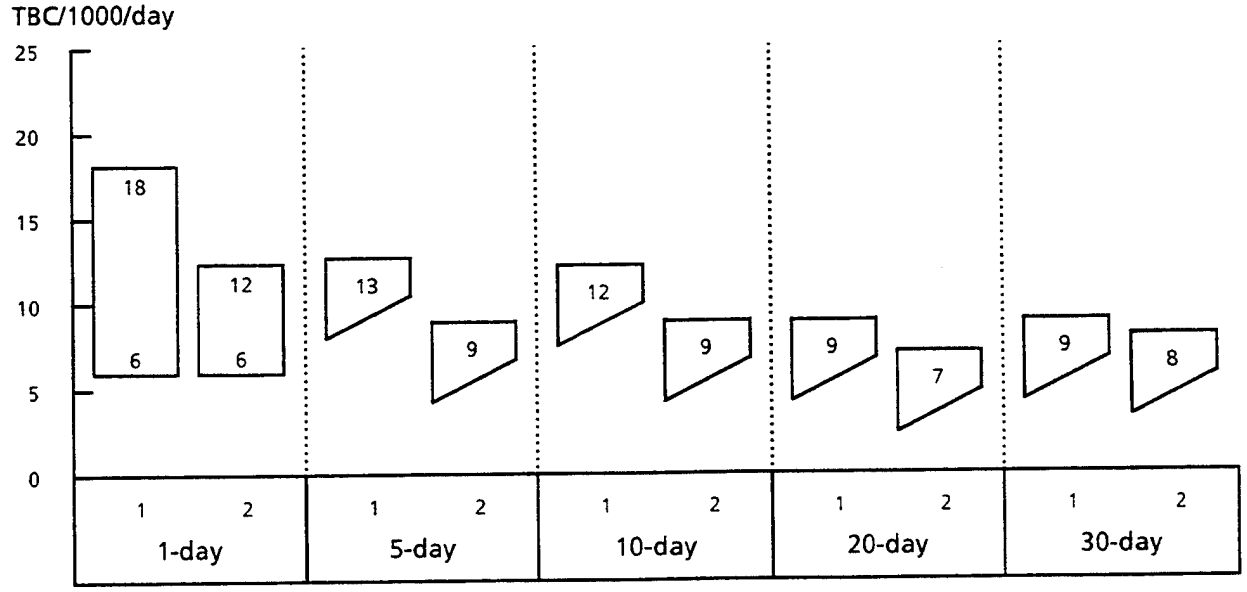
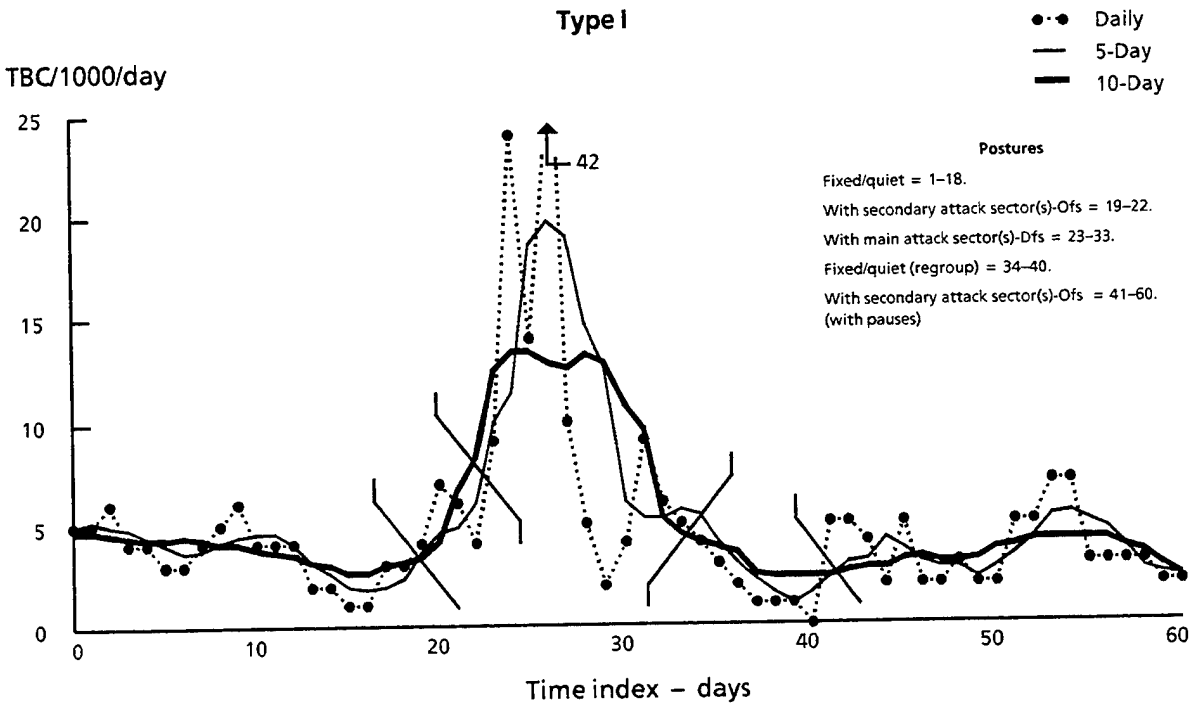


FIG. 2-7. SUMMARY TIME PERSPECTIVES ON ARMY PULSE RATES – OFFENSE, LOW (1) AND HIGHER (2) FLOT MOVEMENT (Continuous front)

ILLUSTRATIVE RATE CURVES

The following figures depict actual rate pulses and pauses during 60-day periods. They are meant for illustrative purposes only: no two pulse-pause combinations will be identical, but projections should at least reasonably resemble the illustrated curves' general character. The sector types being experienced are marked along the course of the time lines and noted in the keys. (Rates are army-day rates for the divisional force.)

The planner may find these time series curves useful, first, to see the character of daily rates that comprise pulses and pauses of various general magnitudes (seen more easily in the 5- and 10-day moving average curves). Second, the curves should be studied to gain a sense of the numbers of pulses that have been witnessed during periods of up to 60 days – recognizing that these curves depict the most active 60-day periods (for continuous-front operations) in the data.



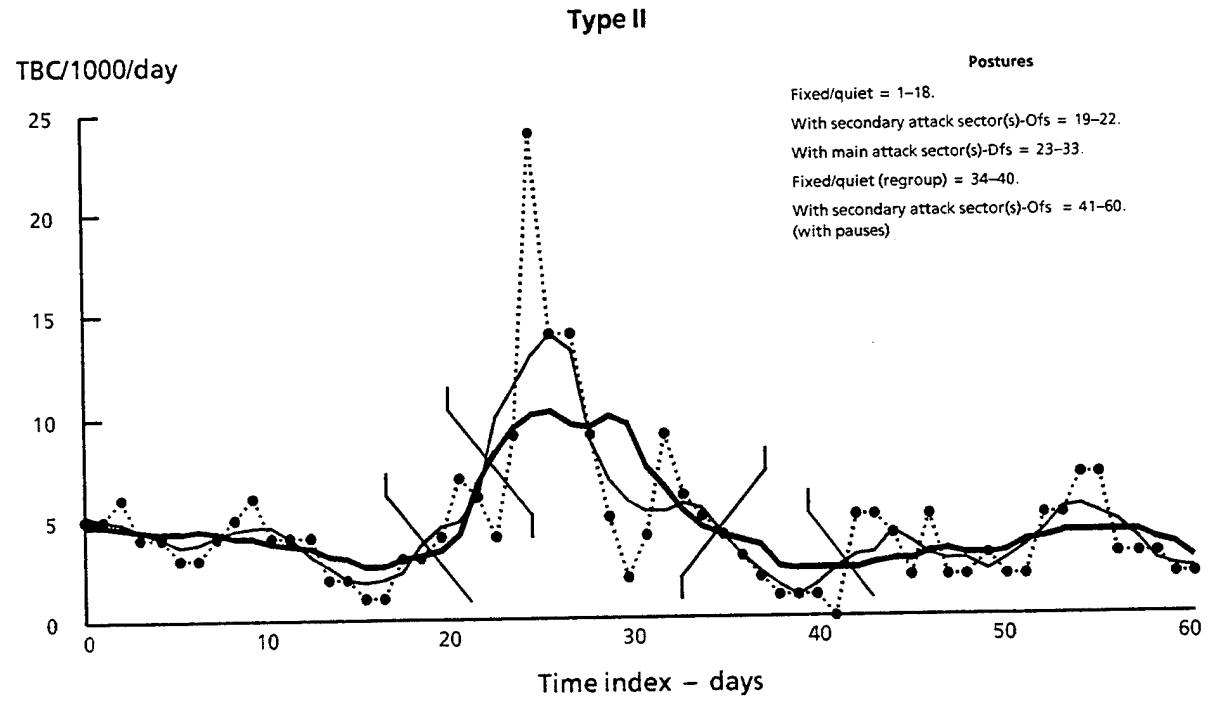
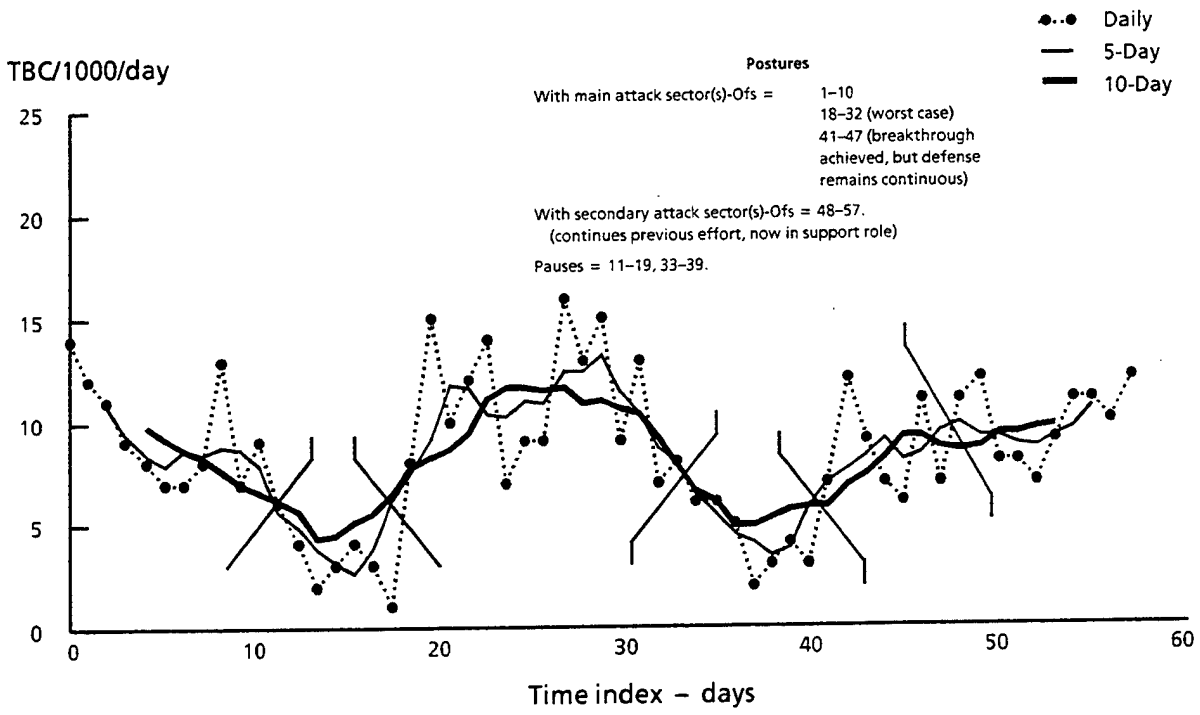


FIG. 2-8. ILLUSTRATIVE RATE CURVES – ARMY ON DEFENSIVE, TYPES I AND II



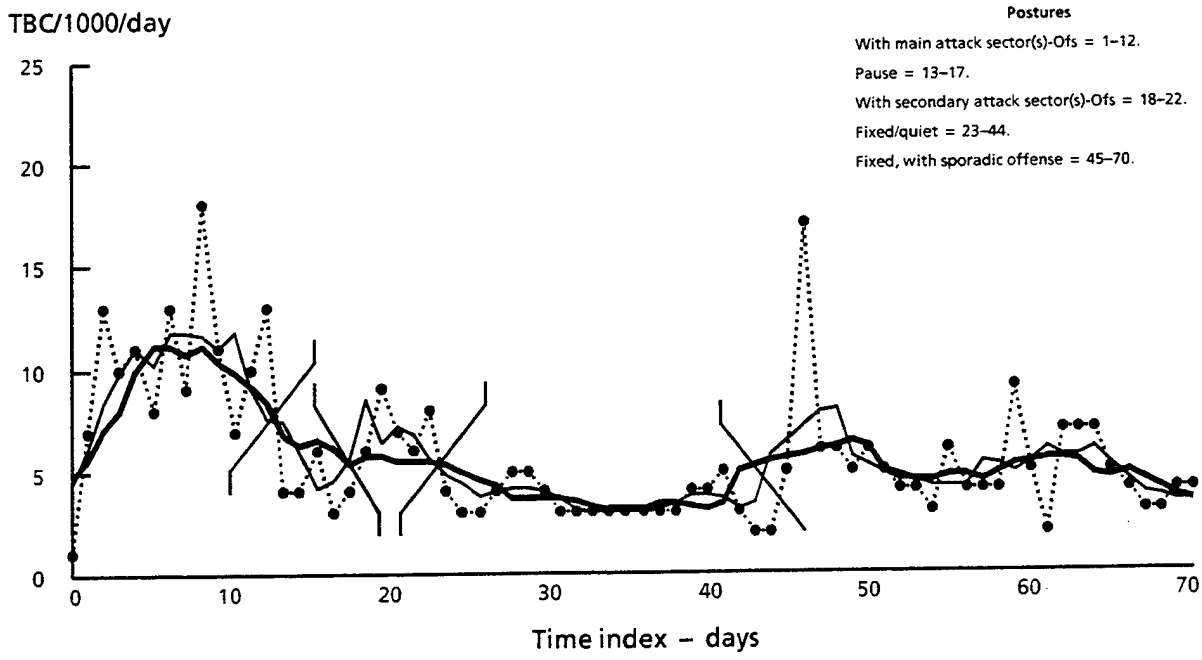


FIG. 2-9. ILLUSTRATIVE RATE CURVES – ARMY ON OFFENSIVE

ILLUSTRATIVE LATERAL RATES

The following figures depict relative lateral rates experienced by army-size forces on both the offensive and defensive. (Rates are for the divisional force.)

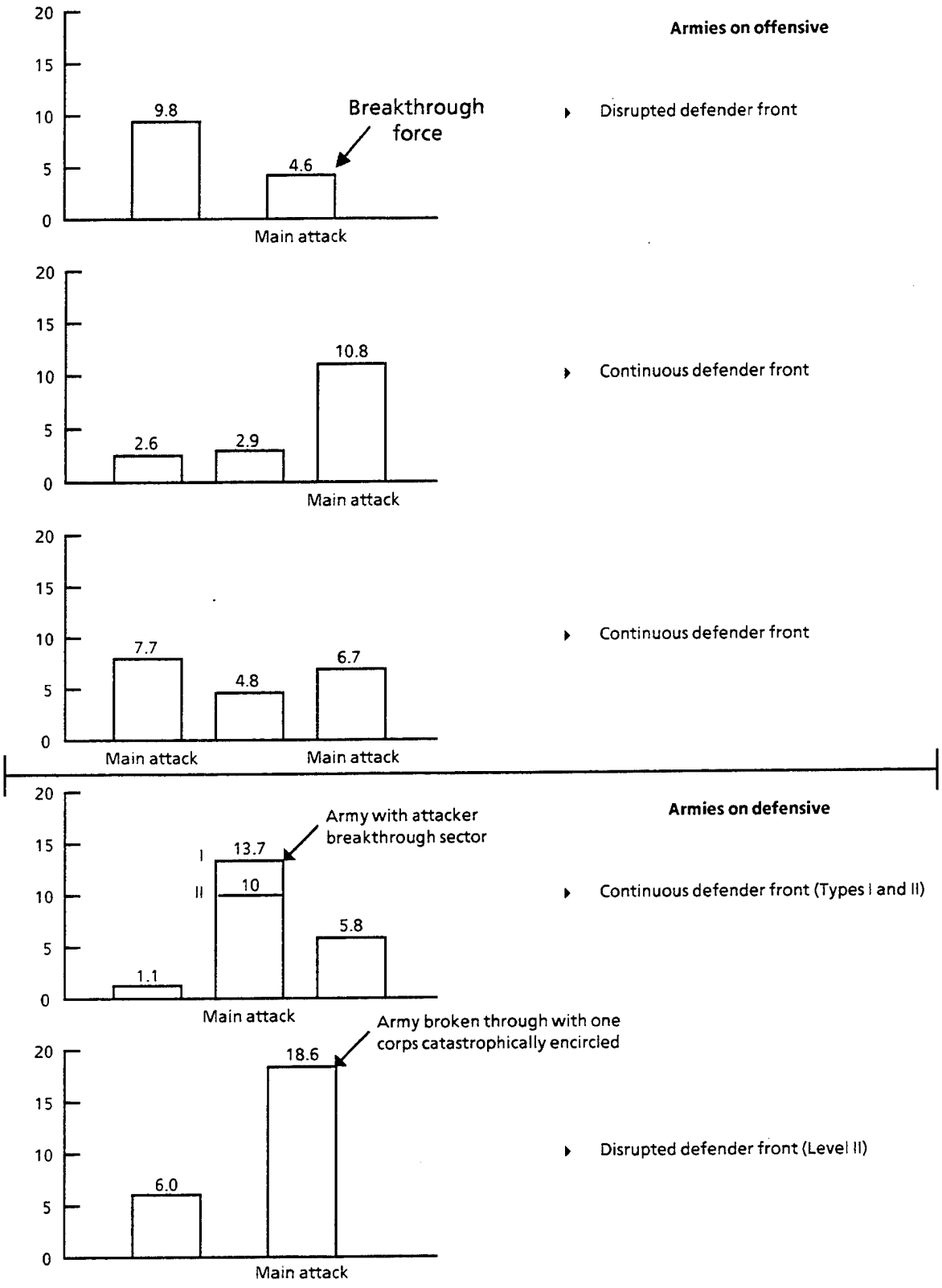


FIG. 2-10. ILLUSTRATIVE LATERAL 10-DAY TBC RATES FOR ARMY-SIZE FORCES (TBC/1000/day)

RATE DISTRIBUTIONS

The following tables depict distributions of the finer rates that are embedded within the rate averages shown previously under Rate Ranges. These data will help planners anticipate likely or possible medical workloads and personnel replacements requirements not only at the theater level but at those portions of the theater or front where activity is the most intense.

The Rate Ranges delimit the set of rate averages appropriate over varying periods of time for various forms of operations. For example, a rate that falls within the suggested range of 10-day rates is an average for that 10-day period. The rate ranges change with changing operational parameters. The rate distributions change as well.

Three sorts of rate distribution are provided: the spread of the set of daily rates (from maximum to minimum), the incidence of those daily rates in three broad classes of rates, and the breakdown of casualties by type of casualty.

The rate spread and class grouping data are especially useful to help planners gain a fuller sense of the probable magnitudes of daily rates in the most intense combat sectors and times. The rates in the higher reaches of these distributions should be linked by planners to those locales and particular units anticipated in operations plans to be the centers of operational activity.

The nature of rate pulses and pauses means, of course, that these higher rates in the distribution will not, during the period, be the sole experience of the most intense areas and their units. Other areas and units in the army may also experience such rates – and, therefore, some portion of the total number of such rates must be "apportioned" among these. However, to the extent operations plans are fully developed, planners may reasonably anticipate that the higher rates will be mostly focused in the projected areas of greatest intensity.

Defensive scenarios depict Type I and II distributions. Offensive distributions cite a worst case (with low FLOT movement) and a composite of four offensive pulses (with both low and high FLOT movement).

The cited distributions may be considered representative for planning purposes of the distributions to be expected during pulses of the cited types regardless of where the planner projects a particular average (mean) rate in the Rate Range for the cited sector type. Of course, the distribution used in planning should be one with a mean rate as close to that projected as is available.

TABLE 2-5

PULSE RATE DISTRIBUTIONS: ARMY WITH MAIN ATTACK SECTOR(S), DEFENSE – TYPES I AND II
(Assuming continuous front)

Rate statistic	TBC rate distributions by force days (TBC/1000/day)															
	10-day period								5-day peak							
	Type I				Type II				Type I				Type II			
	Divisional force			Full army	Divisional force			Full army	Divisional force			Full army	Divisional force			Full army
	A	B	C		A	B	C		A	B	C		A	B	C	
Maximum	577	112	42	25	149	59	24	15	577	112	42	25	149	59	24	15
75th percentile	10	13	14	9	10	13	14	9	14	15	24	15	14	15	14	9
Mean	14	14	14	8	10	10	10	6	20	20	20	12	14	14	14	9
50th percentile (median)	4	8	9	5	3	7	9	5	6	10	14	9	6	10	14	9
25th percentile	1	2	5	3	1	2	4	3	2	7	9	6	2	7	9	6
Minimum	0	1	2	1	0	1	2	1	0	2	9	5	0	2	9	5

Note: Divisional force: A = division-day rates; B = corps-day rates; C = army-day rates.

Rate class (TBC/1000/day)	Proportion of force days (division days) and rate averages per rate class							
	10-day period				5-day peak			
	Percent of division-day observations		Mean TBC rate (TBC/1000/day)		Percent of division-day observations		Mean TBC rate (TBC/1000/day)	
	Type I	Type II	Type I	Type II	Type I	Type II	Type I	Type II
≥ 40	7	7	113	66	13	12	113	66
10 to <40	19	20	18	18	23	24	19	19
<10	74	74	3	3	64	64	3	3

10-day pulse	Casualty rates by category (per 1000/day – divisional force)			
	TBC	KCMIA	WIA	WIA/TBC ratio
Full period				
Type I	13.7	9.2	4.4	.32
Type II	10.2	5.9	4.3	.42
5-day peak				
Type I	20.1	14.3	5 8	.29
Type II	14.1	8.5	5.6	40

TABLE 2-6

PULSE RATE DISTRIBUTIONS: ARMY WITH MAIN ATTACK SECTOR(S), OFFENSE
(Assuming continuous front)

Rate statistic	TBC rate distributions by force-days (TBC/1000/day)															
	10-day period								5-day peak							
	Worst case[a]				Composite case[b]				Worst case[a]				Composite case[b]			
	Divisional force			Full army	Divisional force			Full army	Divisional force			Full army	Divisional force			Full army
	A	B	C		A	B	C		A	B	C		A	B	C	
Maximum	88	30	17	14	88	33	19	14	43	26	17	14	64	31	19	14
75th percentile	20	20	14	11	15	15	12	9	23	21	15	13	17	19	13	10
Mean	12	12	11	9	10	10	10	8	13	14	13	11	11	12	11	8
50th percentile (median)	8	12	11	9	7	9	10	7	13	14	13	11	9	11	11	8
25th percentile	1	3	9	7	2	5	8	6	4	7	12	10	3	6	9	6
Minimum	0	0	7	6	0	0	7	3	0	2	8	7	0	2	7	4

Note: Divisional force: A = division-day rates; B = corps-day rates; C = army-day rates.

[a] Worst case (1 army pulse, worst seen, 140 division days).

[b] Composite case (4 army pulses, range of severity/conditions, 436 division days).

Rate class (TBC/1000/day)	Proportion of force days (division days) and rate averages per rate class							
	10-day period				5-day peak			
	Percent of division-day observations		Mean TBC rate (TBC/1000/day)		Percent of division-day observations		Mean TBC rate (TBC/1000/day)	
	Worst case	Composite case	Worst case	Composite case	Worst case	Composite case	Worst case	Composite case
≥ 40	2	3	66	53	2	3	43	47
10 to <40	41	37	22	19	53	41	22	19
<10	56	61	2	4	45	56	4	4

10-day pulse	Casualty rates by category (per 1000/day – divisional force)			
	TBC	KCMIA	WIA	WIA/TBC ratio
Full period				
Worst case	11.5	2.7	8.8	.77
Composite case	10.4	2.7	7.7	.74
5-day peak				
Worst case	13.4	3.1	10.2	76
Composite case	11.4	3.0	8.4	74

RATE VARIABILITY

Figure 2-11 depicts the relationship of an army's (divisional force's) mean rate experienced during a pulse (measured over a 10-day period) and the variability of that army's daily rates during the 10 days. The measure of rate variability is the standard deviation of those 10 daily points about that mean. (The single-day rates are army-day rates for the divisional force.)

Planning projections with daily rates may be compared to the figure's suggested mean-variability relationship.

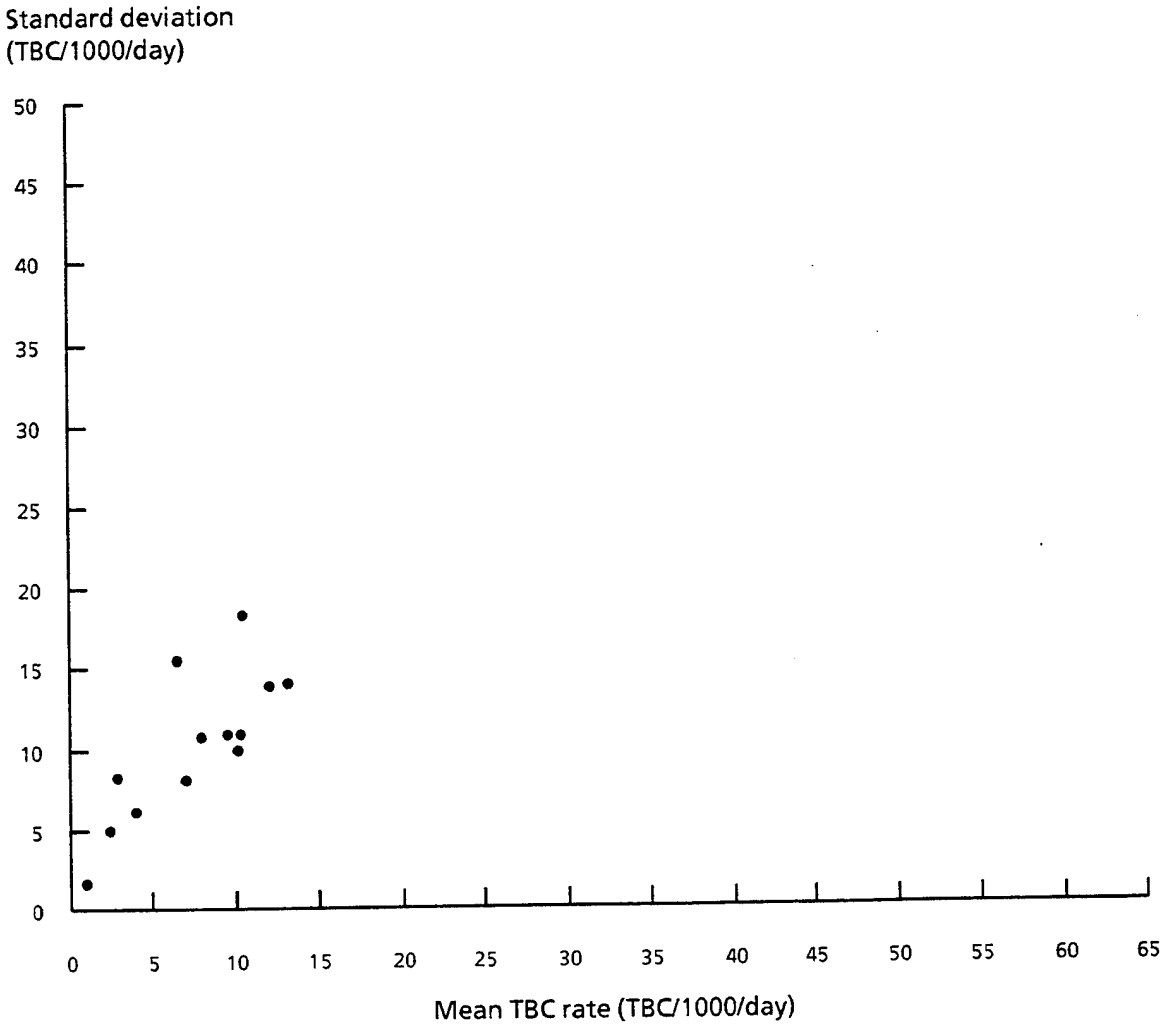


FIG. 2-11. MEAN AND STANDARD DEVIATION FOR 13 10-DAY ARMY PULSES

(Empirical)

CONTINUOUS-FRONT SCENARIOS
CORPS-SIZE FORCES

- Rate Ranges: Table 2-7
  Figures 2-12 through 2-21
- Illustrative Rate Curves: Figures 2-22 through 2-28
- Illustrative Lateral Rates: Figures 2-29 through 2-31
- Rate Distributions: Tables 2-8 through 2-11
- Rate Variability: Figure 2-32

RATE RANGES

The following table and figures show the ranges of rates that may be expected for a corps in various sector types for various time periods. (Rates are corps-day rates for the divisional force.)

It is important to recognize that the longer time frames (e.g., 20 or 30 days) cite rate ranges that include as many pulses for such periods as have been witnessed empirically. That is, these longer time perspectives are not merely a single pulse experience seen over a longer time period, but show ranges of rates for the sector type cited over the time cited, which usually includes multiple pulses and their pauses.

In every case, the rates cited are averages (means) experienced over the cited time period. The distributions of 1-day rates that comprise certain of these averages – rate pulses in particular types or phases of operations – are shown under Rate Distributions.

We exhibit ranges for various multiday measures of pulse periods – up to 30 days, for three principal reasons. First, a planner will find 30 days to be a period that probably encompasses most, if not all, of the foreseeable events in an operations plan. Second, to the extent the planner is able or required to envision operations beyond 30 days, it will be found that 30 days (probably fewer) fully encompass at least one major phase of the operation; follow-on phases may then be planned using the data provided for various time intervals. Third, to assist in the latter planning cases, we have provided in our accompanying section, Illustrative Rate Curves, time line views of events in the most active sets of 60-day periods witnessed for continuous-front operations. The planner may wish to orient himself on the numbers of pulses and pauses, and their relationships, within those extended time lines.[23] Of course, operations do not neatly divide into recurring time blocks, so the planner may use the various time perspectives on ranges of pulse period rates (and the table's set of pause rates and durations) to describe an operation's phases. Thus, the range data may be used for planning periods of essentially any length.

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[23]A comparison to disrupted-front operations is useful. We are unaware of any cases of a front being disrupted in a period outside the first 10 days of that concerted effort's planned beginning; that is, fronts are disrupted or not within the first 10 days of such an operation's commencement. Operations that have begun with disruptions have lasted generally from 10 to 60 days – a very few have endured for as many as 70 to 80 days. However, in all cases, the disruption and any subsequent major encirclements have occurred in phases lasting 30 days or less. The longer time lines were comprised of various combinations of offensive or defensive continuous-front operations – or, simply, force movement until defenses were restored and such operations resumed.

TABLE 2-7

RANGES OF 1-DAY PULSE AND PAUSE RATES, CORPS-SIZE FORCES
(Assuming continuous front)

Corps	TBC rates (per 1000/day)	WIA rates (per 1000/day)	Duration (days)
In Main Attack Sector			
Defense, Type I	60–112 > a 12–25 > a	21–25 6–10	1 V a 6–8
Defense, Type II	30–85 > a 12–25 > a	12–30 6–10	1 V a 6–8
Pause	2–6	<2–5	8 to 10 +

Remarks: A corps defensive pulse, Type I, will show 1-day TBC peak rates of 60 to 112. These peak rates will be *1-day events*. A Type II pulse will show peak rates of 30 to 85. In each case, such peak-rate events will be separated by 1 or more days of considerably lower rates (of 12 to 25). Up to two peak-rate events may be experienced in a 3-day period; up to three may be seen in a 6- to 8-day period. The pulse will be followed by an operational pause (or interval) of 8 to 10 days with low rates (probably 2 to 6).

The pause could, in turn, be followed by any of four general operational possibilities. First, a follow-on defensive pulse might occur with a renewed effort by the attacker (or the arrival of follow-on forces); the attacker's relative combat power would, however, be far less than in the first pulse, and other defender forces would also be active in the area by now. The corps rates during such a follow-on defensive pulse would likely resemble a defensive pulse in a secondary attack sector (see below). Second, the corps might generate its own counteroffensive pulse against the attacker. Third, the corps might participate in a general offensive. However, in either the second attack sector or third cases, such offensive activity after an interval of only 8 to 10 days is highly likely to achieve (at best) a secondary attack sector character (see below). Finally, the corps might well experience an interval considerably longer than 8 to 10 days. A determination of which of the last three basic possibilities is likely will depend largely on whether the corps is strengthened with fresh combat power or must instead regenerate combat power alone.

Counterattack into attacker's flanks			
Prepared flank[b]	24 8–17	18 6–13	1 V a 2–3
Unprepared flank[c]	5–12	4–9	2–4
Pause	2–8	<2–6	See remarks

[a] General note: Daily rates during pulses sometimes occur in what appear to be identifiably separate rate ranges. For example, a pulse may show rates in one range for nearly its full duration with occasional 1-day rates *during that period* in a significantly higher range. The latter events are indicated both in the TBC and WIA columns and under Duration (by a "V" placing them within the overall longer period).

[b] The flank of an enemy attacking force that is prepared to receive a defender's counterattack.

[c] The flank of an enemy attacking force caught unprepared for a defender's counterattack.

Remarks: Corps-level counterattacks in continuous-front settings tend to be of relatively brief duration. They may be followed by an equally brief interval and easily flow thereafter into offensive or defensive activity of a type more characteristic of a secondary attack sector.

TABLE 2-7

RANGES OF 1-DAY PULSE AND PAUSE RATES, CORPS-SIZE FORCES (Continued)
(Assuming continuous front)

Corps	TBC rates (per 1000/day)	WIA rates (per 1000/day)	Duration (days)
Offense	34 16–23 ≥10 (3–11)[b]	24–27 11-18 7–8 (2–9)[b]	1 [a] 3–5 ≤10–15 (4–10)[b]
Pause	2–8	<2–6	6–12 (21[c])
Remarks: A corps offensive pulse may endure 10 to 15 days with TBC rates generally over 10. Rates of 16 to 23 may endure 3 to 5 days consecutively, and a rate as high as 34 may be experienced once or twice on nonconsecutive days. During such a pulse, rates of 8 to 12 may be seen for a day (or 2 consecutive days) interspersed among the higher rates. The pulse will be followed by an interval of 6 to 12 days with rates between 2 and 8. A corps may wage several successive offensive pulses separated by pauses. It is unlikely that these pulses will all be of a main attack sector character; probably they will include secondary attack sector pulse rates. However, the evidence suggests that up to three offensive pulses may be seen – with main attack sector and secondary attack sector pulses intermixed, and with pauses – within a period of 50 to 60 days.			
In Secondary Attack Sector ***Defense***	20 10–16 ≥5	10–12 5–10 ≥2	1 2–3 ≤8
Pause	2–8	2–6	3–7
Offense	23[c] 6–17	16–18 5–11	1 ≤13
Pause	1–5	<1–4	4–7 (11, 27[d])

[a] General note: Daily rates during pulses sometimes occur in what appear to be identifiably separate rate ranges. For example, a pulse may show rates in one range for nearly its full duration with occasional 1-day rates *during that period* in a significantly higher range. The latter events are indicated both in the TBC and WIA columns and under Duration (by a "V" placing them within the overall longer period).

[b] These rates depict attacker experience in a breakthrough sector into a continuous defender front (Type I or II) – perhaps especially one weakened by firepower or surprised by maneuver.

[c] Small corps (e.g., 2 divisions) may see rates of 23 to 31.

[d] Pauses as long as this (and even up to ~40 days) also witnessed.

Remarks: As with rates in every kind of sector and posture, daily fluctuation within the rate range will occur

TABLE 2-7

RANGES OF 1-DAY PULSE AND PAUSE RATES, CORPS-SIZE FORCES (Continued)
(Assuming continuous front)

Corps	TBC rates (per 1000/day)	WIA rates (per 1000/day)	Duration (days)
In "Fixed" Sector *Defense or offense*	2–8	<2–6	See remarks
Pause	0–2	0–<2	See remarks
Remarks: A corps sector may be fixed for the duration of a campaign (from, say, about 15 to 40 days). More likely, it will be fixed for the duration of one or a few successive pulses (and their intervals) in neighboring sectors and then serve as a more active (pulse) sector of some kind.			
In "Quiet" (static) Sector	0–2	0–<2	See remarks
Remarks: The occurrence of quiet sectors is more likely in scenarios with an extended (theater-size) frontage, or between major campaigns, or with sectors that are relatively isolated naturally (say, geographically) or operationally (say, bypassed by combat events). Thus, duration may be quite brief (e.g., 3 to 10 days) or indefinite.			

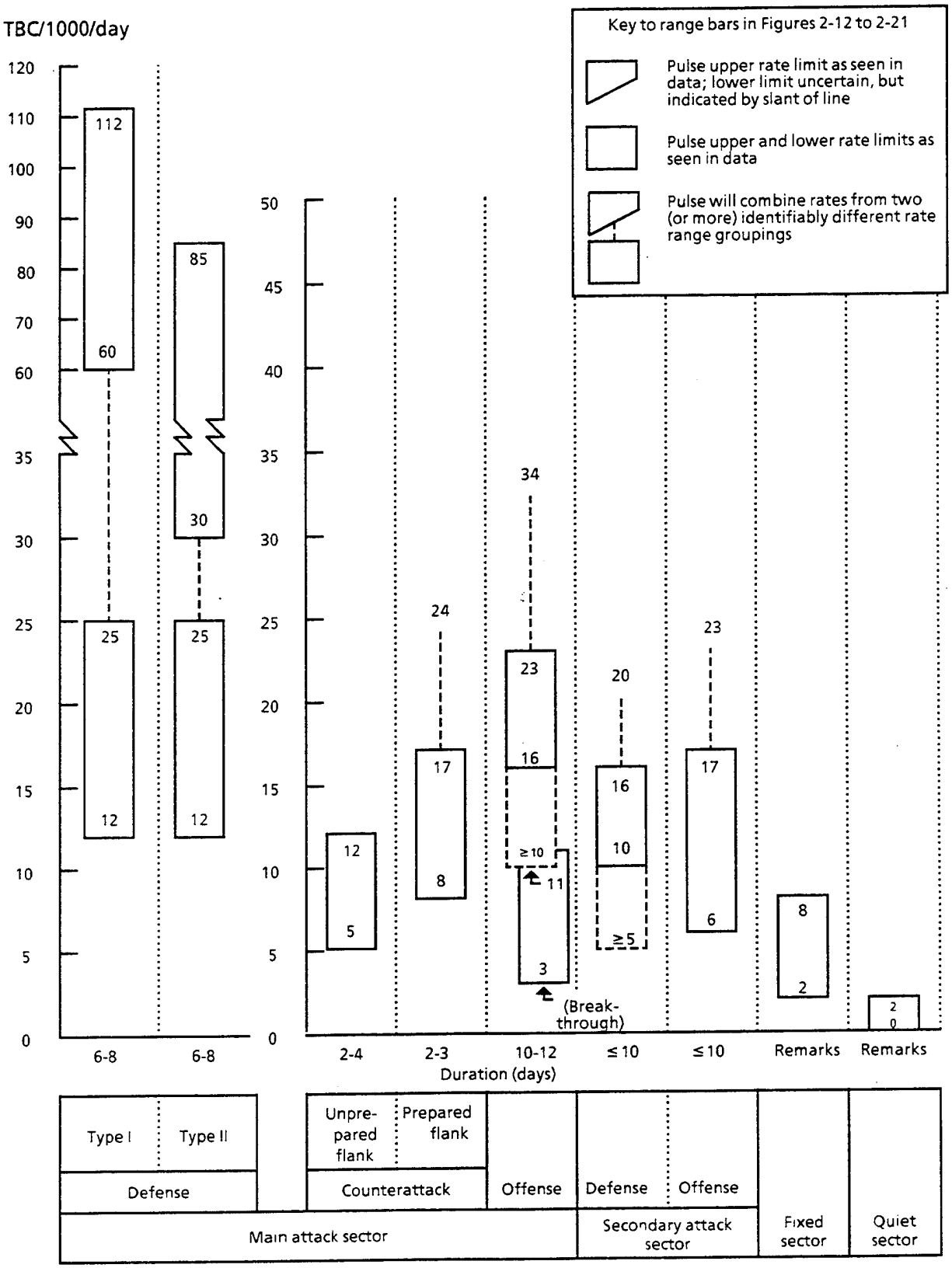
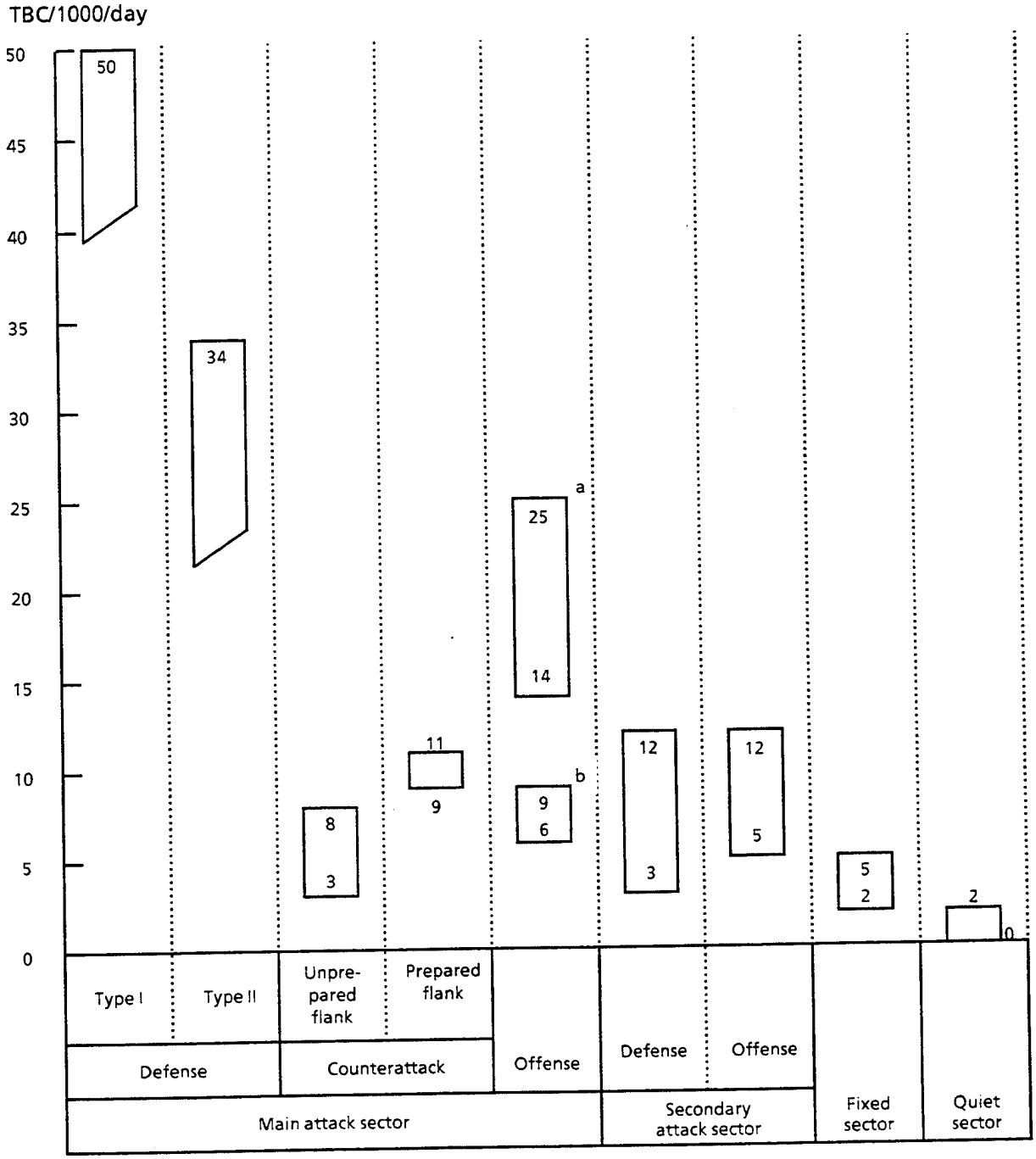
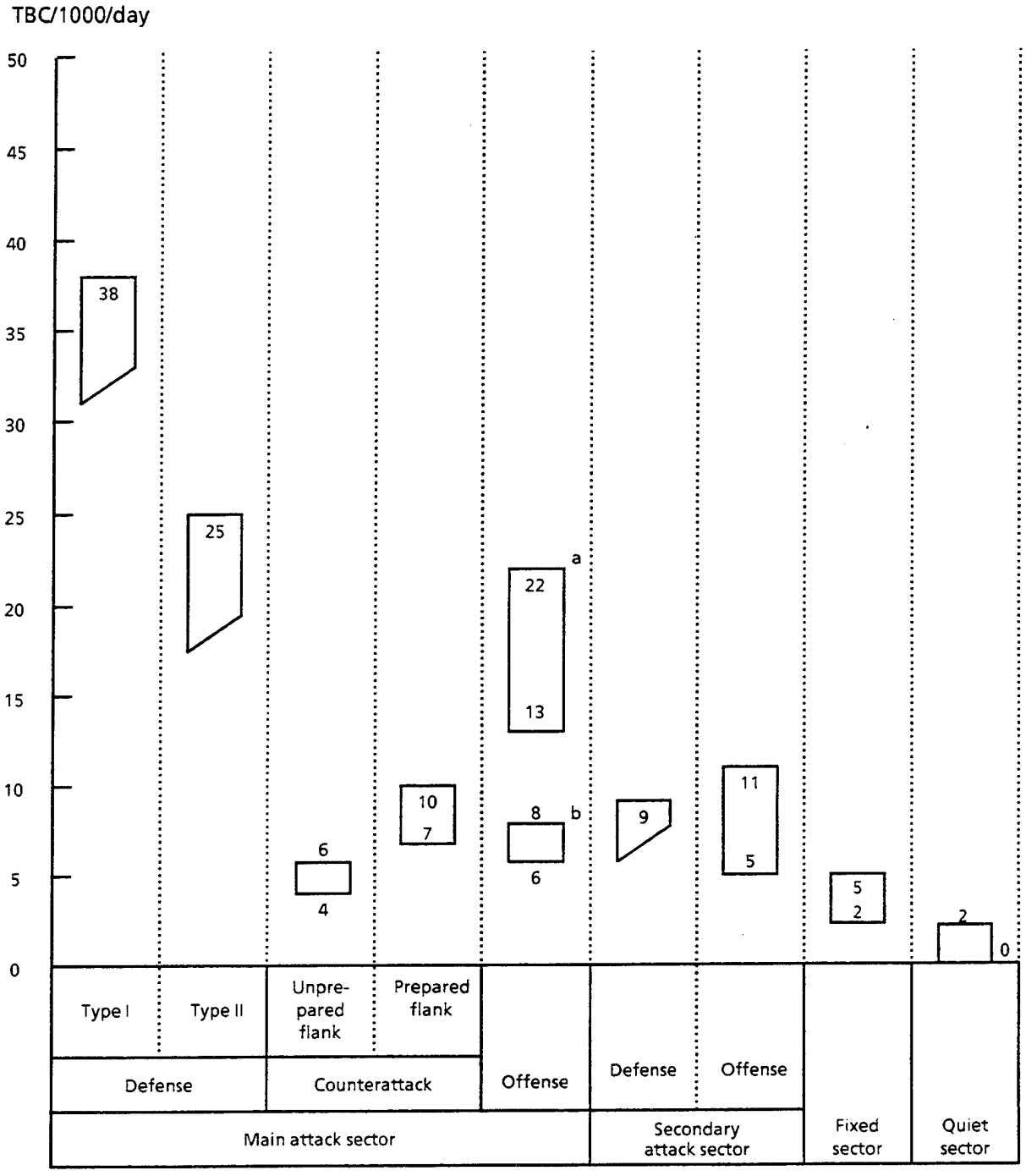


FIG. 2-12. RANGES OF 1-DAY PULSE RATES, CORPS-SIZE FORCE (Assuming continuous front)



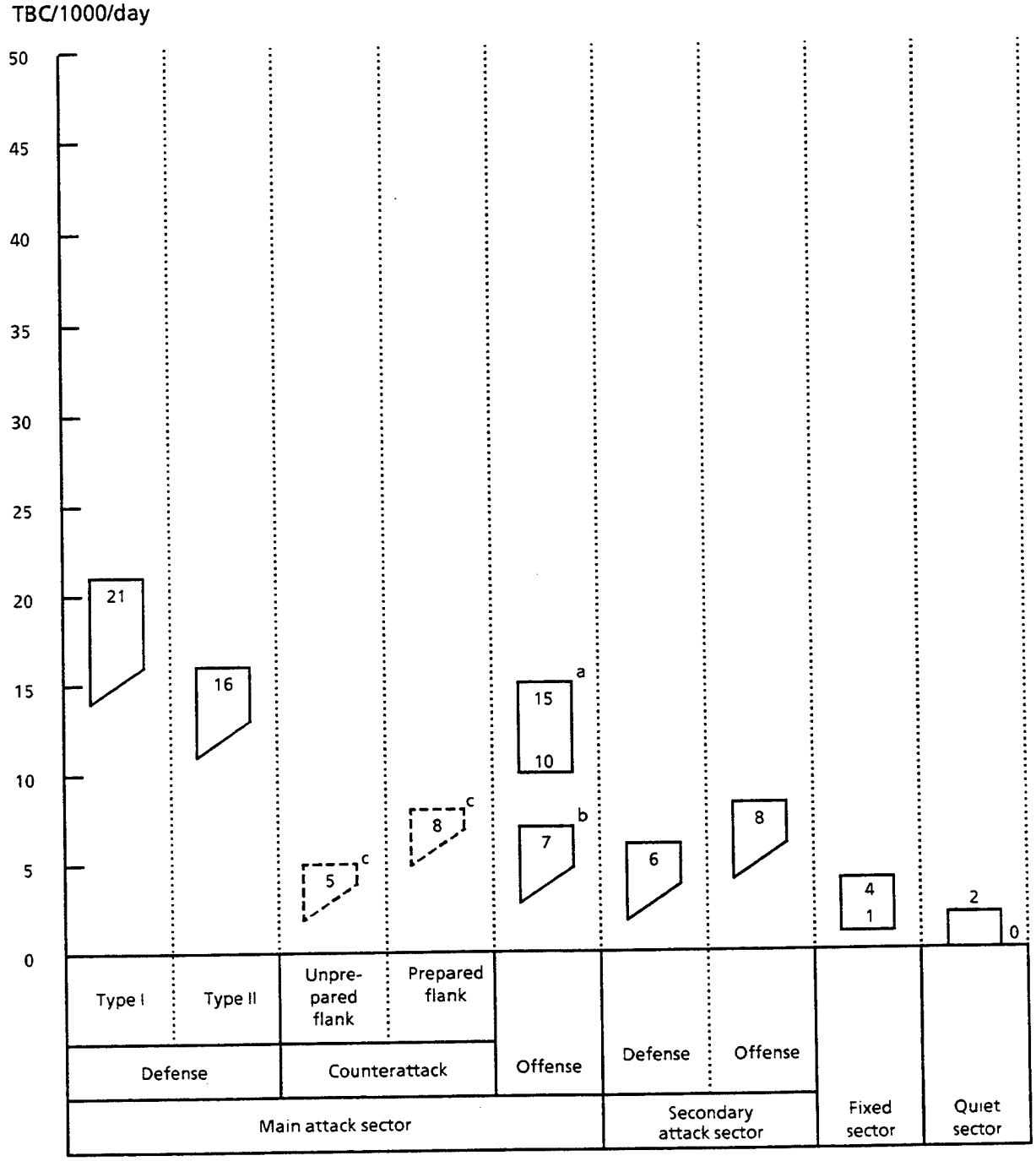
[a] Cases of low or relatively low FLOT movement.
[b] Cases of breakthrough (relatively significant FLOT movement) – but still in a continuous-front setting.

FIG. 2-13. RANGES OF 5-DAY PULSE RATES, CORPS-SIZE FORCE (Assuming continuous front)



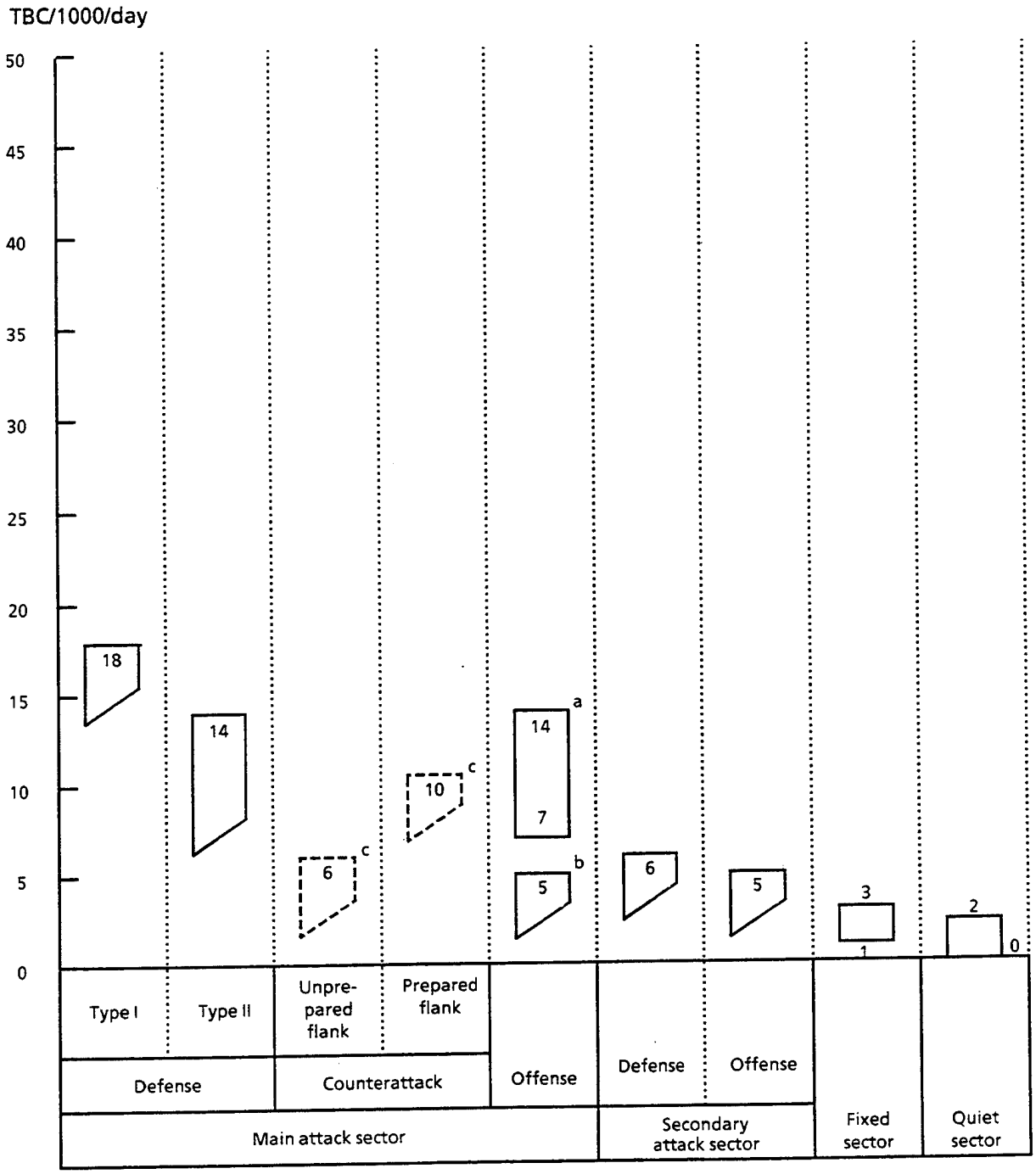
[a] Cases of low or relatively low FLOT movement.
[b] Cases of breakthrough (relatively significant FLOT movement) – but still in a continuous-front setting.

FIG. 2-14. RANGES OF 10-DAY PULSE RATES, CORPS-SIZE FORCE (Assuming continuous front)



[a] Cases of low or relatively low FLOT movement.
[b] Cases of breakthrough (relatively significant FLOT movement) – but still in a continuous-front setting.
[c] Counterattack rates (which are short duration) become less distinct in 20-day measures.

FIG. 2-15. RANGES OF 20-DAY PULSE RATES, CORPS-SIZE FORCE (Assuming continuous front)



[a] Cases of low or relatively low FLOT movement.

[b] Cases of breakthrough (relatively significant FLOT movement) – but still in a continuous-front setting.

[c] Counterattack rates (which are short duration) tend to blend into other rates in 30-day measures (e.g., will exhibit rises when mixed with other pulses).

FIG. 2-16. RANGES OF 30-DAY PULSE RATES, CORPS-SIZE FORCE (Assuming continuous front)

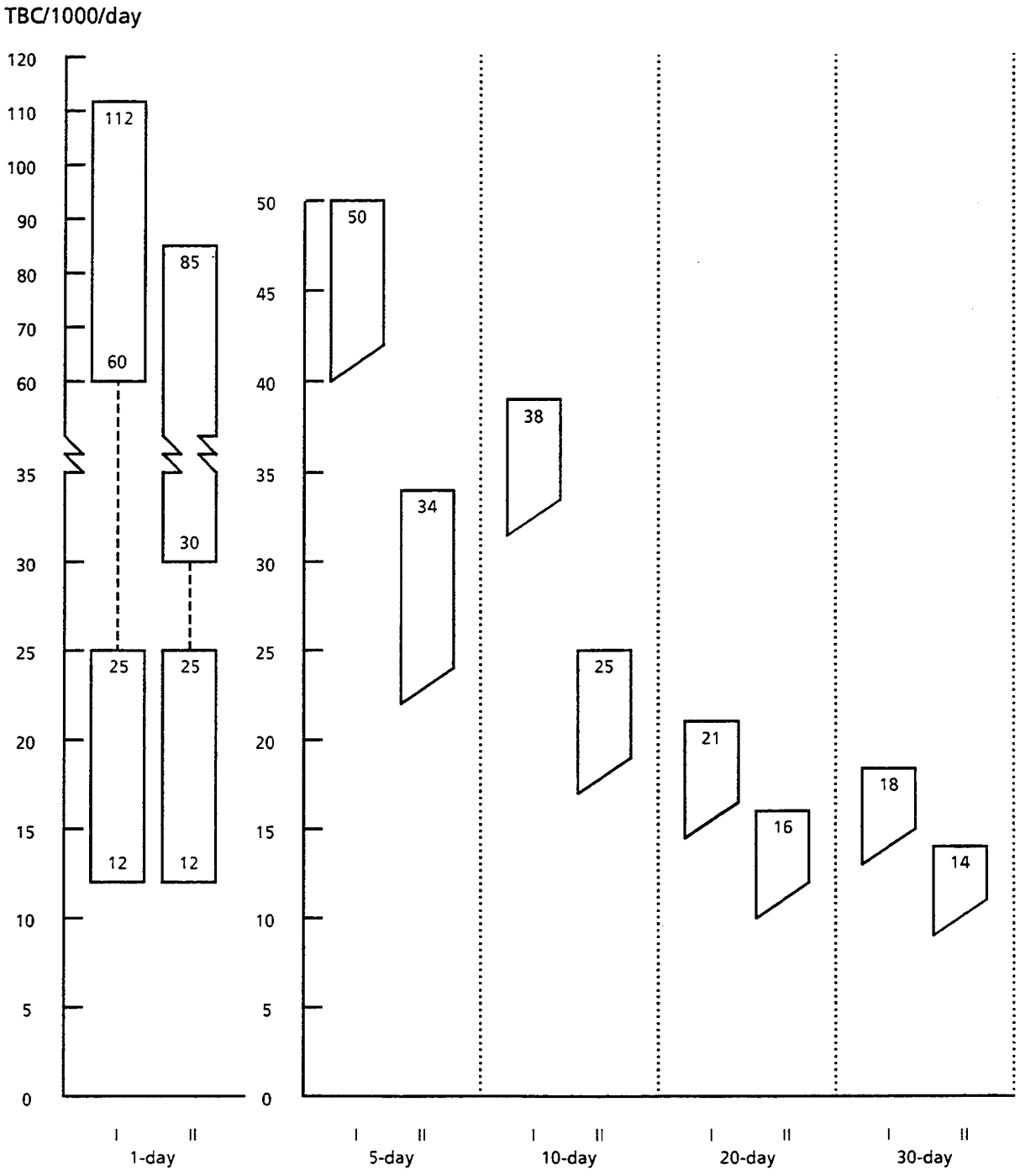
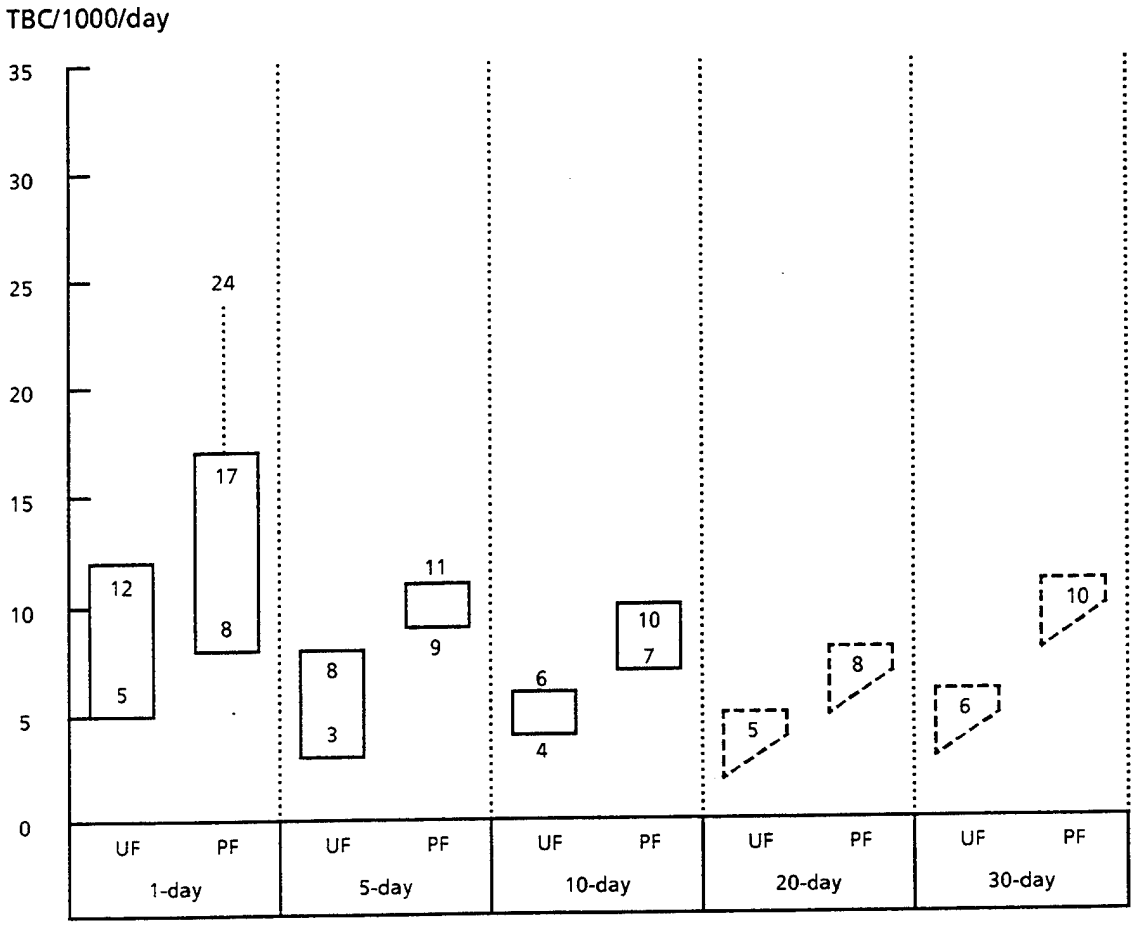
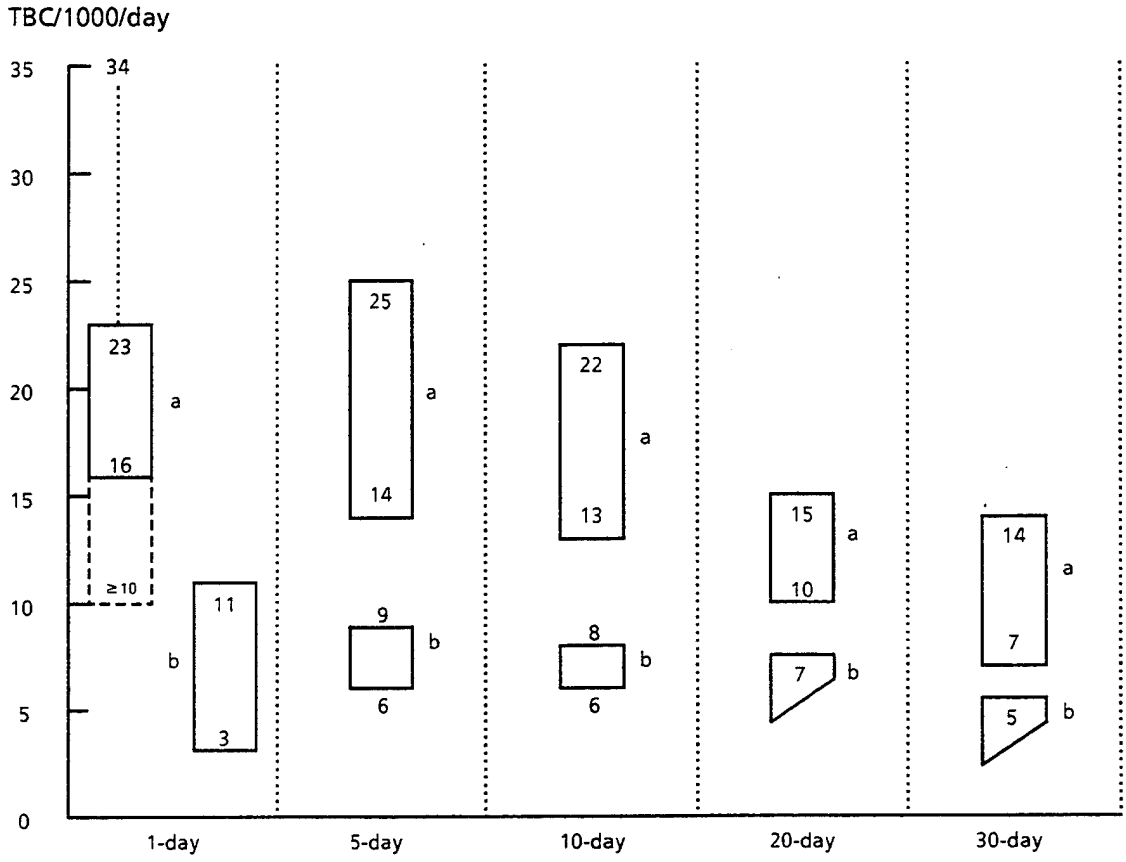


FIG. 2-17. SUMMARY TIME PERSPECTIVES ON CORPS PULSE RATES – DEFENSE (TYPES I AND II), MAIN ATTACK SECTOR
(Continuous front)



Note: Corps-level counterattacks are short-lived. A 20- or 30-day average for them would tend to be mixed with rates for the corps in some other posture (e.g., a main or secondary attack or defense, if not a fixed or quiet posture).

FIG. 2-18. SUMMARY TIME PERSPECTIVES ON CORPS PULSE RATES – COUNTERATTACK, MAIN ATTACK SECTOR



[a] Cases of low or relatively low FLOT movement.
[b] Cases of breakthrough (relatively significant FLOT movement) – but still in a continuous-front setting.

FIG. 2-19. SUMMARY TIME PERSPECTIVES ON CORPS PULSE RATES – OFFENSE, MAIN ATTACK SECTOR

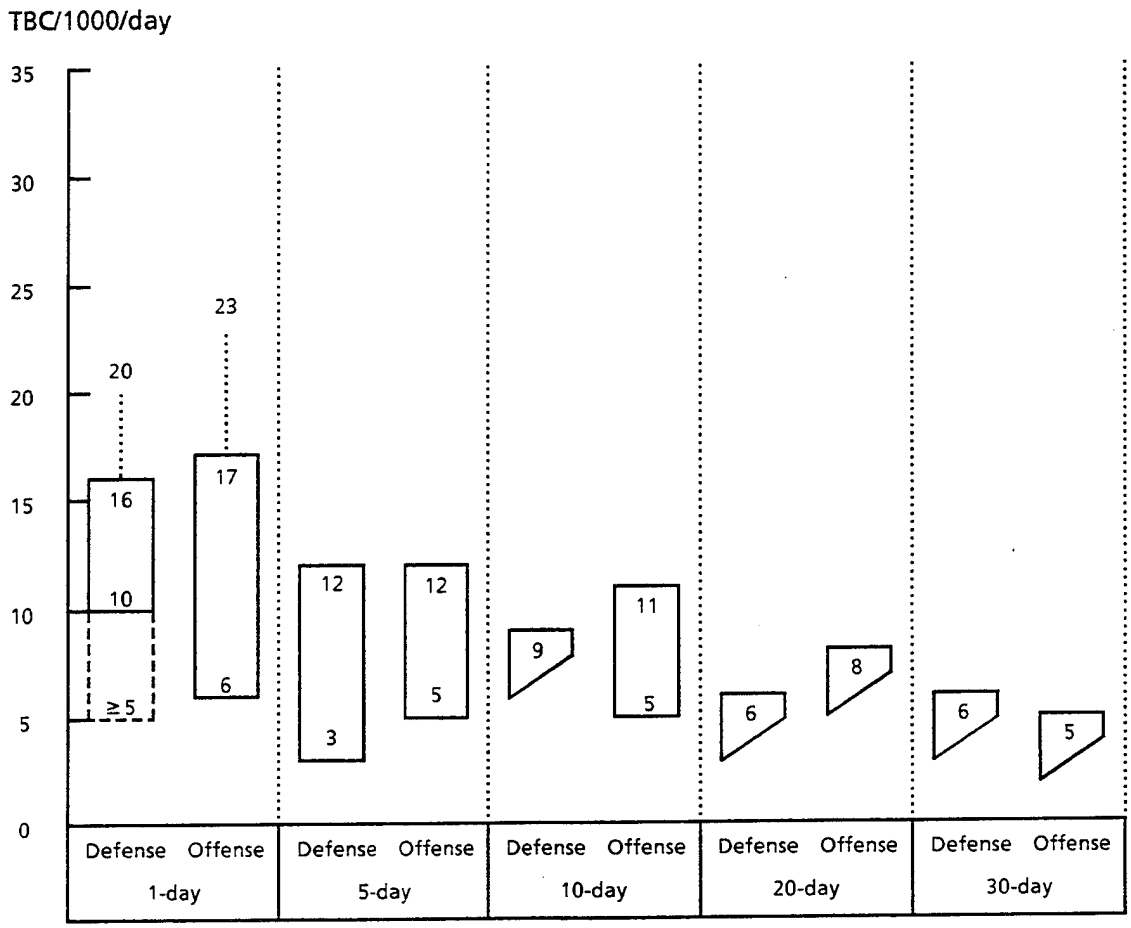


FIG. 2-20. SUMMARY TIME PERSPECTIVES ON CORPS PULSE RATES – DEFENSE AND OFFENSE, SECONDARY ATTACK SECTOR

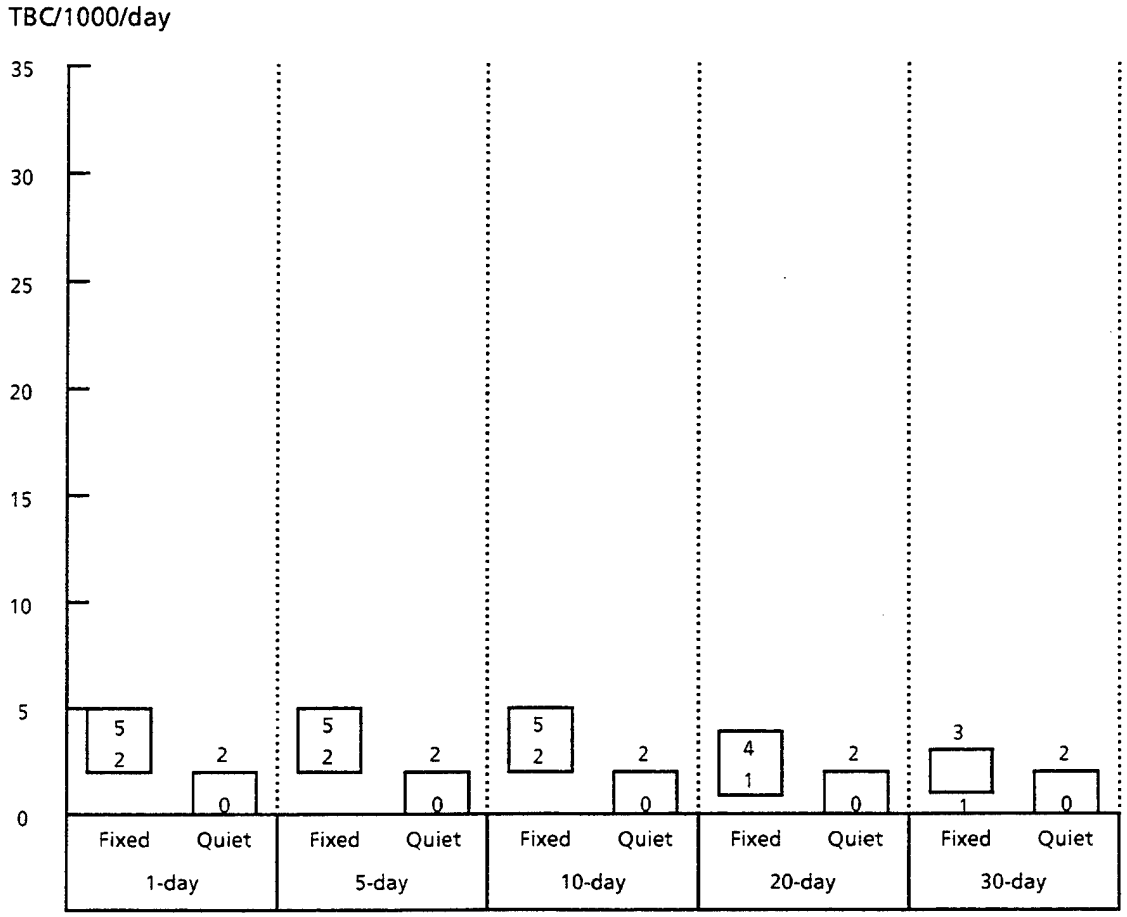


FIG. 2-21. SUMMARY TIME PERSPECTIVES ON CORPS PULSE RATES – FIXED AND QUIET SECTORS

ILLUSTRATIVE RATE CURVES

The following figures depict relative actual rate pulses and pauses during 60-day periods. They are meant for illustrative purposes only: no two pulse-pause combinations will be identical, but projections should at least reasonably resemble the illustrated curves' general character. The sector types being experienced are marked along the course of the time lines and noted in the keys. (Rates are corps-day rates for the divisional force.)

The planner may find these time series curves useful, first, to see the character of daily rates that comprise pulses and pauses of various general magnitudes (seen more easily in the 5- and 10-day moving average curves). Second, the curves should be studied to gain a sense of the numbers of pulses that have been witnessed during periods of up to 60 days – recognizing that these curves depict the most active 60-day periods (for continuous-front operations) in the data.

We note in particular the two sets of breakthrough rates. Figure 2-25 (upper panel) depicts a major corps offensive breakthrough while the enemy front remains continuous. Figure 2-24 shows rates for corps that penetrated through a disrupted enemy front and pursued deep operational objectives against little organized resistance. (These data should be compared to the lateral view of the same events seen in Figure 2-31 under Illustrative Lateral Rates. The continuous-front breakthrough rates are also noted in Rate Ranges data.)

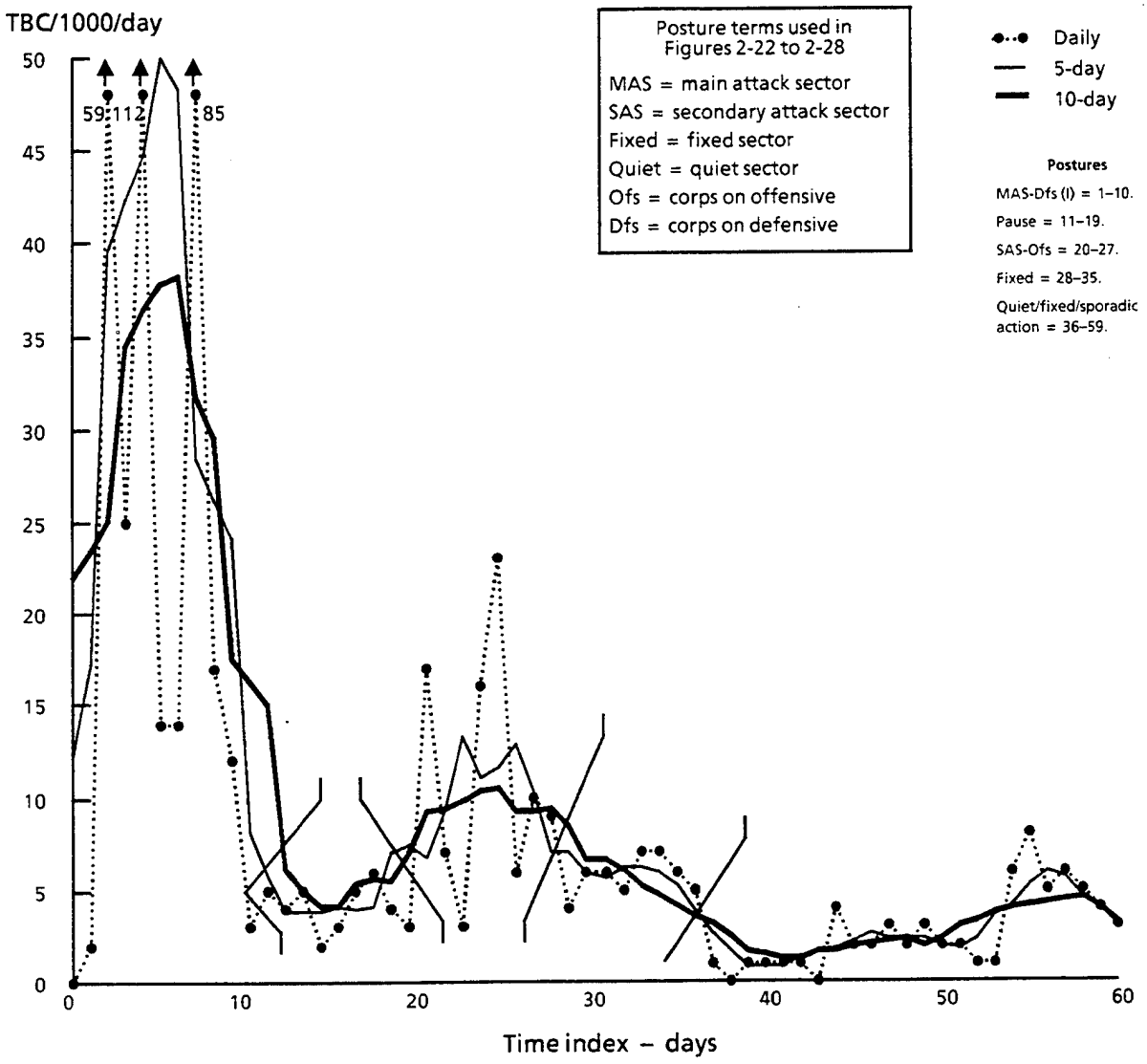


FIG. 2-22. ILLUSTRATIVE RATE CURVES – CORPS, TYPE I DEFENSE (And subsequent operations)

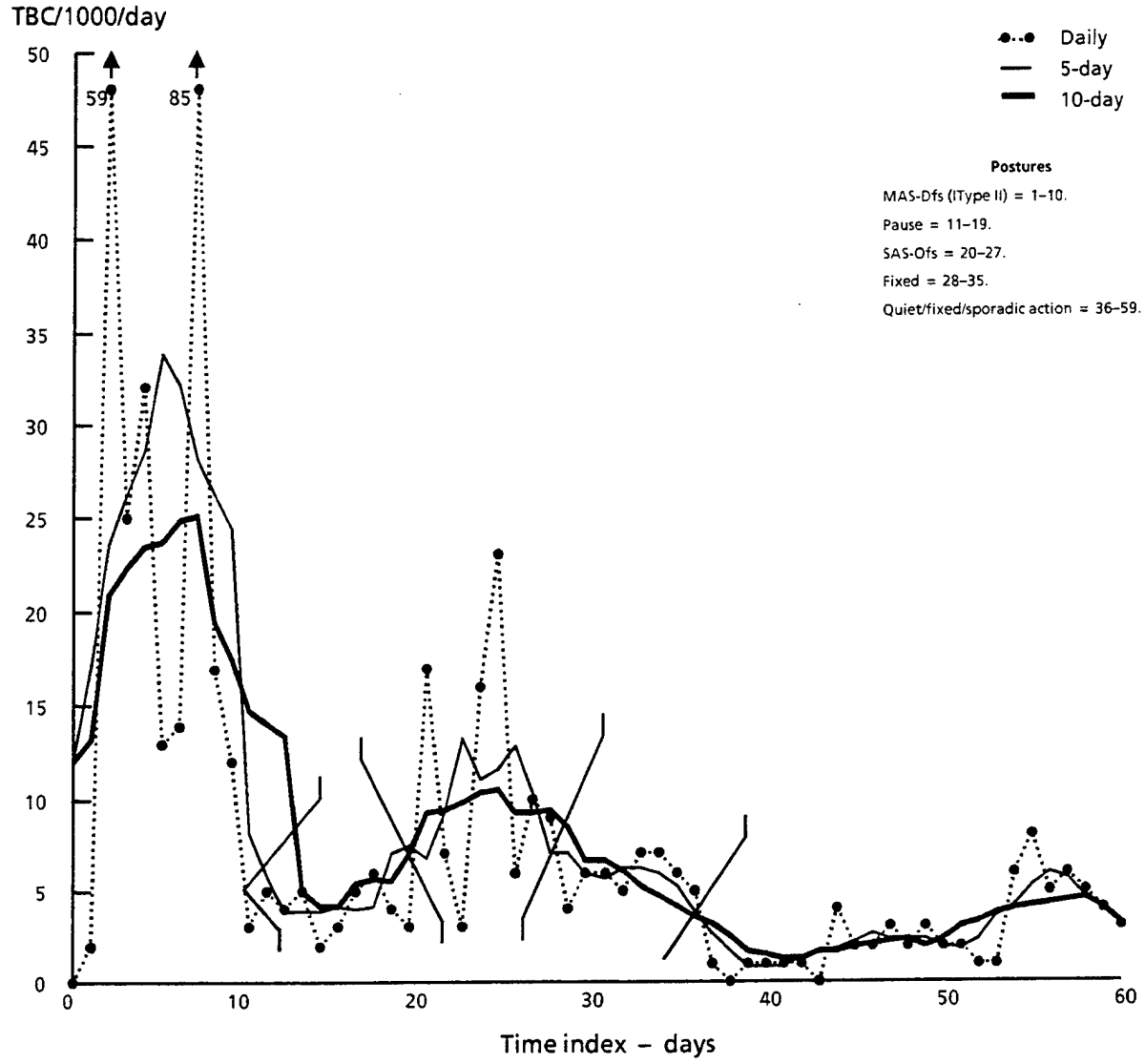
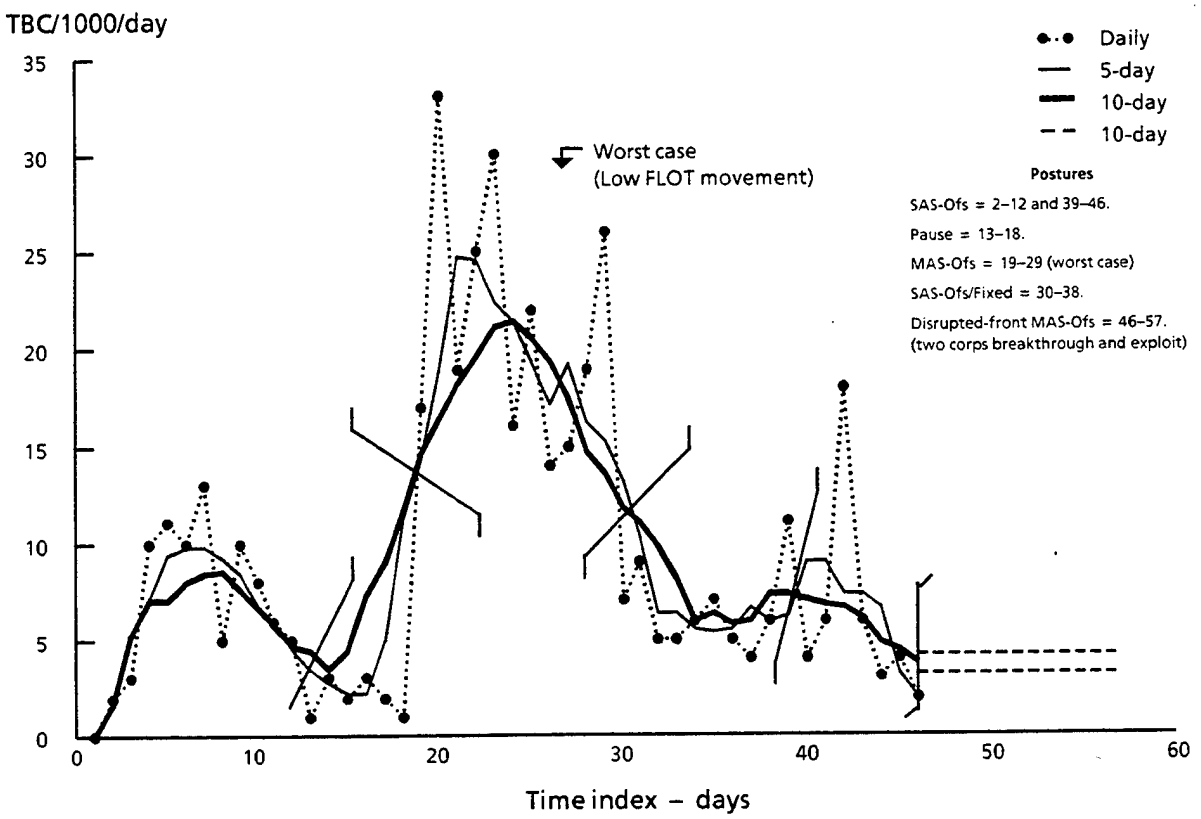


FIG. 2-23. ILLUSTRATIVE RATE CURVES – CORPS, TYPE II DEFENSE (And subsequent operations)



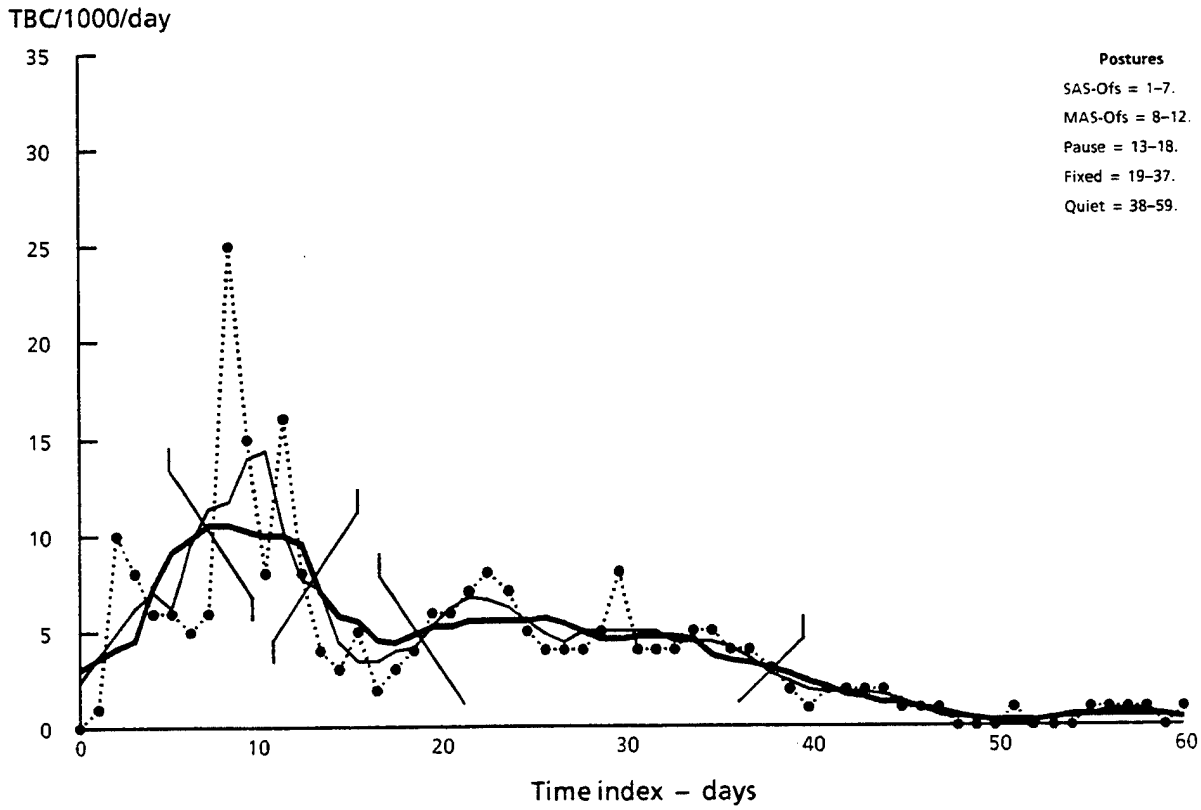
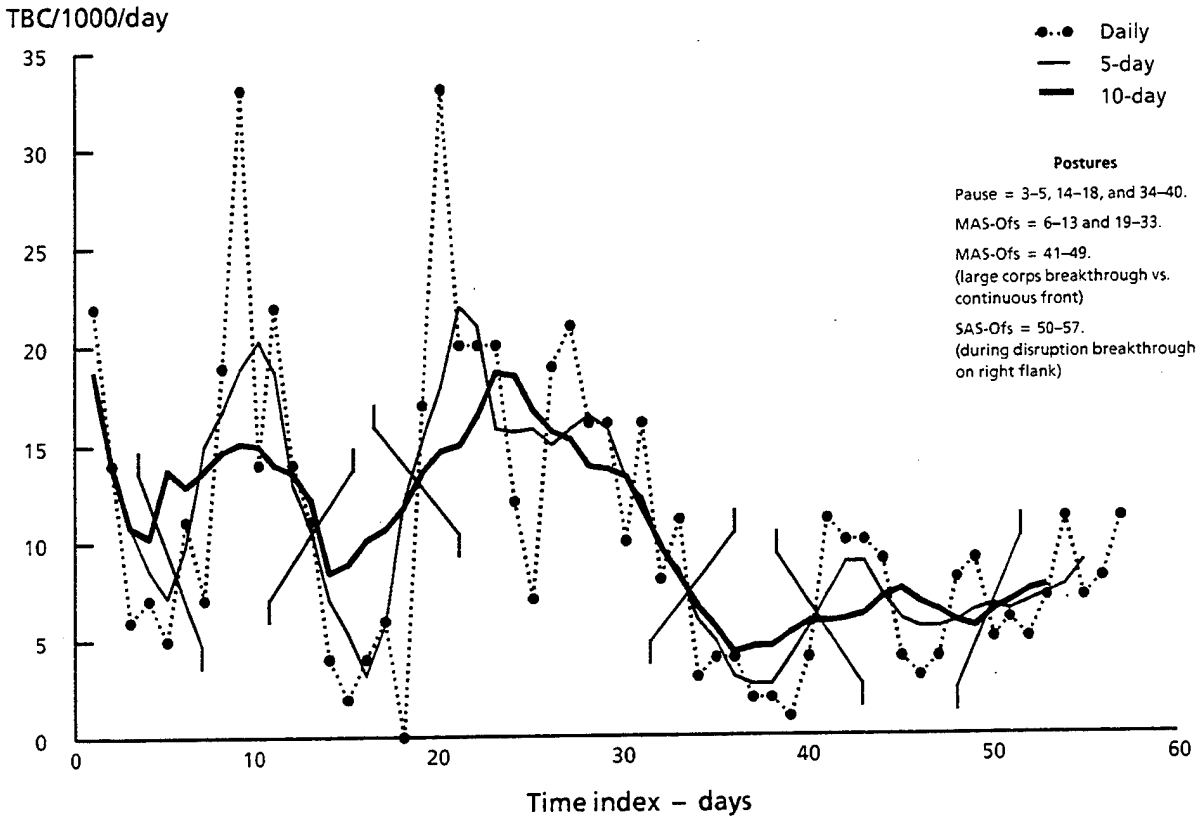


FIG. 2-24. ILLUSTRATIVE RATE CURVES – CORPS ON OFFENSIVE



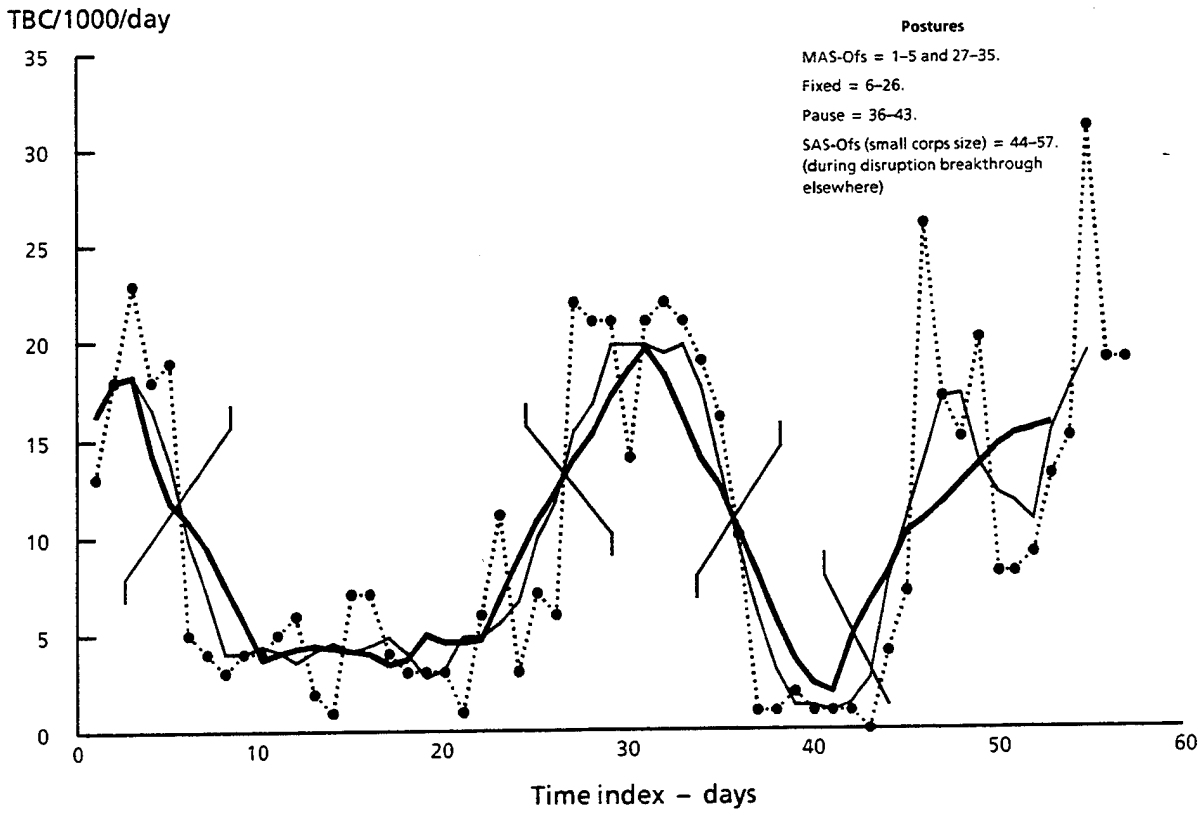
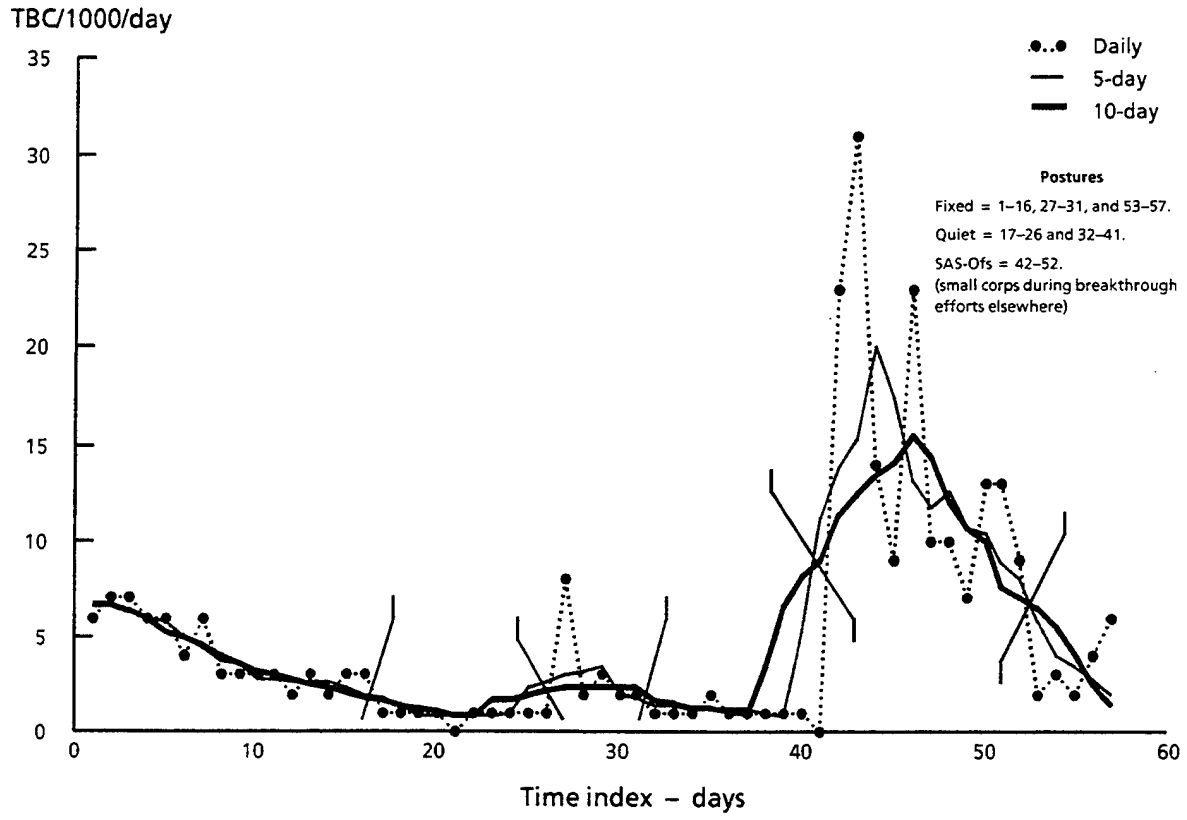


FIG. 2-25. ILLUSTRATIVE RATE CURVES – CORPS ON OFFENSIVE



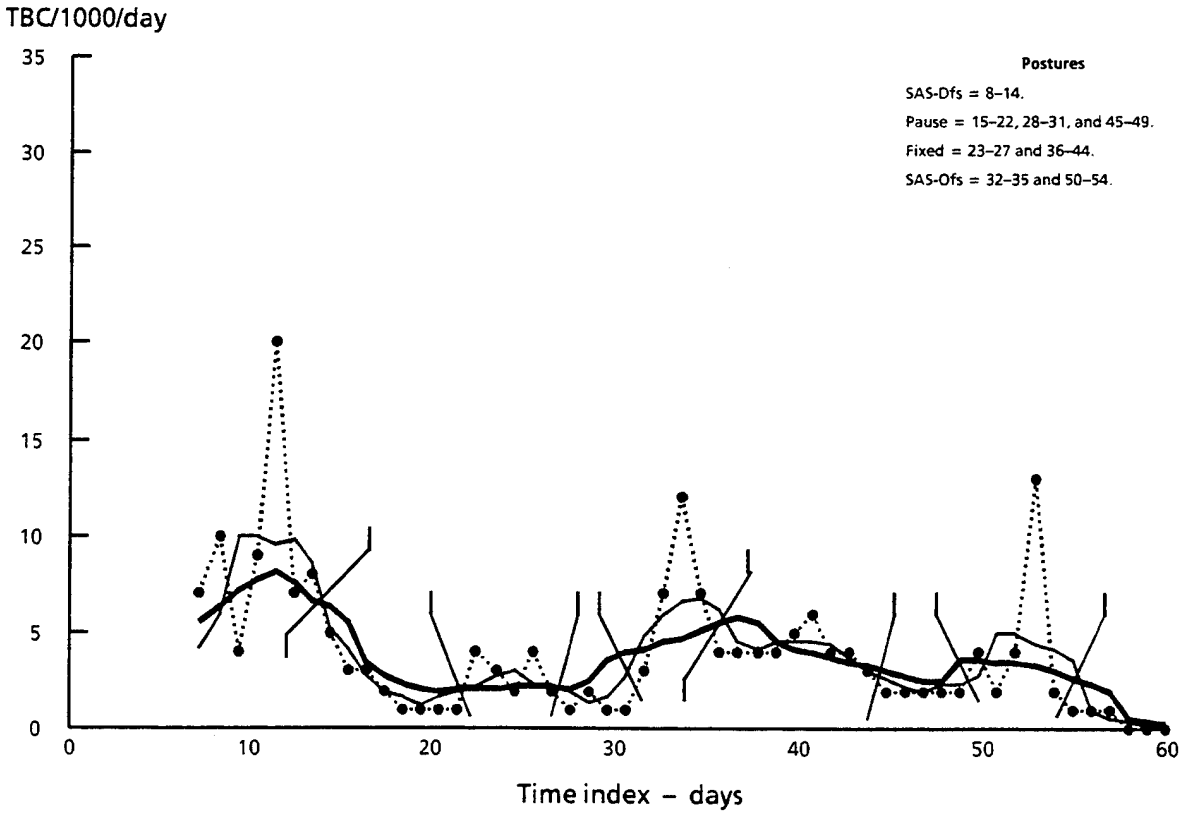
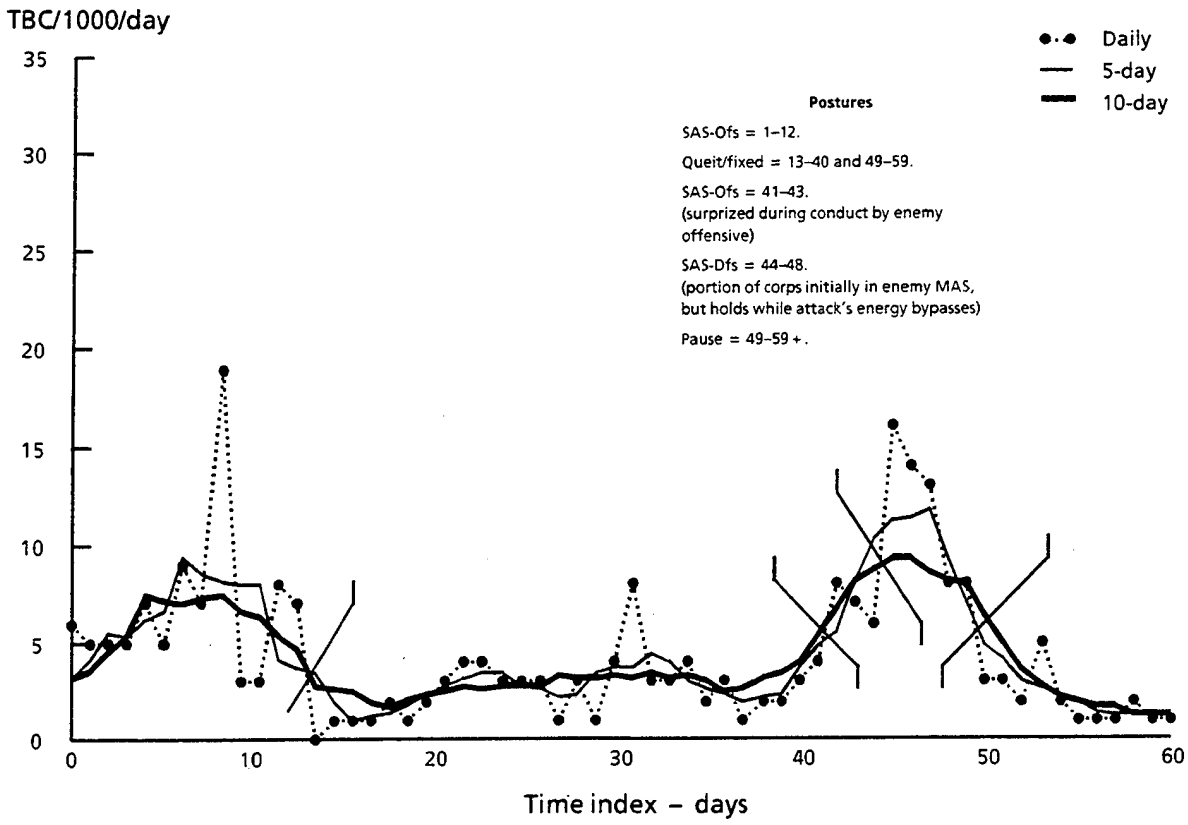


FIG. 2-26. ILLUSTRATIVE RATE – CORPS ON OFFENSIVE



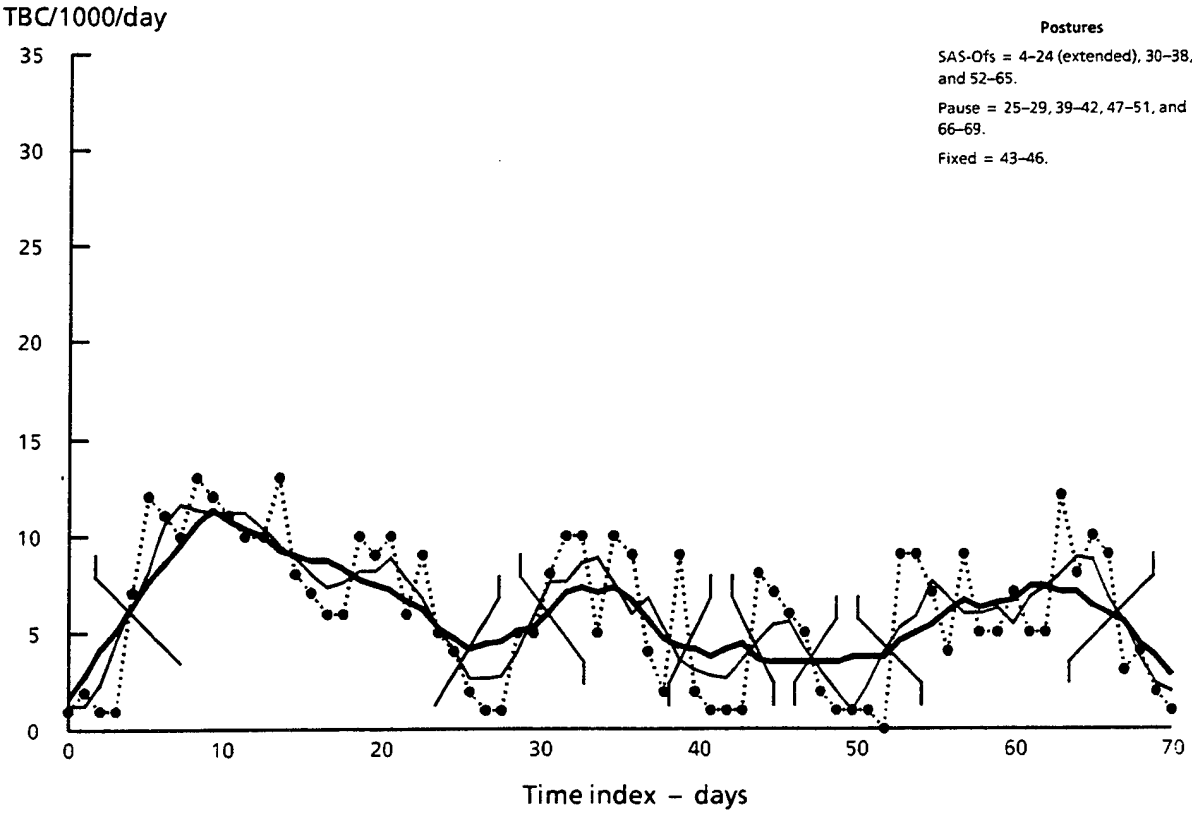
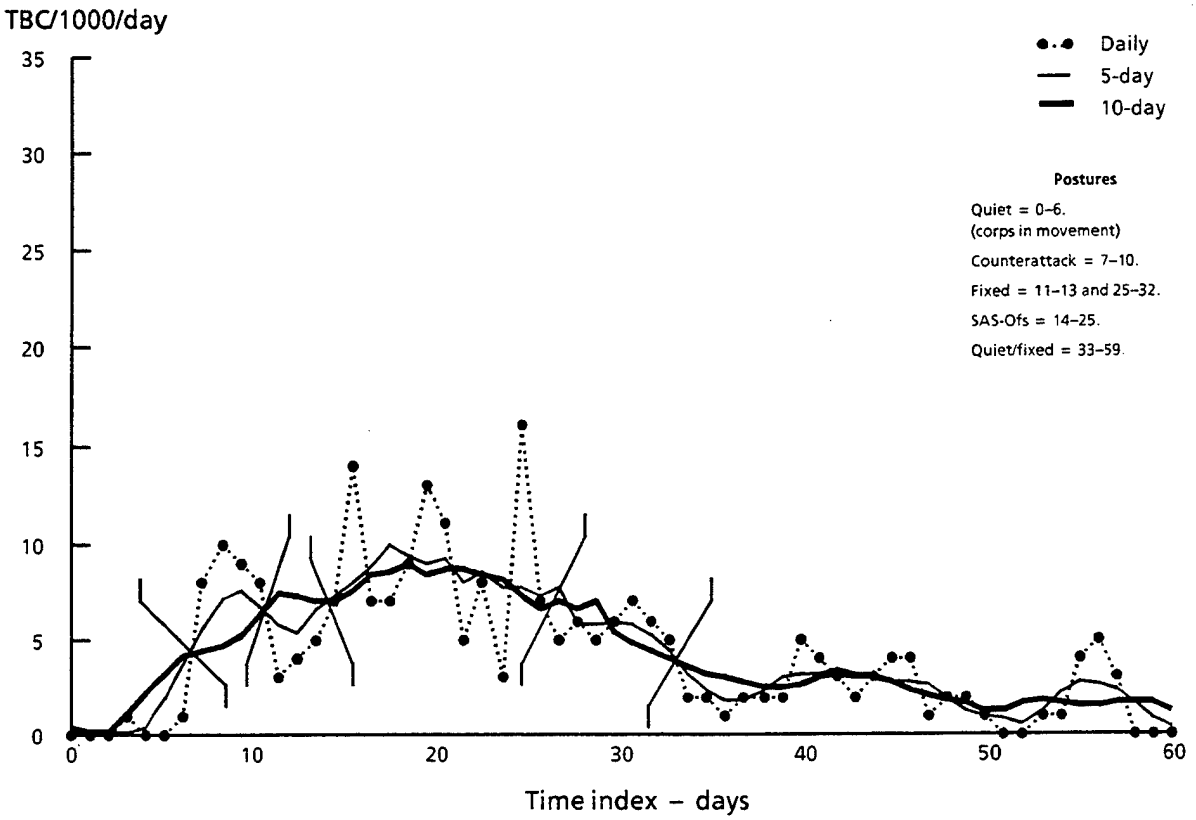


FIG. 2-27. ILLUSTRATIVE RATE CURVES – CORPS ON OFFENSIVE



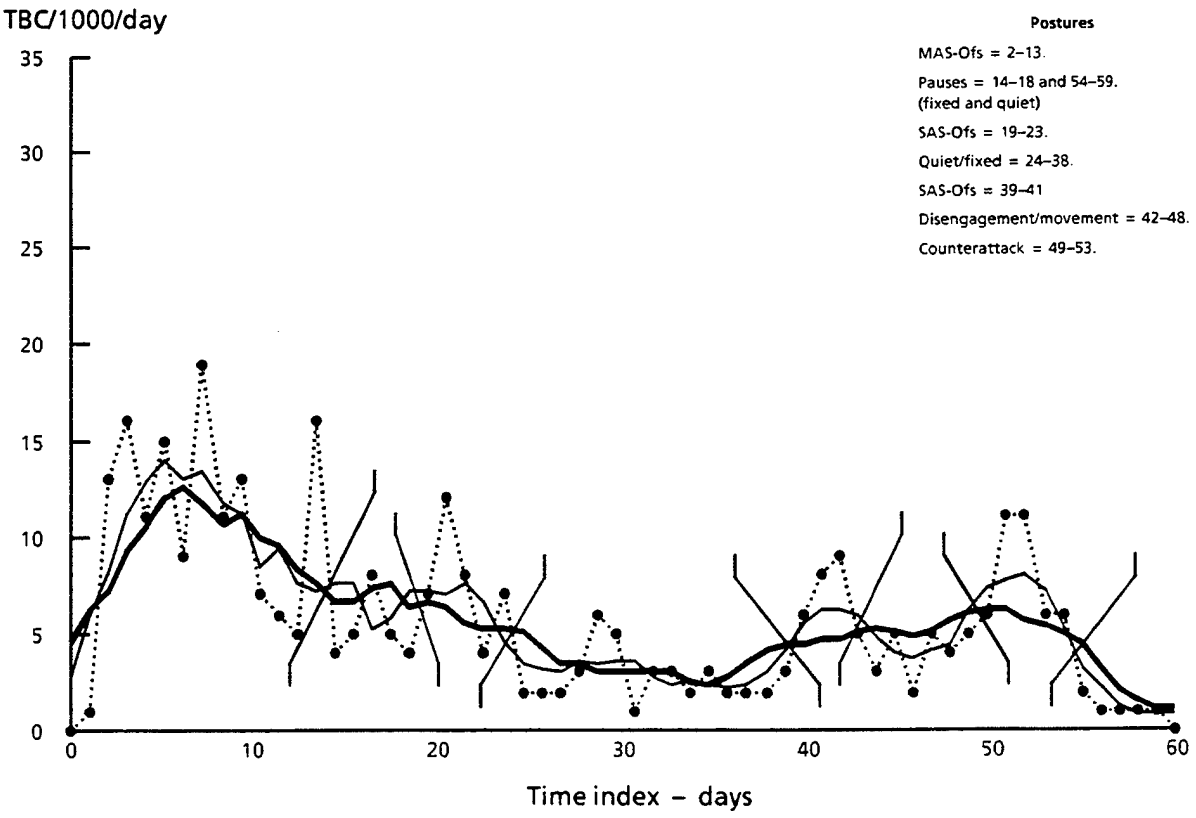


FIG. 2-28. ILLUSTRATIVE RATE CURVES – CORPS ON COUNTEROFFENSIVE AND OFFENSIVE

ILLUSTRATIVE LATERAL RATES

The following figures depict relative lateral rates experienced by corps within army-size forces on both the defensive and offensive. (The rates are for the corps' divisional forces.)

Figure 2-31 shows two views of breakthrough experiences. The upper panel depicts rates during a period when one attacking corps achieves breakthrough while the overall defender front remains continuous.[22] The lower panel depicts rates when one corps-size portion of the defender front is disrupted and attacker corps rush through the resulting gap.[23] (Significantly, the events depicted in the upper panel immediately preceded and led to the events depicted in the lower panel.)

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[24]Rates over time for the upper panel's breakthrough sector are shown in Figure 2-25 (upper panel).

[25]Rates over time for the lower panel's breakthrough sector are shown in Figure 2-24 (upper panel).

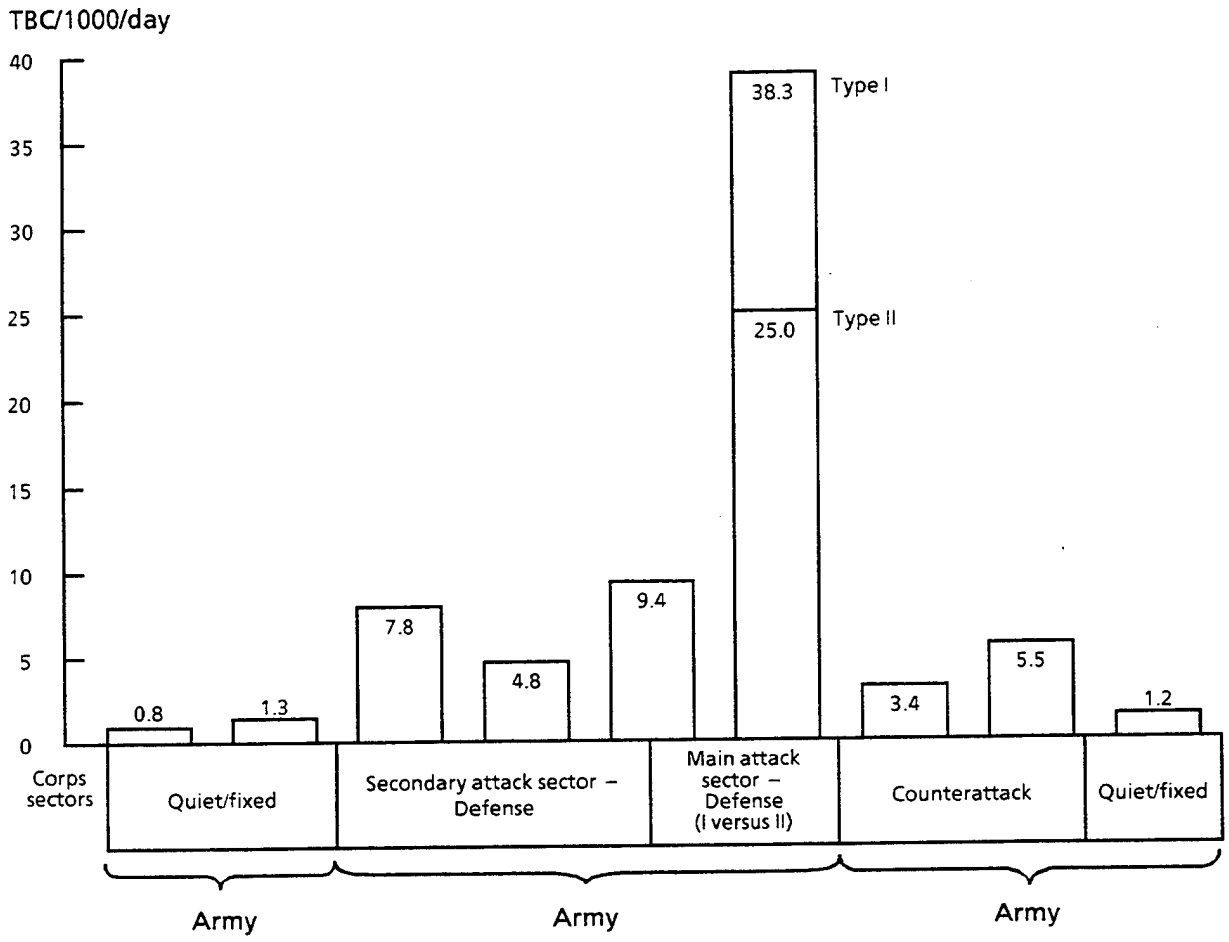


FIG. 2-29. ILLUSTRATIVE LATERAL 10-DAY CORPS RATES – DEFENSIVE

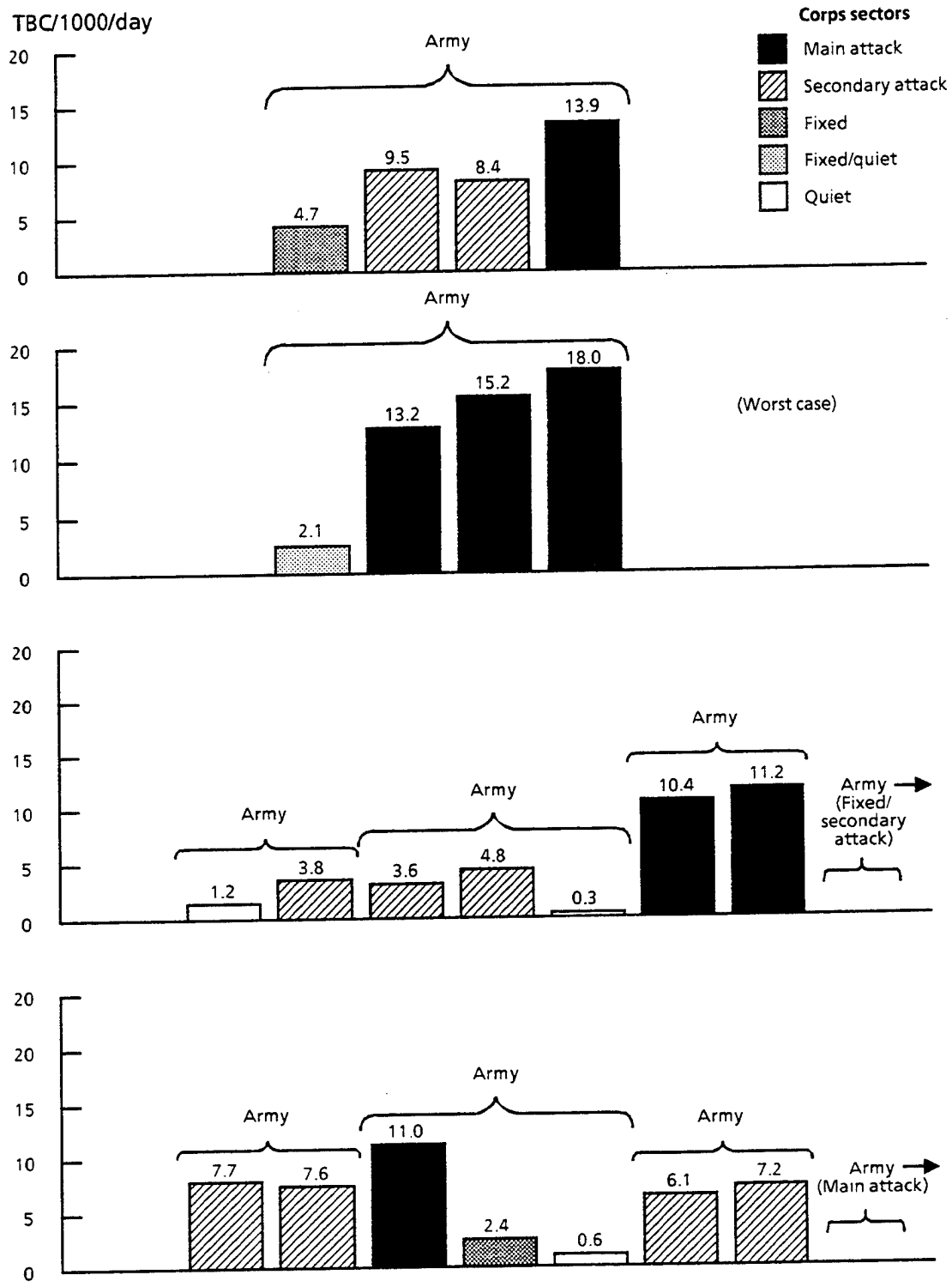
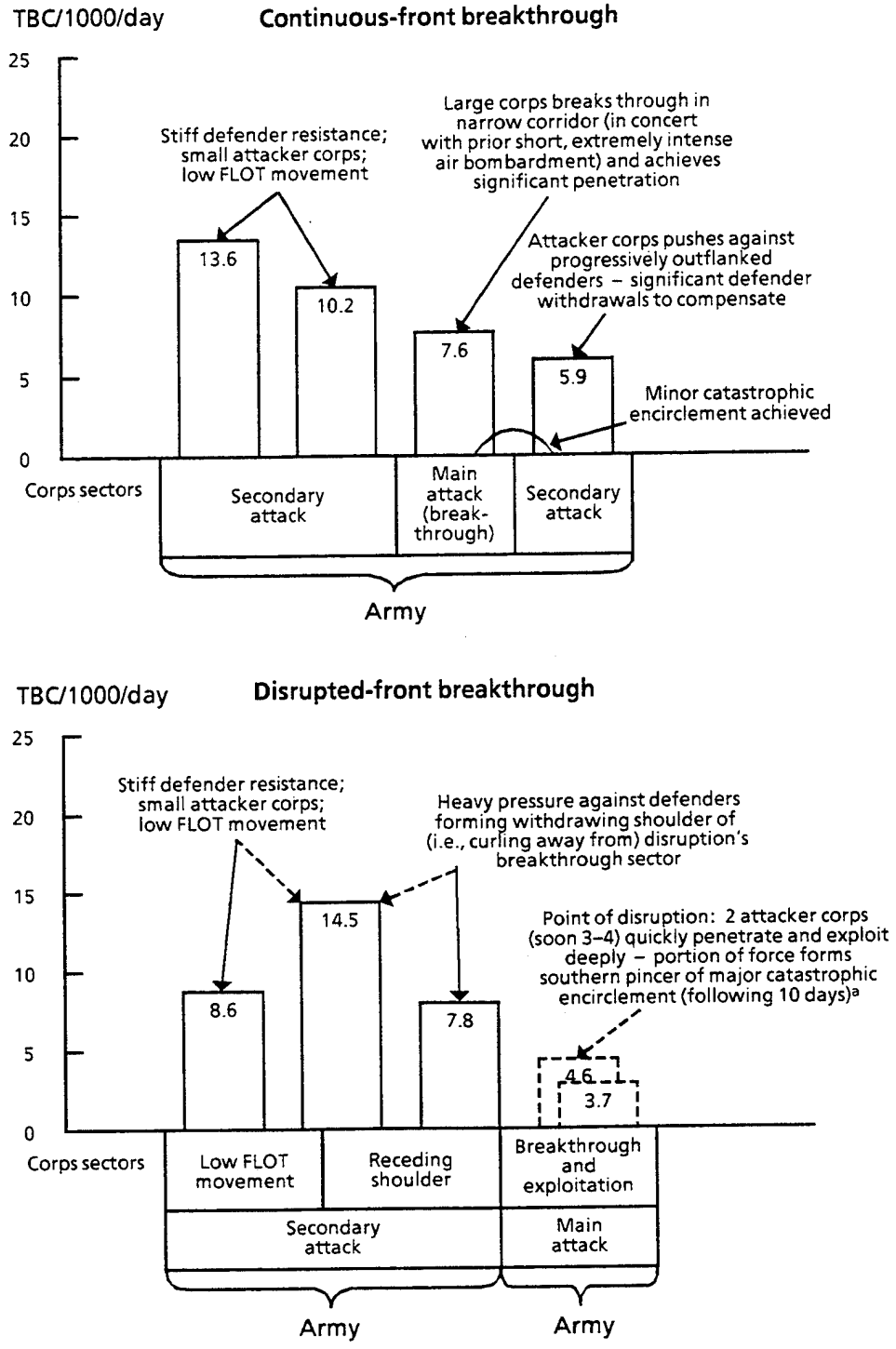


FIG. 2-30. ILLUSTRATIVE LATERAL 10-DAY CORPS RATES – OFFENSIVE (Continuous fronts)



[a] Defender counterattacks or major resistance against exploiting corps will drive exploiting corps 10-day rates to range of 7–8/1000/day.

FIG. 2-31. ILLUSTRATIVE LATERAL 10-DAY CORPS RATES (Offensive breakthroughs along continuous and disrupted fronts)

RATE DISTRIBUTIONS

The following tables depict distributions of the finer rates that are embedded within the rate averages shown previously under Rate Ranges. These data will help planners anticipate likely or possible medical workloads and personnel replacement requirements not only at the theater level but at those portions of the theater or front where activity is the most intense.

The Rate Ranges delimit the set of rate averages appropriate over varying periods of time for various forms of operations. For example, a rate that falls within the suggested range of 10-day rates is an average for that 10-day period. The rate ranges change with changing operational parameters. The rate distributions change as well.

Three sorts of rate distribution are provided: the spread of the set of daily rates (from maximum to minimum), the incidence of those daily rates in three broad classes of rates, and the breakdown of casualties by type of casualty.

The rate spread and class grouping data are especially useful to help planners gain a fuller sense of the probable magnitudes of daily rates in the most intense combat sectors and times. The rates in the higher reaches of these distributions should be linked by planners to those locales and particular units anticipated in operations plans to be the centers of operational activity.

The nature of rate pulses and pauses means, of course, that these higher rates in the distribution will not, during the period, be the sole experience of the most intense areas and their units. Other areas and units in the corps may also experience such rates – and, therefore, some portion of the total number of such rates must be "apportioned" among these. However, to the extent operations plans are fully developed, planners may reasonably anticipate that the higher rates will be mostly focused in the projected areas of greatest intensity.

Several of the sector types cite more than one version of a rate experience – for example, a worst case and a more typical case. Those cases are noted, where applicable, in the tables.

The cited distributions may be considered representative for planning purposes of the distributions to be expected during pulses of the cited types regardless of where the planner projects a particular average (mean) rate in the Rate Range for the cited sector type. Of course, the distribution used in planning should be one with a mean rate as close to that projected as is available.

TABLE 2-8

PULSE RATE DISTRIBUTIONS: CORPS WITH MAIN ATTACK SECTOR, DEFENSE – TYPES I AND II
(Assuming continuous front)

Rate statistic	TBC rate distributions by force days (TBC/1000/day)											
	10-day period						5-day peak					
	Type I			Type II			Type I			Type II		
	Divisional force		Full corps	Divisional force		Full corps	Divisional force		Full corps	Divisional force		Full corps
	A	B		A	B		A	B		A	B	
Maximum	577	112	92	149	85	71	577	112	92	149	85	71
75th percentile	44	59	49	36	32	28	53	85	71	50	32	28
Mean	38	38	29	25	25	20	50	50	40	34	34	26
50th percentile (median)	10	16	11	10	16	11	12	25	21	12	25	21
25th percentile	2	12	7	2	12	7	2	14	11	2	14	10
Minimum	0	2	1	0	2	1	0	14	10	0	13	10

Note: Divisional force: A = division-day rates; B = corps-day rates.

Rate class (TBC/1000/day)	Proportion of force days (division days) and rate averages per rate class							
	10-day period				5-day peak			
	Percent of division-day observations		Mean TBC rate (TBC/1000/day)		Percent of division-day observations		Mean TBC rate (TBC/1000/day)	
	Type I	Type II	Type I	Type II	Type I	Type II	Type I	Type II
≥ 40	26	24	119	74	33	30	132	69
10 to <40	22	24	17	18	19	22	18	20
<10	52	52	4	4	48	48	4	4

10-day pulse	Casualty rates by category (per 1000/day – divisional force)			
	TBC	KCMIA	WIA	WIA/TBC ratio
Full period				
Type I	38.3	29.5	8.9	.23
Type II	25.2	16.8	8.4	.33
5-day peak				
Type I	49.7	39.4	10.3	.21
Type II	34.0	22.4	11.6	34

TABLE 2-9

PULSE RATE DISTRIBUTIONS: CORPS WITH MAIN ATTACK SECTOR, OFFENSE
(Assuming continuous front)

Rate statistic	TBC rate distributions by force days (TBC/1000/day)																	
	10-day period									5-day peak								
	Divisional force						Full corps			Divisional force						Full corps		
	Case 1[a]		Case 2[b]		Case 3[c]		Cases			Case 1[a]		Case 2[b]		Case 3[c]		Cases		
	A	B	A	B	A	B	1[a]	2[b]	3[c]	A	B	A	B	A	B	1[a]	2[b]	3[c]
Maximum	109	34	69	33	46	12	29	28	10	109	34	53	33	46	12	29	28	10
75th percentile	27	26	20	20	10	10	22	17	8	29	30	26	21	11	10	26	18	9
Mean	20	20	14	14	8	7	17	12	6	24	24	19	19	9	9	21	15	8
50th percentile (median)	19	19	12	15	6	7	17	12	6	22	22	16	19	6	10	19	14	8
25th percentile	6	15	6	8	2	4	13	6	4	5	19	11	15	2	9	17	12	8
Minimum	0	7	0	1	0	3	6	1	3	0	16	2	7	0	4	14	6	4

Note: Divisional force: A = division-day rates; B = corps-day rates.

Rate class (TBC/1000/day)	Proportion of force days (division days) and rate averages per rate class											
	10-day period						5-day peak					
	Percent of division-day observations			Mean TBC rate (TBC/1000/day)			Percent of division-day observations			Mean TBC rate (TBC/1000/day)		
	Case 1[a]	Case 2[b]	Case 3[c]	Case 1[a]	Case 2[b]	Case 3[c]	1[a]	2[b]	3[c]	1[a]	2[b]	3[c]
≥ 40	8	5	2	63	52	46	16	5	4	63	47	46
10 to <40	56	51	22	23	20	18	52	72	25	24	21	20
<10	36	44	76	5	4	4	32	23	71	2	6	4

10-day pulse	Casualty rates by category (per 1000/day – divisional force)			
	TBC	KCMIA	WIA	WIA/TBC ratio
Full period				
Case 1[a]	20.0	4.6	15.5	.77
Case 2[b]	14.2	3.3	10.9	.77
Case 3[c]	7.6	1.8	5.8	.77
5-day peak				
Case 1[a]	23.5	4.8	18.7	.79
Case 2[b]	18.5	4.1	14.4	.78
Case 3[c]	9.0	2.1	6.9	.76

[a] Worst case: Low frontal (FLOT) movement, no breakthrough.
[b] Typical case: Somewhat higher frontal (FLOT) movement, no breakthrough.
[c] Best case: Significant frontal (FLOT) movement, breakthrough achieved – but against continued resistance in continuous-front (Type I or II) defender scenario.

TABLE 2-10

PULSE RATE DISTRIBUTIONS: CORPS SECONDARY ATTACK SECTOR – DEFENSE
(Assuming continuous front)

Rate statistic	TBC rate distributions by force days (TBC/1000/day)					
	10-day period			5-day peak		
	Divisional force		Full corps	Divisional force		Full corps
	A	B		A	B	
Maximum	34-47	16-18	11-14	34-47	16-18	11-14
75th percentile	9	13	10	14	14	11
Mean	8	8	6	12	12	9
50th percentile (median)	3	6	5	9	13	10
25th percentile	2	3	2	3	8	7
Minimum	0	2	2	0	8	6

Note: Divisional force: A = division-day rates; B = corps-day rates.

Rate class (TBC/1000/day)	Proportion of force days (division days) and rate averages per rate class			
	10-day period		5-day peak	
	Percent of division-day observations	Mean TBC rate (TBC/1000/day)	Percent of division-day observations	Mean TBC rate (TBC/1000/day)
≥ 40	2	40-47	4	40-47
10 to <40	18	22	34	22
<10	80	4	62	4

10-day pulse	Casualty rates by category (per 1000/day – divisional force)			
	TBC	KCMIA	WIA	WIA/TBC ratio
Full period	7.8	3.7	4.1	.52
5-day peak	11.7	5.9	5.8	.50

TABLE 2-11

PULSE RATE DISTRIBUTIONS: CORPS SECONDARY ATTACK SECTOR – OFFENSE
(Assuming continuous front)

Rate statistic	TBC rate distributions by force-days (TBC/1000/day)											
	10-day period						5-day peak					
	Case 1[a]			Case 2[b]			Case 1[a]			Case 2[b]		
	Divisional force		Full corps	Divisional force		Full corps	Divisional force		Full corps	Divisional force		Full corps
	A	B		A	B		A	B		A	B	
Maximum	41	23	15	46	31	22	41	23	15	46	31	22
75th percentile	12	11	9	18	23	17	16	15	10	30	23	18
Mean	9	9	7	14	14	11	12	12	9	19	19	14
50th percentile (median)	6	8	5	12	12	9	9	11	9	13	23	17
25th percentile	2	5	4	6	9	7	3	8	6	10	14	11
Minimum	0	0	0	0	1	0	0	5	4	6	9	7

Note: Divisional force: A = division-day rates; B = corps-day rates.

[a] Representative case for this type sector and posture.

[b] Unusual case: probably smaller-size corps (1 to 2 divisions), heavy resistance, low FLOT movement. Case 2 represents a situation where an attack by a corps supports the main attack – the latter makes significant progress while the supporting attack aggressively fixes a stubborn opposition.

Rate class (TBC/1000/day)	Proportion of force days (division days) and rate averages per rate class							
	10-day period				5-day peak			
	Percent of division-day observations		Mean TBC rate (TBC/1000/day)		Percent of division-day observations		Mean TBC rate (TBC/1000/day)	
	Case 1	Case 2	Case 1	Case 2	Case 1	Case 2	Case 1	Case 2
≥ 40	2	4	49	46	3	8	49	46
10 to <40	32	48	17	20	44	62	19	21
<10	67	48	4	5	54	31	4	8

10-day pulse	Casualty rates by category (per 1000/day – divisional force)			
	TBC	KCMIA	WIA	WIA/TBC ratio
Full period				
Case 1	9.0	2.7	6.3	.70
Case 2	13.6	2.9	10.7	.79
5-day peak				
Case 1	11.6	3.7	8.0	69
Case 2	18.9	4.1	14.8	78

RATE VARIABILITY

Figure 2-32 depicts the relationship of a corps' (division force's) mean rate experienced during a pulse (measured over a 10-day period) and the variability of that corps' daily rates during the 10 days. The measure of variability is the standard deviation of those 10 daily points about that mean. (The single-day rates are corps-day rates for the divisional force.)

Planning projections with daily rates may be compared to the figure's suggested mean-variability relationship.

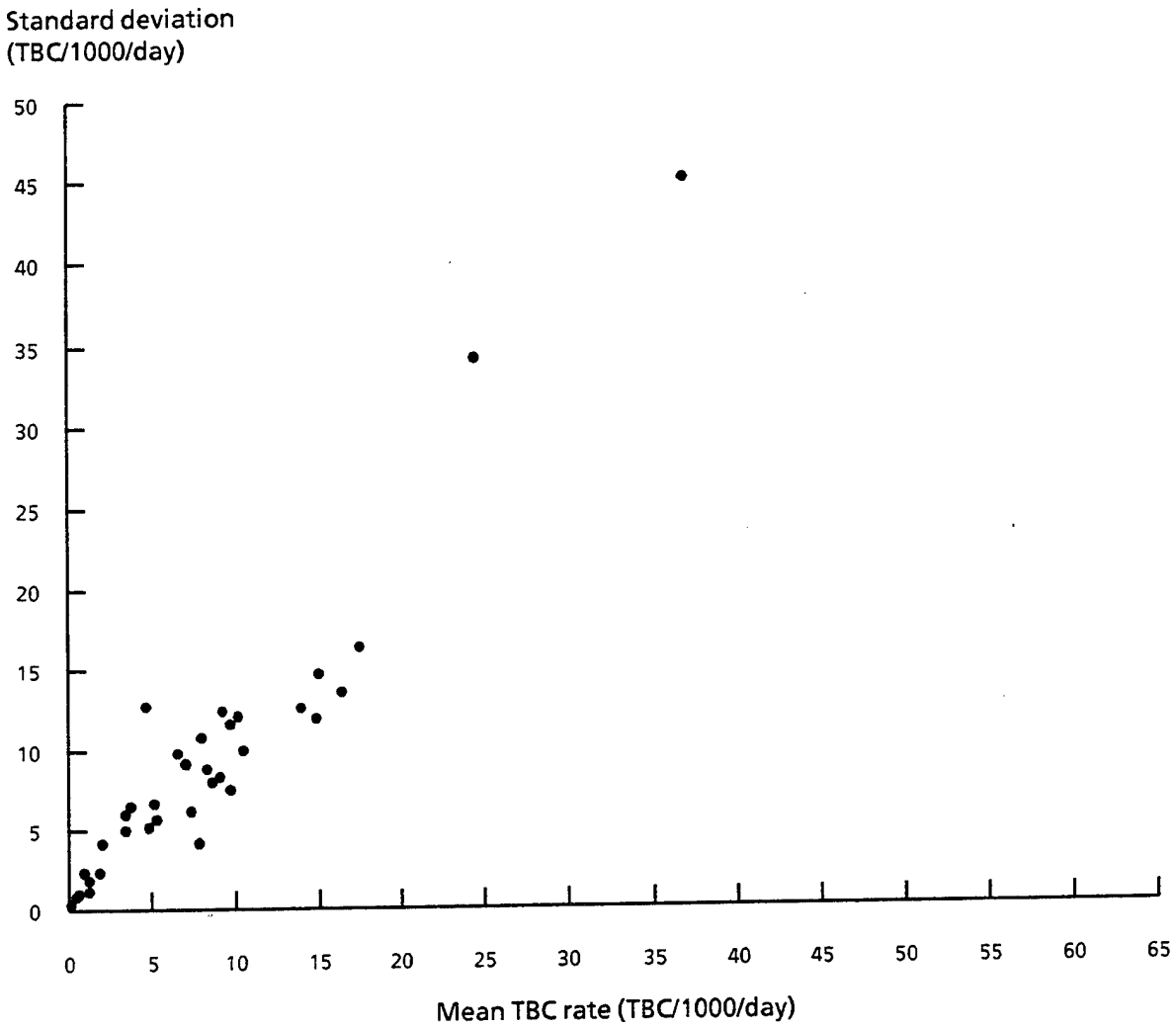


FIG. 2-32. MEAN AND STANDARD DEVIATION FOR 35 10-DAY CORPS PULSES (Empirical)

DISRUPTED-FRONT SCENARIOS

- Defender Experience: Table 2-12
- Attacker Experience: Table 2-13

DEFENDER EXPERIENCE

The table is constructed to be read from top to bottom. The table first focuses on forces in a disruption sector; it begins with rates for divisions and lower echelons at the points of breakthrough and then shows rates for forces that are catastrophically encircled during exploitation. The overall disruption experience for corps is then summarized: the overall rates include both the breakthrough and encirclement experiences. The table next shows rates for corps-size forces in sectors other than those that are disrupted. Finally, rates for army-size forces – which include the lower-echelon disruption and nondisruption experiences just discussed – are provided.

A second portion of the table, at the bottom, suggests proportions of the TBC rates (shown in the upper portion) that fall into the two categories of KCMIA and WIA (who are recovered). This is the only measure of rate distribution offered for disrupted-front scenarios.

TABLE 2-12

DISRUPTED FRONT: PERSPECTIVES ON FIRST 10 DAYS
(Defender experience)

	Level I		Level II		Level III		Level IV	
	Points of breakthrough	Catastrophic encirclement	Points of breakthrough	Catastrophic encirclement	Points of breakthrough	Catastrophic encirclements	Points of breakthrough	Catastrophic encirclements
BREAKTHROUGH AND EXPLOITATION SECTORS								
Occurrence	Yes	No[b]	Yes	Yes	Yes	Yes	Yes	Yes
Number (per army)	1 (or few)[a]	–	1–2	1	1–2	1–2	1–2	2–4
Size	1–2 bde/rgt per breakthrough	–	1–2 bde/rgt per breakthrough	~20–25% of overall divisional force	Bde/rgt-level (1–2) up to full division per breakthrough	~30–40% of overall divisional force	Bde/rgt-level (1–2) up to full division per breakthrough	~50–80% of overall divisional force
Timing (during)	Days 2–4	–	Days 2–4	Days 5–10	Days 2–4	Days 5–10	Days 2–4	Days 5–10
TBC rates (TBC/1000/day)	(Division and below)	(Encircled force)	(Division and below)	(Encircled force)	(Division and below)	(Encircled force)	(Division and below)	(Encircled force)
Forces immediately engaged (Divisional force)	3-day Div: 80–130[c] (200–300)[c] Bde/rgt: 200–300 Bn: (≤100%)	–	3-day Div: 80–130[c] (200–300)[c] Bde/rgt: 200–300 Bn: (≤100%)	6-day 75–150	3-day Div: 200–300 Bde/rgt: 200–300 Bn: (≤100%)	6-day 75–150	3-day Div: 200–300 Bde/rgt: 200–300 Bn: (≤100%)	6-day 75–150
Corps in disruption sector(s) (Divisional force)[d]	≤38/1000/day		45–90/1000/day		45–90/1000/day		45–90/1000/day	
CORPS IN OTHER SECTORS								
Secondary attack	(TBC rates similar to those with continuous front)		(TBC rates similar to those with continuous front)		(TBC rates similar to those with continuous front)		(TBC rates similar to those with continuous front)	
Fixed								
Quiet								
OVERALL ARMY-SIZE FORCE (Divisional force)[d]	≤9–14/1000/day		17–26/1000/day		28–38/1000/day		40–70/1000/day	
RATE PROPORTIONS BY CATEGORY (FULL 10 DAYS)	KCMIA	WIA (recovered)	KCMIA	WIA (recovered)	KCMIA	WIA (recovered)	KCMIA	WIA (recovered)
Corps in disruption sectors	65–77%	23–35%	>80%	<20%	>80%	<20%	>80%	<20%
Corps in other sectors (secondary attack, fixed, quiet)	(same as continuous front)		(same as continuous front)		(same as continuous front)		(same as continuous front)	
Army-size force	55–70%	30–45%	>70%	<30%	>70%	<30%	>70%	<30%

Note: Bde = brigade; rgt = regiment; and bn = battalion.

[a] Operational areas with relatively low densities of combat forces on both sides (or low defender preparedness) are more likely to experience multiple penetrations or breakthroughs than are areas more densely arrayed (or better prepared). The latter areas will invite very few main penetrations (usually 1 or 2 per army frontage) under Soviet-style approaches.

[b] No forces catastrophically encircled beyond the breakthrough sector itself. Forces in the breakthrough sector may well be destroyed by encirclement (or overrun).

[c] Either the lower or the higher set of rates may be seen by a division at the point of disruption – as either may not be seen at the point of penetration in a worst-case continuous-front defensive (Type I or II). The higher set represents successful encirclement or overrun of most of a division's brigade/regimented units. The difference between disrupted and continuous fronts in these cases is the attacker's more rapid push of substantial forces into the defender's rear areas before the defender succeeds in re-establishing a relatively cohesive defensive. The difference between Level I and II disruptions is the greater likelihood of the higher division rates in the breakthrough sector in the Level II situation.

[d] Rates cover at least the divisional force. They may easily also cover the full corps or army force, including support personnel caught in any encirclement

ATTACKER EXPERIENCE

The table's focus is on rates for corps effecting disruption breakthroughs and exploitations. Rates for a larger, army-size force are dependent on the experiences of constituent corps forces, which can vary widely.

TABLE 2-13

DISRUPTED FRONT: PERSPECTIVES ON FIRST 10 DAYS
(Attacker experience)

<table>
<tr><th colspan="4">TBC rates</th></tr>
<tr><td rowspan="8">Corps-size force(s)
(TBC/1000/day)</td><td colspan="3">Breakthrough phase
Probable duration: 2 to 4 days
Occurrence probable during days 1 to 5</td></tr>
<tr><td colspan="3">Breakthrough sector force</td></tr>
<tr><td>Case 1
Fluid operations
(defenders quickly defeated, ineffective, or bypassed)</td><td>Case 2
Defender resistance moderately but only briefly successful</td><td>Case 3
Stiff defender resistance; defender front broken only after major attacker effort</td></tr>
<tr><td>3–5</td><td>6–8</td><td>Variable: similar to daily rates in continuous front corps main attack sector – but lasting only 2–4 days (10-day limit probably in 10–15 range)</td></tr>
<tr><td colspan="3">Other sectors
(TBC rates similar to those with continuous front)</td></tr>
<tr><td colspan="3">Exploitation phase
Probable duration: 5 to 20 days (commencing upon breakthrough)</td></tr>
<tr><td colspan="3">Exploitation force</td></tr>
<tr><td>Case A
Fluid operations
(defenders quickly defeated, ineffective, or bypassed)</td><td>Case B
Containment of encircled pocket(s)
(and/or isolated division-level counterattacks and resistance)</td><td>Case C
Subjected to major counterattack by one or more corps</td></tr>
<tr><td>3–5</td><td>6–8</td><td>Variable: rates similar to continuous-front defensive sectors – unless some/all of exploitation force isolated by counterattack; then, disrupted front defense rate could apply</td></tr>
<tr><td colspan="3">Other sectors
(TBC rates similar to those with continuous front)</td></tr>
<tr><td>Army-size force
(TBC/1000/day)</td><td colspan="3">Breakthrough and exploitation phases</td></tr>
<tr><td colspan="3">Rate variable: depending on whether army as whole penetrates through breakthrough sector and exploits, or only corps-size portion penetrates while remainder engages defensive sectors (such as secondary attack, fixed, or quiet sectors)</td></tr>
</table>

TABLE 2-13

DISRUPTED FRONT: PERSPECTIVES ON FIRST 10 DAYS (Continued)
(Attacker experience)

TBC rate distribution – proportions by casualty category			
The evidence suggests two sets of possible proportions of rates among the KCMIA and WIA categories:			
	KCMIA	WIA	
(1)	20–25%	75–80%	• Where breakthrough or exploitation phase experience is similar to continuous-front offensive conditions (Cases 2 or 3 and B or C)
(2)	30–40%	60–70%	• Where more fluid, rapid-moving operations are achieved and maintained throughout (Cases 1 and A)
The difference between (1) and (2) appears to be a higher proportion of missing casualties among the lower rates in the more fluid/rapid advances.			

CHAPTER 3

APPLICATIONS OF RATE BEHAVIOR

GENERAL

Whether one is constructing or evaluating a rate projection, the central considerations must be the character, in the given case, of the three key operational parameters: force size/echelon, time, and scenario/sector. Depending on how broadly they are interpreted, they usefully frame the array of factors that influence casualty rates and thus must be considered in assessing the reasonableness of projections. We have addressed these parameters in various respects in this study's reports. Their nature is hopefully evident. Some additional observations, however, may help deepen the planner's considerations.

After remarking on these additional observations, we comment on two broad applications of the rate data: to evaluate a rate projection and to construct a rate profile. We provide a hypothetical example of how the rate data in Chapter 2 may be used in constructing a rate profile. First, however, a brief comment may be in order to clarify the relationship of various of the data sets in Chapter 2.

COMMENT ON HOW TO RELATE DATA SETS

A planner making use of the rate data in Chapter 2 may find it helpful to see an example of how extracts of the data from some of the tables and figures relate. We illustrate data set relationships by choosing to look at a corps on the offensive in a main attack sector of a continuous-front scenario. We select a worst-case situation: the corps presses continuously and aggressively throughout a 10-day period but fails to advance significantly against the defender.

A planner using the data in Chapter 2 to construct a rate profile would need, for example, to judge how severe the rate pulse might be – whether, for example, a pulse would last the maximum duration and include the maximum number of the highest 1-day rates. The ranges of daily rates during corps pulses are provided in Table 3-1 (an extract of Table 2-7). The table depicts the ranges of possible 1-day rates for a pulse in the sample corps' situation.

TABLE 3-1

TABLE 2-7 EXTRACT – RANGES OF 1-DAY PULSE RATES, CORPS-SIZE FORCES

Corps	TBC rates (per 1000/day)	WIA rates (per 1000/day)	Duration (days)
Offense	34 16–23 ≥ 10 (3–11)	24–27 11–18 7–8 (2–9)	1 3–4 10–12 (4–10)

The ranges of corps offensive rates for a continuous-front main attack sector are summarized in Figure 3-1 (an extract of Figure 2-19) for various time perspectives. The figure depicts the rate ranges within which the sample corps should fall. As the sample case is projected to be a worst case, its 10-day measure might fall at or near the top of the range for 10-day measures. Next, we note that one of our curves of actual rates – Figure 2-24 (upper panel) – illustrates a worst-case corps offensive pulse. Also, the distributions of rates inherent in such an experience are shown in Table 2-9 (for corps offensives, main attack sector). Figure 3-2 (opposite page) shows extracts from both the rate curve and the distribution data that describe rates for a corps in a worst-case offensive. (Study of the several sets of data in Chapter 2 will reveal similar relationships between rate data in the various displays.)

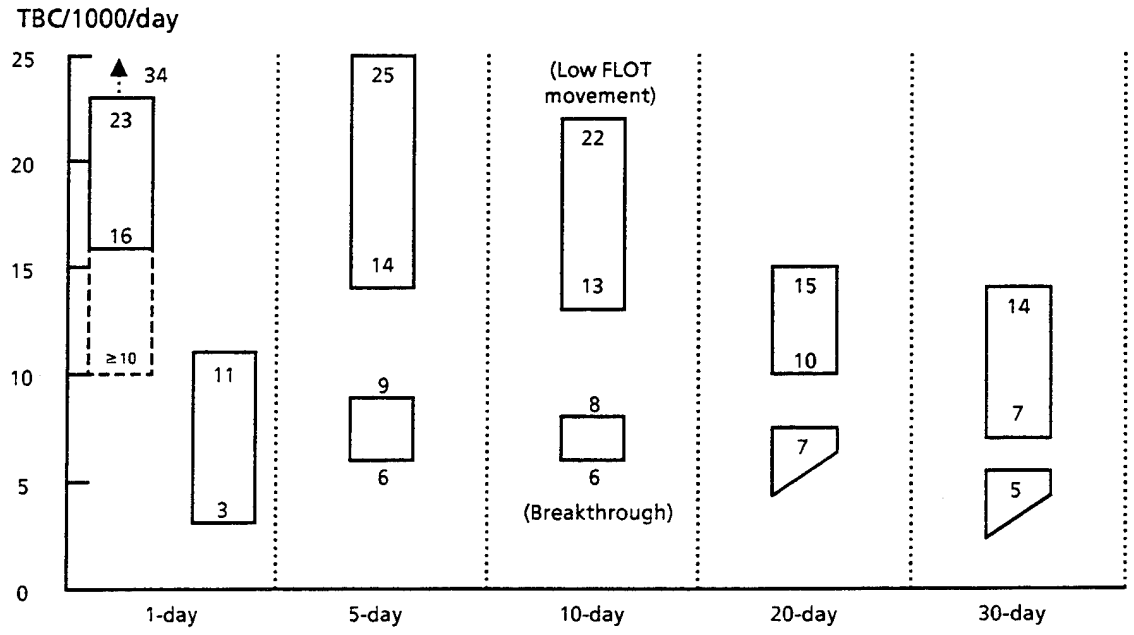
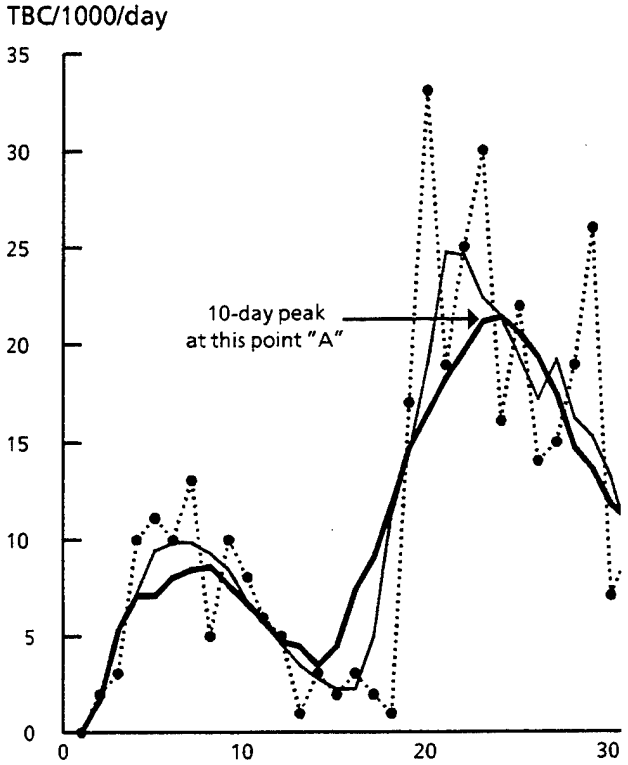
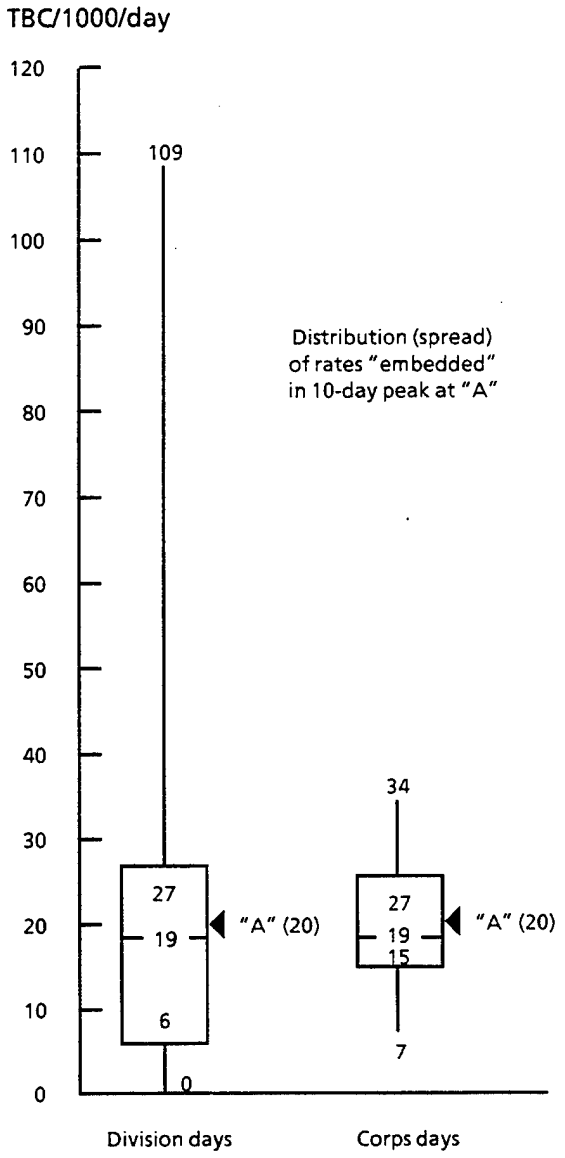


FIG. 3-1. FIG. 2-19 EXTRACT – SUMMARY TIME PERSPECTIVES ON CORPS PULSE RATES





Proportion of force days (division days) and rate averages per rate class		
Rate class (TBC/1000/day)	**Percent of observations**	**Mean TBC rate (TBC/1000/day)**
≥40	8	63
10 to <40	56	23
<10	36	5

Casualty rates by category (per 1000/day – divisional force)			
TBC	**KCMIA**	**WIA**	**WIA/TBC ratio**
20.0	4.6	15.5	.77

Notes: The data sets displayed here are taken from: curve display, Figure 2-24 and other distributions, Table 2-9.

The slight difference between the mean rates of "A" in the rate curve and the distribution (rate spreads shown in Tukey plots) is due to slight computational differences in two programs producing the data.

FIG. 3-2. ILLUSTRATIVE EXTRACTS SHOWING RELATION BETWEEN PULSE RATES AND ASSOCIATED RATE DISTRIBUTIONS – CORPS OFFENSIVE (WORST-CASE), MAIN ATTACK SECTOR (Assuming continuous front)

FURTHER CONSIDERATIONS RELEVANT TO RATE PROJECTIONS

Several further observations bear mostly on the parameter of scenario/sector. They should assist the planner in selecting appropriate rate ranges, or in inclining within those ranges toward somewhat higher or lower rates.

Planning Perspective

The premier consideration among the several major considerations informing planning efforts is that planners must ground their efforts on the probable or plausible operational circumstances of the force in question. This is the case whether the aim is to evaluate a casualty rate projection or to construct one. *Casualty rate planning is at base operational planning.* If this fact is ignored or forgotten, there is a high likelihood that the rate projections will bear little relation to plausible operational prospects.

Policy-Level Objectives

It nearly goes without saying that casualty rate planning has always keyed on the military situation and that military objectives are defined, given a set of particular circumstances, in order to achieve policy objectives. Such objectives have in the past been relatively well defined for U.S. planners, almost given. This helpful circumstance promises now to fade rapidly.

Potential military operations have long been set into a framework of international relations dominated by the confrontation of the two superpowers. Potential threat forces and objectives regarding them have been fairly clear. Policy objectives for NATO, in the four decades of the Cold War, became relatively settled matters, as with them did the basic set of military objectives. The debate largely centered on the enormously difficult question of how to achieve such relatively settled ends in changing conditions. Planners could focus almost immediately and directly on the "how," since the "what" had long been basically decided.

The Cold War era was, from the point of view of the planner having to characterize a scenario, a relatively benign environment. The post-Cold War environment necessarily returns the planner to the fundamental issue of the relationship between policy and military objectives. The nature of potential military operations – hence,

the nature of the ranges of casualty rates that may be reasonable – is immediately contingent on the nature of the policy objectives to be achieved.

These fundamental questions of policy and military objectives promise to be relatively unsettled – requiring answers in each situation as it arises – for the foreseeable, or at least immediate, future. Even NATO objectives seem likely to be subject to some degree of redefinition. However, situations such as those in Lebanon, Grenada, Panama, and the Persian Gulf require the most elementary laying out of objectives from the highest policy levels to the level of choices concerning military means to those ends. Policy objectives may permit, or even require, early and outright destruction of a major enemy force's capability – disruption of that force in a major confrontation. Policy may instead require withstanding an offensive before taking any overt action, and may limit that responsive action to restoring a political boundary. Casualty rates in these two or three cases may differ radically.

Policy Time Lines

Time is, of course, profoundly important to casualty rates. We have previously referred to time in terms of its role as a measure of rates – are rates to be measured on a daily basis or on some other basis?

Time has, however, another aspect critical to assessing the reasonableness of rate projections. As in the case of policy and military objectives, this deeper aspect of time will probably become more important both to constructing and assessing rate projections in likely future scenarios.

The judgment must be made – at the least, in terms of policy objectives (and constraints) and military probabilities – how long operations are likely to take. Pursuit of a given policy objective may, of course, take different military routes, with exceedingly different casualty rate possibilities.

Much of the U.S. policy and planning community has traditionally judged that a NATO-Warsaw Pact confrontation was potentially of such scope that a 6-month[1] planning perspective was desirable and required. Certain contingencies in the

[1]Some portions of this community have inclined toward time lines that were either considerably shorter (usually between 30 and 90 days) or considerably longer (the long-war scenario often favored by naval thinkers).

foreseeable future may suggest and even require exactly the opposite – that is, a brief planning perspective.

Before determining the more detailed time aspects of the phases of an operational plan, the planner must determine whether a shorter or longer time line is paramount to either national or military policy or constraints. The character of operations may largely depend on this judgment alone. The different possible time lines should be clarified.

Character of the Conduct of Operations

The manner of an operation's conduct may bear directly on its probable casualty rate result.

Two paradigmatic approaches to conventional operations have emerged in the twentieth century: the German Blitzkrieg and the Soviet Deep Operations theories. Each – either originally in World War II or in derivative forms subsequently – has recorded decisive victories, achieving major disruptions of the defensive front, deep penetrations, and catastrophic encirclements. An active debate in the United States has focused for years on the proper character, and necessary attributes, of such operations.

The planner must be aware of the expected manner of each side's conduct of operations. The two basic approaches may differ significantly in their casualty results in the breakthrough sector especially.

In brief,[2] disruptions effected through Blitzkrieg-like operations are likely to result in lower killed and wounded casualty rates for both attackers and defenders than is the case generally with Deep Operations-like approaches. The difference proceeds from the trait of true Blitzkrieg operations to be *pulled* from lower-level tactical elements through weak places in the defense. The result is rapid; penetrations are deep; encirclements are ultimately as conclusive as in Deep Operations. However, Deep Operations approaches (more especially, multi-echeloned operations) tend to *push* through a predetermined sector. To be sure, that sector has been carefully determined to be susceptible to collapse and is kept especially narrow (again, particularly in multiecheloned operations) to further this

[2]It is beyond the scope of this report to attempt detailed elaborations of the characters of the competing major operational doctrines.

susceptibility. Nevertheless, the attack through that sector is more deliberately aimed at forcibly overwhelming the defender (often with massed firepower in accompaniment) than is usually the case with Blitzkrieg-like practices.

Further, Blitzkrieg-type breakthrough sectors may well be at least somewhat broader than Deep Operations breakthrough sectors (again, especially those of multiecheloned offensives). The former approach will aim to increase the probability of finding multiple defender weak points and of enhancing frontal collapse through the cumulative results of attacking these weak points.

It should be noted, however, that these same attributes – in the sense of having a larger number of individually less powerful breakthrough sectors spread more broadly over a frontage – are also likely to characterize Deep Operations approaches in conditions of low-force densities. In such conditions, the probability greatly increases that Deep Operations will dictate multiple, single-echeloned penetration axes. The premium is always on speed of disruptive effect, but the mass usually deemed necessary in denser force conditions to effect the disruption is not required.[3]

The occurrence in the breakthrough sector itself of major encirclement and overrun leading to capture of defenders may be more common within Blitzkrieg operations than with Deep Operations approaches. The data are incomplete on the incidence of encirclement and overrun leading to capture within the narrowly focused breakthrough sectors of classic multiecheloned Soviet operations. The sheer power and energy of many of the Soviet multiecheloned operations against the Germans suggest that that incidence may not have been high.

General Operation Plan Alternatives

We have noted that casualty rate planning – whether constructing rate profiles or evaluating them – must key on plausible operational contingencies. No one operations plan scheme can adequately describe the set of basic alternative possibilities or contingencies inherent in a scenario. Several alternative schemes are probably needed to bound that set of possibilities in a reasonable – not, of course, a necessarily exhaustive or conclusive – way. The planner thus would benefit by

[3]We must draw attention to the possibility that lower force levels in the future Europe would be likely to invite this alternative approach from the Deep Operations planners in the apparently unlikely event major hostilities were again threatened.

having access to, or being able to posit with some assurance of reasonableness, a series of alternative basic operational contingencies.[4]

These alternatives should stress a range of contingencies for modern ground operations. This range should include operations lasting (or conducted during) the limit of the time permitted by policy or reasonably foreseeable in the circumstances. More rapidly concluding operations should also be characterized.

Of particular concern is that both continuous-front and disrupted-front contingencies be included, assuming that both are plausible. Some planning lines might assume lower, and others higher, movement of the FLOT in a continuous-front setting.

Following out such a set of basic operational alternatives will almost inevitably require different arrangements of the force's activity. Certainly, sector types and force postures will vary.

"Shading" of Operational Parameter Details

Once a series of basic operational alternatives has been outlined, the planner may well adjust the values of some of their constituent parameters.

Several examples may illustrate. The sizes or structures of corps forces (say, the number or character of divisions) might be adjusted. A larger corps (5 versus only 3 divisions), or a considerably heavier corps, will tend to have a lower casualty rate in the same setting and time period. Within a given operational scenario – e.g., given an overall continuous or disrupted front – the planner may vary the arrangement of tactical missions or objectives among the force groupings in sectors, sector sizes, or

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[4]Our interviews with theater planners revealed that planners for personnel and medical requirements have traditionally received little, if any, authoritative assistance from operations and intelligence staffs in preparing casualty rate projections in support of operations plans. Operations and intelligence staffs have, understandably, been leery of "committing" themselves to a particular version of a sequence of operational possibilities, much less to several. They have preferred merely to pass on whether a single, general description of possible operations by personnel or medical planners is reasonable – at best, sometimes agreeing to characterizations of combat intensity in different sectors and phases; usually, agreeing to affirm only the most general characterizations for the entire force over relatively long time periods. The latter set of characterizations – e.g., some asserted level of intensity for the entire theater force for some extended period (which in combat could be fewer than even 20 or 30 days) – are, if not entirely useless, then nearly so.

their postures. Given sector areas may have their respective force postures over time varied.

Such adjustments could reveal casualty rate variations with significant potential impact on planning requirements or operational possibilities.

Level of War

A final note is offered more as a speculation that may be relevant to planners' considerations. Reflection on its possible relevance to a given situation may lead the planner to place or expect rates either somewhat higher or somewhat lower in the expected ranges for a given situation.

We have suggested in the previous reports that there is at least the possibility that rates might be expected, on average, to be somewhat lower or higher for similar tactical units, simply on the basis of the character of the overall operational setting: Does it represent the operational level of war or the purely tactical level? Tactical rates in the latter may, on average, be higher than tactical rates in operational-level situations.

No simple or conclusive line separates the two levels of war, but the difference may perhaps be usefully bounded.

The *operational level of war* would certainly be represented by a group of two or more corps, comprised of at least eight divisions, that operates for at least 10 days in a single coherent operation. The *tactical level of war* would, in turn, certainly describe a setting in which a smaller force – the limit, however, probably being a force of up to six divisions structured in one or two corps – pursues its objectives in operations lasting fewer than 10 days each. Beyond such fairly straightforward descriptions, defining settings in terms if the two levels of war inevitably becomes murkier. However, the fact that the tactical-level force conducts several operations, or phases of operations, over a total time exceeding 10 days would probably not alter the tactical nature of that smaller force's setting. Likewise, if two or more corps (or forces) are operating at the same time but in relatively isolated settings – that is, where their separate operations do not immediately or directly influence each other tactically – it is advisable that each be considered separately as a tactical-level event.

Both levels of war, of course, contain tactical events – rates for forces of up to corps size for periods of fewer than 10 days. Operations in a setting at the purely tactical level of war are limited to these, while operations in a setting at the operational level of war must consider such events in a broader context.

The research has indicated the possibility that rates for tactical units operating in a purely tactical overall setting might be expected, on average, to be somewhat higher than tactical rates for similar units operating in an overall setting at the operational level of war. At the same time, however, rates for tactical units in operational-level settings are likely, on average, to be higher in projected main attack sectors than rates for such units in purely tactical settings. This latter probability is especially the case in likely worst-case defender situations at points of breakthrough in main attack sectors – whether in a continuous- or disrupted-front scenario.

Both possibilities appear bound up in the fundamental patterns of operations at the two levels of war and their relative probabilities of bringing force to bear against objectives. Operational-level settings appear to make probable greater concentrations of force at relatively narrower points than is the case in purely tactical settings. This greater focus of effort suggests simultaneously higher rates, on average, for defenders at the point(s) of focus and lower rates, on average, elsewhere (even for defenders). The corollary pattern of operations in purely tactical settings appears to offer the opportunity, perhaps even the necessity, for engagements that are relatively independent of one another. What force is directed against a given objective is not as "diluted" by involvement (or even concern) with other threats as is a comparable tactical force – again, on average – in an operational-level context.

As stated above, these remain speculations, although speculations grounded in observation of extensive examples of the patterns of operations. They are offered because they may substantiate a planner's independent anticipations in a particular scenario – anticipations that may seem to be supported only by a planner's judgment

of possibilities in that case but, perhaps, also supportable by inferences about possible casualty rate patterns that have been suggested in our overall study.[5]

APPLICATIONS OF CASUALTY RATE DATA

Two broad applications of the data in Chapter 2 are possible. The first uses them to evaluate rate projections. The second uses them to construct rate projections.

Evaluating A Casualty Rate Projection

Some involved in the overall planning process do not produce rate projections but must evaluate them for reasonableness. These include those who make use of the rates and who evaluate the use of the rates.

Such planners may find a series of questions useful to help keep the considerations detailed in this and the previous chapter in mind. These questions apply whether the projection is produced by assignment methods or by calculation.

1. *Are the three central operational parameters adequately defined?* These are, of course, force size/echelon, time period, and scenario/sector.[6]

2. *Does the projection show a profile of rate pulses and pauses that are plausible* given the values of the three parameters in the operational situation purportedly represented? Answers to this question follow several courses.

   The first concern is with whether the profile shows *pulses and pauses* at all. The projection may manifest (a) no such rate behavior, (b) a rough approximation of such behavior, or (c) a detailed picture of the behavior.

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[5]We should make clear that we expected, on the basis of these speculations, that rates in the Middle East wars of 1967 and 1973 – which, given the time periods involved and the various separated operational areas and sizes of forces in each, were tactical contexts – should have had a higher mean than rates for comparable force sizes and times in the operational-level context of World War II. This expectation was based not on presumed links between greater munitions lethalities and higher casualty rates – our first report shows in detail how such links are abundantly disproved in the empirical record – but on patterns of operations and rates. The facts (for 1-division, 1-day events): the mean of Israeli rates was only 67 percent of the earlier rates' average, the mean Arab rate was almost twice as high, and the mean for the combined Arab-Israeli set of rates was only about 20 percent higher than the earlier average. Given that the proper comparison is between U.S. and Israeli forces, and that in any case a purely tactical context probably (i.e., theoretically) should witness at least somewhat higher rates on average than an operational-level context, we judged that the Middle East wars' and the World War II rates were for practical purposes essentially equivalent. See pp. 10-4 to 10-13 and G-12 to G-13 in our first report.

[6]If the projection focuses on a force within a larger operational whole, the parameters for that whole should also be characterized at least generally so the particular force's parameters can be understood in context.

The projection (a) may be made merely in terms of uniform and relatively long *time blocks* – for example, in a series of 10-day periods. The *ranges* of plausible rates set forth in Figures 2-1 to 2-7 (army-size forces) and 2-12 to 2-21 (corps-size forces) will define upper limits of rates (for various time periods) that should not be exceeded in the combined-parameters setting.

Other projections (b) may attempt to show pulses and pauses by defining rate averages for successive, identifiable phases of an operation in a series of relatively short periods of time, each representing a projected phase.[7] For example, an offensive pulse might be characterized by a single pulse rate that reduces 3 or 4 days' rates into a single average rate; this might be followed by other and different average rates representing subsequent pauses and pulses in a series of phases of the operation. Such individually defined pulses and pauses can be assessed directly – even in the absence of whatever actual daily rates might have been used in the construction. The evaluator would first consult the ranges of 1-day rates plausible in such a setting (see Tables 2-4 and/or 2-7 and Figures 2-1 and/or 2-12 for armies and corps, respectively) and then calculate whether the averages could have come from reasonable combinations of rates in those ranges (of course, ensuring variability of daily rates). These more detailed pulses and pauses should also always be reduced to rates for blocks of time (again, for example, 10-day blocks) and assessed against rate ranges for those time blocks.[8]

If the projections (c) offer *daily rates*, a number of checks may be performed. First, the plausibility of the pulses and pauses may be assessed by judging the *characters of the rate curves.* This is best done using moving 5- and 10-day averages to bring out the pulse-pause behavior – as demonstrated in our Illustrative Rate Curve figures. The 5- and 10-day curves ought to show magnitudes and durations (heights and widths) of pulses and pauses roughly comparable to those found in the illustrations of empirical data for comparable parameters.

Second, the daily rates and the rates at the peaks of the depicted 5- and 10-day rate (moving) averages may be compared to the appropriate set(s) of rate-range tables and figures, as above.

A third check on daily rates – especially useful in cases where rates are produced by mathematical models – would be one of the appropriateness of

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[7]Our hypothetical case example later in this chapter takes this second approach. See pp. 3-14 to 3-32.

[8]Our hypothetical case example again follows this path of translating the more articulated pulse-pause profile into sets of 10-day block rates. See p. 3-30. Without reducing the more articulated pulses and pauses to such blocks, the evaluator might also simply directly compare the projection's various pulses' durations to the trends of ranges suggested in the summary range figures (e.g., Figures 2-17 to 2-21 for corps-size forces). It should at least be clear – through interpolation – whether the rate for the period projected falls into the trend suggested by the set of various rate ranges provided in the summary figures.

daily *rate variability*. This check would compare the mean-variability relationships of projected daily rates during pulses to corresponding sets of empirically established relationships.[9] Those latter sets of relationships have been established for 10-day measures of pulses for army- (Figure 2-11), corps- (Figure 2-32), and division-size (Appendix B) forces.

3. *If multiple corps or armies are involved, do their lateral rates accord reasonably with the kinds of relative lateral rates seen empirically?* We have illustrated at least the general looks of such relative lateral rates for armies and corps on the offensive and defensive in Figures 2-10 (armies) and 2-29 to 2-31 (corps). The rates are expressed in 10-day measures for pulse periods.

4. In all cases, *what set of rate distributions is appropriate for the force and situation?* Where 10- or 5-day block rates are available, the implicit set of distributions may be determined by consulting among the tables provided. (See Tables 2-5 and 2-6 for armies and 2-8 through 2-11 for corps.) The tables illustrate empirically demonstrated rate distributions that may be used to suggest likely distributions embedded in a projection's 10- or 5-day rate average (mean). Where daily rates are available, direct comparisons can be performed between the projections and the empirical evidence by calculating the projection's rate distributions for 10- and 5-day peak periods. Both projected and empirical pulses that are roughly comparable in terms of the three parameters ought to have distributions that are, again at least roughly, comparable in character.

The Issue of Rate "Elasticity"

The question inevitably arises whether a rate remains reasonable that falls outside – especially above – the ranges of empirically established rates supportable for given settings.

We have consistently maintained in these reports that it is the *patterns of rates* that must ultimately be controlling in assessing reasonableness. The ranges of rates set forth in Chapter 2 derive from, and illustrate the character of, such patterns. According to the empirical evidence of which we are aware, the ranges are both appropriate for the stated settings and robust in being conservative rate characterizations: we think it highly improbable that rates would exceed the maximums shown.

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[9]These mean-variability relationships are discussed at length in the previous two reports. Those reports also describe and demonstrate other tests that might be useful in evaluating simulation output – several of which are referenced under Near-Term recommendations in Chapter 5.

We would suggest the following considerations in cases where a rate projection exceeds the limits of empirically established rate ranges. First, somewhat more leeway should be permitted, in general, to rate projections the smaller the force size and shorter the time period represented. Judgment must be used: more leeway goes to 5-day corps projections than to 10-day; more to corps projections for a given period than to army projections for a similar period.

However, a second consideration places bounds on the first. In certain cases, the upper limits in our rate range figures should be considered simply controlling – not because rates could not conceivably or reasonably go higher, but because any higher rates in these particular cases would likely be considerably higher because of an operational scenario substantially different from the one asserted.

Four sets of 5- and 10-day range upper limits ought not to be exceeded if the planning scenario asserts *continuous-front* conditions: an army in a Type I defensive; a corps in a main attack sector, Type I defensive; an army on the offensive, worst case; a corps in a main attack sector, worst-case offensive.

These four particular scenarios, with their upper casualty rate limits, do not represent merely four cases of personnel attrition that could be more or less severe in a given episode. Our analysis strongly indicates that these particular upper limit rates represent attrition descriptors of the boundaries between operations of one fundamental kind and another.

In each of these four cases, a rate exceeding the upper limit of the range would represent the transition operationally to a *disrupted-front* setting. The two defensive-rate limits (army and corps) would rise only if the attacking force succeeded in opening one or more significant gaps in the defender's cohesion and pushing significant forces, largely unopposed, into defender rear areas. The two offensive-rate limits (army and corps) would rise only if the attacking force suffered a counter disruption by having a significant portion of itself cut off and encircled. Certainly, such higher rate events have transpired. They represent, however, circumstances fundamentally different from those of continuous-front operations.

Constructing a Casualty Rate Profile: A Hypothetical Case

We offer a brief example of how the data in Chapter 2 may be used to characterize a prospective operational scenario. The Persian Gulf crisis arose during

this report's preparation and seemed a useful candidate for applying the data hypothetically.

We stress that *the following is merely a hypothetical exercise.* No information about U.S. or coalition objectives or planning, other than what had been speculated upon in the open press, was available. We freely constructed all assumptions about objectives, time lines, conduct of operations, and so on.[10]

Assumptions

We assumed the following about the three operational parameters concerning ground forces.

Force Size / Echelon. The U.S./coalition force would consist of two major functional parts: a Force A capable of either major offensive or defensive action, and a Force B directed mainly toward defensive action, with strict limitations applying on support of any possible offensive activity.

Force A would be made up of U.S. and U.K. personnel. Force B would encompass the bulk of Arab and other nations' personnel. Table 3-2 suggests the size and structure of the two sets of *divisional forces* assumed.

These forces would be maintained at at least 90 percent strength throughout prospective operations.

Scenario. The general assumption is that diplomatic and embargo efforts to convince Iraq to pull out of Kuwait have failed. Policy judgments about Iraq and the general international situation dictate that Iraqi forces must be directly engaged in order to free Kuwait and, in addition, must be defeated in a way that deals a crippling blow to Iraqi offensive military power. Policy also dictates that, in order to be considered successful, ground operations must be completed within a short span of time – which is understood by policymakers, based on operational commanders' advice, to be a month and possibly less from the initiation of major ground combat.

The assumed military judgment is that Iraq's potential military threat is principally focused in its ground forces, especially the elite Guards force. These are

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[10]This hypothetical exercise was constructed in early October 1990, without knowledge of or reference to the "Phase II" larger force with fuller capabilities that was later committed. The Phase II divisional force, for "Force A" in this exercise, appears to have grown by January 1991 to about 160,000 personnel organized in three corps-size formations.

TABLE 3-2

HYPOTHESIZED U.S./COALITION DIVISIONAL FORCES

	Personnel	Number and type of divisions
Force A	~100,000	~7 divisions formed in two corps:
	60,000	Heavy force: 3-2/3 divisions 1 Infantry (Mech) 2 Armored 1 Armored cavalry regiment 1 Separate armored brigade
	40,000	Light force: 3 divisions 1 Airmobile 1 Marine 1 Airborne
Force B	~50,000–65,000	3 to 4 division equivalents

Note: the structure of Force A into two corps derives, as explained under Scenario/Sector, from judgments about the military objective and the operational requirements to accomplish it.

the forces that in the future might again move south to capture oil areas and could also move south or west or north to confront (and conceivably overthrow) other nations' political and military establishments. Iraqi chemical, biological, and nuclear assets also pose significant threats – although, for the time being, they are more political and psychological in their nature than of war-winning implication.

The assumption is that the heart of the ground threat must be destroyed and that chemical, biological, and nuclear assets must be destroyed or at least severely damaged. A further assumption is that the surest – perhaps indispensable – military means of destroying a heavy and competent ground field force is by ground forces (assisted by air and other forces). The chemical, biological, and nuclear assets are more properly the targets of air and other forces.

The center of Iraqi ground-force strength is judged to be its Guards force. The rest of the Iraqi ground force, although large, is judged to be of inferior fighting quality and mobility. The assessment is that if the Guards force is destroyed, the rest of the Iraqi ground force will quickly be made ineffective or irrelevant. The assessment is, further, that a the comparably-sudden loss of senior Iraqi leadership will ensure the rapid collapse of the overall Iraqi ground force.

The division of the Guards force into two parts is considered an opportunity. The main Guards force is deployed as an operational reserve, within striking distance of the Iraqi border defensive force and Kuwait City. The rest of the Guards force is held near Baghdad to protect the senior leadership.

The rapid, outright destruction of the Guards force in the Kuwait vicinity, and the simultaneous neutralization of the senior Iraqi leadership, are judged the principal objectives of military operations. Collapse of other Iraqi forces in the Kuwait area should follow achievement of these twin primary objectives. The secondary military objective is the severe damage or destruction of Iraq's chemical, biological, and nuclear assets (production facilities and any stores) and their long-range delivery systems. Other military objectives (e.g., destruction of command and control centers, communications, and air assets) are considered supporting actions.

Turning to the ground force operation itself, the judgment is that the main Guards force may be isolated and suppressed by air and special operations while a rapid and violent ground strike aims to disrupt the isolated force. Close evaluation of the target Guards force's dispositions indicates that a rapid offensive against certain points promises the force's disruption and the rapid encirclement of some 40 to 70 percent. An attack with sufficient violence and speed promises that the encircled elements will soon collapse in confusion. The collapse of the main body of the deployed Guards force, coupled with heavy and sustained ground and air pressure against the rest of that force, will quickly render the remaining force ineffective.

Time. Two planning time lines are projected (explained in Rate Profile Projections). An optimistic case envisions ground operations being completed within 10 days. A pessimistic case allows for ground operations over 30 days.

In each of the two cases, two rate profiles are prepared. The first describes the operation's phases. The second then summarizes the more detailed operational phases profile in 10-day block periods.

Sectors. Sectors are based on forces and their projected actions: the sector area will expand or contract, just as the force composition may alter, in conjunction with the performance of the projected actions.

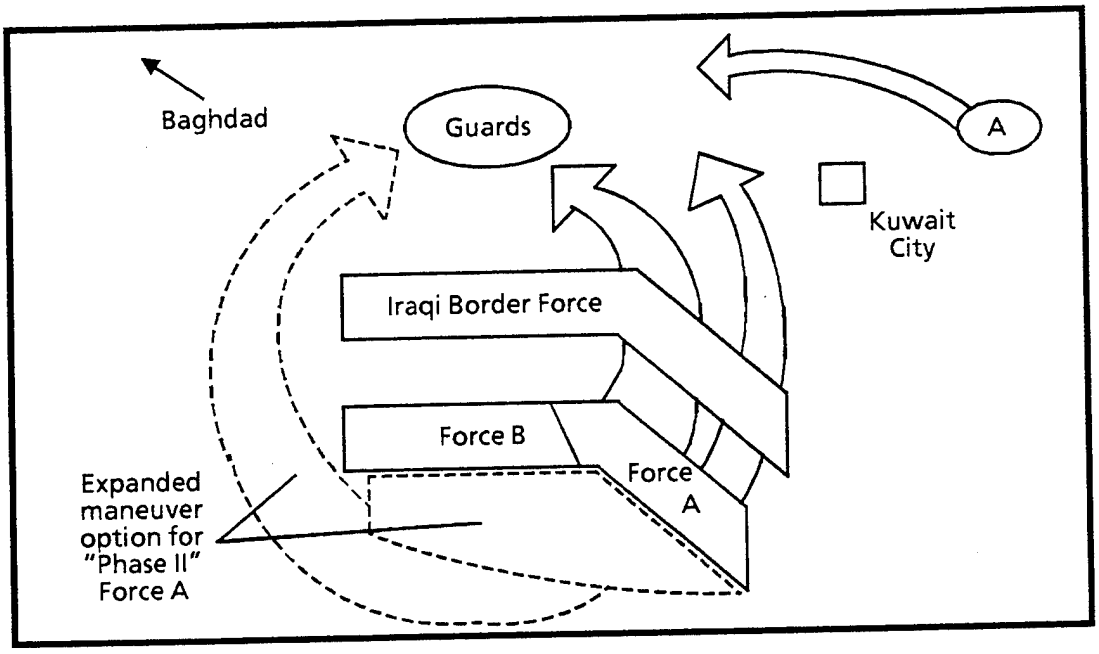
The U.S./coalition operational area is divided first into two broad sectors, for Forces A and B, with one of these (Force A) then redivided into two offensive sectors.

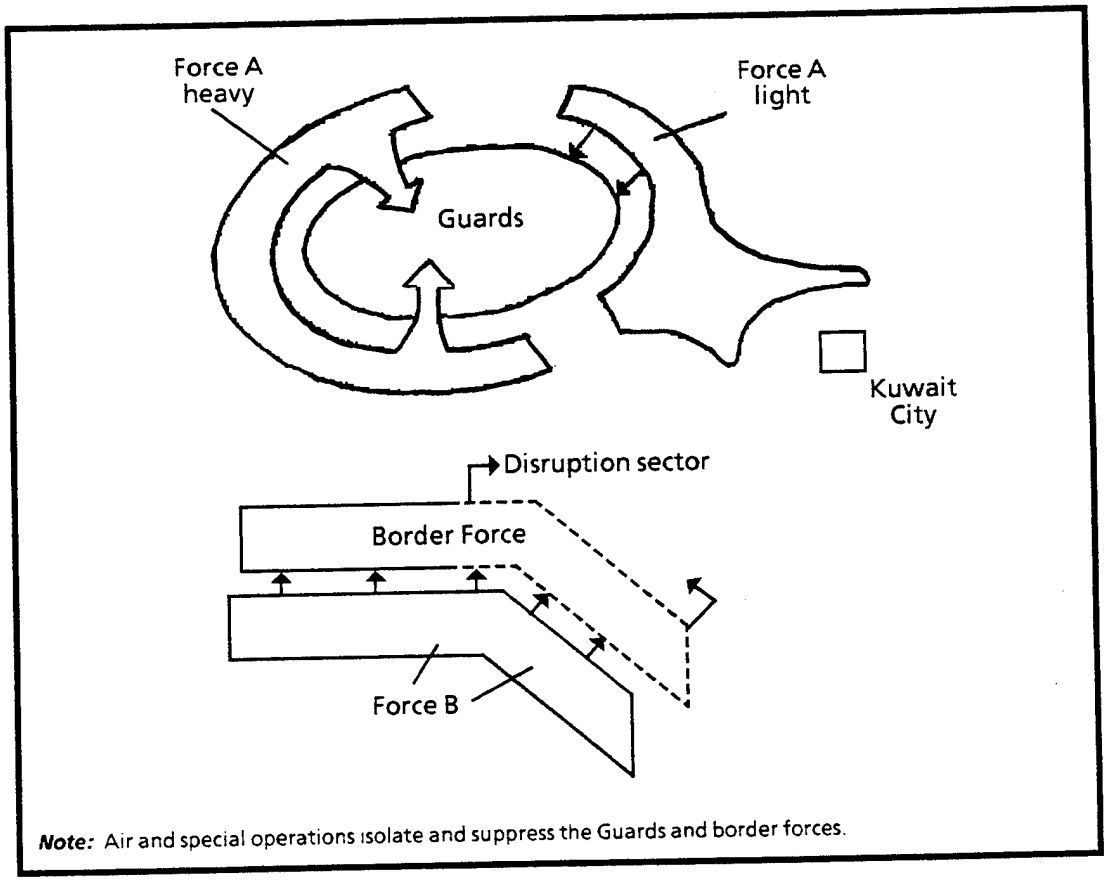
The operation planned in the two offensive sectors is a highly mobile one; the areas for each will shift considerably and expand as operations reach projected depths. The operation in the other major (Force B) sector will involve a lateral expansion of that sector's area. Plans do not anticipate alterations in the sizes or structures of forces in the respective sectors. (Figure 3-3 will be referred to during much of the following discussion.)

Forces A and B will initially occupy defensive sectors as shown in Figure 3-3 (upper panel). The scheme of maneuver projects Force A rapidly transiting the Iraqi border defensive belt, both overland and by air and sea. The overland passage will involve two actions, one of them commencing earlier but both planned to hit the target Guards force in close conjunction. First, a portion of Force A will attack through the fortified border cordon along corridors – initially cut by artillery and air strikes – by means of lighter forces infiltrating and then heavier forces passing through. Somewhat later, another (heavy) portion of Force A will rapidly flank (envelop) the defender forces to their west.[11] Throughout these actions, the Iraqi border force will be heavily suppressed across its full breadth and depth, largely with air power.

Force B is dedicated to defensive operations. This force will not participate in an offensive to disrupt the Guards force. However, during the first days of operations, it will act to fix a substantial portion of the Iraqi border force with offensive pressure. It will maintain this pressure throughout the operation – insuring that no Iraqi border forces may turn to offensive activities against Saudi territory. After Force A's initial passage through its portion of the Iraqi border force, Force B will expand its area of responsibility and act to fix the entire border force. In the overall operation's last days, Force B will help mop up and police resistance along the border.

[11]The expanded Phase II coalition force would permit this flanking movement to be of full corps size.





Note: Air and special operations isolate and suppress the Guards and border forces.

FIG. 3-3. HYPOTHETICAL EXAMPLE'S OPERATIONAL SECTORS AND MANEUVER

Rate-Profile Projections: Operational Phase Rates

Rate profiles for projected phases of operations are based on the projected scheme(s) of maneuver to secure military objectives in the particular scenario. We will illustrate the preparation of rate profiles, using Force A's heavy corps.[12]

Force A will deploy into Kuwait in two parts: a heavy force will maneuver to encircle the Guards from the south, west, and northwest and to drive simultaneously into the Guards force's weak points in order to effect violent disruption; a lighter force will deploy in blocking and fixing actions to the north and west of Kuwait City. The scheme of maneuver envisions an early, major attack by the heavy force to disrupt the center-western portions of the Guards force and to block escape in a westerly or northwesterly direction. The lighter force will act to fix the eastern portions of the Guards, to conduct a secondary offensive pulse coordinated with the heavy force's pause(s), and to block escape of forces to the northeast or any attacks against Kuwait City.

It is judged that Force A must engage the Guards force not later than Day 4 of the ground offensive. Engagement could occur sooner but it is judged desirable that, if possible, at least some portion of the Guards be drawn out from prepared positions and toward the border region. Engagement must be achieved by Day 4 in any case.

Major breakthrough of a force targeted for disruption has been shown empirically to occur, if achieved at all, within 2 to 4 days of a breakthrough pulse's commencement. If breakthrough in the Guards force is achieved in a single major offensive pulse, it will likely occur on Days 5 to 7; encirclement and overrun would follow over the next several days. Such a disruption operation could bring about an end of major ground actions against the Guards force within about the first 10 days.

The optimistic time line is therefore judged to be 10 days. It rests on the heavy force's successfully breaking apart the Guards force and then proceeding with violent attacks to effect the Guards' overall rapid collapse. The light force will have maintained a steady and threatening pressure during the period.

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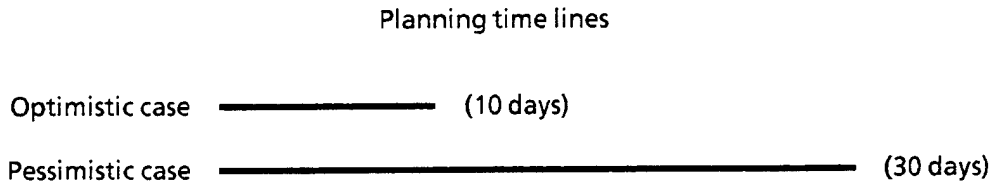
[12]This process of projecting a rate profile must be conducted for each corps force in the scenario: the heavy and light forces of Force A and for Force B.

A pessimistic operational time line should also be envisioned. It is assumed that operations planners have informed senior policymakers that 30 days is a period that, in the end, will be sufficient to disrupt the Guards force – even if the first attack fails to secure that objective.

Projected casualty rates must thus describe at least two time lines: 10 days (optimistic) and 30 days (pessimistic). Each will result in disruption of the Iraqi Guards force and collapse of Iraqi forces generally in the Kuwait region. Neither projection contemplates further ground operations deeper in Iraq.



Detailed projection of plausible casualty rate profiles must be prepared for each planning case.

Both cases require that Force A transit the border defensive belt. Both require that the Guards force be engaged by Day 4. The transit period will thus be identical in the two cases.

The Iraqi border force is assessed to be composed of inferior troops and also highly vulnerable to heavy concentrations of artillery/air assault – especially in passage corridors where such assaults would be followed by light force infiltration and then by heavier force passage. The empirical record suggests relatively low rates for a corps-size offensive against defenders partially but significantly stunned by bombardment (see in Chapter 2 the upper panel of Figure 2-25, Days 41 through 49, which links to the upper panel of Figure 2-31).

We will assume that the border passage requires 2 days, and is followed by a day of maneuver of the two corps-size parts of Force A into positions for their respective missions. (The passage phase would include any wide flanking movement by elements of Force A's heavy portion.)

We consult the empirical data and find that a highly successful breakthrough operation involving disruption (as is the case here for the Iraqi border force) would produce corps TBC rates of 3 to 5/1000/day (see Case 1, Table 2-13 and the upper

panel of Figure 2-24). A breakthrough sector attacker experience for a continuous-front setting would be closer to 7 to 8/1000/day (see Figure 2-25, top panel). Planning is conservative – therefore, we will set the passage rates at an average for the 2 days of 7/1000/day. This is followed by a 1-day pause at a rate of 2/1000/day – only sporadic ground engagements are contemplated while forces rapidly maneuver deep, which when judged in terms of the corps' full strength represents a light rate (see pause rates for corps in the various offensive figures).

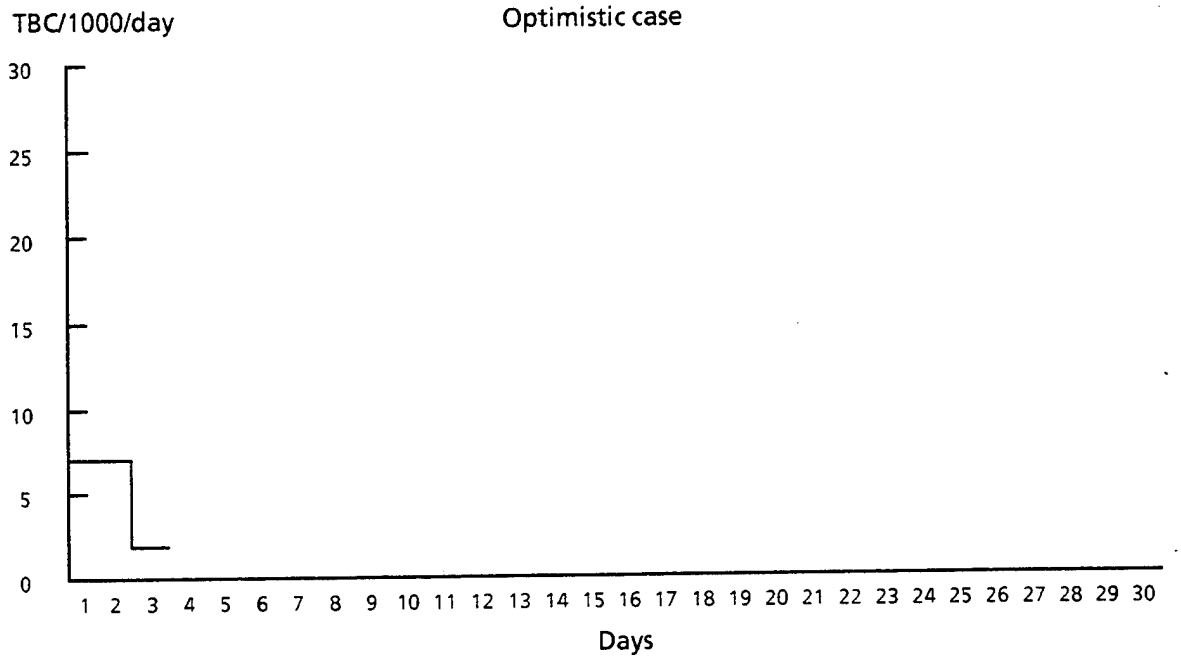
Our two operational phase rate profiles thus have their first 3 days' rates defined, as shown in Figure 3-4.

The two rate profiles may or may not diverge after Day 3. The optimistic case envisions successful disruption of the Guards force over the remainder of the first 10 days. The pessimistic case sees the first major pulse by the heavy force as a continuous-front offensive that fails to disrupt the enemy's cohesion. Operationally, the rates should certainly diverge, with the disruption rates falling far below those of continuous-front operations. The empirical evidence for a corps-size force's offensive rates during a rapidly successful disruption shows quite low rates – about 3 to 5/1000/day, as cited above.

We, however, follow our conservative planning inclination and decide that the two planning cases will, in fact, agree on rates for the first 10 days, despite the clearly different operational outcomes. We choose, that is, to assume for even the optimistic (10-day) case that the disruption will only follow a rate experience that parallels those for continuous-front offensives.

The question becomes how long a continuous-front offensive pulse rate for the heavy force's first offensive would likely last in the planning scenario, and with what character or shape over that time. We consult corps rates for continuous-front offensives, and the set of illustrative rate curves, in order to assess the look of such rates over multiple-day periods.

Panels from Figures 2-25 and 2-24 (repeated in Figure 3-5) illustrate useful differences in the set of offensive rate experiences. Each shows that maximum daily corps rates on the offensive will reach to about 33 to 34/1000/day. Figure 3-5's lower panel (from Figure 2-24) shows the worst continuous-front offensive pulse on file – when the offensive corps sustained relatively high rates throughout the pulse while the FLOT moved very little against effective opposition. On the other hand, the



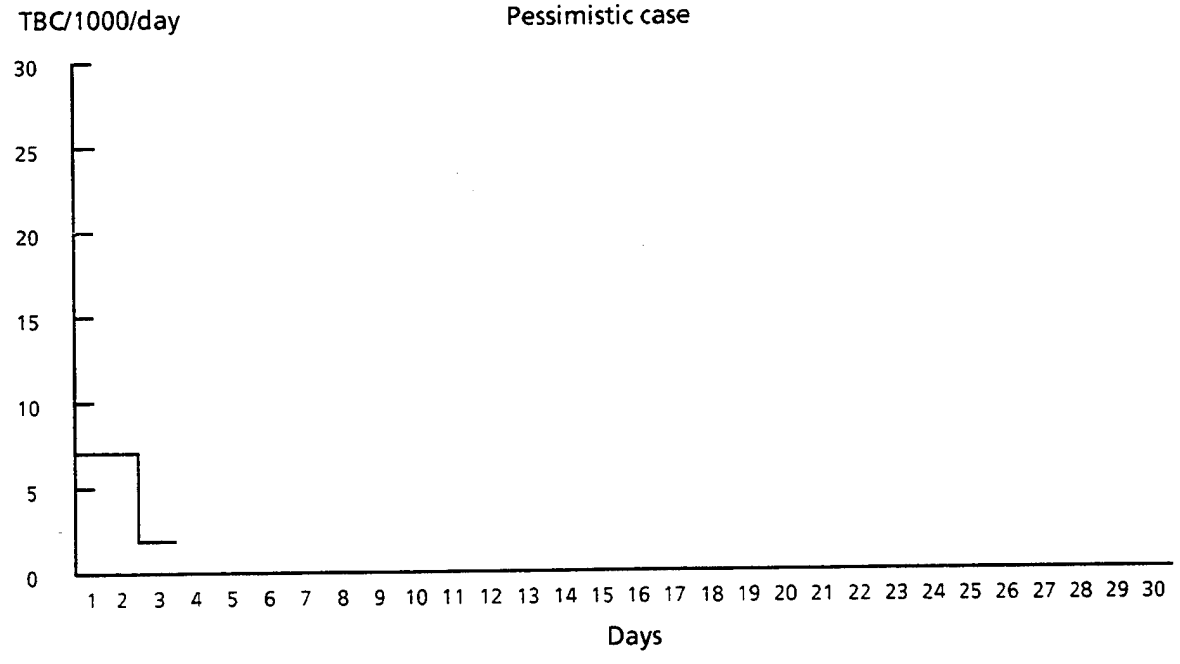


FIG. 3-4. RATE PROFILE PROJECTIONS
Border passage phase
(Force A – heavy)

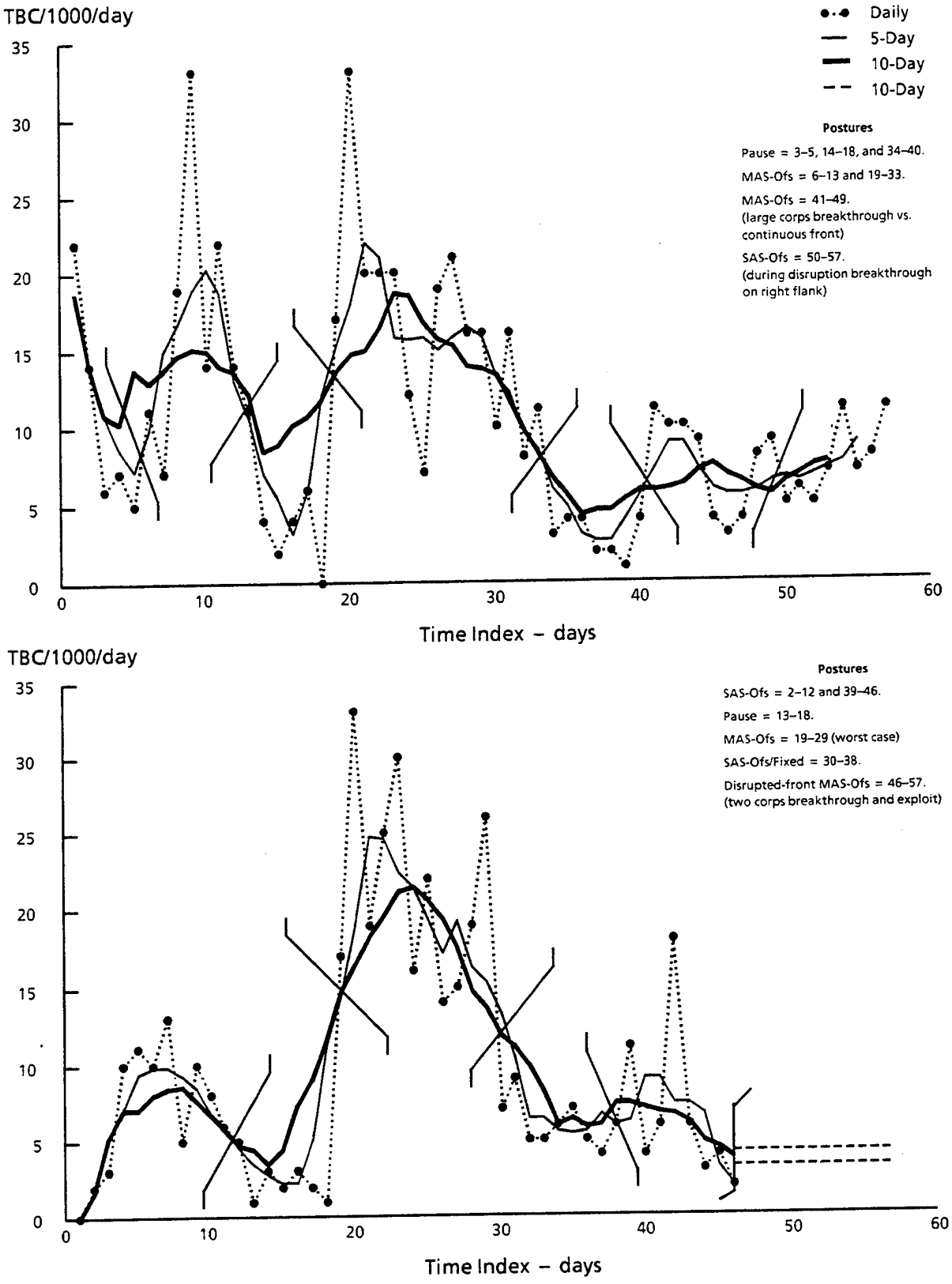


FIG. 3-5. EXTRACTS FROM FIG. 2-25 (UPPER PANEL) AND 2-24 (LOWER PANEL)
Illustrative corps offensive rate curves

upper panel (from Figure 2-25) shows pulse curves for more successful offensive actions: shorter pulse periods, although with maximum 1-day rates as high as in the worst case.

The longest corps-size offensive pulses seen in the empirical data endured from 10 to 15 days.[13] We decide our pessimistic case projection will assume 11 days of continuous offensive operations in the first major offensive pulse.

The second aspect of projecting a rate profile for this initial offensive concerns the probable shape of the rate pulse over the 11-day period. We decide that the first major pulse by the heavy force would assume a 4-day maximum-rate period, with 7 other days of significant but lower rates (averaged over those several days).

The 4-day peak period represents a conservative statement of the time the empirical evidence has shown to be required for a successful breakthrough (generally 2 to 4 days). It also assumes, however, that in the planning scenario a continuous-front offensive would exhibit rates that do not precisely parallel the worst-case rate curve for continuous-front offensives (which shows high rates for a full 12 days) but would look more like the rate curve seen in the second pulse displayed in Figure 3-4's upper panel. This latter assumption is due largely to the character of this particular scenario: operations will remain highly mobile in this open terrain, which differs considerably from the Normandy-style, close terrain and low FLOT movement underlying the rates in the worst-case example.

Combining the two planning judgments – a 4-day breakthrough effort, at maximum rates seen empirically for such a period in a continuous-front offensive – leads to our setting a 4-day peak rate average at 25/1000/day.

We decide that the remaining 7 days of the overall 11-day offensive pulse will have a rate average that parallels those seen during the bulk of the longer empirical offensive pulses – if the brief peaks within those pulses are set apart. We observe that rates during such pulses generally remain above 10/1000/day throughout the pulse, with the average (again, setting aside the interior peaks) in that vicinity.

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[13]These data are seen in the corps Illustrative Rate Curve figures. In most cases, the rates describe offensives that failed to move the FLOT very far.

It must also be remembered, of course, that a *pulse* is different from the overall offensive effort itself, which may extend over a longer time.

Putting the two aspects of the 11-day pulse together – the 4-day peak and the other 7 days – we assign the following rates: 25/1000/day for the peak, 12/1000/day for the other days. We then alter the set of the 7 other days slightly to place one of the 12s on the day before the 25s occur. Our reasoning is that we have observed in the empirical data that peak rates during a pulse often do not begin occurring on the first day of the confrontation.[14]

These considerations lead us to project the optimistic and pessimistic cases of the heavy force's experience during its first major attack as shown in Figure 3-6. Both the optimistic case (conservatively portrayed) and the pessimistic case show the same overall rate experience for the first 10 days.[15] (The rate profile for the optimistic case is terminated at Day 10.)

We now follow through the rest of the pessimistic case. A pause in the heavy force's activity must inevitably follow such a major offensive pulse. The empirical evidence (as seen in Table 2-7) shows that pauses following a major offensive pulse will last from 6 to 12 days while a corps remains in a general offensive posture in a continuous-front settting. Again, we are conservative and assume the pause will last only 3 days.

Study of pause 1-day rates shows that they range between 2 and 8/1000/day when the corps remains in the offensive posture. We assume the corps will keep at least "fixing" pressure on the enemy during the pause. Because "fixing" rates are between 2 and 5/1000/day over a 5-day period (and with low rate variability), we will assign an average rate of 4/1000/day for the 3 days.

The brief pause will be followed by renewed pulse action – probably an offensive effort, albeit one not nearly as powerful as the first. The purpose of the second offensive effort is to retain the initiative, keep the Guards off balance, and gain time to prepare for what is envisioned as the second major – and, in the pessimistic case, projected successful – effort at disruption.

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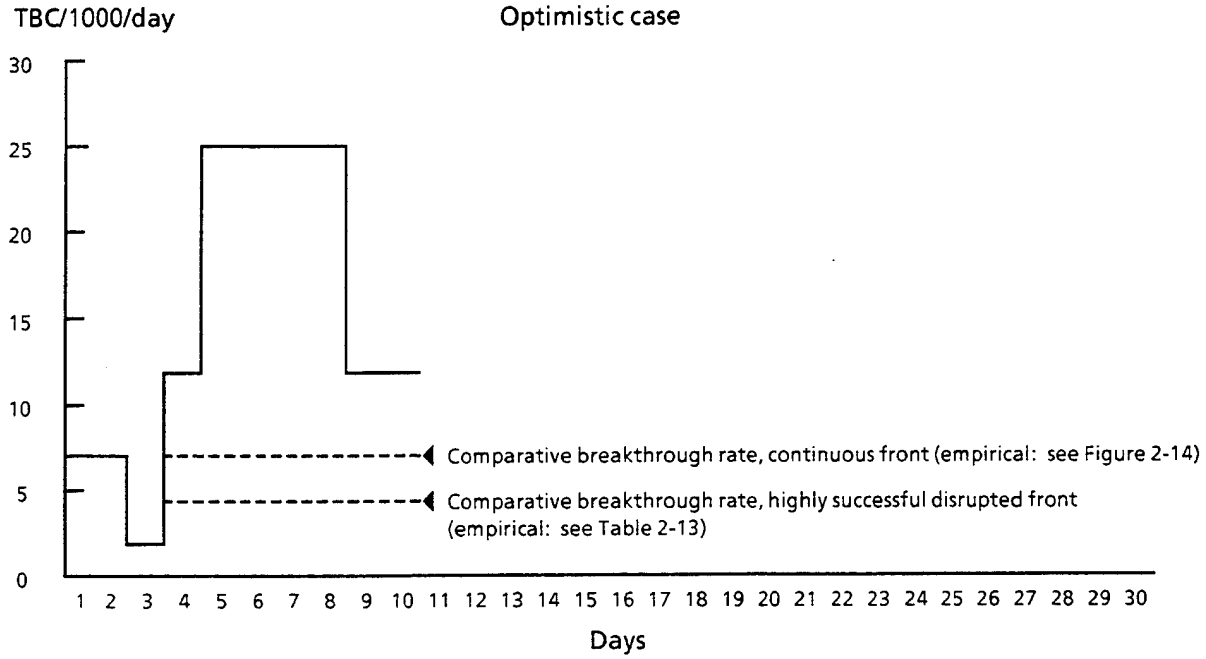
[14]Our impression from the data is that, more often than not, the first day of an offensive is spent by forces at the low-tactical level clarifying detailed enemy deployments while closing with the enemy.

[15]The use of rates for corps-level breakthroughs in a continuous-front setting would have reduced the projected rate for the 7-day battle pulse in the optimistic case to 7 to 8/1000/day instead of the very conservatively projected 19/1000/day rate (calculated over the 7-day pulse period). Rates from actual disrupted-front settings would, of course, lower that considerably further.



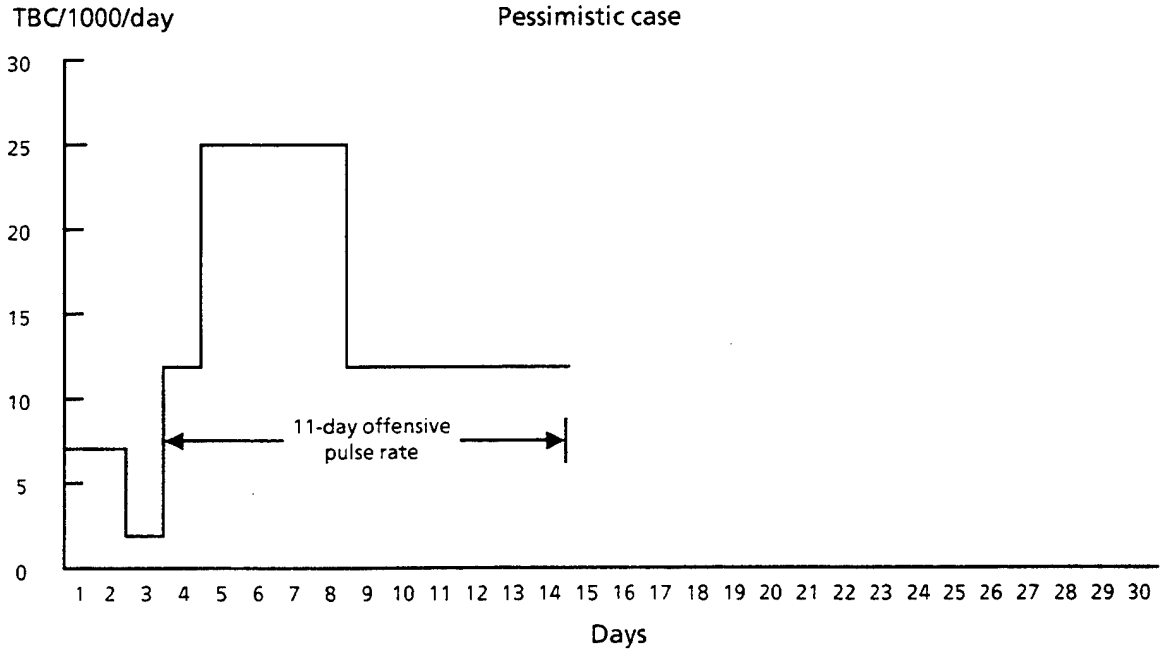


FIG. 3-6. RATE PROFILE PROJECTIONS
First offensive pulse: main attack sector
(Force A – heavy)

It is also, however, possible that the Guards will be able to mount a counterattack marking an end of the pause period. The evidence shows that counterattacks are generally of short duration. It is judged that this Guards force, in particular, will not now be able to muster the operational coherence and strength to mount more than a relatively short-lived counterattack, if that.

Given either possibility (its own offensive or a defense against a brief counterattack), the heavy force's second pulse is assessed to be of a secondary attack sector character. The casualty data suggest that rates are similar for either a secondary offensive effort (of the sort the heavy force might now mount) or for fending off a counterattack (which, given its brief duration, would parallel in scope a secondary defensive effort for the heavy force). A rate of 8/1000/day is chosen from the empirical data to cover either possibility reasonably. It is judged that this second, brief pulse of activity will possibly last 3 days.

A 2-day pause is judged to follow. Using the same reasoning as before about probable "fixing" efforts by the heavy force, the rate of 4/1000/day is again assigned for the pause. (See Figure 3-7.)

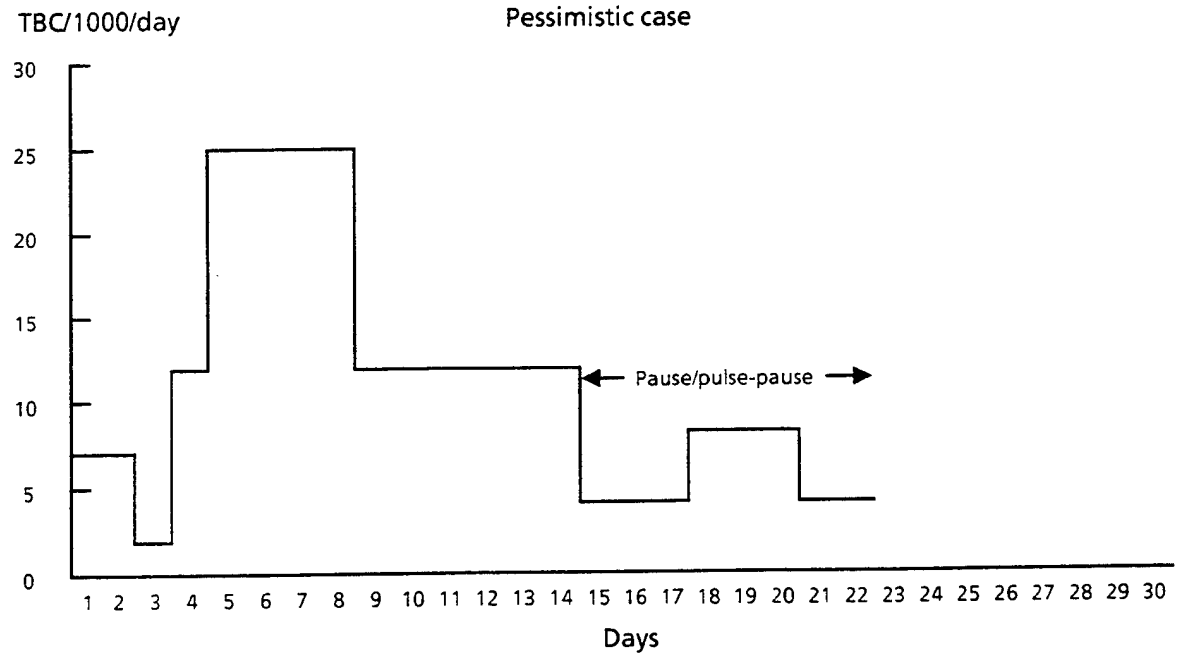


FIG. 3-7. RATE PROFILE PROJECTION
Second offensive pulse: secondary attack sector
(Force A – heavy)

The heavy force finally launches its second major offensive aimed at disrupting the Guards force. We apply the same general reasoning about conservative planning to this pulse's characterization – that is, we do not use empirical rates from disruption events, but continuous-front rates instead.

In this second offensive episode, however, we estimate that the Guards force would by now be seriously weakened. With reference to the empirical data in the set of corps Illustrative Rate Curve figures, we judge that the projected second pulse's overall duration would be reduced from that seen in the first pulse – 6 days seems a reasonably conservative projection given the various pulse durations seen in the empirical data. Following this reasoning, we also shorten slightly the projected peak period within that overall pulse period (from 4 to 3 days) and somewhat reduce the rates both within the peak and for the rest of the pulse. A rate of 22/1000/day is assigned to the peak 3 days, a rate of 9/1000/day to the pulse's other 3 days, and a rate of 4/1000/day (the conservative fixing rate) to a projected brief period for mop-up of remaining resistance.

The overall pessimistic case rate profile for Force A's heavy force, thus constructed, is displayed in Figure 3-8.

Rate-Profile Projections: Block-Time Rates

The two rate profiles portraying phases of operations are then reduced to rates for sequential 10-day blocks (see Figure 3-9). Each 10-day rate is then checked against the ranges of 10-day rates found in Figures 2-19 and 2-20 (for, respectively, corps-level offensives in a main attack sector and offensives/defensives in a secondary attack sector). The projections fall into the suggested ranges at places along the spectrums that appear reasonable for the scenario circumstances: 15.2 and 10.9/1000/day averages for the two main offensive pulses, and 8.4/1000/day for the secondary pulse.

Rate Distributions

A final step in characterizing the force's projected rate experience is to determine the more detailed distributions of rates that may be expected for the rate profiles. These rate distributions – some of which help identify rates at the "hot spots" – would be especially useful in gauging more detailed in-theater plans for medical and personnel resources.

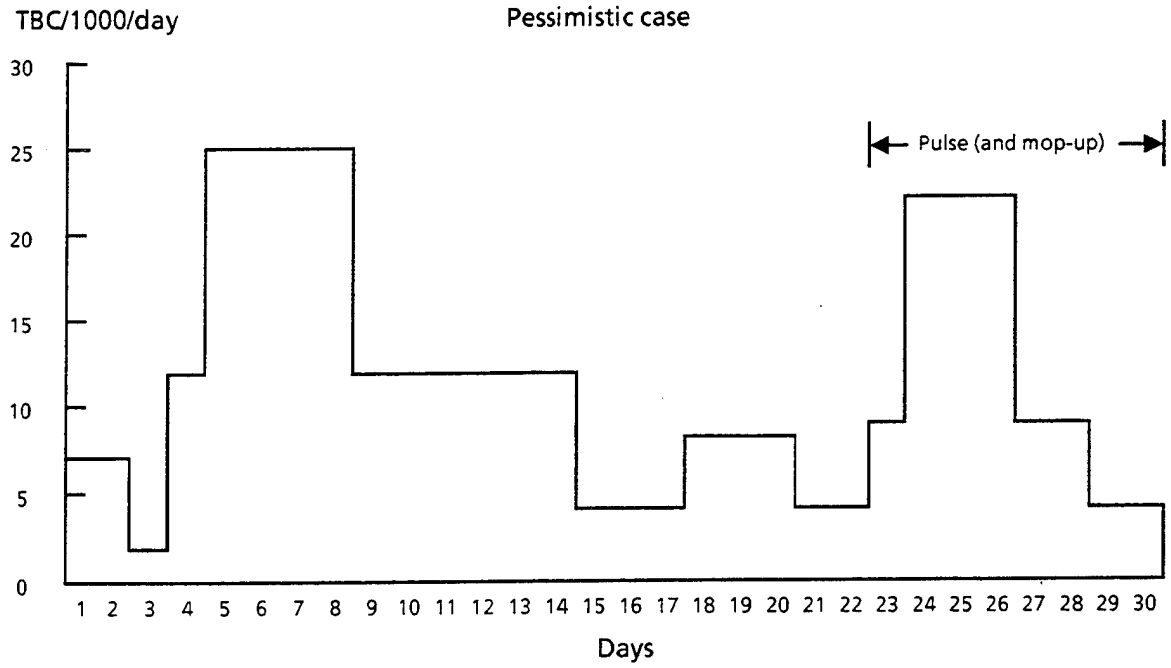
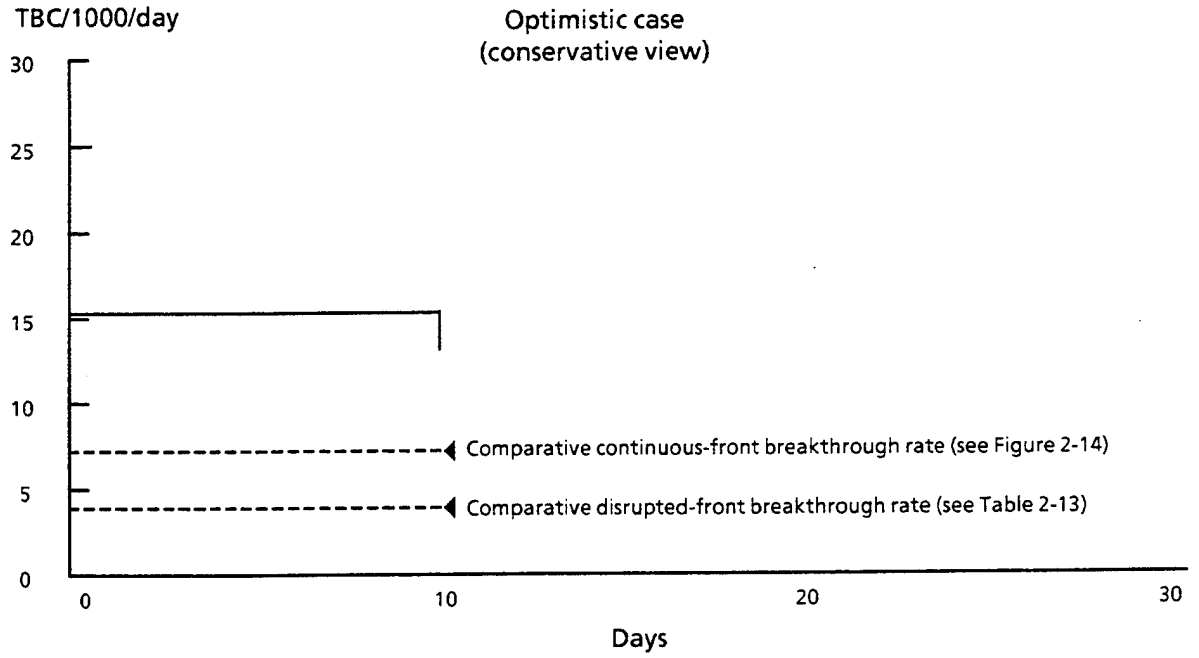


FIG. 3-8. RATE PROFILE PROJECTION
Third offensive pulse: main attack sector
(Force A – heavy)

Table 3-3 was constructed for the heavy force's pessimistic case by taking the three 10-day rates (shown in Figure 3-9) and finding the appropriate distributions for a corps on the offensive in continuous-front scenarios. Distributions for the divisional force for each of the three 10-day periods are available. (Distributions for 5-day peaks within the longer periods are also available.) We consulted the distribution tables for corps-size forces in Chapter 2.

Table 2-9 contains rate distributions to be expected for a corps on the offensive in a main attack sector, while Tables 2-10 and 2-11 show distributions for a secondary attack sector. It happened in this example that each of the 10-day periods was



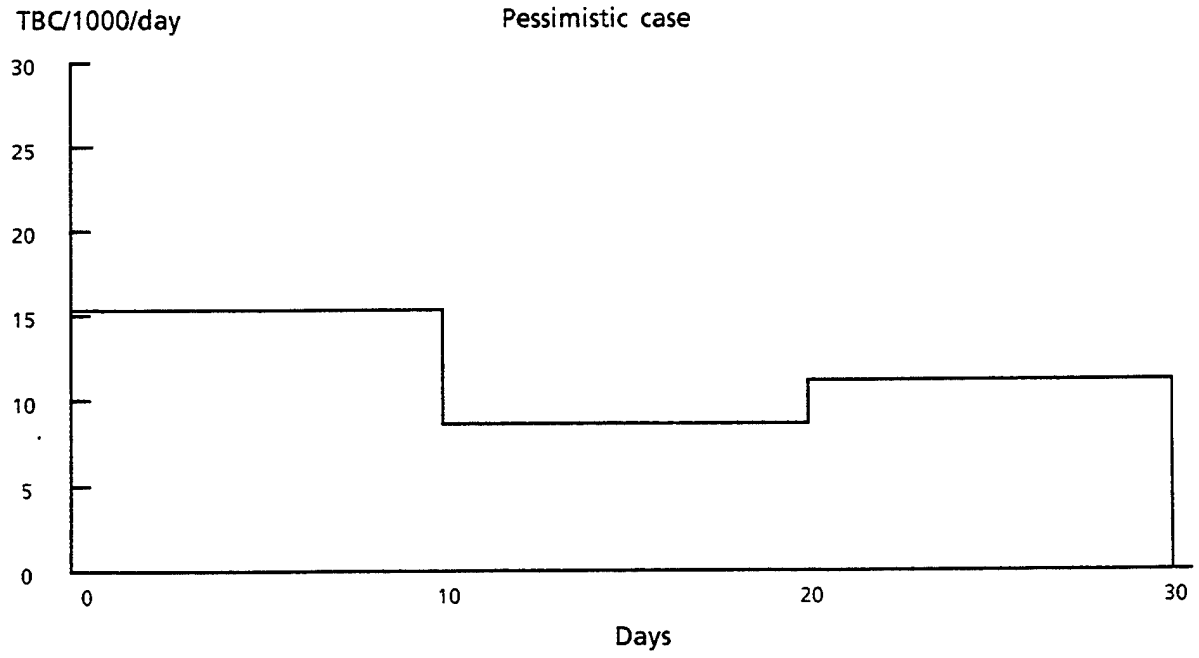


FIG. 3-9. 10-DAY BLOCK RATES
Translation of operational phase rates to block-time perspectives
(Force A – heavy)

TABLE 3-3

RATE DISTRIBUTIONS FOR HYPOTHETICAL FORCE A (HEAVY): PESSIMISTIC CASE
(Divisional force)

Probable TBC rate distributions by force-days (TBC/1000/day)						
Rate statistic	First 10 days		Second 10 days		Third 10 days	
	Division-days	Corps-days	Division-days	Corps-days	Division-days	Corps-days
Maximum	69	33	41	23	69	33
75th percentile	20	20	12	11	20	20
Mean	14	14	9	9	14	14
50th percentile (median)	12	15	6	8	12	15
25th percentile	6	8	2	5	6	8
Minimum	0	1	0	0	0	1

Probable portions of force-days (division-days) and rate averages per rate class						
Rate class (TBC/1000/day)	Percent of observations			Mean TBC rate (TBC/1000/day)		
	Day 1–10	11–20	21–30	Day 1–10	11–20	21–30
≥40	5	2	5	52	49	52
10 to <40	51	32	51	20	17	20
<10	44	67	44	4	4	4

Casualty rate by category (per 1000/day – divisional force)				
Time blocks (days)	TBC	KCMIA	WIA	WIA/TBC rate
1–10	15.2	3.9	11.3	.74
11–20	8.4	2.5	5.9	.70
21–30	10.9	2.8	8.1	.74

characterized by a dominant pulse type: the first and third periods by a main attack sector offensive pulse and the central period by a secondary attack sector offensive.[16]

Summary

This planning process would need to be performed for each of the major constituent forces – in this hypothetical example, for the heavy and light portions of Force A and for Force B – and the results translated into an overall picture of the projected force experience. Once the planner becomes accustomed to the character of the data sets in Chapter 2, sketching alternative operational possibilities for varied schemes of maneuver, organizations of forces, and/or time lines may be accomplished with speed and facility, and with the assurance that rates are empirically supportable.

Table 3-4 shows one possible set of overall results for the hypothetical case.

Concluding Remark

The role of judgment in casualty rate planning should not be ignored or relegated to minor status. Whether a planner is evaluating or constructing a rate projection, the fact is that the projection may be reasonable within a range of possibilities. Judgment will and must determine where within such ranges any particular projection falls.

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[16]It will be recalled that either a secondary offensive or defensive (against a counterattack) was expected during the second 10 days. The planner would note that the differences in distributions in the two cases are relatively minor and would select one or the other according to the more probable case projected. (Of course, if the projected operation's phase possibilities differed significantly in terms of either rates or distributions, the planner would need to select one or plan for both.) In the hypothetical case above, we selected the secondary offensive case, as it was assumed the heavy force would act to keep pressure on the Guards force – obviously, recognizing that pauses must occur – throughout the 30 days.

TABLE 3-4

HYPOTHETICAL CASE BATTLE CASUALTY PROJECTIONS
(Divisional force)

Optimistic case (10 days)	Casualty data				
	Sector experience	TBC rate (TBC/1000/day)	Casualties		
			TBC	KCMIA	WIA
Conservative view					
Force A – heavy	MAS-Ofs[a]	15.2[a]	9,120	2,371	6,749
Force A – light	Fixing	4.4	1,760	440	1,320
Total			10,880	2,811	8,069
Force B	Fixing	4.0	~2,400	600	1,800
Optimistic view					
Force A – heavy	MAS-Ofs[b]	7.0[b]	4,200	1,260	2,940
Force A – light	Fixing	4.4	1,760	440	1,320
Total			5,960	1,700	4,260
Force B	Fixing	4.0	~2,400	600	1,800

Note: MAS = main attack sector; Ofs = offense.

[a] Sector experience described in text: disruption requires effort in Days 1 to 10 parallel to pessimistic case.

[b] Sector experience if disruption achieved with effort similar to a continuous-front breakthrough. See "comparative" rates displayed in Figure 3-9. (The most optimistic planning view would show a rate of 3–5/1000/day – a view that projected the disruption being achieved by the kind of fluid operations seen in disrupted-front settings. See Table 2-13.)

TABLE 3-4

HYPOTHETICAL CASE BATTLE CASUALTY PROJECTIONS (Continued)
(Divisional force)

Pessimistic case (30 days)	Casualty data				
	Sector experience	TBC rate (TBC/1000/day)	Casualties		
			TBC	KCMIA	WIA
Force A – heavy					
Days 1–10	MAS-Ofs	15.2	9,120	2,371	6,749
Days 11–20	SAS-Ofs	8.4	4,536	1,361	3,175
Days 21–30	MAS-Ofs	10.9	5,886	1,530	4,356
Subtotal			19,542	5,262	14,280
Force A – light					
Days 1–10	Fixing	4.4	1,760	440	1,320
Days 11–20	SAS-Ofs	8.7	3,306	992	2,314
Days 21–30	SAS-Ofs	8.7	3,132	940	2,192
Subtotal			8,198	2,372	5,826
Force A total			27,740	7,634	20,106
Force B					
Days 1–10	Fixing	4.0	~3,000	750	2,250
Days 11–20	Fixing	4.0	~2,850	712	2,138
Days 21–30	Fixing	4.0	~2,700	675	2,025
Force B total			~8,550	2,137	6,413

Note: SAS = secondary attack sector; Ofs = offense.

CHAPTER 4

COMMENT ON REQUIRED PLANNING INFORMATION AND TOOLS

GENERAL

Planning involving casualty rates requires (1) information about the prospective operational context and (2) planning tools capable of representing rates set in terms of that information. Sufficient information must be available to planners to make sense of the reasonableness of projections, whether in their construction or their evaluation. Rate projections must, of course, be made in terms of this information. Planning tools amenable to manipulation in terms of that information must be available to planners.

REQUIRED PLANNING INFORMATION

We present two versions of the information needed to construct reasonable casualty rate projections or to assess the reasonableness of casualty rate projections. The first provides a fuller view, intended for operations planners for purposes both of constructing rate profiles in support of actual planning and of evaluating those plans in terms of their possible casualty rate consequences.

The second provides a more constrained view intended for planners outside the operations community. These planners cannot function effectively without at least the minimum essential elements of information needed to assess the reasonableness of projections.

Full Disclosure Information

Full evaluation of the reasonableness of casualty rate projections would require at least the following elements of information. Full disclosure of these elements would probably be limited to operations plan (OPLAN) annexes and similarly classified descriptions of the details of operational possibilities.

The elements are based on a full explication of the three operational parameters associated with a given situation. (We alter the presentation of the parameters slightly from the usual order of our discussion.)

Force Size / Echelon

The information in Table 4-1 should be provided. The number of personnel in the divisional force should be shown, along with their organizational structure in terms of numbers of divisions per echelon above division. The full echelon strength – the divisional force plus all support personnel per echelon – should also be stated.

TABLE 4-1

FORCE SIZE AND ECHELON DATA REQUIRED

Force measured	Force size (number of personnel)	Force structure (number of divisions per army and/or corps)
Divisional force Full echelon force		

This information should be provided for the full planning time line. The data should be provided to match the time increments used for the projected casualty-rate profile(s): both the pulse/pause profile and any longer block-time periods (such as 10-day periods) used for summary planning purposes (see Rate Profiles).

Planners should also be apprised of whether replacement personnel will be available to forces. The longer the time line is for potential combat, the more the replacements issue will be critical to rate projections. Certain possible future scenarios may envision only brief combat, but they may also, therefore, not envision or provide for replacements.[1]

[1]Replacements may either be in the form of individual replacements, returnees to duty, or even unit (e.g., whole battalions) replacements. The rate data in this report are keyed on the *assigned* strengths of units by day – units that have a stream of both individual replacements and returnees to duty maintaining divisional strength at generally 80 percent to 95 percent of authorized strength.

Scenario / Sector

The scenario should be defined first in terms of policy and military objectives. In cases of long-established alliances or scenarios, these may be generally well known and accepted. In many, perhaps most, future scenarios they probably need to be articulated.

The two levels of objectives should begin with a statement of the national policy objective(s). A statement of the planned operational objective(s) judged necessary to fulfill the policy objectives should follow. The operational objective(s), in particular, should be described as concretely as possible.[2]

The elements of the operational scenario should be specified. These elements should include a full characterization of the threat, the operational objectives, and the projected character of the conduct of operations for both enemy and friendly forces.

The operational scenario should be characterized as a continuous-front or disrupted-front setting, or both (as could be the case if the disruption is projected at some latter part of a time line). If disruption is projected, its timing should be specified.

Combat-sector types should be projected over the time line, with the forces expected to be resident in them. The sector information should be at least broadly characterized for any other forces placed laterally as well as for the planning force.

Time

Three levels of time line should be specified, as suggested in Table 4-2.

The controlling policy time is that time judged necessary to achieve the national objective(s) while remaining consistent with the spectrum of national interests. Policy time will almost certainly be expressed only broadly, in guidelines such as

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[2]For example, "corps defensive (with division-level counterattacks) against expected main enemy [force size] penetration effort" should be cited rather than more vague descriptions such as "resist any attempted enemy penetration." Further, policy objectives ("restore border") should not be confused with the operational objectives ("envelop and destroy . . .") judged necessary to achieve them.

TABLE 4-2

PLANNING TIME LINES

Level	Description
Policy	Time limit judged necessary for achievement of policy objectives
Operational	Time judged necessary for conduct of operations in OPLAN(s)
Preparatory	Time judged prudent for planning operations in area to ensure achievement of policy and military objectives even in worst cases

"short term" or "long term." Still, it would be useful to planners to define even these broad terms by ranges of time keyed to operational considerations.[3]

The operational time line is that time judged necessary to accomplish the military objectives required to achieve the national objective(s). It is probable that a reasonable time-line projection for a single coherent operation (or linked series of operations) will not exceed perhaps 30 to 60 days. Operations plans usually decay in periods far shorter than that, but the plans may plausibly contemplate one or more coherent series of actions over such extended periods.

The preparatory time line is that time judged prudent, for planning purposes, for which preparations ought to be made – given the scope of national interest and any uncertainty surrounding the ability to achieve the military objectives within the operational time projection. When the preparatory time line exceeds the operational projection, it should be composed of several groups or sets of assessed operational contingencies – which should represent likely general follow-on possibilities to the basic operational projections.

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[3]One possible approach would define policy time guidelines for conventional force scenarios as follows: 10 to 60 days, "short term"; 60 to 120 days, "medium term"; more than 120 days, "long term." The 60- and 120-day demarcations might be taken from (1) the maximum time that could be envisioned for a single coherent series of operations using current Active and Reserve personnel (60 days?) and (2) the earliest time when draftees might be made available to field forces in a major mobilization (120 days?). The definitions could be drawn, of course, quite differently.

Neither the operational nor the preparatory time line ought to exceed the policy time line.

Minimum Required Information

The following elements of information are considered to be the minimum necessary to evaluate the reasonableness of a projected casualty-rate profile.

Force Size / Echelon

The information minimally required exactly matches that under full disclosure.

Scenario / Sector

The full details of the operational scenario are not necessary to the minimal essential elements of information. The details of operations plans are obviously out of these bounds.

At the least, however, the elements of scenario/sector should include characterizations of the front type projected (continuous or disrupted) and the kinds and mix of sector types (e.g., main attack-defensive) projected to be experienced over the planning time line. In particular, these sector projections should match the time increments in the Rate Profiles (see below).

Time

The policy and preparatory time lines ought at least to be available.

Time frames judged by commanders to represent the outer limits for achieving operational objectives might, though not necessarily, be excluded. Of course, the projected actual operational time line should fit within the policy and preparatory time lines and should be precisely reflected – though not thereby openly acknowledged – along that portion of the preparatory line with which it overlaps.

Rate Profiles

Regardless of which set of parameter information is made available (full disclosure or minimum essential), two kinds of rate profile should be prepared: one showing anticipated pulses and pauses over the planning time line, and one reducing

the first to a simplified version in uniform time blocks (e.g., the 10-day time blocks normally employed) more useful for some planning systems.

Both of these profile types are illustrated in our hypothetical example in Chapter 3. Figure 4-1 compares the two profile types, using one of the example's sets of results.[4]

PLANNING TOOLS

Planners who construct casualty rate projections or assess them should strive to achieve a series of them in order to appreciate the range of rate profiles that may reasonably characterize a situation. The planning tools depicting requirements based on the rate profiles should be structured to translate the possible variety of profiles (with their changing parameter data) easily and reliably into requirements.

At least five attributes of planning tools making use of casualty rate profiles would be necessary to provide the balance of capabilities needed. We list those attributes and then compare certain current tools in terms of the attributes.[5]

Required Attributes

Table 4-3 outlines the five attributes that would be necessary in a planning tool that usefully employs casualty rate profiles to produce requirements data for broader planning processes.

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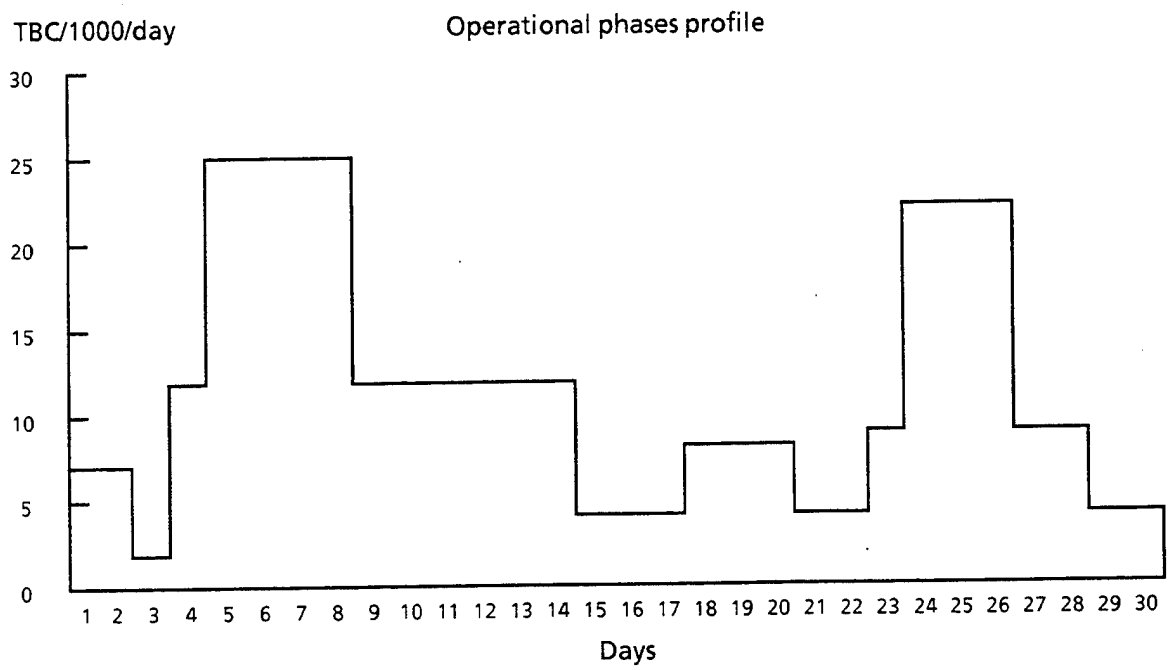
[4]Of course, the first type could also be composed of daily rates, substantially improving the ability to check the underlying quantitative patterns of rates in the rate projection.

[5]We discuss later the two models used as primary interfaces between casualty rates and populations-at-risk to translate rates into casualty numbers and medical requirements. For personnel requirements, one of these models (the Medical Planning Module) is also used and the numbers generated then transferred to the Wartime Manpower Planning System (WARMAPS) along with breakdowns (provided by other models) of the casualty numbers by personnel categories.

We do not address the WARMAPS process, since it is a wholly derivative use or application of rates and the numbers produced otherwise. However, a difficulty that may warrant further attention is whether – just as it is now clear that both rate averages and rate distributions change with changes in the three operational parameters – distributions of casualties across the several personnel categories may also change. One example would be a case where support personnel within a continuous-front main attack sector take considerably heavier casualties than those in other lateral sectors during a given period. Another example would be a case where a major group of support personnel behind one portion of frontage is encircled along with divisional personnel in a disrupted-front scenario.

Planning for personnel requirements may not be satisfied merely by finding ranges of reasonable casualty rates. Establishing such ranges, and the rate distributions within them, may be only the first – although a major – step forward in preparing a robust personnel planning scheme.



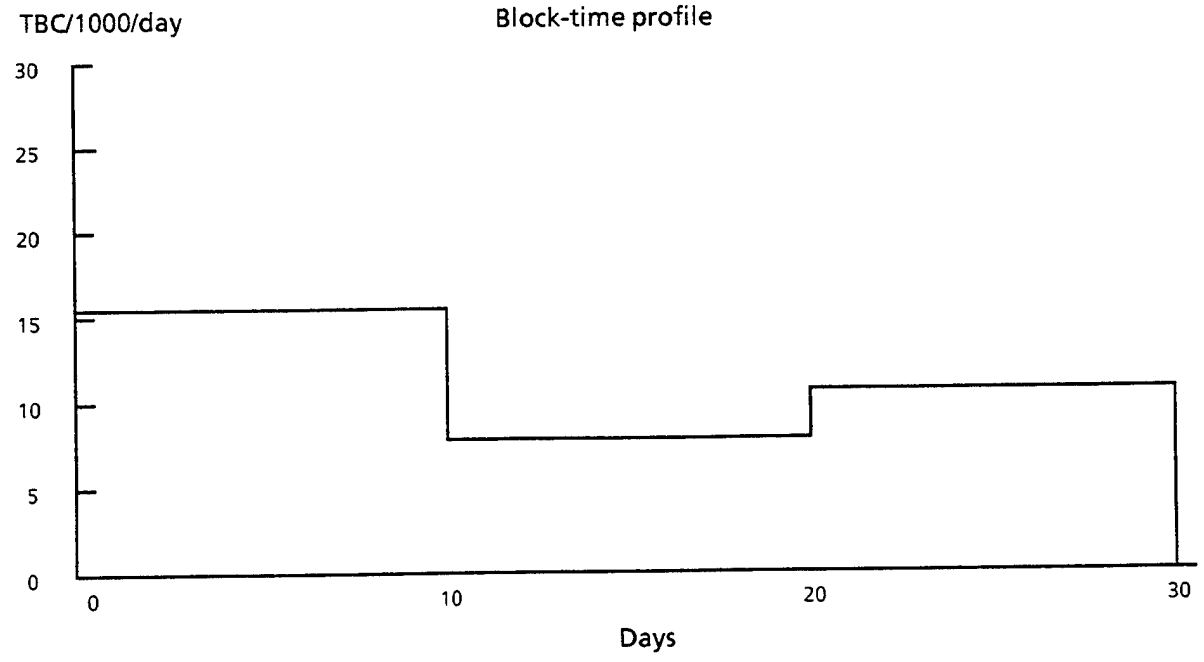


FIG. 4-1. TWO RATE PROFILE TYPES
Force A – Heavy: Pessimistic case

TABLE 4-3

RECOMMENDED PLANNING TOOL ATTRIBUTES

Attribute	Description
Variable force size	Ability to vary force size by any time increment or period over full course of time line
Variable time increments	Ability to assign rates for any time increments chosen (both for single days and for varied longer periods along the same time line)
Multiple lateral sectors	Availability of multiple lateral sectors for which force size and rates may be assigned
Relationship of rate to supportability	Output of model informing planner of supportability of rate profile projected across the projected force
Ease of access and use	Whether planner may easily access planning tool in order to assess multiple possible contingencies, including varying three parameters' data

Three of the attributes trace directly to the three operational parameters needed to make sense of rates in the first instance. The planning tool must be able to accommodate changes in either one or all of these parameters that might include designations as brief as 1 day or for whatever longer term period might be judged appropriate. The variability in the planning tool thus addresses (1) force size/ echelon (or "population-at-risk" or "PAR"), (2) the time a rate in the profile holds (for a given PAR), and (3) the sector type (which hosts the PAR and rate).

The other attributes relate to the planning tool's ability to produce relevant requirements data for the planner quickly. First, the device should state what medical structure is necessary to support a rate profile. Second, the tool should be easy to use either once or many times (the latter to afford several perspectives on possible rate experience). The last requirement probably means that the tool is available on a personal computer.

Current Assignment Tools

Most current planning tools use the rate assignment methodology.[6] We will address only two of these, the Medical Planning Module (MPM) and the Patient Flow Model (PFM).

Table 4-4 suggests the relative strengths and constraints in these two tools with regard to the attributes named above. The MPM is now undergoing a major revision; thus, we contrast the current version to the upcoming Version 2.0.

TABLE 4-4

CURRENT PLANNING TOOLS' ATTRIBUTES

Attribute	Medical Planning Module		Patient Flow Model
	Current	Version 2.0[a]	
Variable force size	Yes	Yes	Yes
Variable time increments	Yes – limited to 18 increments	Yes	No – time increments may be adjusted (no less than 2 days) but once set are all identical throughout full time line
Multiple lateral sectors	No	Yes	Yes – limited to 8
Relationship of rate to supportability	Partial – numbers of certain staff required provided, but not resultant force structure	Yes	Yes
Ease of access and use	Limited	Yes	Yes

[a] MPM 2.0 with functional features as designed by the Joint Operations and Execution System (JOPES) Medical Working Group.

[6]This method includes the Medical Planning Module (MPM) and Patient Flow Model (PFM) briefly covered in the text. It also includes the U.S. Marine Corps methodology, one or possibly two models in use at U.S. Army, Europe (USAREUR), and a training model in use at the Soldier Support Center. Such tools proliferate quickly.

MPM (Current) and PFM

Both systems are currently capable of altering force sizes over time. Each, however, requires that the planner manually designate the divisional force.

The MPM (Current) is capable of a limited number (18) of rate assignments in variable time increments, including daily rate assignments. It is probable that its limit of time increments would be taxed by a planner portraying the rate pulses and pauses for operations over a planning time line of even 30 days. The PFM is not now capable of variable time increments (or of 1-day increments at all). Its user must select a time increment (at least 2 days), which is then applied uniformly throughout the full time line. This block-time increment approach makes it quite difficult for the planner to focus on using rate data appropriate to the various phases or types of operations possible.

The MPM (Current) cannot represent forces simultaneously in different lateral sectors of an operations zone. The PFM is capable currently of distinguishing up to eight lateral sectors simultaneously.

The fourth attribute touches on a lingering controversy between advocates of the MPM (Current) and the PFM.[7] The MPM (Current) provides a planner with the numbers of beds, and staff in several categories, needed to support a projected rate profile. No translation of these numbers into medical force structure is made. The PFM provides the planner with the medical force structure necessary to support the rate profile. Both permit varying the evacuation policy, although the PFM will also suggest a policy for a set of inputs.

The MPM (Current) is generally accessible to planners only through the Worldwide Military Command and Control System (WWMCCS) network and requires a top secret clearance. The PFM is available on a personal computer and unclassified.

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[7]Given the same inputs of populations at risk and casualty rates, the MPM (Current) and the PFM apparently produce nearly identical casualty numbers. They differ significantly on overall force structure requirements. This latter difference owes to different approaches to assessing workload and staffing requirements. We do not here address which approach might be the better or more accurate.

MPM Version 2.0

The MPM is under major revision to accommodate planning needs better. The new MPM promises to meet all five of the general attributes recommended for a planning tool.

Force size (and compositions) will be variable across the full planning period. They are assignable (hence, variable) by sector.

The planner may choose time increments of 1 day or longer to suit rate pulse-pause projections. The number of time increments is limited only by the overall planning time line – a 90-day period could see as many as 90 increments. The time increments are assignable for each sector.

The planner may identify up to six lateral sectors per operations zone, with 5 zones, and therefore up to 30 lateral sector designations.

The new Version 2.0 provides the planner the means to construct a medical force that supports the projected rate profile. The new model thus bridges what has been a major gap between the MPM (Current) and the PFM.

Finally, the revision plan includes construction of a "PC Analog" that will make the MPM 2.0 easily accessible and usable for planners desiring to characterize multiple scenario possibilities.

Current Calculation Tools

Projection methodologies that attempt to calculate rates – most relying on mathematical simulations – face inherently more severe obstacles to improvement than do assignment approaches. These calculation methodologies have yet to overcome fundamental difficulties in attempting to represent combat's dynamics mathematically.

Central to these difficulties – beyond the apparently still-elusive identification of the mathematics appropriate to representing combat phenomena – is the empirical evidence that rates at the operational and tactical levels of war, while certainly sharing some general pattern characteristics, show different forms in certain critical respects. Neither of the two standard modeling approaches – from

"the bottom up"[8] or "the top down"[9] – has yet taken adequate account of such different patterns. Each appears to produce rates and rate characteristics geared more to its original focus – either to a tactical perspective or a higher level one – and in the process tends to misrepresent rate patterns characteristic to either level of war. Thus, rate projections are common that show average (mean) rates across operational-level forces and times for a rate pulse that are significantly higher than those probable, while at the same time not showing rates within that overall setting that are nearly as high as is likely for particular tactical sectors and times – even if the overall operational-level mean were significantly lower.

CONCLUSIONS

Parameter information provided to planners who either construct or evaluate casualty rate profiles is, currently, usually inadequate for purposes of assessing the reasonableness of rate projections. The two major planning tools now in use to translate rates into casualty numbers and requirements – the MPM (Current) and the PFM – need amendment in order to correspond to the structures of parameter information necessary to assess projected rates' reasonableness.

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[8]See our discussion of one of the premier examples of this approach, the U.S. Army's Concepts Evaluation Model (CEM), in our last report (May 1990, chapters 4 and 6).

[9]Those that attempt a "top-down" perspective have been forced, if they refer to empirical rates at all, either to use (often through judgmental aggregations of) rates taken directly from tactical-level databases – which are the most common – or to use rates for large forces and longer time periods. The latter rates are usually composed of single values (averages over the full forces and times). In both cases, the rates fail to make clear the true composition of the operational-level experience with its mixes of numerous, sharp rates for the "hot" spots along with lesser rates for other sectors and times.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

GENERAL

Our study of casualty rates has previously found that most contemporary rate projections, given the operational scenarios they assume, tend to be overstated for the anticipated periods of greatest combat intensity. At the same time, the projections do not make clear to planners that – even at lower overall rates – significant portions of the planning force, in critical sectors, could experience extraordinary rates.

Planners need reference to rates associated with probable forms or patterns of operations – forms or patterns that themselves are plausible for broadly defined operational scenarios. Rate projections resulting from the use of such information, which in turn are used in planning tools to project requirements, ought to be explainable in straightforward descriptions of planning scenarios and their chief operational parameters. Significant casualty rate changes due to alterations in those settings' parameters ought to be similarly describable in straightforward operational terms.

Rate data used by planners should indicate the kinds of magnitudes that might reasonably be expected both in pulse periods and in pauses during operations of various types. The data should provide the planner flexibility in characterizing contingencies; thus, they should indicate the ranges of these magnitudes that are plausible rather than merely point values. The data should suggest the kinds of rate distributions embedded in the rate magnitudes bounded in the ranges. The sets of rates and distributions should reflect the kinds of changes in basic operational parameters so fundamental to the dynamics of operations.

Planners also need planning tools structured to accommodate and make effective use of such rate data. These tools should be capable of reflecting the basic parameters for various patterns of operations and the rates characteristic of those patterns. The tools must be able to accommodate easily to any changes in the basic operational parameters – so the planner may relatively easily represent whatever

alternative operational contingencies are judged reasonably possible in a given circumstance.

CONCLUSIONS

Rate data currently in use – both in assignments methodologies and as produced by calculation methodologies – do not appropriately embody the various patterns of modern operations, especially at the operational level of war, or the patterns of rates characteristic of those operational patterns.

Achievement of more reliable casualty rate projections through improved calculation methodologies based on mathematical modeling is a long-term task. The best and most reliable source of improved rates is the empirical record of the patterns of rate behavior across the spectrum of modern operations. This report provides rate data for the fundamental patterns of modern conventional operations and the rate patterns characteristic of them.

Planning tools currently in use – to translate projected rates into requirements data – cannot now easily and usefully accommodate more realistic rate data. However, assignments methodologies' planning tools are capable in the near term, with relatively minor adjustments, of making use of better rate data.

In particular, U.S. planners may most readily adapt either the MPM or the PFM to use data, such as those in this report, that better reflect the basic patterns of operations and their rates. Such revision is now under way for the MPM.

RECOMMENDATIONS

Actions to improve casualty rate planning for conventional ground forces may be taken in both the near and longer terms.

Near Term

1. Casualty rate projections should be explicitly tied to characterizations of the three operational parameters: force size/echelons, time, and scenario/ sectors.

   Within the operations community (for example, for annexes supporting operations plans), planners should provide the full disclosure information described in Chapter 4 for the three parameters. Information made

available to planners in communities other than the operations community should meet the specifications for the minimum required information.

In concert with an explicitly grounded operational approach underlying projections, planning efforts need the direct participation of the operations community. The planners who prepare rate projections should therefore be either those responsible for operations plans or else personnel/medical planners (as currently) who have access to direct and close coordination with those responsible for the plans. Commanders should be urged to insist on far closer coordination of rate projections with careful articulations of plausible operational possibilities than has usually been the case. Rate projections not tied carefully to realistic operational possibilities are almost inevitably misleading.

2. The characterizations in this report of patterns of operations and of the rates appropriate to them should be considered for incorporation into current planning approaches and procedures. The data define reasonable rate limits for modern operations and provide different data sets to reflect various changes in the basic parameters of those operations. They permit the planner to represent alternative operational settings quickly in terms that are readily understandable militarily.

   The data are structured to be usable immediately with existing (assignment) planning tools, given relatively minor adaptations in those tools (see 4, below).

   As a check (and an elaboration of the underlying casualty database), battle casualty data from any major conventional ground campaign should be collected in a form consistent with that of the data collected for this overall study, and they should be subjected to an identical series of tests and analyses. The data should permit portrayal of the force's total battle casualties (killed, wounded, captured/missing) and assigned (on-hand) strength, arranged according to the three critical operational parameters: by force size and echelons (by unit/organization, for both the divisional force and the full echelon force), by time (daily, for all units and organizations), and by scenario/sectors (as they evolve over the campaign's projected and actual time lines).

3. Planners in the operations, personnel, medical, and other portions of the planning community should be urged to use these rate data to evaluate the reasonableness of rate projections made by whatever means – whether by assignment or calculation methods.

   All projections should, at the least, be evaluated in terms of suggested rate ranges and distributions (including lateral sectors' relative rates) for pulse periods in the broad operational settings represented. Projections that provide daily data should also be tested in more detail.

In particular, the character and credibility (i.e., the validity) of the underlying quantitative patterns of rates in both current and future simulations' output should be tested in comparisons with the character of the empirical data. These comparisons should be structured to test for several rate patterns, including: the shapes of the simulations' pulses and pauses drawn in daily and moving-average curves;[1] rate variability for pulses (measured in 10-day periods), quantified at the several echelons (army, corps, and division) in terms of mean-variability relationships; durations of rates by rate classes; the sequence of daily counts of rates falling into rate classes; and the sequence of daily rate distributions from high to low (with special attention to whether rates are appropriately heavily skewed).[2]

4. The current project to revise the MPM into Version 2.0 (with functional features as designed by the JOPES Medical Working Group and with PC Analog) should be supported to completion. The PFM should be adapted to provide variable time increments for each lateral sector. Both the new MPM 2.0 and the PFM should be altered to distinguish for the planner the divisional force and the full echelon force in the combat zone (as well as distinguishing combat zone and communications zone personnel, as is currently done).

   The objective should be to ensure that these two planning tools permit the planner to characterize operational settings easily and rapidly, in order to be able easily to project a reasonable range of operational possibilities.

Longer Term

1. Efforts should be continued to find mathematical representations of combat that permit reliable simulation of the patterns of rates and operations found in modern, combined arms operations at both the operational and the tactical levels of war. These efforts should focus in at least two distinct areas: further research into the empirical evidence of rates, and research in the mathematics needed to simulate rate phenomena.

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[1] A related test, of "lag" rates relative to 1-day rates during pulses (for various echelon perspectives within the divisional force), is described and demonstrated in our second report (May 1990 especially pp. 4-18 to 4-27).

[2] Tests for rate variability, rate duration, daily rate class counts, and daily rate distribution (skewness) are described and demonstrated in our previous reports [see especially Chapter 7 (September 1989) and Chapters 4 and 6 (May 1990)].

Data assembled during this project might be further examined to uncover deeper quantitative relationships among rates that may tie together the patterns described in this series of reports.[3] This effort would probably best focus on rate characteristics of divisions in corps and armies.[4] Simultaneously, research in mathematics is necessary to establish mathematical concepts and procedures more capable than those in standard use today of representing the operational character of empirical rate patterns.

Until fundamentally better approaches to simulating combat are found, an interim measure may be possible that joins use of contemporary simulation techniques and use of data sets representing empirical rate patterns. That interim measure would involve amending mathematical simulations producing casualty rates to incorporate the empirical rates and distributions represented in this report (or a fuller, more articulated set of representations). Research would be needed to indicate whether and how – by keying the model's internal structure to definitions of the three operational parameters – the rate data could be incorporated internally in a way that calibrates model output for personnel casualties to fall into empirically supportable ranges and distributions.

2. The U.S. Army's Field Manual 101-10-1/2 is a widely used planning guide. Its chapters addressing personnel casualty rates (Chapters 4 and 5) should be amended to incorporate this study's treatment of patterns of modern conventional operations and their rates and distributions.[5]

3. Planning responsibilities in some fashion (either directly or indirectly relying on projections of personnel casualty rates) will fall to many officers at least by their field-grade years. A basic appreciation of the empirically demonstrated relationships between casualty rates, the three key operational parameters, and patterns of operations is highly advisable so they may better evaluate the credibility of various planning projections.

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[3]The research may or may not be assisted by attempting to combine these data with other sets of rate data – or other data altogether, such as those for movement rates – assembled under other auspices. We found early in this task that the conceptual or analytic underpinnings of many of the available sets of *casualty rate* data made the different sets effectively incommensurable.

[4]Study of rate characteristics at echelons-below-division – especially, study of the ranges and distributions of those rates in relation to a division's rate – would require further data collection and analysis (but see Appendix A). The same holds true for surprise operations aimed at the near-immediate collapse of a hostile force or even regime – i.e., operations that suddenly and nearly simultaneously "pounce" on the critical objectives throughout the enemy's depth, with no subsequent objectives required to secure the enemy's collapse. (A special case of such operations is the rapier-like *coup de main* operation.) However, effective operations of this sort will exhibit quite low attacker casualty rates.

[5]The manual's current rate content reflects either outdated operational settings and rate patterns or 1-day rates for several particular tactical settings that may be applied only with great difficulty and uncertainty – and almost inevitably inappropriately – to a robust and coherent representation of operations involving multiple units over varying time lines.

Consideration should therefore be given to incorporating study of the relationships of rate patterns and patterns of modern operations into curricula at appropriate military schools where the character of operations is a central focus. Candidate schools should include the U.S. Army's Command and General Staff College (and its associated School for Advanced Military Studies), the U.S. Marine Corps' Command and Staff College, and the Uniformed Services University of the Health Sciences (USUHS). Consideration should also be given to establishing instruction geared specifically to those assigned to planning billets involving casualty rate projections. An appropriate site for the latter course work may be the USUHS.

APPENDIX A

COMMENT ON ECHELONS-BELOW-DIVISION RATES

Battle casualty rates for echelons below division exhibit the same general behavior in pulses and pauses seen in higher level organizations. As is to be expected, however, pulses tend to be much sharper (i.e., notably higher and briefer) than those for the larger organizations.

Most planning scenarios have traditionally envisioned a planning force larger than a single brigade or battalion.[1] The challenge for rate projections seeking to characterize rates at lower levels would be to relate these lower echelon rate possibilities to those that may be expected at some higher echelon – probably a division rate.

It should come as no surprise that a single number – e.g., a single ratio of battalion (or other) rate to division rate – would quite inadequately describe these lower echelon rates. These rates are considerably more wide ranging and variable than rates for larger organizations.

Figure A-1 suggests the ranges of battalion rates known to have been associated with three ranges of division rates. The figure is meant only for illustrative purposes. An authoritative characterization of the behavior of rates at this force level would require far more data collection and analysis of force experience at this level than has been possible in this study.[2]

The figure may, however, help planners visualize the ranges of battalion rates – and the proportion of the division's battalions experiencing such rates – that are possible should a division rate fall into certain ranges. The figure may help planners trace to battalion level the rate pattern behaviors the report characterizes by means of rate ranges and distributions for the divisional force.

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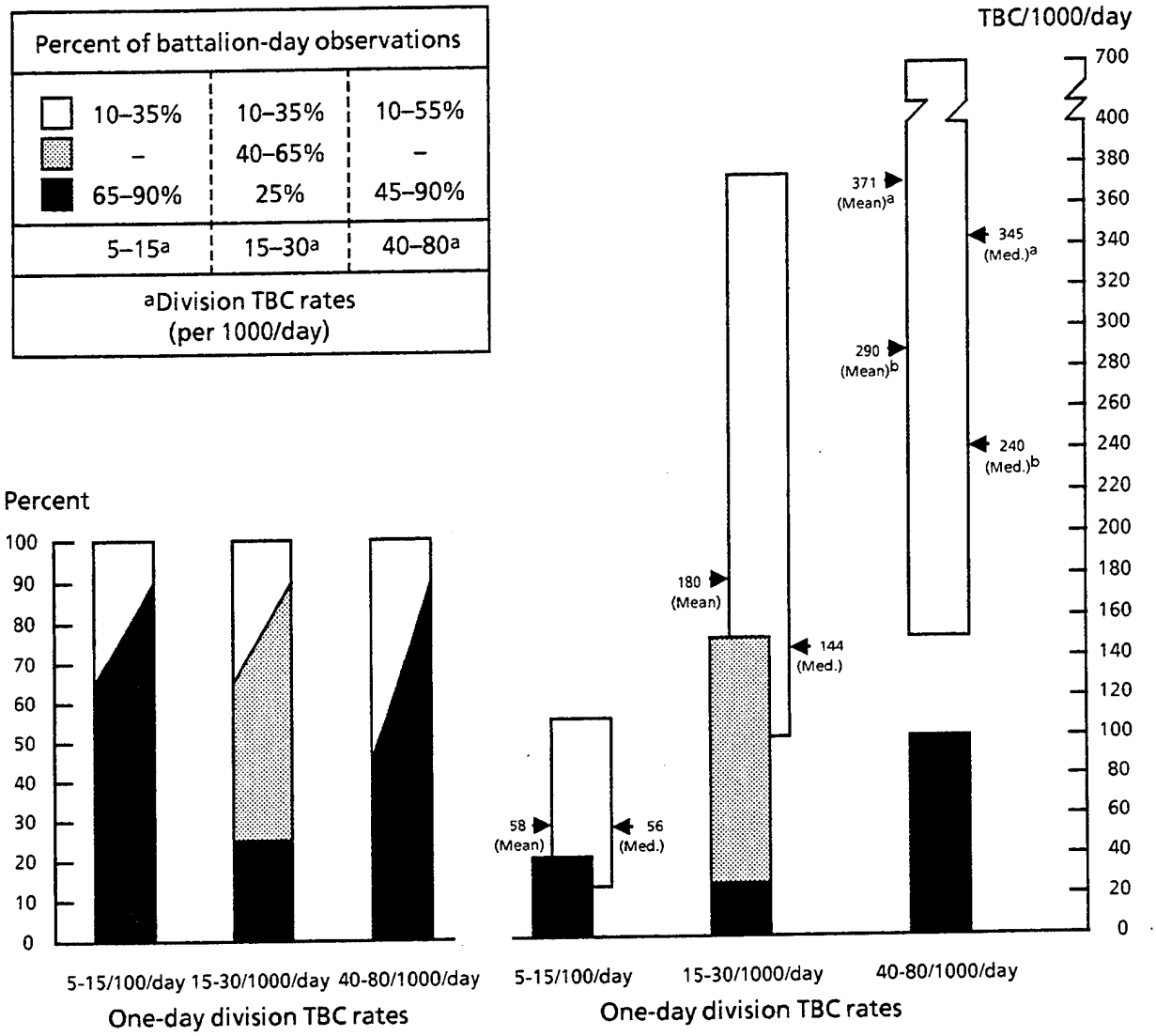
[1]There have long been some planning scenarios (e.g., for the U.S. Marine Corps) that do contemplate employment of a force smaller than a division.

[2]The data used to construct the figure were actual 1-day rates seen in battles that lasted from 1 to 6 days and involved from 1 to 4 divisions. Both the division's and its battalions' rates are known for each day



[a] Battalion data for 1-day division rates at or near 80/1000/day.
[b] Battalion data for multiple (6–8) cases of 1-day division rates across range of 40 to 80/1000/day.

FIG. A-1. ILLUSTRATIVE BATTALION:DIVISION TBC RATE DISTRIBUTIONS (Proportions of battalion-day observations and associated rate ranges linked to division rates)

APPENDIX B

DIVISION PULSE MEAN-VARIABILITY RELATIONSHIPS

Planners who know the daily rates for divisions in a projected rate profile may compare the variability of the projected rates during a pulse period to the variability of rates seen empirically for 106 division pulse experiences.

Figure B-1 graphs the relationship of a division's mean rate for a 10-day period during which a pulse occurs to the variability of the 10 individual daily rates during the period. The measure of variability is the standard deviation of the 10 daily points about the mean.

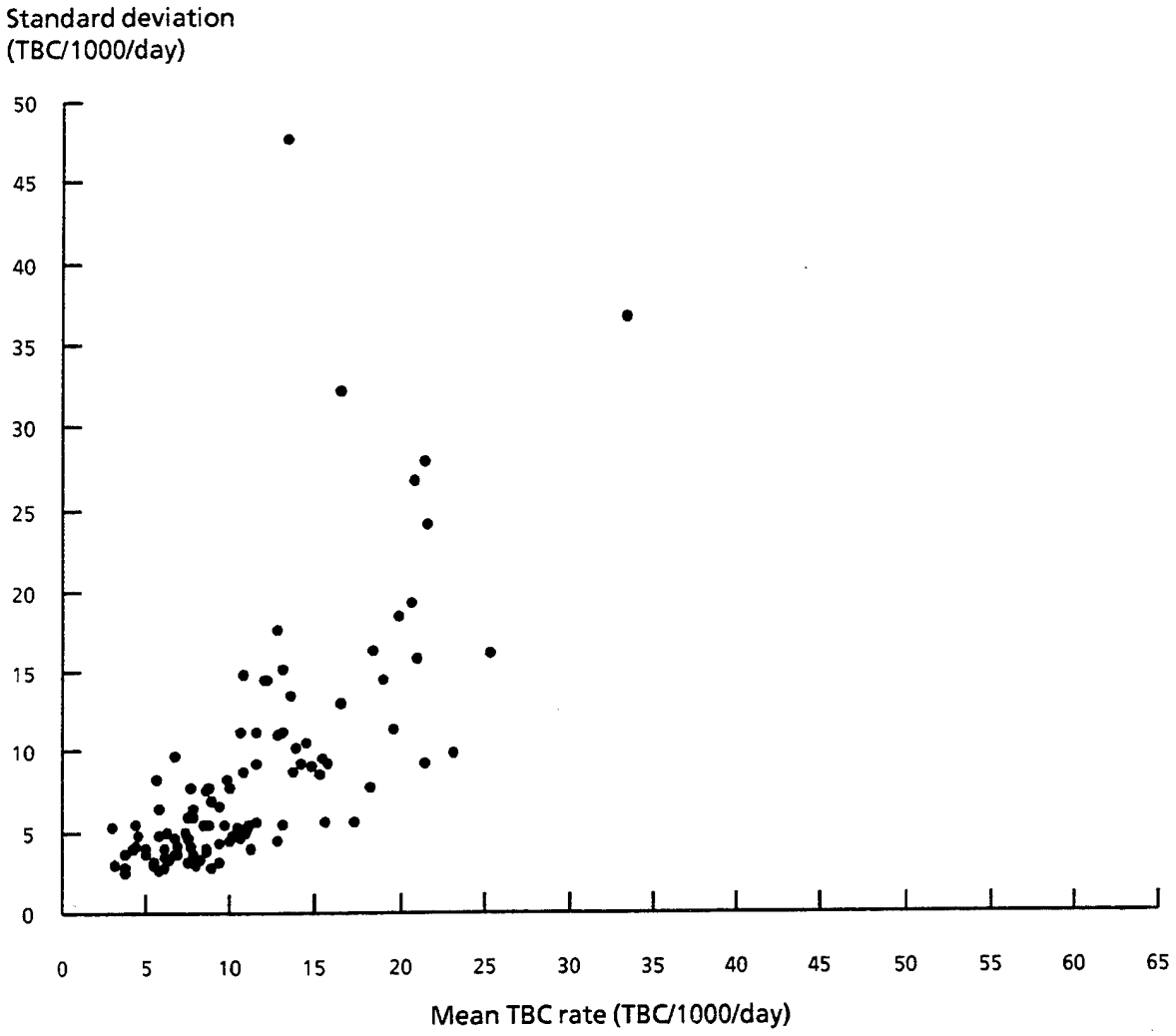


FIG. B-1. MEAN AND STANDARD DEVIATION FOR 106 10-DAY DIVISION PULSES (Empirical)