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by

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CONTENTS

Appendix A

ARMY ORDNANCE REPORTS OF AMMUNITION EXPENDITURES

INTRODUCTION

The tables contained in this appendix are obtained from army ordnance reports of ammunition expenditures. These reports show the total number of shells issued to field artillery battalions at the ammunition supply points; as these records do not contain firing data, they cannot be used to obtain ammunition expenditures in a short period.* The accuracy of these reports in predicting the expenditure rate increases as the time period is lengthened. The total expenditures in a period of 6 or 7 weeks are approximately correct. Errors of 1 and 2 percent were obtained in a 4-month period of the Italian campaign of the Fifth Army; these errors would increase to 10 and 20 percent for 2-week periods.

DISCUSSION

All tables for the First and Third Armies have been divided into three phases of action. The first of these phases is the exploitation of the Saint-Lô breakthrough, 6 Aug–12 Sep 44. This action covers the capture of Paris, the battle of northern France, and the advance to the Siegfried Line. The period 13 Sep–15 Dec 44 is the battle of Germany from the Aachen offensive at the Siegfried Line to the Roer River. The third phase, 16 Dec 44–22 Feb 45, is the German counteroffensive and the second drive to the Roer River. The first period that is given for the Fifth Army corresponds to the static phase that existed before and after the summer campaign of 1944. The period 12 May–8 June is approximately the phase of the initial attack against the German army; the choice of this period was dictated by the ordnance officer's biweekly reports. The third period, 9 June–19 July, corresponds to the movement phase, from Rome to Florence.

Tables A1 to A3 give the average number of weapons assigned to the three armies; these figures were obtained from records of the army artillery officer.[1,2] Tables A4 to A7 give the total ammunition expenditures of the weapons in each army.[3–6] The data for ammunition tonnage are based on packing weights of complete rounds. The original ordnance records of the First and Third Armies were unavailable; this resulted in missing data for the expenditures of 75-mm How ammunition. Table A8 gives the expenditure rates (rounds per gun per day) for the First Army. Table A8 is based on the number of weapons in action each day, not on the number of weapons assigned to the army. Fifth Army ordnance records computed the

*Errors are due to loss from enemy action, returns, and abandonment.

statistics of rounds per gun per day on the basis of the number of weapons assigned to the army. Fifth Army figures have not been included in this appendix (they are available in Ref 2); new statistics have been computed on the basis of the original firing records and are in App B.

The average artillery support of the Eighth Army in Korea, 1 Aug–20 Dec 51, is given in Table A9. The total ammunition expenditures for this period are given in Table A10. This period is the first 4 months of the Korean stalemate that lasted from 30 Jul 51 to 27 Jul 53. Army ordnance reports do not contain ammunition expenditures for periods prior to this.

Table A1

AVERAGE ARTILLERY SUPPORT IN FIRST ARMY[1]
(Number of pieces)

Artillery category and weapon	6 Aug–12 Sep 44	12 Sep–15 Dec 44	16 Dec 44–22 Feb 45
Light			
75-mm How	141	132	192
105-mm How	582	767	775
Medium			
4.5 in. gun	30	48	39
155-mm How	198	261	267
Heavy			
155-mm gun	96	120	37
8-in. How	41	45	33
Very heavy			
8-in. gun	4.5	12	18
240-mm How	12	24	24
Total	1104	1409	1435

Table A2

AVERAGE ARTILLERY SUPPORT IN FIFTH ARMY[2]
(Number of pieces)

Artillery category and weapon	May 1944	June 1944	July and August 1944
Light			
75-mm How	181	187	110
105-mm How	636	639	441
Medium			
4.5-in. gun	24	24	24
155-mm How	225	225	142
Heavy			
155-mm gun	96	96	60
8-in. How	48	46	45
Very heavy			
8-in. gun	2	4	4
240-mm How	12	12	12
Total	1224	1263	823

Table A3

ARTILLERY SUPPORT IN NINTH ARMY, MARCH 1945
(Number of pieces)

Artillery category and weapon	XIX Corps	Ninth Army total
Light		
25-lb shell	36	36
75-mm How	12	108
105-mm How	432	630
Medium		
4.5-in. gun	36	43
155-mm How	96	224
Heavy		
155-mm gun	48	108
8-in. How	60	96
Very heavy		
8-in. gun	6	6
240-mm How	18	18
Total	744	1274

Table A4

FIRST ARMY AMMUNITION EXPENDITURES, WEIGHT AND ROUNDS[3]

Artillery category and weapon	6 Aug–12 Sep 44		13 Sep–15 Dec 44		16 Dec 44–22 Feb 45	
	Wt, tons	Rounds	Wt, tons	Rounds	Wt, tons	Rounds
Light						
105-mm How	10,448	360,280	51,036	1,759,849	39,832	1,373,524
Medium						
4.5-in. gun	722	16,964	4,180	98,121	2,363	55,472
155-mm How	5,501	89,593	25,671	418,097	29,385	478,588
Heavy						
155-mm gun	3,453	46,416	12,374	166,320	10,589	142,324
8-in. How	963	8,159	5,317	45,061	4,439	37,619
Very heavy						
8-in. gun	131	831	644	3,547	1,065	5,666
240-mm How	582	2,583	1,810	8,026	1,86-	8,356
Total	21,820	524,826	101,032	2,499,021	89,557	2,101,749

Table A5

THIRD ARMY AMMUNITION EXPENDITURES, WEIGHT AND ROUNDS[4]

Artillery category and weapon	6 Aug–10 Sep 44		11 Sep–16 Dec 44		17 Dec 44–18 Feb 45	
	Wt, tons	Rounds	Wt, tons	Rounds	Wt, tons	Rounds
Light						
105-mm How	8,120	279,993	36,429	1,256,165	42,889	1,478,929
Medium						
4.5-in. gun	281	6,605	2,982	70,009	2,308	54,182
155-mm How	4,379	71,324	17,659	287,604	25,891	421,681
Heavy						
155-mm gun	2,150	28,894	7,062	94,813	13,363	179,612
8-in. How	1,113	9,430	5,835	49,452	4,183	35,445
Very heavy						
8-in. gun	314	1,728	356	1,964	935	5,154
240-mm How	445	1,972	2,348	10,414	1 112	4,930
Total	16,802	399,946	72,671	1,770,421	90 68	2,179,934

Table A6

FIFTH ARMY AMMUNITION EXPENDITURES, WEIGHT AND ROUNDS[5]

Artillery category and weapon	13 Apr–11 May 44 and 20 Jul–31 Aug 44		12 May–8 Jun 44		9 Jun–19 Jul 44	
	Wt, tons	Rounds	Wt, tons	Rounds	Wt, tons	Rounds
Light						
75-mm How	1,627	129,146	2,401	190,565	1,478	117,283
105-mm How	26,847	925,769	41,664	1,436,694	32,972	1,136,955
Medium						
4.5-in. gun	1,613	37,855	1,781	41,804	780	18,299
155-mm How	12,986	211,502	21,264	346,319	11,765	191,609
Heavy						
155-mm gun	6,282	84,436	7,060	94,893	4,746	63,791
8-in. How	3,511	29,750	5,320	45,081	1,690	14,324
Very heavy						
8-in. gun	256	1,409	405	2,233	60	330
240-mm How	1,394	6,184	1,005	4,457	1,736	7,699
Total	54,516	1,426,051	80,900	2,162,046	55,227	1,550,290

Table A7

TOTAL ARMY AMMUNITION EXPENDITURES, WEIGHT AND ROUNDS

Artillery category and weapon	First Army		Third Army		Fifth Army	
	6 Aug 44–22 Feb 45		6 Aug 44–18 Feb 45		13 Apr–31 Aug 44	
	Wt, tons	Rounds	Wt, tons	Rounds	Wt, tons	Rounds
Light						
75-mm How	–	–	–	–	5,506	436,994
105-mm How	101,316	3,493,651	87,438	3,015,087	101,483	3,499,418
Medium						
4.5-in. gun	7,266	170,557	5,572	130,796	4,173	97,958
155-mm How	80,557	986,278	47,929	780,609	46,015	749,430
Heavy						
155-mm gun	26,416	355,060	22,567	303,319	18,088	243,120
8-in. How	10,719	90,839	11,131	94,328	10,521	89,155
Very heavy						
8-in. gun	1,859	10,244	1,606	8,846	721	3,972
240-mm How	4,277	18,965	3,905	17,316	4,136	18,340
TOTAL	292,410	5,125,594	180,148	4,350,301	190,643	5,138,387

Table A8

FIRST ARMY AMMUNITION EXPENDITURES, ROUNDS PER GUN PER DAY[3]

and weapon	1–30 Jun 44	6 Aug–12 Sep 44	13 Sep–15 Dec 44	16–30 Dec 44	16 Dec 44–22 Feb 45	Average for period 6 Aug 44–22 Feb 45
Light						
105-mm How	45.1	20.7	35.3	70.4	42.7	35.1
Medium						
4.5-in. gun	20.1	22.4	24.1	34.6	23.9	23.9
155-mm How	26.4	14.2	19.2	45.1	29.9	22.3
Heavy						
155-mm gun	15.5	15.3	15.3	32.0	25.3	18.2
8-in. How	11.0	12.1[a]	11.5	18.8	17.3	13.5
Very heavy						
8-in. gun	3.8	13.9[b]	3.7	8.3	7.8	5.8
240-mm How	5.6	8.5[b]	3.9	7.2	6.0	5.1

[a] Firing limited to period 6 Aug–2 Sep 44.
[b] Firing limited to period 6–19 Aug 44.

Table A9

AVERAGE ARTILLERY SUPPORT IN EIGHTH ARMY[6]
(1 Aug–20 Dec 51)

Artillery category and weapon	Pieces
Light	
75-mm How	82
4.2-in. mortar	649
4.5-in. rocket	10
105-mm How	702
Medium	
155-mm How	319
Heavy	
155-mm gun	27
8-in. How	27
Total	1816

Table A10

EIGHTH ARMY AMMUNITION EXPENDITURES[6]
(1 Aug–20 Dec 51)

Artillery category and weapon	Rounds	Wt, tons	Rounds/gun/day
Light			
75-mm How	70,104	883	6.0
4.2-in. mortar	1,136,479	3,911	12.3
4.5-in. rocket	12,45[illegible]	249	8.8
105-mm How	3,951,391	114,590	39.6
Medium			
155-mm How	1,193,367	73,273	28.3
Heavy			
155-mm gun	103,798	7,723	27.1
8-in. How	108,952	12,856	28.4
Total	6,576,548	225,485	—

Appendix B

TABULATED AMMUNITION EXPENDITURES BY WEAPONS, RANGES, MISSIONS, AND TARGETS

INTRODUCTION

This appendix contains the basic tabulation of the original firing records of field artillery units supporting the Fifth Army in Italy. About 90 percent of the records for corps artillery battalions and about 20 percent of the records of division artillery battalions were obtained for the period 1 May–31 Aug 44; this amounted to 34,425 missions, 1.562 million rounds, and 50,600 tons of ammunition.

In the beginning of May 1944 the Fifth Army was in a static position preparing for an attack against the German Army. Approximately half the Allied forces were on the Anzio Beachhead; the other half were on the Southern Front 30 miles to the west. On the Southern Front the static phase lasted until 11 May; at Anzio the static phase lasted until 23 May. The initial attack started on these dates; in the Southern Front the heavy resistance to the Allied attack lasted 6 days. In Anzio the heavy resistance lasted 9 days, until 1 June. After this resistance had been broken the Allied advance continued until 25 July; the remainder of July and all August was a second static phase. Three phases are distinguished in describing the weapon and target characteristics: static, attack, and movement phases.

Table B1 shows the total number of complete daily firing records that were obtained for each weapon in each of the three phases. The complete daily firing record was chosen as the basic sampling unit in the analysis in order that missions that are more likely to appear in a particular portion of the day (e.g., harassing missions) would not be omitted.

In many of the tables nine basic target groupings have been used to classify the 62 mission categories that were used in the original data reduction. A complete classification of the various target categories is listed in Table B2. The first of these nine targets is the soft area target; this is primarily a personnel target, but it also contains surprise fire, infantry supporting fire, and infantry defensive fire. The hard area target is composed of missions against infantry under cover, infantry weapons and mortars, artillery rockets, and supply areas. Point targets are targets that require precision-fire techniques to obtain destruction; these are missions against observation and command posts, pillboxes, and houses. Mobile targets include all instances of vehicular targets; tanks and self-propelled guns have been listed as a subclassification. Counterbattery targets are targets composed of enemy field artillery and AAA weapons. The preparation targets are targets of fire prior to an attack; whenever possible they have been identified more accurately. The category of harassing and interdiction fire contains missions fired to deny enemy use of

an area (interdiction fire) and missions fired to lower enemy morale through the threat of inflicting casualties (harassing fire). The registration missions are missions fired to obtain corrections for fire on subsequent targets. The category of miscellaneous missions contains smoke, propaganda, training, and testing missions.

The distribution of missions in the different categories of targets is given in Tables B3 to B5 for the seven weapons in action in Italy. Table B3 gives data for the static phase, Table B4 for the attack phase, and Table B5 for the movement phase. Tables B6 to B8 show the corresponding breakdown of rounds fired by each weapon. Table B9 is the first of the derived distributions; it contains the distributions of the average tonnage fired by the battalions per day. The weight given is the weight of the shell and fuze; it is not the packing weight or the weight of the complete round. The figures for the attack phase are for the average of the entire period of the attack, and not for the heaviest few days. Table B10 shows the distribution of rounds per gun per day for each of the phases. Table B11 shows the distribution of rounds per mission for each phase.

The percentage of missions that were adjusted by air or ground observation and the percentage of missions that were unadjusted are shown for each weapon and target category in Tables B13, B18, B22, B27, B32, B37, and B39. The data were inadequate to compute the percentage of observed fire in the period of the advance for the 4.5-in. gun, 8-in. gun, and 240-mm How. Although the number of missions fired by the 4.5-in. gun and the 240-mm How would have provided adequate data for analysis the type of observation was not listed in the original firing records.

The computation of the gun-to-target ranges was made from the original data with an IBM 650 computer. Not all the missions were available for this computation as some of the original firing records did not contain the coordinates of the firing battery or the target (these missions were used only for the tables given in App B). In particular no gun-to-target ranges have been computed for the 240-mm How during the movement phase although 146 missions were fired in this period. Some of the original firing records were missing for this period; although the number of missions and rounds fired was known the location of the target was not known. All missions that were recorded as being fired at impossible ranges have been eliminated from the tables. These missions were primarily the result of unrecorded moves or missions fired from a new location before the records indicated that a move had taken place.

Field artillery weapons are usually emplaced so that the majority of the firing is accomplished at ranges close to 75 percent of the maximum possible range of the weapon. Table B12 shows the percentage of missions that were fired at ranges greater than 75 and 90 percent of the maximum. Tables B13, B13, B22, B27, B32, B37, and B39 show observation by target category.

The gun-to-target range distributions for the entire firing available in each of the three phases of action are given in Tables B14 to B16, B19, B20, B23 to B25, B28 to B30, B33 to B35, B38, B40, and B41, and Figs. B1 to B3, B7 to B9, B12 to B14, B18 to B20, B24 to B26, B30 to B33, for each of the seven artillery weapons. In each of these tables the range is given

in 1000-yd intervals, and the upper limit of each interval is shown as the percentage of the maximum possible range of the weapon. The final column in these tables is the range distribution of all firing in the Italian campaign for this particular weapon. The tables on gun-to-target ranges have been subdivided into distributions of range by type of observation and of range by type of target. There was enough data for the four primary artillery weapons (105-mm How, 155-mm How, 155-mm gun, and 8-in. How) to allow this analysis. The data for the 4.5-in. gun were not adequate to compute distributions of range by type of target; data for the 8-in. gun were not adequate to allow any division of the gun-to-target range distributions. For the 8-in. gun in both the attack and the static phases the computations would have had to be based on less than 20 missions in both categories of counterbattery and registration missions. The categories of point and hard area targets have been combined since they showed no significant difference. The distributions of preparation and miscellaneous missions were not computed. No computations have been made of the gun-to-target ranges of the individual targets attacked by the 8-in. gun; in both the static and the attack phases, these computations would have had to be based on less than 20 missions in both categories of counterbattery and registration missions.

No attempt has been made to smooth the distributions; the range distributions of the 8-in. gun and 240-mm How are affected by the terrain and emplacement of targets. Any smoothing of these distributions would have given a higher degree of apparent accuracy to these distributions. The range distributions of the light-artillery weapons did not require any smoothing technique.

The analysis of the ranges from front line to target has been made by plotting the target location on an overlay map of the front lines. During the static phase the location of the front lines was available from daily situation maps in unit journals. In the attack phase all the missions were plotted on an overlay map of the area; the line showing the limit of the closest targets was used as the location of the front line. This line would change during the day, and a closer analysis in hourly intervals showed the movement of units as they advanced. Occasionally situation maps would be available, and these were used to obtain corrections to the lines that had been plotted. This yielded a fair approximation to the front lines during the day. It was not possible to make any corrections to this map for patrols into enemy territory or to make any allowances for the momentary advance of small units. In the movement phase, all that was possible was to plot the targets in hourly intervals. An approximation to the front was obtained by drawing a line 500 yd closer to the friendly forces than the nearest targets. Because of this approximation, the range distributions from front line to target are given in 2000-yd intervals only.

The range distributions from front line to target for six of the seven artillery weapons are given in Tables B17, B21, B26, B31, B36, and B42, and in Figs. B4 to B8, B10, B11, B15 to B17, B21 to B23 B27 to B29, B34, and B35. The firing of the 4.5-in. gun was so sparse during the period of the advance that it was not possible to compute any range distribution. The firing of the 8-in. gun was concentrated on so few targets that no distributions have been computed.

Table B1

BATTALION DAYS OF COMBAT RECORDED IN STUDY

Weapon	Static phase	Attack phase	Movement phase	Total
105-mm How	370	122	362	854
4.5-in. gun	96	14	77	165
155-mm How	352	105	412	869
155-mm gun	128	45	225	398
8-in. How	106	27	169	302
8-in. gun[a]	20	12	23	55
240-mm How	108	16	34	158

[a]Only two batteries of an 8-in.-gun battalion were in action at any time during the Italian campaign of the Fifth Army. These figures have been adjusted to reflect the firing of an entire six-gun battalion.

Table B2

TARGET CATEGORIES

Soft area	Self-propelled artillery weapons
Personnel (not otherwise specified)	Tanks
Assembly area and bivouac areas	Counterbattery
Snipers	Personnel and artillery weapons
TOT[a]	Single guns
Defensive fire[a]	Multiple guns
Counterattack	Counterbattery preparations
Support fire[a]	AA guns
Barrage	Preparation fire
Hard area	Preparation or scheduled fire
Personnel in trenches	Harassing and Interdiction fire
Personnel in woods	Harassing (not otherwise specified)
Personnel and automatic weapons	Suspected supply areas
Personnel and mortars	Suspected personnel
Automatic weapons	Suspected vehicles
Machine guns	Suspected automatic weapons
Mortars	Suspected artillery weapons
Artillery rocket launchers	False preparation
Supply areas	Interdiction of roads
Ammunition areas	Interdiction of railroads
Water points	Interdiction of bridges
Point	Interdiction of towns
Personnel in houses	Registration fire
Observation posts	Registrations
Command posts	Time adjustments
Strong points	High-burst adjustments
Pillboxes	Marking missions
Houses	Calibration missions
Mobile	Miscellaneous missions
Personnel and vehicles	Smoke
Vehicles (not otherwise specified)	Propaganda
Motor parks	Training
Vehicle or tanks in buildings	Testing or emplacement
Self-propelled multiple machine guns	Demonstrations

[a]These terms have been carried into the analysis as they were the only terms used in the original firing records to describe the missions. A TOT mission is only a method of placing fire on an area; it is not a target. TOTs have been included as soft targets since this method of firing is particularly effective on personnel targets. Defensive fire was considered to be fire placed on limited enemy counterattacks. Support fire was unidentified firing at the direct request of an infantry unit.

Table B3

STATIC-PHASE MISSIONS

Target	105-mm How missions		4.5-in. gun missions		155-mm How missions		155-mm gun missions		8-in. How missions		8-in. gun missions		240-mm How missions	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Soft area														
Personnel	532	9.5	8	1.3	117	3.3	19	2.1	12	1.2	2	2.0	1	0.2
TOT	326	5.8	—	—	17	0.5	—	—	—	—	—	—	—	—
Infantry defense	39	0.7	—	—	8	0.2	—	—	—	—	—	—	—	—
Infantry support	77	1.4	5	0.8	29	0.8	2	0.2	—	—	—	—	—	—
Hard area														
Personnel	44	0.8	—	—	8	0.2	—	—	—	—	—	—	—	—
Infantry weapons	133	2.4	—	—	10	0.3	—	—	2	0.2	—	—	—	—
Artillery rockets	25	0.4	3	0.5	5	0.1	5	0.6	5	0.5	—	—	—	—
Mortars	296	5.3	—	—	43	1.2	4	0.4	1	0.1	—	—	—	—
Supply areas	34	0.6	—	—	11	0.3	16	1.8	3	0.3	—	—	2	0.4
Point	360	6.5	36	5.7	183	5.1	25	2.7	162	15.9	6	5.9	71	14.1
Mobile														
Vehicles	196	3.5	18	2.9	87	2.4	9	1.0	15	1.5	—	—	2	0.4
SP guns	99	1.8	6	1.0	20	0.6	5	0.6	6	0.6	—	—	—	—
Tanks	58	1.0	4	0.6	28	0.8	—	—	4	0.4	—	—	—	—
Counterbattery	634	11.4	267	42.5	1685	47.0	570	62.6	592	58.2	17	16.7	366	72.6
Preparation fire	202	3.6	12	1.9	36	1.0	—	—	12	1.2	—	—	—	—
Harassing fire	1426	25.6	34	5.4	612	17.1	87	9.6	82	8.0	18	17.6	7	1.4
Interdiction fire	234	4.2	146	23.2	310	8.6	34	3.7	20	2.0	39	38.2	11	2.2
Registration fire	579	10.4	86	13.7	370	10.3	134	14.7	101	9.9	17	16.7	36	7.1
Miscellaneous fires														
Smoke	5	0.1	—	—	2	0.1	—	—	—	—	—	—	—	—
Propaganda	99	1.8	—	—	—	—	—	—	—	—	—	—	—	—
Training and testing	179	3.2	3	0.5	2	0.1	—	—	—	—	3	2.9	8	1.6
Total	5577	100.0	628	100.0	3583	100.0	910	100.0	1017	100.0	102	100.0	504	100.0

Table B4

ATTACK-PHASE MISSIONS

Target	105-mm How missions		4.5-in. gun missions		155-mm How missions		155-mm gun missions		8-in. How missions		8-in. gun missions		240-mm How missions	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Soft area														
Personnel	387	12.0	12	1.5	141	3.6	31	1.9	12	0.9	—	—	1	0.1
TOT	103	3.2	—	—	66	1.7	1	0.1	—	—	—	—	—	—
Infantry defense	217	6.8	11	1.4	98	2.5	—	—	4	0.3	—	—	3	0.3
Infantry support	173	5.4	8	1.0	115	2.9	—	—	—	—	—	—	—	—
Hard area														
Personnel	13	0.4	—	—	6	0.1	6	0.4	—	—	—	—	—	—
Infantry weapons	67	2.1	—	—	13	0.3	3	0.2	—	—	—	—	—	—
Artillery rockets	15	0.5	2	0.3	41	1.0	9	0.6	10	0.8	—	—	—	—
Mortars	57	1.8	1	0.1	18	0.5	2	0.1	1	0.1	—	—	—	—
Supply areas	18	0.6	1	0.1	1	—	2	0.1	—	—	—	—	—	—
Point	136	4.2	16	2.0	136	3.5	30	1.9	83	6.4	3	2.8	94	9.4
Mobile														
Vehicles	141	4.4	19	2.4	69	1.8	32	2.0	12	0.9	—	—	4	0.4
SP guns	29	0.9	2	0.3	23	0.6	—	—	2	0.2	—	—	1	0.1
Tanks	178	5.5	6	0.8	145	3.7	17	1.0	32	2.5	—	—	8	0.8
Counterbattery	114	3.5	421	53.2	967	24.7	875	54.3	694	53.5	12	11.3	627	62.9
Preparation fire	625	19.5	4	0.5	659	16.8	53	3.3	9	0.7	—	—	—	—
Harassing fire	593	18.5	66	8.3	875	22.3	300	18.6	295	22.7	48	45.3	114	11.4
Interdiction fire	53	1.6	146	18.4	268	6.8	141	8.7	61	4.7	25	23.6	103	10.3
Registration fire	249	7.8	77	9.7	265	6.8	109	6.8	82	6.3	15	14.2	36	3.6
Miscellaneous fires														
Smoke	39	1.2	—	—	7	0.2	—	—	—	—	—	—	—	—
Propaganda	2	0.1	—	—	—	—	—	—	—	—	—	—	—	—
Training and testing	—	—	—	—	10	0.2	—	—	—	—	3	2.8	7	0.7
Total	3209	100.0	792	100.0	3919	100.0	1611	100.0	1297	100.0	106	100.0	998	100.0

Table B5

MOVEMENT-PHASE MISSIONS

Target	105-mm How missions		4.5-in. gun missions		155-mm How missions		155-mm gun missions		8-in. How missions		8-in. gun missions		240-mm How missions	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Soft area														
Personnel	779	17.4	4	1.4	291	8.6	33	2.7	17	2.6	—	—	3	2.1
TOT	79	1.8	—	—	81	2.4	—	—	1	0.2	—	—	—	—
Infantry defense	116	2.6	—	—	57	1.7	3	0.3	2	0.3	—	—	—	—
Infantry support	21	0.5	—	—	1	0.0	—	—	—	—	—	—	—	—
Hard area														
Personnel	24	0.5	—	—	3	0.1	—	—	—	—	—	—	—	—
Infantry weapons	120	2.7	—	—	7	0.2	1	0.1	—	—	—	—	—	—
Artillery rockets	38	0.8	—	—	7	0.2	15	1.2	2	0.3	—	—	—	—
Mortars	99	2.2	2	0.7	24	0.7	—	—	—	—	—	—	—	—
Supply areas	10	0.2	—	—	8	0.2	2	0.2	3	0.4	—	—	1	0.7
Point	357	8.0	11	3.9	202	6.0	23	1.9	51	7.8	1	6.7	23	15.7
Mobile														
Vehicles	342	7.6	15	5.4	249	7.4	68	5.6	23	3.5	—	—	1	0.7
SP guns	109	2.4	1	0.4	34	1.0	3	0.3	5	0.8	—	—	—	—
Tanks	243	5.4	8	2.9	117	3.5	22	1.8	19	2.9	—	—	—	—
Counterbattery	455	10.1	108	38.7	611	18.0	349	29.0	197	30.1	2	13.3	48	32.9
Preparation fire	133	3.0	1	0.4	216	6.4	1	0.1	—	—	—	—	—	—
Harassing fire	858	19.1	11	3.9	728	21.5	364	30.2	145	22.1	6	40.0	18	12.3
Interdiction fire	148	3.3	51	18.3	299	8.8	145	12.0	27	4.1	2	13.3	26	17.8
Registration fire	519	11.6	67	24.0	443	13.1	177	14.7	162	24.7	4	26.7	23	15.7
Miscellaneous fires														
Smoke	31	0.7	—	—	6	0.2	—	—	—	—	—	—	—	—
Propaganda	5	0.1	—	—	—	—	—	—	—	—	—	—	—	—
Training and testing	2	0.0	—	—	1	0.0	—	—	1	0.2	—	—	3	2.1
Total	4488	100.0	279	100.0	3385	100.0	1204	100.0	655	100.0	15	100.0	146	100.0

Table B6

STATIC PHASE, ROUNDS

Target	105-mm How rounds		4.5-in. gun rounds		155-mm How rounds		155-mm gun rounds		8-in. How rounds		8-in. gun rounds		240-mm How rounds	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Soft area														
Personnel	22,281	10.2	188	1.0	3,519	4.6	248	1.3	156	1.2	28	3.2	10	0.2
TOT	18,232	8.3	—	—	352	0.5	—	—	—	—	—	—	—	—
Infantry defense	6,125	2.8	—	—	331	0.4	—	—	—	—	—	—	—	—
Infantry support	3,417	1.6	78	0.4	1,143	1.5	24	0.1	—	—	—	—	—	—
Hard area														
Personnel	1,915	0.9	—	—	180	0.2	—	—	—	—	—	—	—	—
Infantry weapons	3,851	1.8	—	—	236	0.3	—	—	28	0.2	—	—	—	—
Artillery rockets	1,353	0.6	68	0.4	100	0.1	169	0.9	99	0.6	—	—	—	—
Mortars	12,252	5.6	—	—	1,378	1.8	120	0.6	10	0.1	—	—	—	—
Supply areas	1,115	0.5	—	—	220	0.3	412	2.2	64	0.4	—	—	38	0.7
Point	15,559	7.1	1,238	6.7	4,463	5.8	344	1.8	4,194	26.0	23	2.6	1672	31.8
Mobile														
Vehicles	7,267	3.3	446	2.4	2,327	3.0	253	1.3	302	1.9	—	—	17	0.3
SP guns	3,851	1.8	216	1.2	551	0.7	113	0.6	68	0.4	—	—	—	—
Tanks	2,433	1.1	128	0.7	759	1.0	—	—	70	0.4	—	—	—	—
Counterbattery	30,121	13.7	7,472	40.6	36,336	47.1	12,956	67.5	8,752	54.3	108	12.2	3075	58.4
Preparation fire	29,460	13.4	214	1.2	1,303	1.7	—	—	270	1.7	—	—	—	—
Harassing fire	39,969	18.2	1,327	7.2	10,276	13.3	2,438	12.7	833	5.1	230	26.0	64	1.2
Interdiction fire	5,997	2.7	5,920	32.2	9,324	12.1	489	2.6	357	2.2	375	42.4	118	2.3
Registration fire	7,762	3.5	1,087	5.9	4,247	5.5	1,621	8.4	883	5.5	116	13.1	255	4.9
Miscellaneous fires														
Smoke	1,376	0.6	—	—	93	0.1	—	—	—	—	—	—	—	—
Propaganda	1,640	0.8	—	—	—	—	—	—	—	—	—	—	—	—
Training and testing	3,178	1.5	9	0.1	39	0.0	—	—	—	—	4	0.5	11	0.2
Total	219,184	100.0	18,391	100.0	77,177	100.0	19,200	100.0	16,126	100.0	884	100.0	5261	100.0

Table 37

ATTACK PHASE, ROUNDS

Target	105-mm How rounds		4.5-in. gun rounds		155-mm How rounds		155-mm gun rounds		8-in. How rounds		8-in. gun rounds		240-mm How rounds	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Soft area														
Personnel	24,631	7.0	474	1.3	7,743	3.8	1,034	1.6	285	0.8	—	—	4	0.0
TOT	8,134	2.3	—	—	2,654	1.3	47	0.1	—	—	—	—	13	0.2
Infantry defense	42,665	12.0	704	1.9	7,746	3.8	—	—	64	0.2	—	—	—	—
Infantry support	40,761	11.5	1,148	3.0	8,422	4.1	—	—	—	—	—	—	—	—
Hard area														
Personnel	2,044	0.6	—	—	319	0.2	54	0.1	—	—	—	—	—	—
Infantry weapons	3,312	0.9	—	—	501	0.3	48	0.1	—	—	—	—	—	—
Artillery rockets	746	0.2	84	0.2	1,787	0.9	227	0.3	207	0.6	—	—	—	—
Mortars	3,913	1.1	40	0.1	1,525	0.8	61	0.1	17	0.1	—	—	—	—
Supply areas	659	0.2	102	0.3	29	0.0	82	0.1	—	—	—	—	—	—
Point	11,742	3.3	1,379	3.6	6,768	3.3	1,134	1.7	2,174	6.4	33	2.8	1829	22.0
Mobile														
Vehicles	10,850	3.1	1,498	3.9	3,269	1.6	1,853	2.8	736	2.2	—	—	32	0.4
SP guns	2,218	0.6	46	0.1	869	0.4	—	—	47	0.1	—	—	13	0.2
Tanks	14,423	4.1	404	1.1	7,516	3.7	828	1.3	970	2.9	—	—	108	1.3
Counterbattery	29,414	8.3	13,712	35.9	37,970	18.8	29,898	45.7	17,035	50.1	60	5.1	3016	36.3
Preparation fire	89,222	25.2	304	0.8	37,984	18.8	1,607	2.5	550	1.6	—	—	—	—
Harassing fire	57,839	16.3	3,754	9.8	49,699	24.6	17,881	27.3	7,549	22.2	600	50.7	965	11.6
Interdiction fire	3,371	0.9	13,278	34.8	23,035	11.4	9,276	14.2	3,582	10.5	356	30.1	2120	25.6
Registration fire	4,435	1.3	1,224	3.2	3,627	1.8	1,394	2.1	797	2.3	132	11.1	189	2.3
Miscellaneous fires														
Smoke	3,825	1.1	—	—	379	0.2	—	—	—	—	—	—	—	—
Propaganda	87	0.0	—	—	—	—	—	—	—	—	—	—	—	—
Training and testing	—	—	—	—	372	0.2	—	—	—	—	3	0.2	7	0.1
Total	354,291	100.0	38,151	100.0	202,214	100.0	65,424	100.0	34,013	100.0	1184	100.0	8296	100.0

Table B3

MOVEMENT PHASE, ROUNDS

Target	105-mm How rounds		4.5-in gun rounds		155-mm How rounds		155-mm gun rounds		8-in. How rounds		8-in. gun rounds		240-mm How rounds	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Soft area														
Personnel	50,837	16.2	78	0.4	11,444	9.3	242	0.7	178	1.5	—	—	3	0.2
TOT	5,530	1.8	—	—	2,717	2.2	—	—	16	0.1	—	—	—	—
Infantry defense	18,329	5.8	—	—	2,535	2.1	73	0.2	60	0.5	—	—	—	—
Infantry support	6,686	2.1	—	—	164	0.1	—	—	—	—	—	—	—	—
Hard area														
Personnel	1,948	0.6	—	—	219	0.2	—	—	—	—	—	—	—	—
Infantry weapons	7,173	2.3	—	—	134	0.1	13	0.0	—	—	—	—	—	—
Artillery rockets	3,477	1.1	—	—	280	0.2	341	1.0	47	0.4	—	—	—	—
Mortars	6,846	2.2	173	1.0	867	0.7	—	—	—	—	—	—	—	—
Supply areas	921	0.3	—	—	275	0.2	30	0.1	77	0.6	—	—	10	0.7
Point	27,919	8.9	436	2.5	6,953	5.6	558	1.6	1,237	10.1	9	8.6	392	26.8
Mobile														
Vehicles	23,660	7.5	1,189	6.7	7,979	6.5	2,099	6.2	431	3.5	—	—	11	0.7
SP guns	7,888	2.5	20	0.1	1,236	1.0	104	0.3	73	0.6	—	—	—	—
Tanks	19,614	6.3	641	3.6	4,997	4.0	730	2.2	512	4.2	—	—	—	—
Counterbattery	33,861	10.8	8,692	49.3	24,022	19.5	10,621	31.5	4,857	39.8	18	17.2	465	31.8
Preparation fire	14,894	4.7	100	0.6	10,229	8.3	56	0.2	—	—	—	—	—	—
Harassing fire	62,162	19.8	713	4.1	31,659	25.6	12,717	37.7	2,520	20.6	37	35.2	153	10.5
Interdiction	10,169	3.3	4,636	26.3	12,444	10.1	4,203	12.5	821	6.7	10	9.5	275	18.8
Registration fire	8,165	2.6	951	5.4	5,180	4.2	1,962	5.8	1,367	11.2	31	29.5	150	10.2
Miscellaneous fires														
Smoke	3,322	1.1	—	—	90	0.1	—	—	—	—	—	—	—	—
Propaganda	311	0.1	—	—	—	—	—	—	—	—	—	—	—	—
Training and testing	82	0.0	—	—	1	0.0	—	—	24	0.2	—	—	4	0.3
Total	313,814	100.0	17,629	100.0	123,425	100.0	33,749	100.0	12,220	100.0	105	100.0	1463	100.0

Table B9

TONS PER BATTALION PER DAY OF COMBAT

Target	105-mm How			4.5-in. gun			155-mm How			155-mm gun			8-in. How			8-in. gun			240-mm How		
	Phase																				
	Static	Attack	Movement	Static	Attack	Movement	Static	Attack	Movement	Static	Attack	Movement	Static	Attack	Movement	Static	Attack	Movement	Static	Attack	Movement
Soft area																					
Personnel	1.0	3.3	2.9	0.1	0.9	–	0.5	1.5	1.3	0.1	1.1	0.1	0.2	1.1	0.1	0.2	–	–	–	–	–
TOT	0.8	1.1	0.3	–	–	–	–	1.2	0.3	–	–	–	–	–	–	–	–	–	–	0.1	–
Infantry defense	0.3	5.8	0.8	–	1.4	–	–	3.5	0.3	–	–	–	–	0.2	–	–	–	–	–	–	–
Infantry support	0.2	5.5	0.3	–	2.3	–	0.2	3.8	–	–	–	–	–	–	–	–	–	–	–	–	–
Hard area																					
Personnel	0.1	0.3	0.1	–	–	–	–	0.1	–	–	0.1	–	–	–	–	–	–	–	–	–	–
Infantry weapons	0.2	0.4	0.3	–	–	–	–	0.2	–	–	0.1	–	–	–	–	–	–	–	–	–	–
Artillery rockets	0.1	0.1	0.2	–	0.2	–	–	0.8	–	0.1	0.2	0.1	0.1	0.8	–	–	–	–	–	–	–
Mortars	0.5	0.5	0.3	–	0.1	0.1	0.2	0.7	0.1	–	0.1	–	–	0.1	–	–	–	–	–	–	–
Supply areas	–	0.1	–	–	0.2	–	–	–	–	0.2	0.1	–	0.1	–	–	–	–	–	0.1	–	0.1
Point	0.7	1.6	1.3	0.4	2.7	0.3	0.6	3.1	0.8	0.1	1.2	0.1	4.0	8.1	0.7	0.1	0.3	–	2.8	20.6	2.1
Mobile																					
Vehicles	0.3	1.5	1.1	0.1	2.9	0.4	0.3	1.5	0.9	0.1	2.0	0.4	0.3	2.7	0.3	–	–	–	–	0.4	0.1
SP guns	0.2	0.3	0.4	0.1	0.1	–	0.1	0.4	0.1	–	–	–	0.1	0.2	–	–	–	–	–	0.1	–
Tanks	0.1	2.0	0.9	–	0.8	0.2	0.1	3.4	0.6	–	0.9	0.2	0.1	3.6	0.3	–	–	–	–	1.2	–
Counterbattery	1.3	4.0	1.5	2.1	26.9	3.1	4.9	17.2	2.8	4.8	31.6	2.2	8.3	63.1	2.9	0.6	0.6	0.1	5.1	33.9	2.5
Preparation fire	1.3	12.1	0.7	0.1	0.6	–	0.2	17.2	1.2	–	1.7	–	0.3	2.0	–	–	–	–	–	–	–
Harassing fire	1.8	7.8	2.8	0.4	7.4	0.3	1.4	22.5	3.6	0.9	18.9	2.7	0.8	24.0	1.5	1.4	6.0	0.2	0.1	10.9	0.8
Interdiction fire	0.3	0.5	0.5	0.7	28.1	1.7	1.3	10.4	1.4	0.2	6.8	0.9	0.3	13.0	0.5	2.2	3.6	0.1	0.2	23.9	1.5
Registration fire	0.3	0.6	0.4	0.3	2.7	0.3	0.6	1.6	0.6	0.6	1.5	0.4	0.8	3.0	0.8	0.7	1.3	0.2	0.4	2.1	0.8
Miscellaneous fires																					
Smoke	0.1	0.5	0.2	–	–	–	–	0.2	–	–	–	–	–	–	–	–	–	–	–	–	–
Propaganda	0.1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Training and testing	0.1	–	–	–	–	–	–	0.2	–	–	–	–	–	–	–	–	–	–	–	0.1	–
Total	9.9	48.0	14.4	5.3	75.3	6.3	10.4	91.5	14.0	7.1	69.3	7.1	15.4	126.2	7.1	5.2	11.8	0.6	8.7	93.3	7.9

Table B10

ROUNDS PER GUN PER DAY

Target	105-mm How			4.5-in. gun			155-mm How			155-mm gun			8-in. How			8-in. gun			240-mm How		
	Phase																				
	Static	Attack	Movement	Static	Attack	Movement	Static	Attack	Movement	Static	Attack	Movement	Static	Attack	Movement	Static	Attack	Movement	Static	Attack	Movement
Soft area	5.0	16.8	11.7	0.2	2.8	0.1	0.8	6.1	2.3	0.1	1.9	0.1	0.2	0.9	0.1	0.2	–	–	–	–	–
Personnel	4.1	5.8	1.3	–	–	–	0.1	2.1	0.5	–	0.1	–	–	–	–	–	–	–	–	0.1	–
TOT	1.4	29.1	4.2	–	4.2	–	0.1	6.1	0.5	–	–	–	–	0.2	–	–	–	–	–	–	–
Infantry defense	0.8	27.3	1.5	0.1	6.8	–	0.3	6.7	–	–	–	–	–	–	–	–	–	–	–	–	–
Infantry support																					
Hard area	0.4	1.4	0.4	–	–	–	–	0.3	–	–	0.1	–	–	–	–	–	–	–	–	–	–
Personnel	0.9	2.3	1.7	–	–	–	0.1	0.4	–	–	0.1	–	–	–	–	–	–	–	–	–	–
Infantry weapons	0.3	0.5	0.8	0.1	0.5	–	–	1.4	0.1	0.1	0.4	0.1	0.1	0.6	–	–	–	–	–	–	–
Artillery rockets	2.8	2.7	1.6	–	0.2	0.2	0.3	1.2	0.2	0.1	0.1	–	–	0.1	–	–	–	–	0.1	–	–
Mortars	0.2	0.4	0.2	–	0.6	–	0.1	–	0.1	0.2	0.2	–	–	–	–	–	–	–	2.0	19.1	1.8
Supply areas	3.5	8.0	6.4	1.1	8.2	0.5	1.1	5.4	1.4	0.2	2.1	0.2	3.3	6.7	0.6	0.2	0.5	0.1	–	0.3	0.1
Point																			–	0.1	–
Mobile	1.6	7.4	5.4	0.4	8.9	1.3	0.6	2.6	1.6	0.2	3.4	0.8	0.3	2.3	0.2	–	–	–	–	1.1	–
Vehicles	0.9	1.5	1.8	0.2	0.3	–	0.1	0.7	0.3	0.1	–	–	–	0.1	–	–	–	–	–	31.4	2.7
SP guns	0.5	9.9	4.5	0.1	2.4	0.7	0.2	6.0	1.0	–	1.5	0.3	–	3.0	0.3	–	–	–	–	–	–
Tanks	6.5	30.1	7.8	6.5	81.8	9.4	8.6	30.1	4.9	8.5	53.4	3.9	6.9	52.6	2.4	0.9	0.8	0.1	4.7	10.1	0.4
Counterbattery	6.8	60.9	3.4	0.2	1.8	0.1	0.3	30.1	2.1	–	3.0	–	0.2	1.7	–	–	–	–	0.1	22.1	1.3
Preparation fire	9.0	39.5	14.3	1.2	12.3	0.8	2.4	39.4	6.4	1.6	33.1	4.7	0.7	23.3	1.3	–	8.3	–	0.2	2.0	0.7
Harassing fire	1.4	2.3	2.3	5.1	79.0	5.0	2.2	18.3	2.5	0.3	17.2	1.6	0.3	11.1	0.4	–	4.9	–	0.4	–	–
Interdiction fire	1.7	3.0	1.9	0.9	7.3	1.0	1.0	2.9	1.0	0.1	2.6	0.7	0.7	2.5	0.7	0.1	1.8	0.1	–	–	–
Registration fire																					
Miscellaneous fires	0.7	2.6	0.8	–	–	–	–	0.3	–	–	–	–	–	–	–	–	–	–	–	–	–
Smoke	0.4	0.1	0.1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Propaganda	0.7	–	–	–	–	–	–	0.3	–	–	–	–	–	–	–	–	–	–	–	–	–
Training and testing																					
Total	49.3	241.9	72.1	16.1	226.9	19.1	18.3	160.4	24.9	12.5	121.2	12.4	12.7	105.1	5.9	7.3	16.3	0.8	8.1	46.4	7.1

Table B11

ROUNDS PER MISSION

Target	105-mm How			4.5-in. gun			155-mm How			155-mm gun			8-in. How			8-in. gun			240-mm How		
	Phase																				
	Static	Attack	Movement	Static	Attack	Movement	Static	Attack	Movement	Static	Attack	Movement	Static	Attack	Movement	Static	Attack	Movement	Static	Attack	Movement
Soft area																					
Personnel	41.1	83.6	85.2	23.5	39.5	19.5	30.0	54.9	39.3	13.0	33.3	22.4	16.3	23.7	10.4	14.0	—	—	10.0	4.0	10.7
TOT	55.9	78.9	70.0	—	—	—	20.7	40.2	33.5	—	47.0	—	—	—	16.0	—	—	—	—	4.3	—
Infantry defense	145.7	217.8	15.7	—	64.0	—	41.5	89.2	46.5	12.0	—	24.3	—	—	30.0	—	—	—	—	—	—
Infantry support	43.4	206.9	343.5	15.6	143.5	—	37.6	61.9	—	—	—	—	—	—	—	—	—	—	—	—	—
Hard area																					
Personnel	41.0	142.0	80.6	—	—	—	22.5	50.1	57.4	—	9.3	—	—	—	—	—		—	—	—	—
Infantry weapons	29.4	49.6	57.6	—	—	—	23.0	38.1	13.2	—	28.0	13.0	14.0	—	—	—	—	—	—	-	—
Artillery rockets	54.1	49.7	91.5	22.6	43.0	—	20.0	43.5	48.0	33.6	25.2	26.2	19.8	20.7	23.5	—	—	—	—	—	—
Mortars	41.3	68.6	69.1	—	40.0	86.5	32.0	84.7	36.1	30.0	30.5	—	10.0	17.0	—	—	—	—	—	—	—
Supply areas	32.7	36.6	92.1	—	103.0	—	20.0	29.0	34.3	25.7	41.0	15.0	21.3	—	25.7	—	—	—	19.0	—	10.0
Point	40.6	86.3	78.2	34.3	86.1	39.6	34.3	49.7	34.4	13.7	37.8	24.2	25.8	26.1	34.2	3.8	11.0	9.0	23.5	19.4	17.0
Mobile																					
Vehicles	37.0	76.9	69.1	24.7	78.8	79.2	26.7	47.2	32.0	28.1	57.9	30.8	20.1	61.3	18.7	—	—	—	8.5	8.0	11.0
SP guns	38.8	76.4	72.3	36.0	23.0	20.0	27.5	37.7	36.3	23.3	—	34.6	11.3	23.5	14.6	—	—	—	—	13.0	—
Tanks	41.9	81.0	80.7	32.0	67.3	80.1	27.1	51.8	42.7	—	48.7	33.1	17.5	30.3	26.9	—	—	—	..	17.5	—
Counterbattery	48.7	258.0	74.4	37.9	32.5	80.4	21.5	39.2	39.3	22.7	34.1	30.4	14.7	24.5	24.6	6.3	5.0	9.0	8.4	4.8	9.6
Preparation fire	145.8	142.7	111.9	17.8	76.0	100.0	36.1	57.6	47.3	—	30.3	56.0	22.5	61.1	—	—	—	—	—	—	—
Harassing fire	29.3	97.5	72.4	36.3	56.8	64.8	16.7	56.7	42.4	28.0	59.6	34.9	10.1	25.5	17.6	12.7	12.5	4.1	9.1	8.4	4.5
Interdiction fire	28.4	63.6	68.8	40.5	90.9	90.9	30.0	85.9	41.8	14.8	65.7	28.9	17.8	58.7	30.4	9.8	14.2	5.0	10.8	20.5	10.5
Registration fire	13.4	17.8	15.7	13.4	15.8	14.1	11.4	13.6	11.6	13.0	13.7	11.0	8.7	9.7	8.4	6.8	8.6	7.7	7.0	5.2	6.5
Miscellaneous fires																					
Smoke	275.2	96.0	107.1	—	—	—	47.5	54.1	15.0	—	—	—	—	—	—	—	—	—	—	—	—
Propaganda	16.5	43.5	63.2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Training and testing	17.7	—	41.0	3.0	—	—	18.5	41.1	1.0	—	—	—	—	—	24.0	1.3	1.0	—	1.4	1.0	1.3
Total shells divided by total mission	48.5	110.5	69.6	29.4	48.1	63.1	21.5	51.4	36.5	21.0	40.6	28.4	15.8	26.3	18.6	8.8	11.4	7.0	10.5	8.3	10.4

Table B12

PERCENTAGE OF MISSIONS FIRED AT RANGES GREATER THAN 75 AND 90 PERCENT OF MAXIMUM RANGE

Weapon	Static phase		Attack phase		Movement phase	
	>75%	>90%	>75%	>90%	>75%	>90%
105-mm How	39	7	14	2	33	5
4.5-in. gun	23	0.1	37	0.8	36	0.7
155-mm How	42	3	31	5	41	1
155-mm gun	35	1	40	2	39	1
8-in. How	26	1	40	0.7	54	0.8
8-in. gun	25	0.0	52	2	—	—
240-mm How	31	6	51	8	—	—

Table B13

OBSERVATION BY TARGET CATEGORY, 105-MM HOW

Target	In static phase, %			In attack phase, %			In movement phase, %		
	Unobserved	Ground observation	Air observation	Unobserved	Ground observation	Air observation	Unobserved	Ground observation	Air observation
Soft area	20	76	4	32	64	4	11	82	7
Hard area	26	64	10	8	81	18	3	84	13
Point	10	77	13	16	77	7	11	74	15
Mobile	11	73	16	5	73	22	5	68	27
Counterbattery	55	37	8	7	60	33	15	54	31
Preparation fire	95	5	—	91	9	—	65	32	3
Harassing fire	84	14	2	77	17	6	73	21	6
Registration fire	—	61	39	1	55	44	2	48	50
Average	47	44	9	41	47	12	26	56	12

Table B14

GUN-TO-TARGET RANGE DISTRIBUTION, 105-MM HOW

Range, thous of yd	Percent of maximum range	In static phase, %	In attack phase, %	In movement phase, %	Average, %
0–1	8	0.2	—	0.2	0.1
1–2	16	0.1	0.3	0.2	0.2
2–3	25	0.6	1.1	0.9	0.8
3–4	33	0.7	3.7	1.9	2.0
4–5	41	2.3	12.4	6.2	6.5
5–6	49	4.2	18.8	8.7	10.1
6–7	57	15.8	19.9	14.5	16.5
7–8	66	19.2	16.7	17.6	18.0
8–9	74	18.2	11.4	16.9	15.8
9–10	82	16.7	8.1	16.3	14.2
10–11	90	14.8	4.9	12.1	11.1
11–12.2	100	7.2	1.7	4.5	4.7
Average range, yd		8370	6800	7690	7770

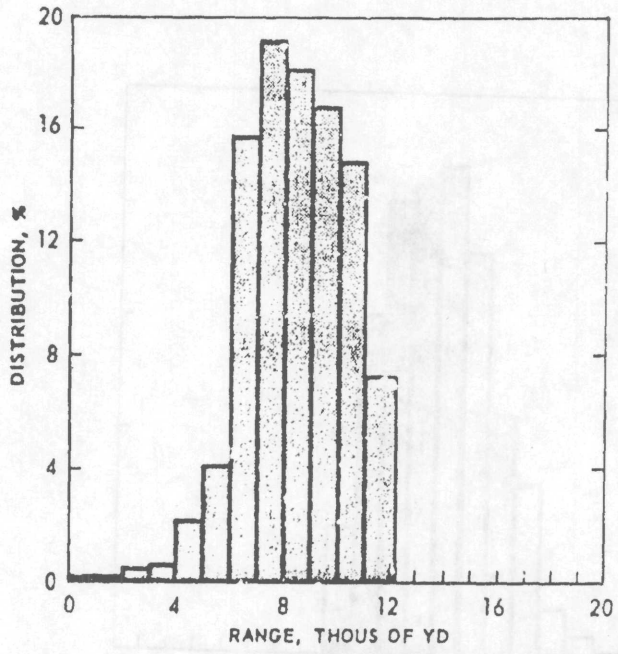


Fig. B1—Gun-to-Target Range Distribution, 105-mm How, Static Phase

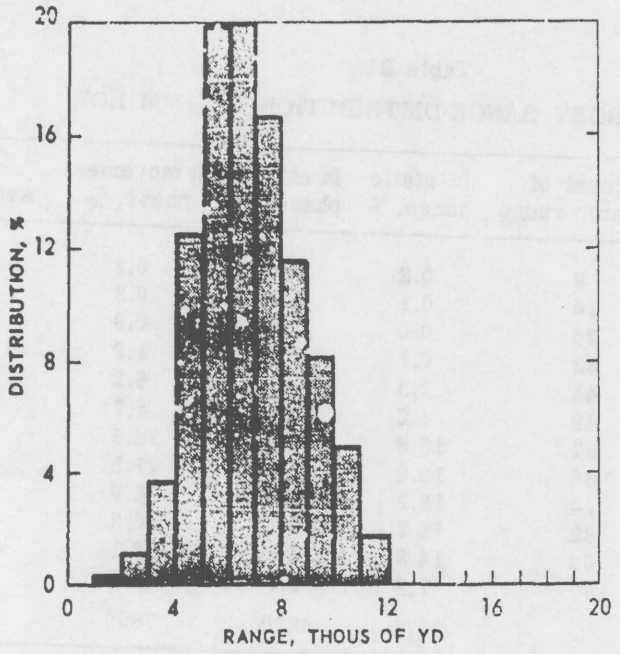


Fig. B2—Gun-to-Target Range Distribution,
105-mm How, Attack Phase

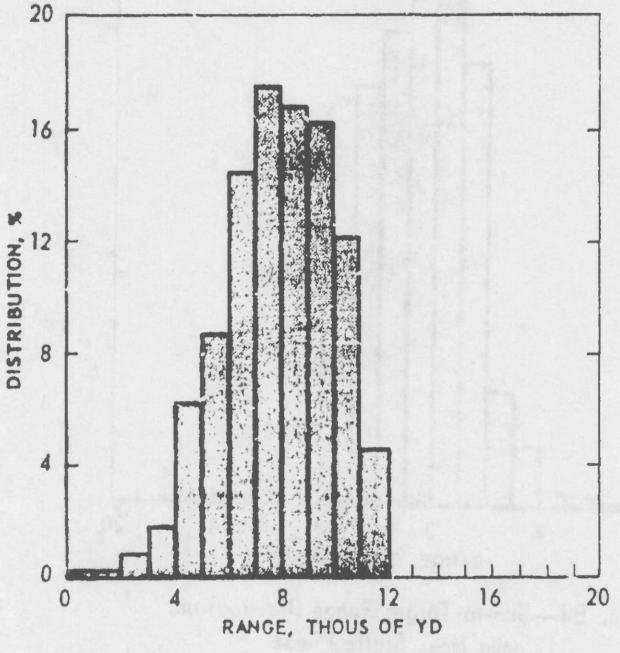


Fig. B3—Gun-to-Target Range Distribution,
105-mm How, Movement Phase

Table B15

GUN-TO-TARGET RANGE DISTRIBUTION BY TYPE OF OBSERVATION, 105-MM HOW

Range, thous of yd	In static phase, %			In attack phase, %			In movement phase, %		
	Unobserved	Ground observation	Air observation	Unobserved	Ground observation	Air observation	Unobserved	Ground observation	Air observation
0–1	—	—	0.3	—	—	—	0.1	—	—
1–2	—	0.1	—	0.5	0.3	—	0.1	0.2	0.1
2–3	0.4	0.5	1.0	0.8	1.5	1.7	0.3	1.1	1.0
3–4	0.8	0.8	1.8	2.1	5.3	4.6	1.4	2.5	1.2
4–5	4.2	3.7	1.8	10.3	13.0	6.0	6.5	7.0	3.9
5–6	6.2	6.2	4.1	19.0	19.2	11.6	8.9	9.8	5.8
6–7	13.7	18.2	9.7	21.0	22.0	14.6	12.7	16.0	12.7
7–8	15.8	20.8	18.2	19.7	15.7	15.6	15.8	18.5	17.9
8–9	17.1	17.3	18.9	12.1	10.5	18.3	15.0	16.5	20.4
9–10	15.7	15.9	21.2	8.4	6.5	14.9	19.4	14.5	18.4
10–11	16.7	12.8	17.4	5.1	3.6	10.0	15.2	9.8	12.6
11–12.2	9.4	3.7	5.6	1.0	2.4	2.7	4.6	4.0	6.0
Average range, yd	8400	8000	8500	6900	6600	7600	8100	7700	8200

Table B16

GUN-TO-TARGET RANGE DISTRIBUTION FOR SELECTED TARGETS, 105-MM HOW

Range, thous of yd	In static phase, %							In attack phase, %							In movement phase, %						
	Soft area target	Hard area target	Mobile target	Counter-battery target	Harassing fire	Registration fire	Total	Soft area target	Hard area target	Mobile target	Counter-battery target	Harassing fire	Registration fire	Total	Soft area target	Hard area target	Mobile target	Counter-battery target	Harassing fire	Registration fire	Total
0–1	—	—	—	—	—	—	0.2	—	—	—	—	—	—	—	—	—	—	—	—	—	0.2
1–2	—	—	—	—	—	—	0.1	—	—	—	—	—	—	0.3	—	—	—	—	—	—	0.2
2–3	1	—	1	1	—	—	0.6	2	1	2	1	1	2	1.1	1	1	2	1	—	1	0.9
3–4	1	—	1	1	1	2	0.7	5	4	3	3	4	2	3.7	2	3	2	2	2	2	1.9
4–5	4	2	2	3	2	4	2.3	16	18	7	10	12	14	12.4	6	8	6	7	6	5	6.2
5–6	5	6	3	4	2	8	4.2	25	20	17	11	21	17	19.8	11	10	6	9	8	8	8.7
6–7	20	19	10	13	16	16	15.4	21	27	22	17	20	16	19.9	18	14	20	13	12	13	14.5
7–8	29	22	14	14	19	29	19.2	15	15	19	16	18	16	16.7	19	17	19	13	18	19	17.6
8–9	13	20	20	14	21	11	18.2	3	7	13	14	11	14	11.4	15	13	13	16	17	24	16.9
9–10	14	18	21	15	17	19	16.7	3	5	8	17	8	11	8.1	13	15	16	16	19	17	16.3
10–11	12	11	23	19	16	9	14.8	3	4	6	7	4	8	4.9	12	10	11	16	13	7	12.1
11–12	5	1	4	10	4	2	4.8	2	—	3	2	1	—	1.4	2	3	4	6	3	3	3.3
12–12.2	1	1	1	1	2	1	2.4	—	—	—	2	—	—	0.3	1	1	1	1	2	1	1.2
Average range, yd	8360	8110	8710	8600	8480	7850	8370	6440	6370	7100	7500	6740	7000	6800	7690	7700	7810	8100	8110	7890	7890

Table B17

RANGE DISTRIBUTION FROM FRONT LINE TO TARGET, 105-MM HOW

Range, thous of yd	In static phase, %	In attack phase, %	In movement phase, %	Average, %
0–2	25	67	23	40
2–4	56	25	47	41
4–6	17	6	18	13
6–8	1	2	12	6
8–10	1	—	—	—
10–12	—	—	—	—
Average range, yd	2940	1860	3380	2700

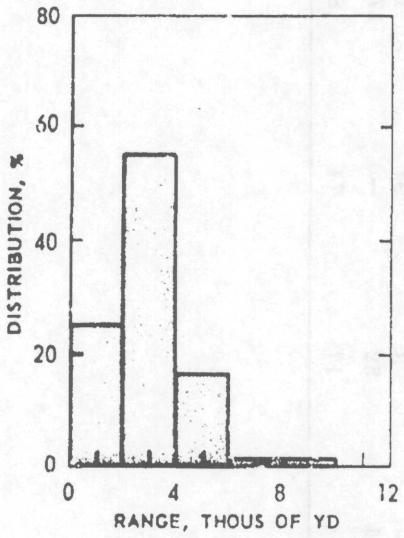


Fig. B4—Range Distribution from Front Line to Target, 105-mm How, Static Phase

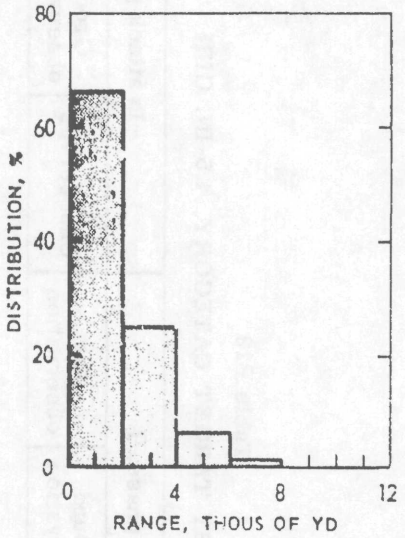


Fig. B5—Range Distribution from Front Line to Target, 105-mm How, Attack Phase

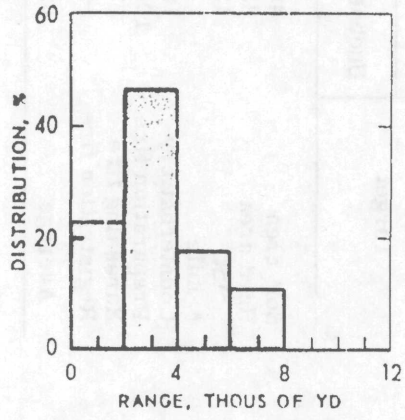


Fig. B6—Range Distribution from Front Line to Target, 105-mm How, Movement Phase

Table B18

OBSERVATION BY TARGET CATEGORY, 4.5-IN. GUN

Target	In static phase, %			In attack phase, %		
	Unobserved	Ground observation	Air observation	Unobserved	Ground observation	Air observation
Soft area	45	55	—	67	22	11
Hard area	33	67	—	100	—	—
Point	13	87	—	36	18	46
Mobile	7	74	19	15	37	48
Counterbattery	78	5	17	84	5	11
Preparation fire	100	—	—	100	—	—
Harassing fire	97	—	3	97	1	2
Registration fire	—	41	59	—	17	83
Average	69	14	17	71	8	21

Table B19

GUN-TO-TARGET RANGE DISTRIBUTION, 4.5-IN. GUN

Range, thous of yd	Percent of maximum range	In static phase, %	In attack phase, %	In movement phase, %	Average, %
3–4	19	—	—	—	—
4–5	24	—	0.1	—	0.1
5–6	28	—	—	0.4	0.1
6–7	33	—	0.1	0.7	0.2
7–8	38	—	—	1.8	0.3
8–9	43	1.5	1.6	0.4	1.4
9–10	47	3.7	2.0	1.9	2.5
10–11	52	2.5	2.9	3.7	2.9
11–12	57	9.3	9.0	8.9	9.1
12–13	62	14.2	9.8	8.5	11.2
13–14	66	12.2	8.2	9.6	9.8
14–15	71	13.5	7.9	11.5	10.4
15–16	76	20.3	21.0	16.7	20.1
16–17	81	12.7	22.7	17.0	18.2
17–18	85	6.5	11.3	13.0	9.8
18–19	90	3.5	2.8	5.2	3.4
19–20	95	—	0.2	0.7	0.2
20–21.1	100	0.1	0.4	—	0.4
Average range, yd		14,240	14,770	14,620	14,550

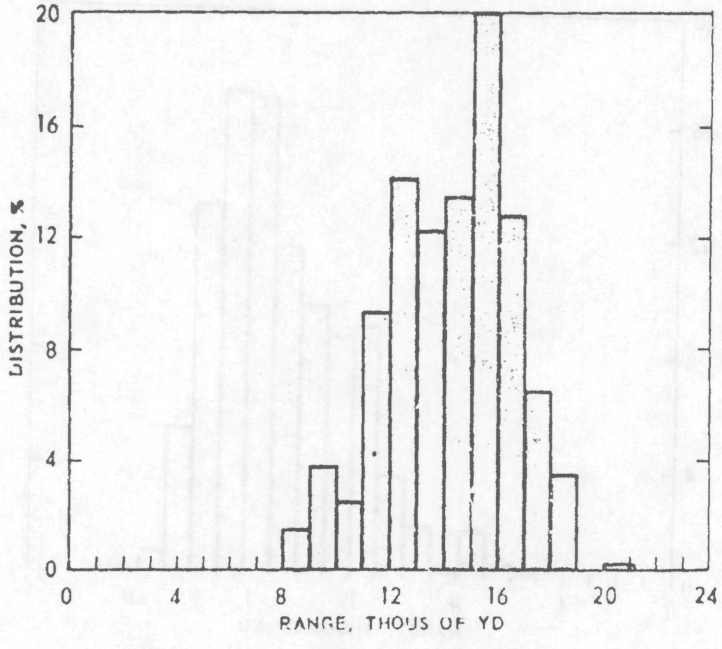


Fig. B7—Gun-to-Target Range Distribution, 4.5-in. Gun, Static Phase

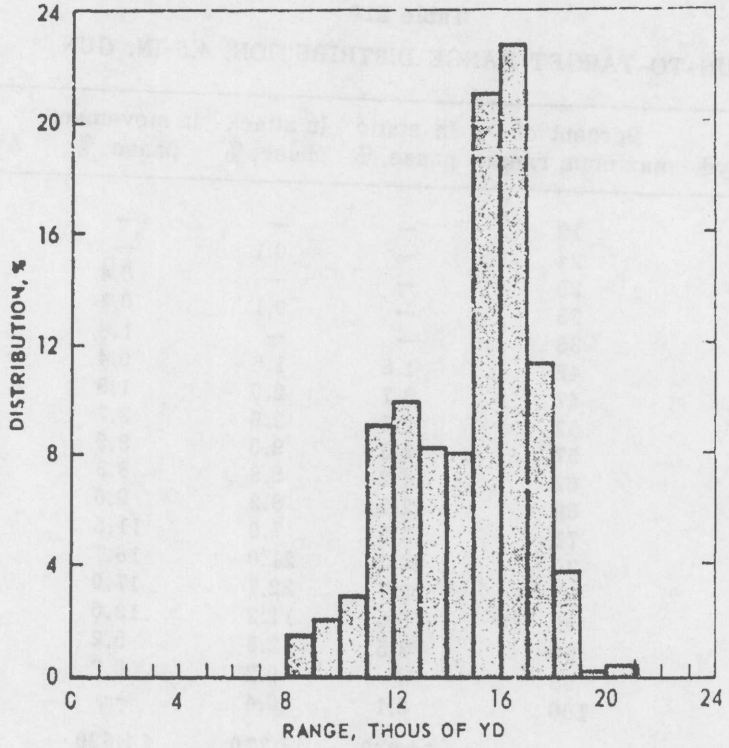


Fig. B8—Gun-to-Target Range Distribution,
4.5-in. Gun, Attack Phase

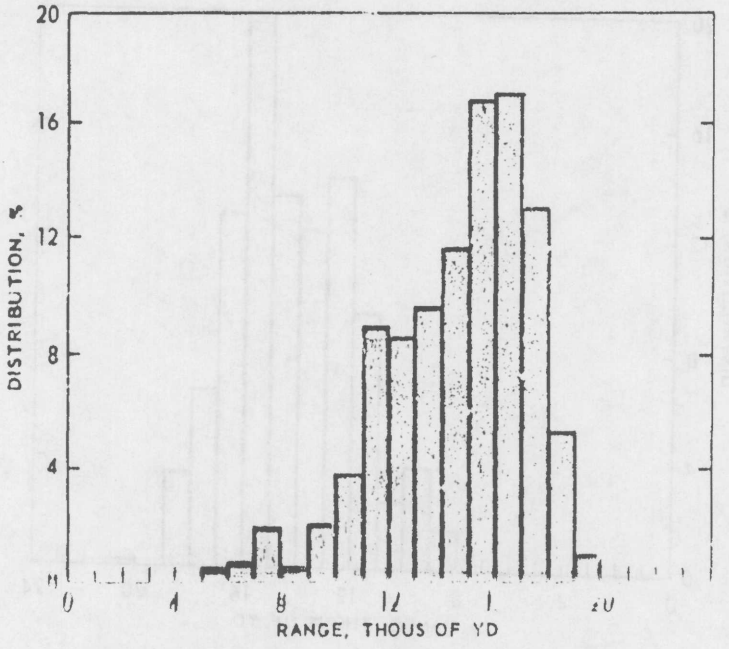


Fig. B9—Gun-to-Target Range Distribution,
4.5-in. Gun, Movement Phase

Table B20

GUN-TO-TARGET RANGE DISTRIBUTION BY TYPE OF OBSERVATION, 4.5-IN. GUN

Range, thous of yd	In static phase, %			In attack phase, %			In movement phase, %		
	Unobserved	Ground observation	Air observation	Unobserved	Ground observation	Air observation	Unobserved	Ground observation	Air observation
4–5	—	—	—	0.2	—	—	—	—	—
5–6	—	—	—	—	—	—	0.8	—	—
6–7	—	—	—	—	—	1	0.8	2	—
7–8	—	—	—	—	—	—	0.8	7	1
8–9	0.5	8	—	1.6	—	2	—	—	1
9–10	0.5	21	3	1.9	6	1	2.5	—	2
10–11	1.4	4	5	2.9	8	2	3.3	4	4
11–12	9.0	4	13	8.2	17	12	5.0	20	9
12–13	11.6	19	15	8.9	27	11	5.0	17	9
13–14	13.7	9	9	7.9	3	10	9.1	9	11
14–15	14.6	10	12	6.3	17	12	13.2	2	13
15–16	23.4	7	22	22.5	8	15	18.2	11	17
16–17	14.4	10	9	24.5	11	19	20.6	7	17
17–18	6.3	7	11	12.2	—	8	14.9	15	10
18–19	4.6	—	1	2.6	3	5	5.0	4	6
19–20	—	—	—	—	—	1	0.8	2	—
20–21.1	—	1	—	0.3	—	1	—	—	—
Average range, yd	14,600	12,800	14,100	14,900	13,200	14,600	15,000	13,600	14,600

Table B21

RANGE DISTRIBUTION FROM FRONT LINE TO TARGET, 4.5-IN. GUN

Range, thous of yd	In static phase, %	In attack phase, %	Average, %
0–2	5	9	7
2–4	20	29	25
4–6	29	32	31
6–8	36	21	28
8–10	8	7	7
10–12	1	2	2
12+	1	—	—
Average range, yd	5580	4880	5180

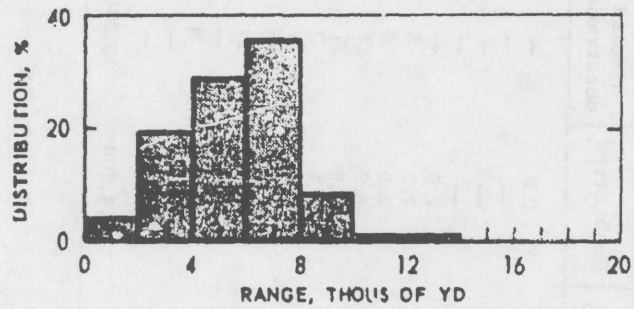


Fig. B10—Range Distribution from Front Line to Target, 4.5-in. Gun, Static Phase

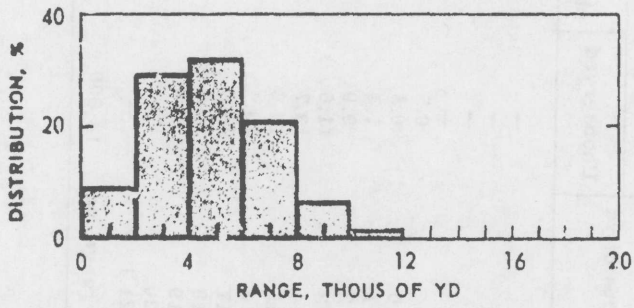


Fig. B11—Range Distribution from Front Line to Target, 4.5-in. Gun, Attack Phase

Table B22

OBSERVATION BY TARGET CATEGORY, 155-MM HOW

Target	In static phase, %			In attack phase, %			In movement phase, %		
	Unobserved	Ground observation	Air observation	Unobserved	Ground observation	Air observation	Unobserved	Ground observation	Air observation
Soft area	43	48	9	78	17	5	72	21	7
Hard area	19	53	28	30	44	26	21	53	26
Point	27	65	8	72	18	10	59	28	13
Mobile	13	68	19	26	42	32	30	34	36
Counterbattery	82	8	10	75	9	16	55	16	29
Preparation fire	98	—	2	99	1	—	97	1	2
Harassing fire	95	2	3	95	1	4	93	2	5
Registration fire	1	44	55	3	26	71	—	7	93
Average	69	17	14	74	11	15	64	13	23

Table B23

GUN-TO-TARGET RANGE DISTRIBUTION, 155-MM HOW

Range, thous of yd	Percent of maximum range	In static phase, %	In attack phase, %	In movement phase, %	Average, %
2–3	18	—	0.1	0.1	0.1
3–4	25	—	0.7	0.4	0.4
4–5	31	0.2	1.5	0.8	0.9
5–6	37	0.4	3.6	1.4	1.9
6–7	43	1.6	4.8	3.0	3.3
7–8	49	4.9	9.4	6.6	7.1
8–9	55	8.2	8.9	9.1	8.7
9–10	61	11.4	12.3	11.2	11.7
10–11	67	13.2	14.3	13.1	13.6
11–12	74	18.4	13.0	13.2	14.7
12–13	80	17.4	14.2	14.5	15.2
13–14	86	14.8	12.2	16.9	14.5
14–15	92	6.7	4.5	8.7	6.5
15–16.3	100	2.8	0.5	1.0	1.4
Average range, yd		11,360	10,380	11,060	10,900

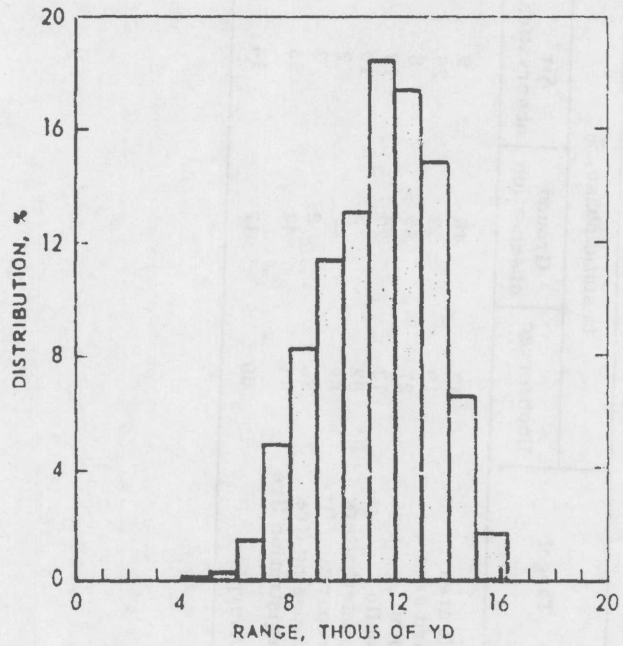


Fig. B12—Gun-to-Target Range Distribution, 155-mm How. Static Phase

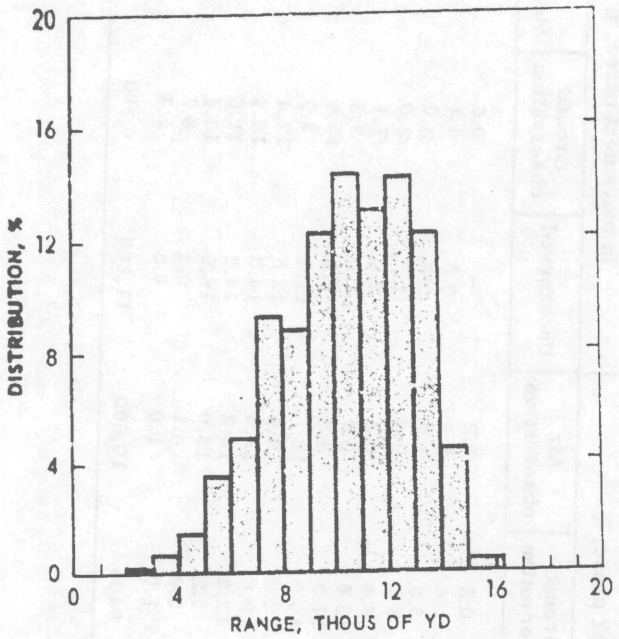


Fig. B13—Gun-to-Target Range Distribution, 155-mm How, Attack Phase

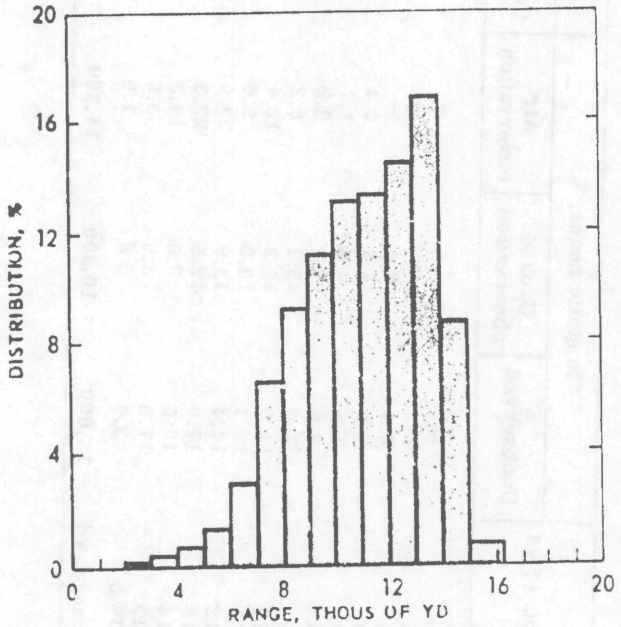


Fig. B14—Gun-to-Target Range Distribution, 155-mm How, Movement Phase

Table B24

GUN-TO-TARGET RANGE DISTRIBUTION BY TYPE OF OBSERVATION, 155-MM HOW

Range, thous of yd	In static phase, %			In attack phase, %			In movement phase, %		
	Unobserved	Ground observation	Air observation	Unobserved	Ground observation	Air observation	Unobserved	Ground observation	Air observation
2–3	—	—	—	—	0.3	0.2	—	0.6	0.2
3–4	—	—	—	0.6	1.6	1.0	0.5	0.4	0.5
4–5	0.3	0.6	—	1.3	3.5	1.2	0.5	3.0	0.5
5–6	0.1	1.1	0.4	3.7	6.4	2.9	1.2	3.0	1.2
6–7	1.3	2.6	1.7	4.5	8.4	6.3	2.6	7.1	2.0
7–8	3.4	11.2	3.2	10.0	13.8	6.7	7.0	9.5	4.5
8–9	7.0	15.2	8.2	8.5	11.3	8.8	8.5	10.6	8.5
9–10	11.0	16.3	12.4	11.6	10.9	12.7	11.6	9.9	11.1
10–11	15.3	13.0	9.0	14.6	12.9	9.4	12.8	12.4	13.0
11–12	17.4	13.9	23.9	13.5	9.6	13.5	14.3	10.4	12.2
12–13	17.0	12.5	22.3	14.1	12.2	16.2	14.2	11.6	17.3
13–14	16.0	9.6	14.3	12.4	5.2	16.0	16.9	13.4	18.6
14–15	7.8	3.5	3.6	4.9	2.9	4.1	9.4	6.7	8.5
15–16.3	3.1	0.5	1.0	0.3	1.0	1.0	0.5	1.4	1.9
Average range, yd	11,600	10,300	11,300	10,400	9400	10,600	11,100	10,300	11,300

Table B25

GUN-TO-TARGET RANGE DISTRIBUTION FOR SELECTED TARGETS, 155-MM HOW

Range, thousand yd	In static phase, %							In attack phase, %							In movement phase, %						
	Soft area target	Hard area target	Mobile target	Counter-battery target	Harassing fire	Registration fire	Total	Soft area target	Hard area target	Mobile target	Counter-battery target	Harassing fire	Registration fire	Total	Soft area target	Hard area target	Mobile target	Counter-battery target	Harassing fire	Registration fire	Total
2–3	–	–	–	–	–	–	–	–	–	1	–	–	–	0.1	1	–	–	–	–	–	0.1
3–4	–	–	–	–	–	–	–	–	3	1	–	–	1	0.7	2	–	–	–	–	–	0.4
4–5	–	–	–	–	–	–	0.2	1	3	2	1	1	2	1.5	2	1	1	–	–	1	0.8
5–6	2	2	–	–	1	–	0.4	6	5	5	1	2	2	3.6	3	1	3	1	1	1	1.4
6–7	2	8	4	–	2	1	1.6	9	7	10	2	3	3	4.8	6	3	5	2	2	1	3.0
7–8	18	12	15	2	5	6	4.9	11	3	13	3	11	5	9.4	7	7	5	3	4	6	6.6
8–9	17	10	21	3	14	8	8.2	5	12	9	6	9	10	8.9	9	7	11	5	9	9	9.1
9–10	14	15	16	9	15	13	11.4	10	13	11	9	13	14	12.3	11	9	11	11	12	9	11.2
10–11	10	14	9	12	16	10	13.2	12	19	13	18	13	9	14.3	14	22	14	12	12	14	13.4
11–12	9	14	12	18	18	35	18.4	7	14	8	15	14	17	13.0	15	12	8	16	14	14	13.2
12–13	14	13	15	20	14	17	17.4	15	4	10	23	14	17	14.2	11	15	14	16	16	16	14.5
13–14	9	11	5	21	8	9	14.8	11	15	9	15	14	15	12.2	12	18	17	18	20	17	16.4
14–15	5	1	5	10	4	1	6.7	11	2	4	6	6	3	4.5	7	9	10	4	10	7	8.7
15–16	–	–	–	3	1	–	1.7	1	–	–	–	–	1	0.3	–	1	1	2	–	1	0.8
16–16.3	–	–	–	2	–	–	1.1	1	–	1	1	–	1	0.2	–	–	–	–	–	1	0.2
Average range, yd	10,140	10,140	10,140	12,160	10,700	10,990	11,369	10,500	9,870	9,520	11,370	10,660	10,790	10,380	10,280	11,290	10,930	11,510	11,410	11,320	11,060

Table B26

RANGE DISTRIBUTION FROM FRONT LINE TO TARGET, 155-MM HOW

Range, thous of yd	In static phase, %	In attack phase, %	In movement phase, %	Average, %
0–2	8	56	13	26
2–4	23	27	25	27
4–6	32	13	40	27
6–8	33	3	22	18
8–10	4	1	—	2
Average range, yd	5040	2320	4420	3860

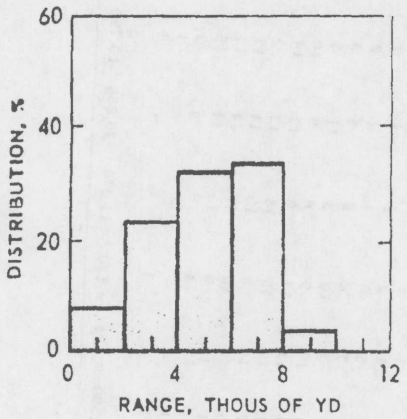


Fig. B15—Range Distribution from Front Line to Target, 155-mm How, Static Phase

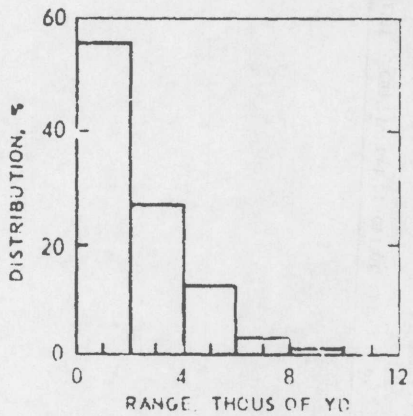


Fig. B16—Range Distribution from Front Line to Target, 155-mm How, Attack Phase

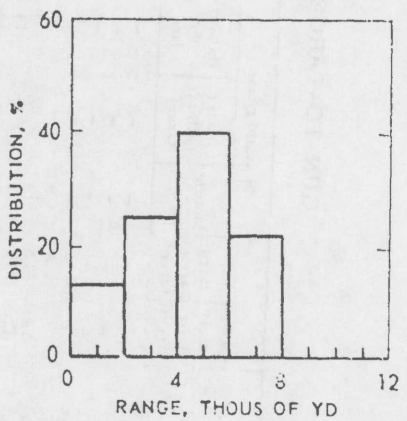


Fig. B17—Range Distribution from Front Line to Target, 155-mm How, Movement Phase

Table B27

OBSERVATION BY TARGET CATEGORY, 155-MM GUN

Target	In static phase, %			In attack phase, %			In movement phase, %		
	Unobserved	Ground observation	Air observation	Unobserved	Ground observation	Air observation	Unobserved	Ground observation	Air observation
Soft area	67	29	4	68	18	14	57	17	26
Hard area	54	38	8	60	27	13	22	56	22
Point	68	21	11	81	6	13	22	44	34
Mobile	14	43	43	13	13	74	13	31	56
Counterbattery	72	8	20	86	3	11	58	11	31
Preparation fire	—	—	—	98	—	2	100	—	—
Harassing fire	83	8	9	84	3	13	91	3	6
Registration fire	—	41	59	—	28	72	1	11	88
Average	61	15	24	75	6	19	60	10	30

Table B28

GUN-TO-TARGET RANGE DISTRIBUTION, 155-MM GUN

Range, thous of yd	Percent of maximum range	In static phase, %	In attack phase, %	In movement phase, %	Average, %
7–8	31	—	0.3	—	0.1
8–9	35	0.1	0.3	0 6	0.4
9–10	39	0.3	0.8	0.5	0.6
10–11	43	1.1	2.5	2.3	2.2
11–12	47	2.7	3.9	2.9	3.3
12–13	51	6.7	3.3	3.6	4.1
13–14	54	7.5	5.0	4.4	5.3
14–15	58	6.7	7.1	5.9	6.6
15–16	62	8.3	9.4	8.4	8.9
16–17	66	10.4	8.2	9.2	9.0
17–18	70	9.0	11.0	10.7	10.5
18–19	74	12.2	8.7	12.8	10.8
19–20	78	14.0	11.6	12.0	12.2
20–21	82	12.9	11.7	10.3	11.4
21–22	86	5.3	11.0	10.3	9.6
22–23	89	1.8	3.5	5.0	3.7
23–24	93	0.6	1.1	0.9	0.9
24–25	97	0.3	0.2	0.2	0.2
25–25.7	100	0.1	0.4	—	0.2
Average range, yd		17,280	17,500	17,700	17,520

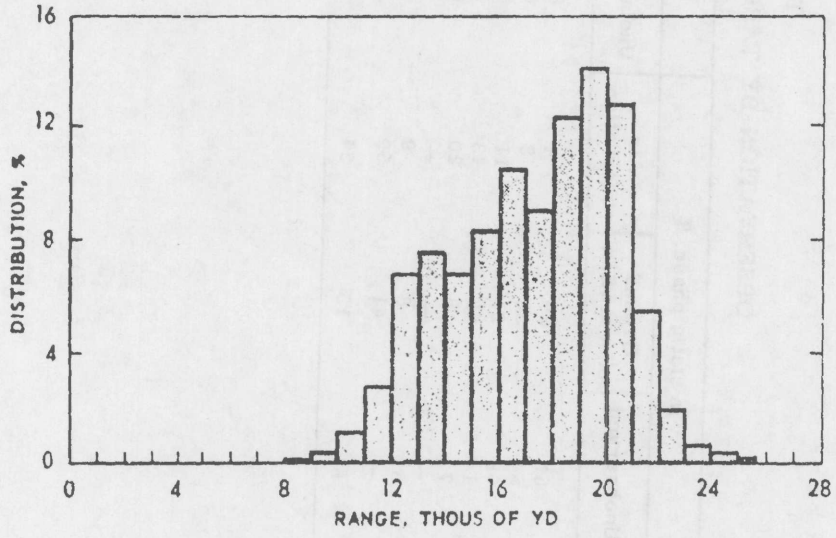


Fig. B18—Gun-to-Target Range Distribution, 155-mm Gun, Static Phase

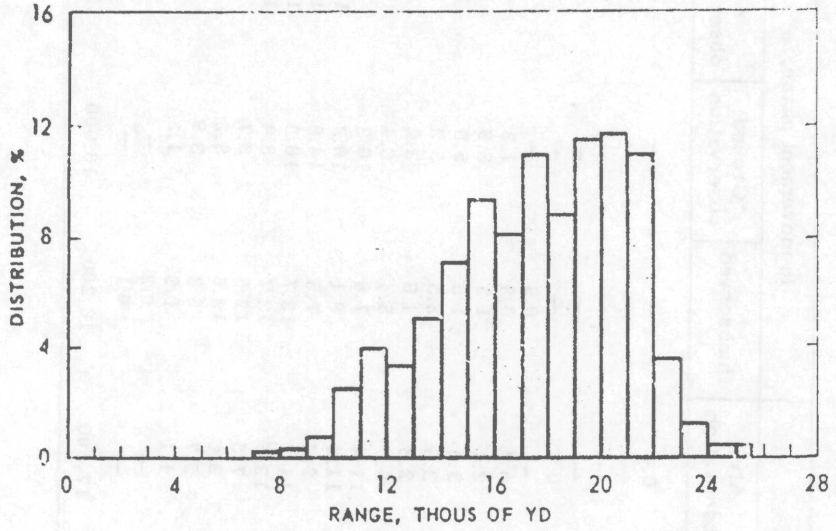


Fig. B19—Gun-to-Target Range Distribution, 155-mm Gun, Attack Phase

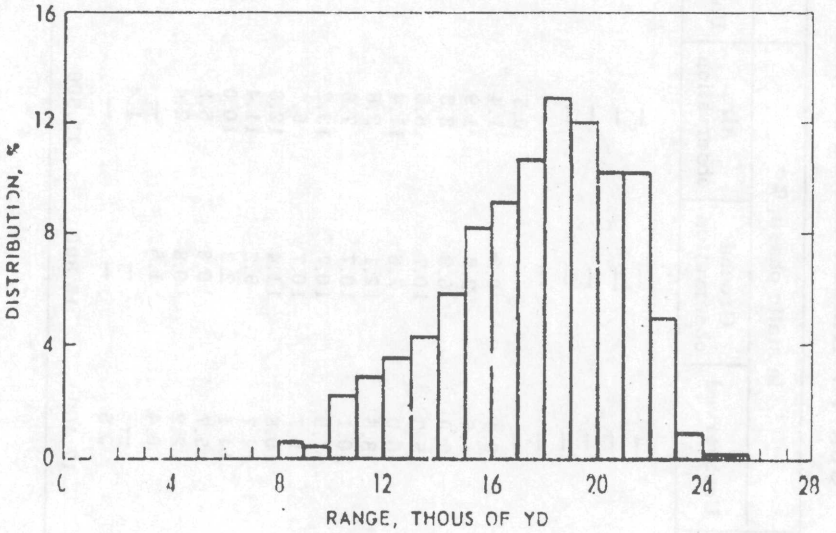


Fig. B20—Gun-to-Target Range Distribution, 155-mm Gun, Movement Phase

Table B29

GUN-TO-TARGET RANGE DISTRIBUTION BY TYPE OF OBSERVATION, 155-MM GUN

Range, thousand yd	In static phase, %			In attack phase, %			In movement phase, %		
	Unobserved	Ground observation	Air observation	Unobserved	Ground observation	Air observation	Unobserved	Ground observation	Air observation
3–4	—	—	—	—	—	0.4	—	—	—
4–5	—	—	—	0.1	—	—	—	—	—
5–6	—	—	—	—	—	—	—	—	—
6–7	—	—	—	—	—	—	—	—	—
7–8	—	—	—	0.2	—	0.7	—	—	—
8–9	—	—	0.5	0.4	—	—	0.9	—	—
9–10	0.4	0.8	1.4	0.9	—	0.7	0.3	1.3	—
10–11	1.6	3.8	1.9	2.8	3	2.1	1.3	3.9	1.1
11–12	2.0	6.9	3.8	3.9	5	3.2	1.5	5.8	3.8
12–13	5.3	10.7	8.5	2.6	11	3.9	2.5	5.2	3.5
13–14	6.0	7.6	11.4	5.2	6	2.8	4.6	3.2	3.8
14–15	8.6	12.1	2.8	6.6	8	5.7	5.4	6.4	6.8
15–16	10.1	10.7	7.6	8.3	10	11.4	7.8	10.3	8.1
16–17	7.9	10.7	13.2	7.4	16	11.4	8.1	10.2	11.1
17–18	9.7	10.7	5.7	11.6	10	9.6	7.5	14.8	15.2
18–19	10.8	11.4	12.8	8.1	8	11.7	13.7	10.3	13.3
19–20	14.7	9.2	11.4	12.8	13	12.5	12.7	8.4	12.5
20–21	14.1	2.3	10.0	12.2	3	7.5	12.5	9.7	8.1
21–22	5.7	0.8	5.2	12.1	5	9.0	13.6	5.2	8.1
22–23	2.2	0.8	2.4	3.0	2	5.7	6.3	3.9	3.8
23–24	0.4	1.5	—	1.3	—	1.1	0.9	1.3	0.8
24–25	—	—	1.4	0.2	—	—	0.3	—	—
25–25.7	0.5	—	—	0.3	—	—	0.1	—	—
Average range, yd	17,400	15,800	16,800	17,600	16,300	17,500	18,200	16,900	17,600

Table B30

GUN-TO-TARGET RANGE DISTRIBUTION FOR SELECTED TARGETS, 155-MM GUN

Range, thous of yd	In static phase, %							In attack phase, %							In movement phase, %						
	Soft area target	Hard area target	Mobile target	Counter-battery target	Harass-ing fire	Registra-tion fire	Total	Soft area target	Hard area target	Mobile target	Counter-battery target	Harass-ing fire	Registra-tion fire	Total	Soft area target	Hard area target	Mobile target	Counter-battery target	Harass-ing fire	Registra-tion fire	Total
7-8	–	–	–	–	–	–	–	–	–	–	–	–	2	0.3	–	–	–	–	–	–	–
8-9	–	–	–	–	–	–	0.1	–	–	–	1	–	–	0.3	2	–	–	–	1	–	0.6
9-10	–	–	–	–	1	–	0.3	–	–	6	1	1	1	0.8	2	–	3	1	–	–	0.5
10-11	–	–	–	2	–	–	1.1	–	–	2	3	2	1	2.5	4	–	–	4	2	1	2.3
11-12	4	–	29	2	3	3	2.7	4	–	4	5	2	4	3.9	8	–	5	3	2	4	2.9
12-13	4	5	14	7	7	8	6.7	1	–	4	3	3	8	3.3	2	10	6	5	3	1	3.6
13-14	4	–	–	5	9	19	7.5	–	–	2	7	4	1	5.0	4	5	4	5	4	3	4.4
14-15	22	–	–	7	4	5	6.7	6	11	2	9	4	2	7.1	8	25	5	7	4	6	5.9
15-16	9	16	14	9	7	4	8.3	3	–	11	11	7	18	9.4	6	–	14	10	8	6	8.4
16-17	22	11	–	11	11	6	10.4	8	–	6	8	7	17	8.2	6	10	10	11	7	11	9.2
17-18	9	16	–	7	15	11	9.0	8	3	9	14	8	12	11.0	14	10	5	11	8	20	10.7
18-19	9	20	29	10	13	17	12.2	17	3	6	8	9	13	8.7	10	25	6	14	11	19	12.8
19-20	4	11	–	15	8	16	14.0	21	28	26	9	15	6	11.6	12	5	8	11	12	16	12.0
20-21	13	16	–	14	13	9	12.9	15	19	13	9	16	7	11.7	8	5	10	9	13	6	10.3
21-22	–	–	14	7	6	1	5.3	14	36	9	8	14	7	11.0	8	5	15	6	16	3	10.3
22-23	–	–	–	2	3	–	1.8	3	–	–	3	5	1	3.5	4	–	6	2	8	3	5.0
23-24	–	–	–	1	–	–	0.6	–	–	–	1	3	–	1.1	2	–	3	1	1	1	2.9
24-25	–	5	–	–	–	1	0.3	–	–	–	–	–	–	0.2	–	–	–	–	–	–	0.2
25-25.7	–	–	–	–	–	–	0.1	–	–	–	–	–	–	0.4	–	–	–	–	–	–	–
Average range, yd	16,400	18,100	15,630	17,470	17,230	16,740	17,280	18,640	19,770	17,980	16,880	18,380	16,670	17,500	16,940	16,650	17,570	17,020	18,330	17,630	17,700

Table B31

RANGE DISTRIBUTION FROM FRONT LINE TO TARGET, 155-MM GUN

Range, thous of yd	In static phase, %	In attack phase, %	In movement phase, %	Average, %
0–2	1	3	—	2
2–4	10	17	3	11
4–6	9	18	17	16
6–8	15	23	25	22
8–10	36	18	38	28
10–12	11	7	16	11
12–14	10	10	1	7
14 +	8	4	—	3
Average range, yd	8760	8340	8000	7780

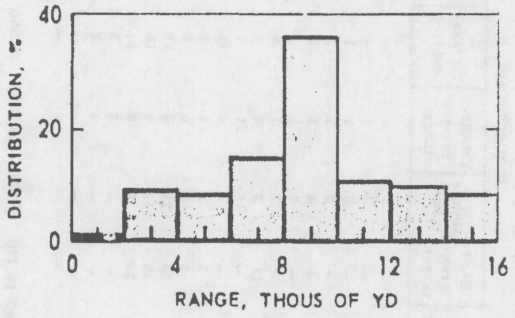


Fig. B21—Range Distribution from Front Line to Target, 155-mm Gun, Static Phase

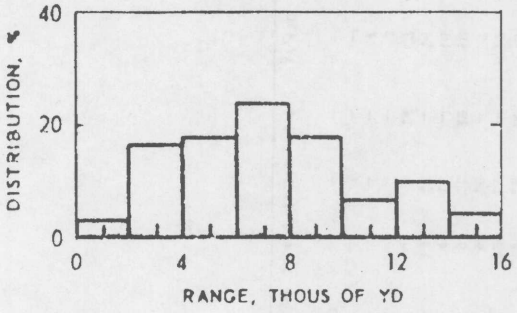


Fig. B22—Range Distribution from Front Line to Target, 155-mm Gun, Attack Phase

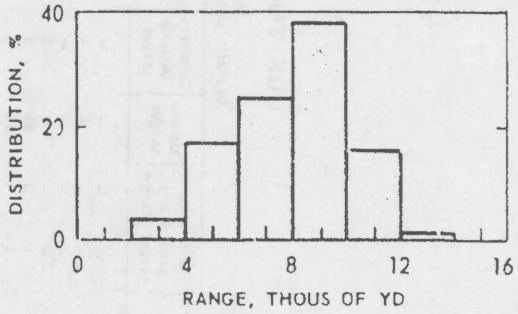


Fig. B23—Range Distribution from Front Line to Target, 155-mm Gun, Movement Phase

Table B32

OBSERVATION BY TARGET CATEGORY, 8-IN. HOW

Target	In static phase, %			In attack phase, %			In movement phase, %		
	Unobserved	Ground observation	Air observation	Unobserved	Ground observation	Air observation	Unobserved	Ground observation	Air observation
Soft area	58	33	9	65	18	17	44	28	28
Hard area	52	9	39	—	67	33	10	60	30
Point	20	16	64	48	10	42	30	33	37
Mobile	9	44	48	26	23	51	11	47	42
Counterbattery	61	6	33	84	4	12	51	19	30
Preparation fire	67	8	25	100	—	—	—	—	—
Harassing fire	64	6	30	97	1	2	91	2	7
Registration fire	—	24	76	3	13	84	—	—	86
Average	48	10	42	77	6	17	47	17	36

Table B33

GUN-TO-TARGET RANGE DISTRIBUTION, 8-IN. HOW

Range, thous of yd	Percent of maximum range	In static phase, %	In attack phase, %	In movement phase, %	Average, %
3–4	22	0.1	—	0.2	0.1
4–5	27	—	0.2	—	0.1
5–6	32	1.4	0.5	0.2	0.7
6–7	38	2.4	1.6	0.3	1.6
7–8	43	3.3	1.3	1.5	2.0
8–9	49	4.5	2.4	0.8	2.7
9–10	54	7.8	3.5	3.4	4.8
10–11	59	12.5	6.0	6.0	8.1
11–12	65	14.0	10.4	7.5	10.9
12–13	70	17.2	15.7	14.0	15.8
13–14	76	11.7	18.0	12.6	14.7
14–15	81	12.1	16.1	18.9	15.5
15–16	86	8.9	15.9	25.2	15.8
16–17	92	3.1	7.7	8.6	6.4
17–18	97	0.8	0.4	0.8	0.6
18–18.5	100	0.2	0.3	—	0.2
Average range, yd		12,080	13,190	13,690	12,940

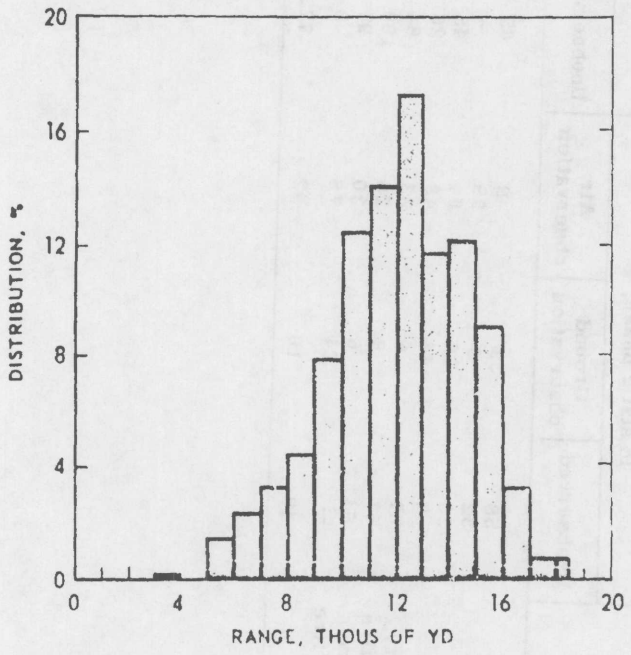


Fig. B24 —Gun-to-Target Range Distribution, 8-in. How, Static Phase

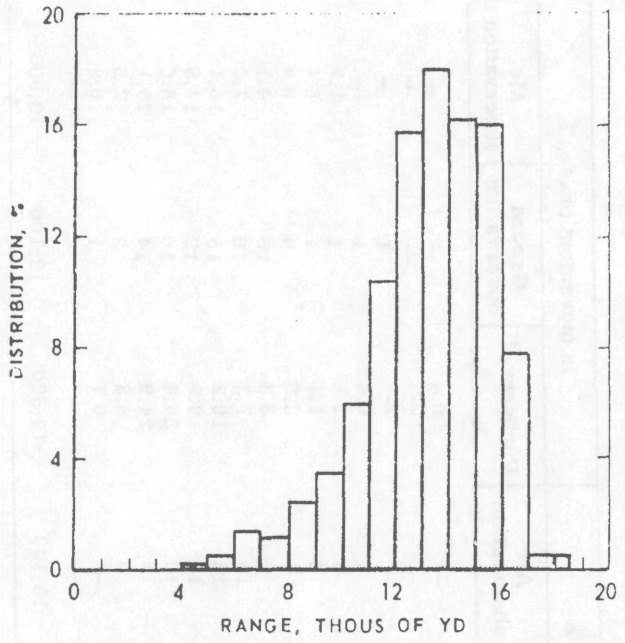


Fig. B25—Gun-to-Target Range Distribution, 8-in. How, Attack Phase

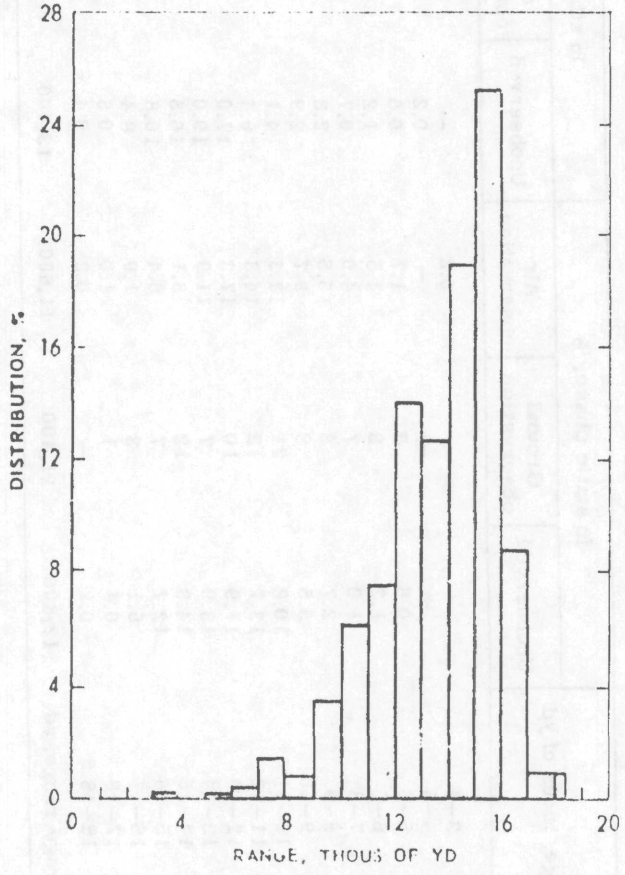


Fig. B26—Gun-to-Target Range Distribution, 8-in. How, Movement Phase

Table B34

GUN-TO-TARGET RANGE DISTRIBUTION BY TYPE OF OBSERVATION, 8-IN. HOW

Range, thous of yd	In static phase, %			In attack phase, %			In movement phase, %		
	Unobserved	Ground observation	Air observation	Unobserved	Ground observation	Air observation	Unobserved	Ground observation	Air observation
3–4	—	—	0.2	—	—	—	0.4	—	—
4–5	—	—	—	0.2	2	—	—	—	—
5–6	0.6	3	1.7	0.6	2	—	—	1	—
6–7	1.2	3	4.5	1.2	3	1	0.4	1	—
7–8	1.0	7	4.0	0.7	3	3	1.8	1	1.7
8–9	2.7	6	5.5	2.3	5	2	1.1	1	0.4
9–10	5.5	8	9.7	2.9	8	4	2.9	9	0.8
10–11	10.2	21	13.3	4.1	10	8	3.3	16	4.3
11–12	13.7	12	14.3	9.4	14	13	7.3	10	7.0
12–13	17.9	10	17.3	17.0	12	13	10.2	15	16.1
13–14	13.9	7	11.9	19.0	10	18	9.8	12	14.5
14–15	14.9	12	8.1	16.5	14	19	24.4	10	18.6
15–16	12.7	7	6.4	16.8	10	14	28.9	14	28.1
16–17	5.1	3	1.9	8.4	7	5	8.8	9	7.9
17–18	0.4	1	1.0	0.5	—	—	0.7	1	0.8
18–18.5	0.2	—	0.2	0.4	—	—	—	—	—
Average range, yd	12,800	11,400	11,600	13,400	12,000	13,100	13,900	12,700	13,900

Table B35

GUN-TO-TARGET RANGE DISTRIBUTION FOR SELECTED TARGETS, 8-IN. HOW

Range, thous of yd	In static phase, %							In attack phase, %							In movement phase, %						
	Soft area target	Hard area target	Mobile target	Counter-battery target	Harassing fire	Registration fire	Total	Soft area target	Hard area target	Mobile target	Counter-battery target	Harassing fire	Registration fire	Total	Soft area target	Hard area target	Mobile target	Counter-battery target	Harassing fire	Registration fire	Total
3-4	–	–	–	–	–	–	0.1	–	–	–	–	–	–	–	–	–	–	–	1	–	0.2
4-5	–	–	–	–	–	–	–	–	–	2	–	1	–	0.2	–	–	–	–	–	–	–
5-6	4	1	6	1	3	–	1.4	–	–	–	1	–	–	0.5	–	–	–	–	–	1	0.2
6-7	–	6	12	1	7	1	2.4	–	1	3	1	3	3	1.6	5	–	–	1	–	–	0.3
7-8	–	11	6	2	1	–	3.3	–	6	3	–	1	4	1.3	–	16	2	1	1	–	1.5
8-9	4	11	–	2	5	6	4.5	19	3	–	1	5	1	2.4	–	9	–	–	1	–	0.8
9-10	31	10	12	6	7	11	7.8	6	6	5	3	4	1	3.5	5	11	7	3	1		3.4
10-11	8	19	12	9	14	21	12.5	13	11	13	5	5	13	6.0	15	18	7	6	3	5	6.0
11-12	–	20	–	14	17	11	14.0	25	19	10	9	11	14	10.4	15	13	8	5	8	8	7.5
12-13	11	9	12	20	12	24	17.2	6	19	13	20	10	9	15.7	25	5	18	11	11	15	14.0
13-14	15	3	17	16	5	12	11.7	6	13	13	20	17	14	18.0	5	5	10	14	13	15	12.6
14-15	19	6	12	15	13	3	12.1	13	11	15	16	16	23	16.1	5	7	23	22	23	17	18.9
15-16	8	3	11	9	11	11	8.9	–	11	10	16	17	17	15.9	25	16	15	24	28	31	25.2
16-17	–	–	–	4	4	–	3.1	12	–	13	8	8	1	7.7	–	–	10	11	10	6	8.6
17-18	–	–	–	1	1	–	0.8	–	–	–	–	1	–	0.4	–	–	–	2	–	1	0.8
18-18.5	–	1	–	–	–	–	0.2	–	–	–	–	1	–	0.3	–	–	–	–	–	–	–
Average range, yd	11,740	10,500	11,200	12,630	11,810	11,850	12,080	11,850	12,110	12,750	13,370	13,090	12,800	13,190	12,500	11,190	13,380	13,970	13,980	13,930	13,690

Table B36

RANGE DISTRIBUTION FROM FRONT LINE TO TARGET, 8-IN. HOW

Range, thous of yd	In static phase, %	In attack phase, %	In movement phase, %	Average, %
0–2	15	31	4	20
2–4	11	28	17	20
4–6	30	28	31	29
6–8	35	11	45	26
8–10	8	1	3	4
10–12	1	1	—	1
Average range, yd	5260	3520	5520	4540

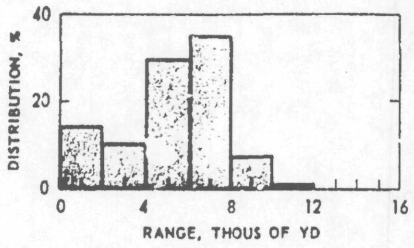


Fig. B27—Range Distribution from Front Line to Target, 8-in. How, Static Phase

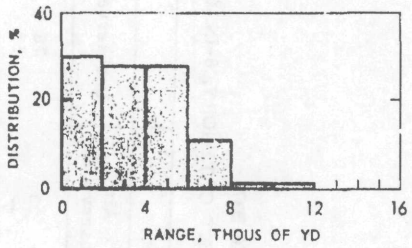


Fig. B28—Range Distribution from Front Line to Target, 8-in. How, Attack Phase

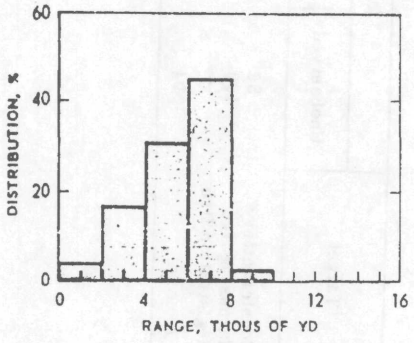


Fig. B29—Range Distribution from Front Line to Target, 8-in How, Movement Phase

Table B37

OBSERVATION BY TARGET CATEGORY, 8-IN. GUN

Target	In static phase, %			In attack phase, %		
	Unobserved	Ground observation	Air observation	Unobserved	Ground observation	Air observation
Counterbattery	56	11	33	78	—	22
Harassing fire	100	—	—	58	—	42
Registration fire	—	8	92	—	33	67
Average	94	1	5	59	1	40

Table B38

GUN-TO-TARGET RANGE DISTRIBUTION, 8-IN. GUN

Range, thous of yd	Percent of maximum range	In static phase, %	In attack phase, %	Average, %
13–14	39	1	—	1
14–15	42	1	1	1
15–16	45	—	1	1
16–17	48	2	—	1
17–18	51	1	—	1
18–19	54	—	—	—
19–20	56	2	—	1
20–21	59	2	—	1
21–22	62	10	4	7
22–23	65	7	4	5
23–24	68	6	8	6
24–25	70	24	7	15
25–26	73	9	6	8
26–27	76	10	17	12
27–28	79	8	1	5
28–29	82	8	15	12
29–30	85	6	6	5
30–31	87	2	20	11
31–32	90	1	8	5
32–33	93	—	—	—
33–34	96	--	1	1
34–35.5	100	—	1	1
Average range, yd		24,720	27,310	26,000

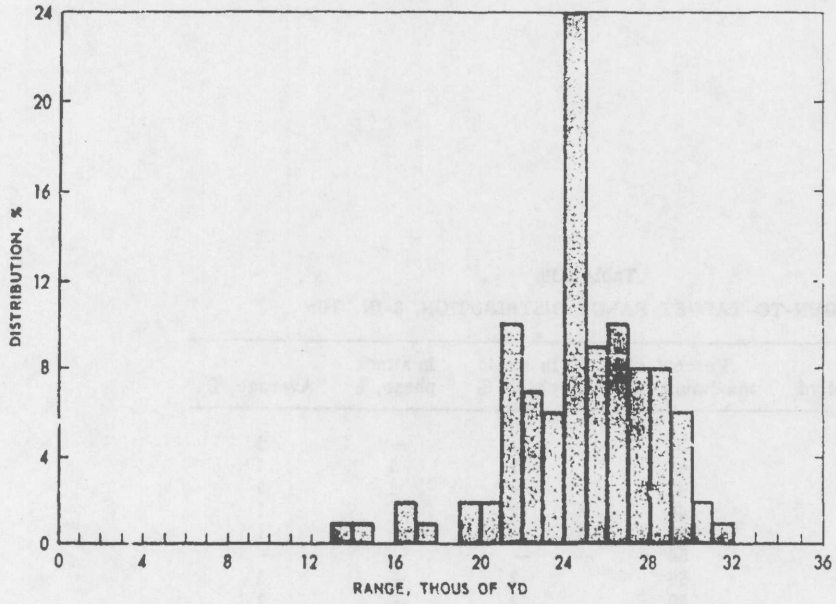


Fig. B30—Gun-to-Target Range Distribution, 8-in. Gun, Static Phase

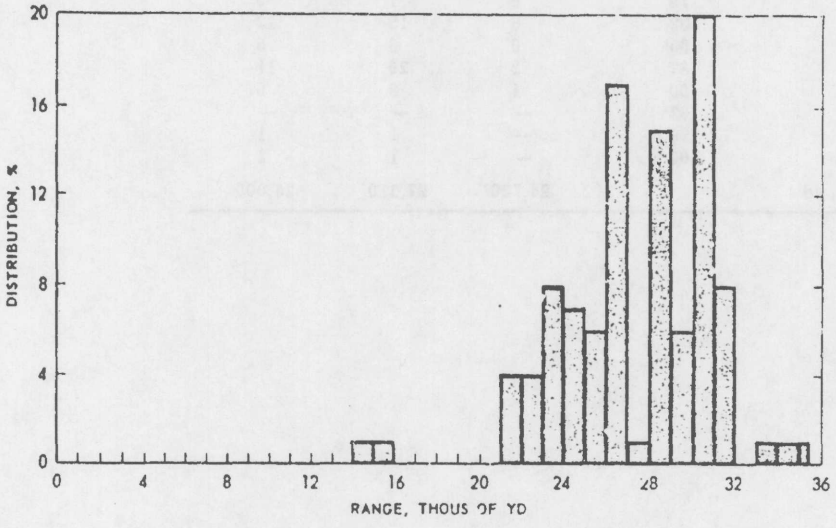


Fig. B31—Gun-to-Target Range Distribution, 8-in. Gun, Attack Phase

Table B39

OBSERVATION BY TARGET CATEGORY, 240-MM HOW

Target	In static phase, %			In attack phase, %		
	Unobserved	Ground observation	Air observation	Unobserved	Ground observation	Air observation
Point	20	20	60	95	—	5
Mobile	50	—	50	33	67	—
Counterbattery	60	2	38	84	1	15
Harassing fire	25	6	69	85	2	13
Registration fire	3	42	55	—	37	63
Average	50	6	44	82	2	16

Table B40

GUN-TO-TARGET RANGE DISTRIBUTION, 240-MM HOW

Range, thous of yd	Percent of maximum range	In static phase, %	In attack phase, %	Average, %
6–7	28	—	1.0	0.4
7–8	32	0.3	0.3	0.3
8–9	36	0.5	8.4	3.5
9–10	40	0.3	—	0.2
10–11	44	0.3	—	0.2
11–12	48	0.5	0.6	0.6
12–13	52	3.3	1.6	2.8
13–14	56	5.1	2.6	4.4
14–15	60	8.7	4.8	7.7
15–16	63	13.3	2.6	10.0
16–17	67	10.2	10.3	10.2
17–18	71	9.7	6.4	8.9
18–19	75	16.4	11.6	14.6
19–20	79	7.4	16.1	10.4
20–21	83	12.5	10.9	11.4
21–22	87	5.4	10.3	6.8
22–23	91	4.6	4.8	4.4
23–24	95	1.5	5.1	2.5
24–25.2	100	—	2.6	0.7
Average range, yd		17,580	18,000	17,600

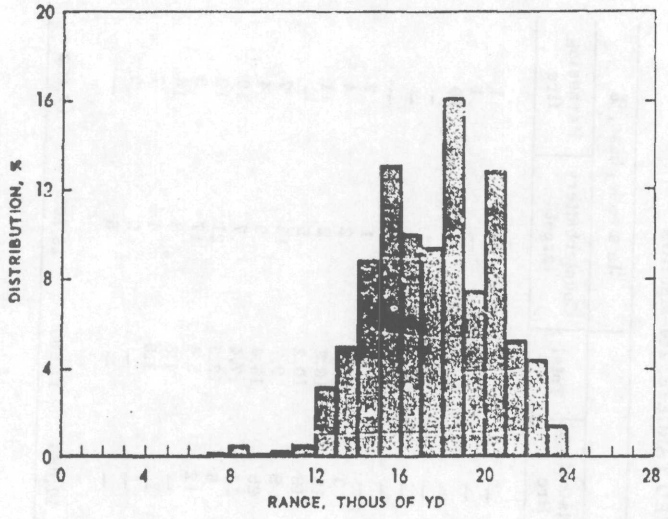


Fig. B32—Gun-to-Target Range Distribution, 240-mm How, Static Phase

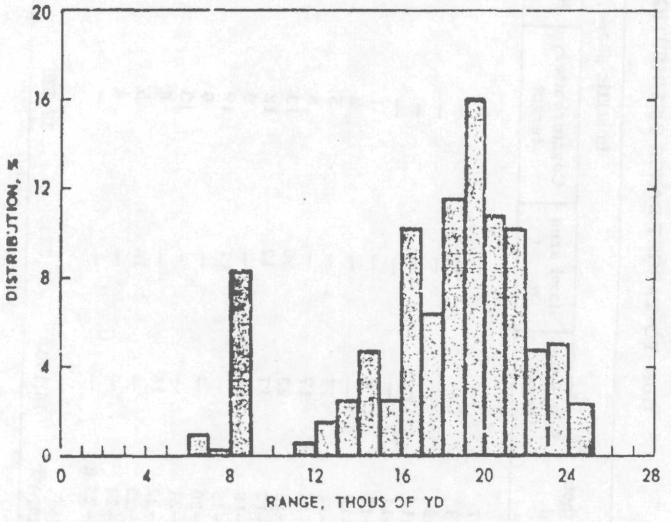


Fig. B33—Gun-to-Target Range Distribution, 240-mm How, Attack Phase

Table B41

GUN-TO-TARGET RANGE DISTRIBUTION FOR SELECTED TARGETS, 240-MM HOW

Range, thous of yd	In static phase, %						In attack phase, %	
	Soft area target	Hard area target	Counterbattery target	Harassing fire	Registration fire	Total	Counterbattery target	Harassing fire
6–7	—	—	—	—	—	—	—	1
7–8	—	—	—	2	—	0.3	—	1
8–9	—	—	—	3	—	0.5	—	10
9–10	—	—	—	—	—	0.3	—	—
10–11	—	—	—	2	—	0.5	—	—
11–12	—	—	1	—	—	3.3	1	—
12–13	—	—	2	10	—	5.1	1	2
13–14	17	—	5	5	3	8.7	2	4
14–15	17	—	8	10	15	13.3	2	11
15–16	23	50	13	5	18	10.2	5	—
16–17	17	17	12	2	9	9.7	13	7
17–18	—	—	9	8	25	16.4	9	4
18–19	—	17	19	10	12	7.4	7	19
19–20	—	—	6	17	6	12.5	21	12
20–21	—	—	13	13	12	5.4	17	3
21–22	16	—	6	3	—	4.6	8	14
22–23	—	16	5	5	—	1.5	4	7
23–24	—	—	1	5	—	—	5	5
24–25.2	—	—	—	—	—	—	5	—
Average range, yd	16,170	17,730	17,730	17,320	17,080	17,580	19,200	17,460

Table B42

RANGE DISTRIBUTION FROM FRONT LINE TO TARGET, 240-MM HOW[a]

Range, thous of yd	In static phase, %	In attack phase, %	Average, %
0–2	1	5	4
2–4	2	12	9
4–6	5	27	20
6–8	10	25	20
8–10	27	15	19
10–12	34	6	15
12–14	15	6	8
14 +	6	4	5
Average range, yd	10,040	6900	7860

[a]There was no firing during the movement phase.

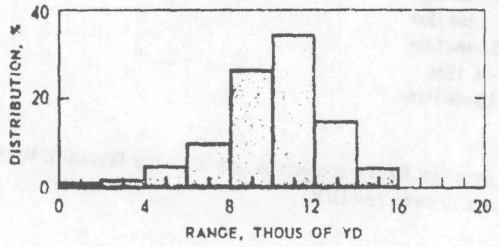


Fig. B34—Range Distribution from Front Line to Target, 240-mm How, Static Phase

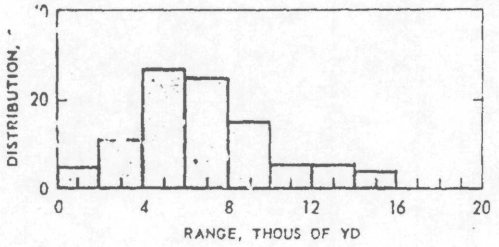


Fig. B35—Range Distribution from Front Line to Target, 240-mm How, Attack Phase

Appendix C

MOVEMENT OF ARTILLERY UNITS

INTRODUCTION

The frequency of movement for the artillery units in the Italian campaign was computed for three phases of the action. These three phases are slightly different from those used in the previous appendixes; there was no attempt to compute either the frequency of moves or the decrease in rounds fired during moves in the static phase. Moves made during the static phase were made for tactical purposes; they were well planned, and moves were made into fully prepared positions. The attack phase is unchanged in this appendix from that used in App B. The movement phase has been divided into slow and rapid movement This movement phase lasted from 1 to 17 Jun 44 and involved the capture of Rome. On approximately 17 June the German forces were able to offer fully organized resistance to the Allied advance, and the rate of movement decreased from an average of 8 miles/day to an average of 2 miles/day. The frequency of these moves, in terms of the number of days between moves, is given in Table C1 for all the weapons except the 8-in. gun. There were only two batteries of the 8-in. gun in the Italian campaign, and these units did not move often enough to provide reasonable data for analysis. The average distance in each move is also given in Table C1. The distance that is listed in this table is the straight-line distance between firing locations; it was not possible to obtain the actual mileage of each move. An attempt was made to relate the distance moved with the time required to move. In terms of the straight-line distances, the average speed of the 105-mm How and the 155-mm How battalions was 3 mph, that of the 155-mm gun and 8-in. How battalions was 2 mph.

The average firing on days that the unit moves is compared with the average firing on days that the unit does not move in Table C2 and Fig. C1. This decrease in the ability to fire is spread over several days. In the attack phase the moves are relatively short; there is some decrease in the number of rounds fired on the days before and after the listed day of the move because these battalions move by batteries. In the movement phase the moves may become long enough so that all batteries are moving at one time, even though the time of beginning the move is different for each battery. The figures for the average firing on days before and after the move are given in Figs. C2 to C8. These figures are only for the period the attack and the slow advance; as the frequency of moves increased it became impossible to find any single move easily separated from other moves. Even in the period of a slow movement it was impossible to obtain the decrease in the number of rounds fired by 105-mm How battalions.

Table C1

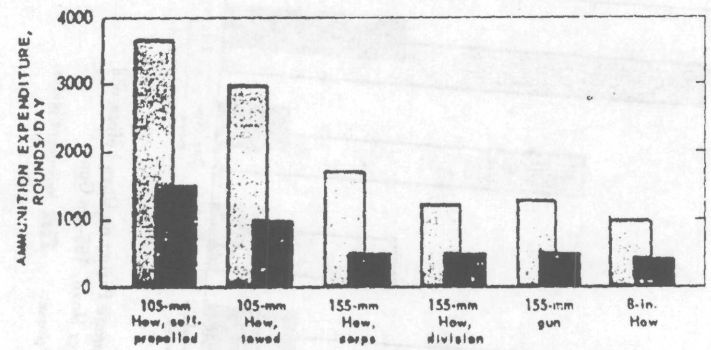
DAYS BETWEEN BATTALION MOVES AND AVERAGE DISTANCE MOVED

Weapon	Attack phase		Movement phase			
			Slow movement		Rapid movement	
	Days	Distance, thous of yd	Days	Distance, thous of yd	Days	Distance, thous of yd
105-mm How						
SP	2.2	5.1	1.8	8.1	1.2	13.2
Towed	3.4	5.9	2.7	7.5	1.2	12.9
4.5-in. gun	4.0	6.6	3.2	12.0	—	—
155-mm How	2.9	6.8	2.6	9.4	1.5	13.3
155-mm gun	4.8	5.8	3.1	11.2	2.2	18.1
8-in. How	5.3	7.9	2.6	8.6	2.1	16.0
240-mm How	10.0	8.5	6.3	16.8	—	—

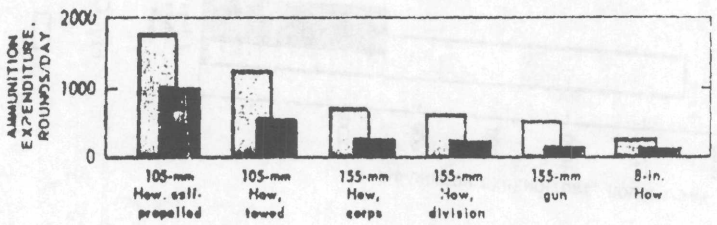
Table C2

AVERAGE ROUNDS PER DAY

Weapon	Rounds fired on day unit does not move		Rounds fired on day unit does move	
	Attack phase	Movement phase	Attack phase	Movement phase
105-mm How				
SP	3700	1800	1500	1000
Towed	3000	1200	1000	550
155-mm How				
Corps	1700	670	470	260
Divisional	1200	600	500	200
155-mm gun	1300	470	520	100
8-in. How	1000	240	400	[illegible]



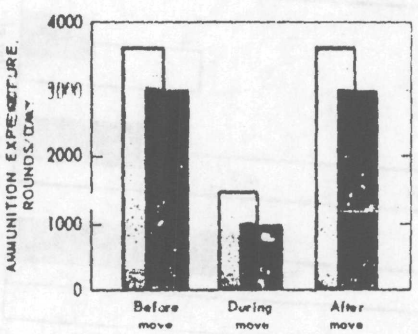
a. Attack Phase



b. Movement Phase

Fig. C1—Average Rounds Fired per Day

Firing on day unit does not move.
Firing on day unit moves.



Attack Phase

Fig. C2—Average Firing on Days before and and after Move, 105-mm How

Self-propelled. Towed.

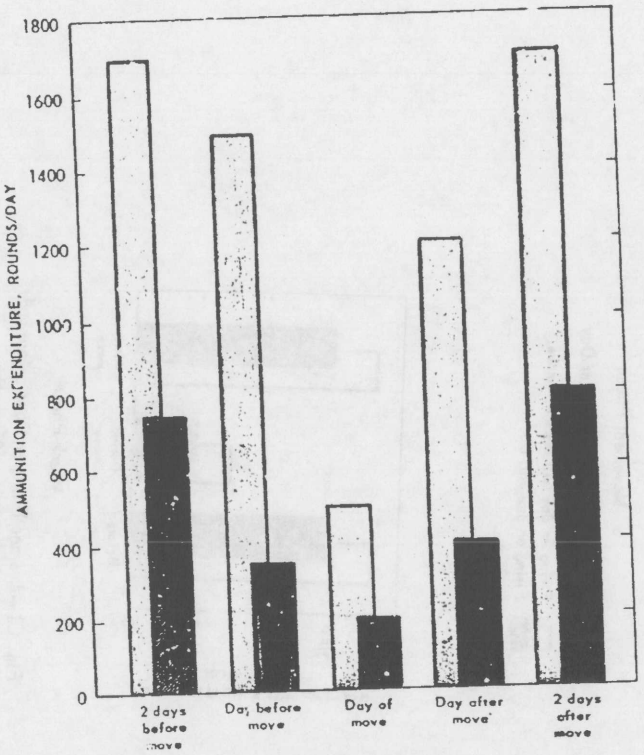


Fig. C3—Average Firing on Days before and after Move, 155-mm How

Attack phase. Movement phase.

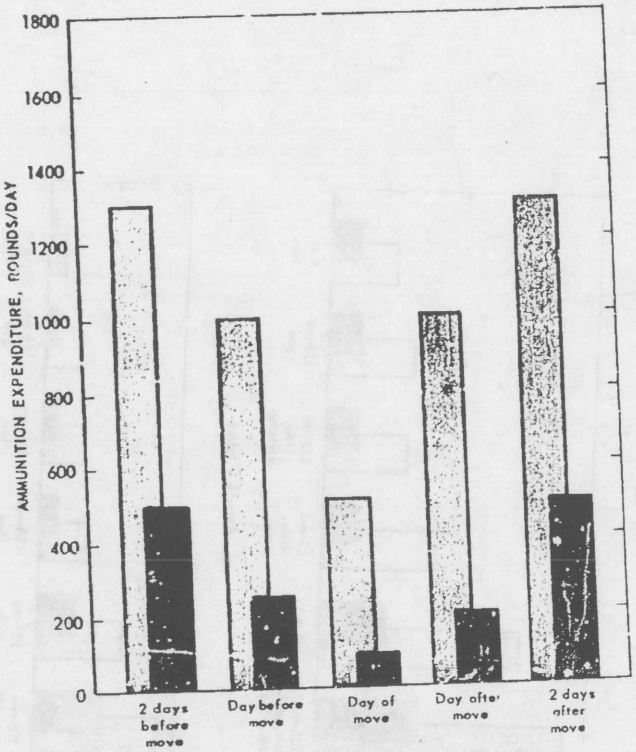


Fig. C4—Average Firing on Days before and after Move, 155-mm Gun

Attack phase. Movement phase.

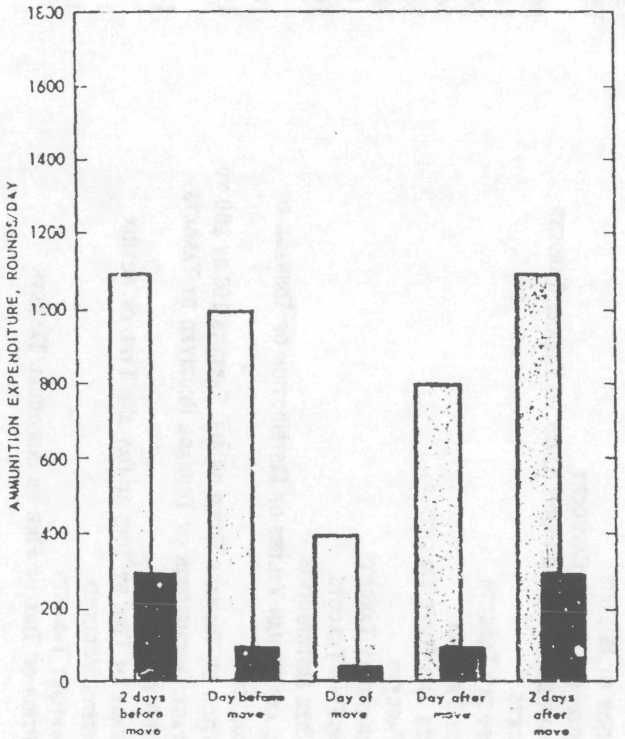


Fig. C5—Average Firing on Days before and after Move, 8-in. How

Attack phase. Movement phase.

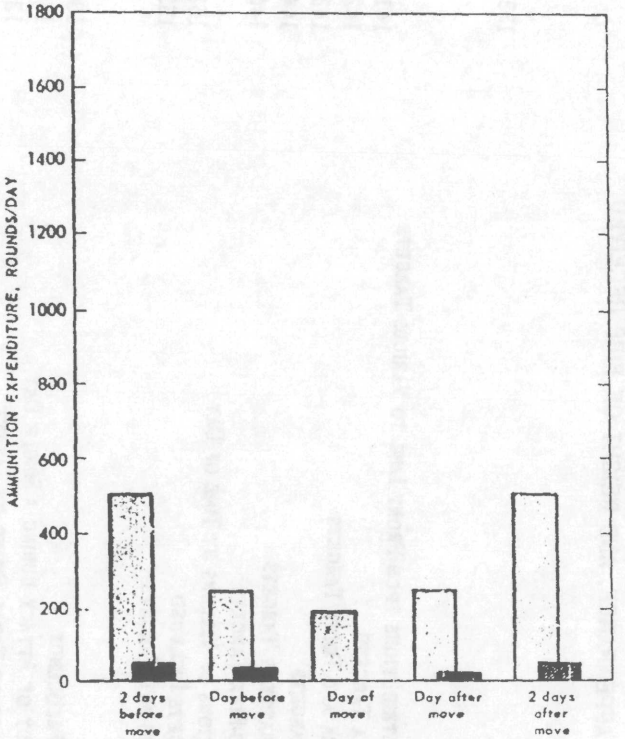


Fig. C6—Average Firing on Days before and after Move, 240-mm How

Attack phase. Movement phase.

Appendix D

TARGET CHARACTERISTICS—RANGE, FREQUENCY, TIME OF APPEARANCE, AND WEIGHT OF FIRE RECEIVED

INTRODUCTION

The targets that appeared in the Italian campaign have been grouped into the nine categories mentioned in App B. The categories of soft area, hard area, point, and mobile targets were further grouped into a block of targets that would closely reflect the frequency of close-support missions. These targets are attacked as soon as they are identified. The frequency of appearance of these targets is shown in Table D1; the table is based on the appearance of the targets, not the number of missions that are fired at the targets. Table D2 shows the distribution of the number of missions fired at each target that appeared. From Table D1 it is seen that the close-support targets form 16, 24, and 45 percent of the target complex in the static, attack, and movement phases. The frequency of repeated attacks, Table D2, explains the difference between the distribution of the missions fired and the frequency of appearance. A category of registration locations is listed in Table D1; these are locations that received registration fire, but were not the targets of any other mission. Although the normal aiming point of a registration is a road intersection, these missions are not fired to interdict traffic, and the two target categories cannot be combined.

Table D3 shows the distribution of missions fired by all the weapons in division artillery and corps artillery. Table D4 shows the distribution of ammunition tonnage fired by these organizations. From Table D3 it is apparent that the close-support targets received 40 percent of the missions fired by division artillery during the static phase; in this static phase the close-support targets received about 39 percent of the ammunition tonnage fired by the division weapons.

The percentage of observation used in firing these missions is shown in Table D5. The percentage of observation in terms of the targets is shown in Table D6. If a single mission were fired on the target the observation of that mission was recorded; if a concentration of several missions were fired on a single target the observation of the first mission was recorded. In all three phases, at least half the fire on close-support targets was adjusted with visual observation. Only in the movement phase was more than half the fire on counterbattery targets adjusted fire. Between 13 and 18 percent of the harassing fire was adjusted in all three phases.

The range distribution from front line to target is given in Tables D7 to D13 and in Figs. D1 to D5, first, for the total target complex, and then for the individual targets. Early in the analysis it was apparent that there was no significant difference between the range distributions from front line to target of the tonnage fired and the missions fired. There was a significant difference between the range distributions of either missions or tons and the distributions of rounds fired. Since the lethality of the ammu-

nition is related to the tonnage, and since the tonnage distribution is not significantly different from that of the missions, all target range distributions have been computed in terms of the missions.

The range distributions of hard area and point targets have been combined because they show no significant difference. These hard area targets, infantry entrenchments and weapons, are often organized about a fortified position, a point target that becomes an integral part of the complex. Although the range distributions of the soft area, hard area, and mobile targets are all different the three do not show a significant difference between attack and movement phases. The counterbattery targets show no significant difference in the range distributions during the static and attack phases; there is a real difference between the attack and movement phases. A higher percentage of the counterbattery targets are in the range from 0 to 2000 yd in the attack than in the static phase. In this attack the German forces were retreating and the increased percentage of targets in the first zone is caused by the lagging of artillery batteries as they move to the rear. The range distributions of harassing fire are different in all three phases. In the static phase the majority of the harassing and interdiction missions are at ranges over 6000 yd. In the attack phase the majority of the harassing missions are at ranges of less than 4000 yd; they are on targets that were troublesome during the day, and the average range of harassing fire is considerably shorter. In the movement phase the harassing fire shifts again to the long-range targets.

In the analysis an attempt was made to find the frequency of attack on large areas covered by counterbattery, area, and groups of mobile targets. To do this missions were plotted and were combined if they were fired on similar types of targets, in the same general area, and were fired at approximately the same time. Since the original firing records did not list the technique of fire or the area covered by the target the minimum area covered by these combined missions has been treated as the approximate size of the target. Areas that were used for this analysis were those in which all firing was available; in order to minimize the effect of the terrain in channeling the enemy forces, samples were taken from several unrelated areas and were taken at different time intervals. Frequency distributions of target areas were obtained from samples of 50 to 100 target groupings, (Table D14).

Target size distributions were obtained for only the soft area, hard area, mobile, and counterbattery firing. The point and hard area targets have been combined in this section as they were combined in the section on range distributions from front line to target. Most of the targets containing both personnel and vehicles occurred in groups of soft personnel targets; as a result these missions have been used to help define the area covered by soft targets. No attempt was made to determine the area covered by harassing, interdiction, or preparation missions; since this area is not a tactical parameter it is determined by the commander of the firing unit.

The pattern of firing did not reveal any size distribution of the close-support targets during the static phase. This does not mean that large targets did not exist during any stalemate but only that the fire placed on these

targets was not sufficiently heavy to delineate an area. Size distributions were obtained for counterbattery targets during the static phase but these did not differ from those obtained in both the attack and the movement phases. The average area covered by these targets along with the approximate dimensions of the average target are also given in Table D14. The average number of targets that appeared in a single day on a 10,000-yd front is also shown in Table D14. These targets do not have the same relative frequency as do the same targets in Table D1; the difference is caused by the grouping of some targets and not of others.

The average and median values of tonnage distribution is shown in Table D15. The distribution of the tonnage fired on all targets 100 by 100 yd in area is shown in Table D16. There would be a significant difference between this distribution and that of the tonnage fired on close-support targets in the static phase only. All the tonnage distributions fit a log-normal distribution, i.e., the logarithm of the tonnage fired has a normal distribution. The distribution of tons fired in the static phase comes fairly close to fitting a Poisson curve also but the upper 4 percent of the concentrations are at values too high to allow the use of a Poisson distribution. The 4 percent consisted entirely of counterbattery and bridge destruction missions. In both the attack and movement phases, the target frequency distributions did not depend on the amount of ammunition fired. The average and median values of the distribution increase with increasing a target size in the attack and movement phases; they do not increase in the static phase. The average and median values of these distributions are given in Table D15 for target sizes of 100 by 100, 200 by 200, and 500 by 500 yd.

Table D17 shows the distribution of tonnage fired at the individual types of targets in the three phases. All these distributions are log-normal distributions; in no instance was there any indication of a possible upper limit to the amount of ammunition fired at a single target. These tables are given for a target size of 100 by 100 yd.

The distribution of the time of completion of firing is given in Table D18. The use of the time of completion of these missions as a measure of the level of firing by time of day is poor only when harassing missions are included. Table D18 and Fig. D6 show the time distribution of fire on all targets. This curve reaches its maximum between 0400 and 0600. This time interval contains most of the harassing missions; the majority of these were programed to be completed at 0430 or 0500. The time distribution of the fire on close-support targets is shown in Table D19 and Fig. D7. This distribution reaches its maximum between 1900 and 2100 during the static phase and 1500 and 1700 in both the attack and movement phases. Table D20 presents the distribution of time of fire on the individual targets. With the exception of the infantry supporting fire, very little of the fire on close-support targets was fired between 2400 and 0800. This infantry supporting fire was most likely preparation fire prior to an attack. In the static phase about 40 percent of the fire on infantry support targets occurred in this interval. With the exception of the movement phase the fire on counterbattery targets was distributed evenly throughout the day; in the movement phase the counterbattery targets are attacked most often in the afternoon and evening.

Table D1

TARGET FREQUENCY

Target	Static phase, %	Attack phase, %	Movement phase, %
Soft area	4.3	9.5	16.9
Hard area	5.1	3.8	3.8
Point	3.4	2.5	6.1
Mobile	3.7	8.0	18.0
Counterbattery	39.0	27.0	11.0
Preparation fire	5.0	8.0	4.5
Harassing fire	25.0	30.0	28.0
Registration fire	13.7	10.1	11.0
Miscellaneous fires	0.8	1.1	0.7

Table D2

FREQUENCY OF ATTACK DURING A SINGLE DAY

Number of times target attacked	Static phase,[a] %	Attack phase,[b] %	Movement phase,[a] %
1	85	71	88
2	11	17	8
3	2	7	3
4	2	3	1
5	—	1	—
6	—	1	—

[a] Average number of times attacked is 1.2.
[b] Average number of times attacked is 1.5.

Table D3

PERCENTAGE OF TOTAL FIRING BY TARGET

Target	Static phase		Attack phase		Movement phase	
	Division	Corps	Division	Corps	Division	Corps
Soft area						
Personnel	9.9	5.6	11.5	2.3	17.5	10.9
TOT	6.2	2.9	3.1	0.8	1.9	1.6
Infantry support	1.2	0.7	3.9	1.3	0.4	0.2
Infantry defense	0.8	0.6	7.1	1.4	2.7	1.8
Hard area						
Personnel and weapons	3.2	1.4	2.4	0.4	2.6	1.4
Artillery rockets	0.5	0.4	0.4	0.7	0.8	0.6
Mortars	5.2	2.7	1.7	0.2	2.4	1.2
Supply areas	0.6	0.6	0.6	--	0.2	0.2
Point	6.9	6.9	3.9	4.0	8.2	6.5
Mobile						
Vehicles	3.3	2.6	4.1	1.6	8.0	6.9
Tanks	1.0	0.7	5.3	2.4	5.7	4.1
SP guns	1.3	0.9	0.9	0.3	2.5	1.5
Counterbattery	10.5	33.6	8.9	41.4	10.5	17.6
Preparation fire	3.9	2.4	18.6	8.4	3.2	3.6
Harassing fire	25.3	18.2	17.5	19.6	17.9	20.8
Interdiction fire	4.0	6.3	1.6	8.3	3.4	6.9
Registration fire	10.8	11.0	7.3	6.6	11.2	13.8
Miscellaneous fires						
Smoke	0.1	0.1	1.1	0.1	0.8	0.3
Propaganda	1.8	0.8	0.1	—	0.1	0.1
Training and testing	3.5	1.6	—	0.2	—	—

Table D4

PERCENTAGE OF TONS OF AMMUNITION ALLOCATION FIRED

Target	Static phase		Attack phase		Movement phase	
	Division	Corps	Division	Corps	Division	Corps
Soft area						
Personnel	8.7	2.7	5.7	2.1	14.3	6.4
TOT	6.0	—	1.9	0.5	2.1	1.4
Infantry support	2.2	—	8.9	1.6	4.8	1.4
Infantry defense	2.0	0.8	8.7	1.8	1.6	—
Hard area						
Personnel and weapons	2.3	—	1.0	0.2	2.1	—
Artillery rockets	0.8	0.5	0.5	0.6	1.0	0.3
Mortars	5.0	0.8	0.9	0.4	1.7	0.5
Supply areas	—	0.9	0.1	—	—	—
Point	6.7	11.2	3.4	5.1	8.2	5.0
Mobile						
Vehicles	3.0	2.0	1.9	2.1	7.3	6.0
Tanks	1.0	0.5	4.0	2.5	5.8	3.9
SP guns	1.7	0.6	0.6	0.2	2.3	0.5
Counterbattery	21.9	53.7	12.5	34.8	12.6	25.6
Preparation fire	10.2	1.3	22.9	8.2	5.8	5.5
Harassing fire	17.0	10.5	19.6	22.9	21.0	27.3
Interdiction fire	5.5	8.2	5.1	14.6	5.1	11.0
Registration fire	3.7	6.3	1.5	2.2	3.1	5.2
Miscellaneous fires						
Smoke	0.8	—	0.7	0.1	1.0	—
Propaganda	0.8	—	—	—	—	—
Training and testing	0.7	—	0.1	0.1	—	—

Table D5

OBSERVATION OF MISSIONS

Phase of action	Unobserved, %		Ground observation, %		Air observation, %	
	Division	Corps	Division	Corps	Division	Corps
Static	71	54	12	40	17	6
Attack	81	44	7	46	12	10
Movement	69	29	13	57	18	14

Table D6

OBSERVATION BY TARGET CATEGORY

Target	In static phase, %			In attack phase, %			In movement phase, %		
	Unobserved	Ground observation	Air observation	Unobserved	Ground observation	Air observation	Unobserved	Ground observation	Air observation
Soft area	24.4	71.2	4.4	42.2	53.8	4.0	28.5	64.0	7.5
Hard area	23.5	66.0	10.5	11.0	76.0	13.0	5.1	80.0	14.9
Point	15.2	68.8	16.0	40.0	49.0	11.0	22.5	62.0	15.5
Mobile	11.4	71.1	17.5	12.2	61.3	26.5	10.2	59.8	30.0
Counterbattery	71.4	15.4	13.2	61.4	19.8	18.8	37.5	31.5	31.0
Preparation fire	95.4	3.9	0.7	95.2	4.3	0.5	79.9	17.5	2.6
Harassing fire	87.0	9.8	3.2	86.9	7.5	5.6	81.7	12.3	6.0

Table D7

RANGE DISTRIBUTION FROM FRONT LINES TO ALL TARGETS

Range, thous of yd	In static phase, %	In attack phase, %	In movement phase, %
0–2	20	58	37
2–4	45	25	33
4–6	20	10	18
6–8	10	4	6
8–10	3	1.5	3
10–12	1	1.0	2
12–16	1	0.5	1
Average range, yd	3760	2400	3300

Table D8

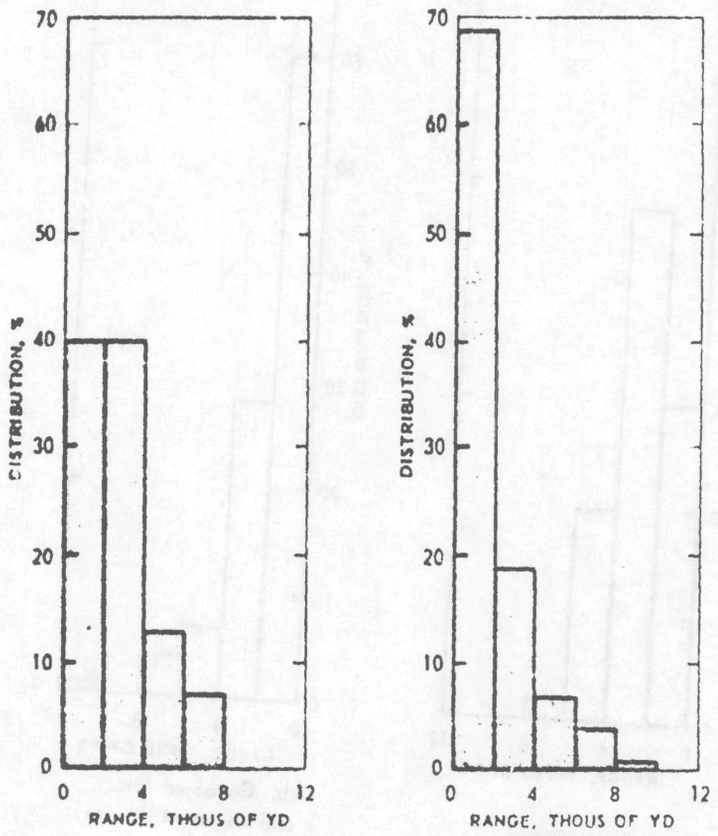
RANGE DISTRIBUTION FROM FRONT LINES TO CLOSE-SUPPORT TARGETS

Range, thous of yd	In static phase, %	In attack phase, %	In movement phase, %
0–2	32	55	54
2–4	46	24	27
4–6	19	11	16
6–8	3	7	1
8–10	—	2	1
10–12	—	1	1
Average range, yd	2860	2600	2400

Table D9

RANGE DISTRIBUTION FROM FRONT LINES TO SOFT AREA TARGETS

Range, thous of yd	In static phase, %	In attack phase, %	In movement phase, %	In combined phases, %
0–2	40	69	69	69
2–4	40	19	20	19
4–6	13	6	11	7
6–8	7	4	—	4
8–10	—	2	—	1
Average range, yd	2700	2000	1800	2000



a. Static Phase

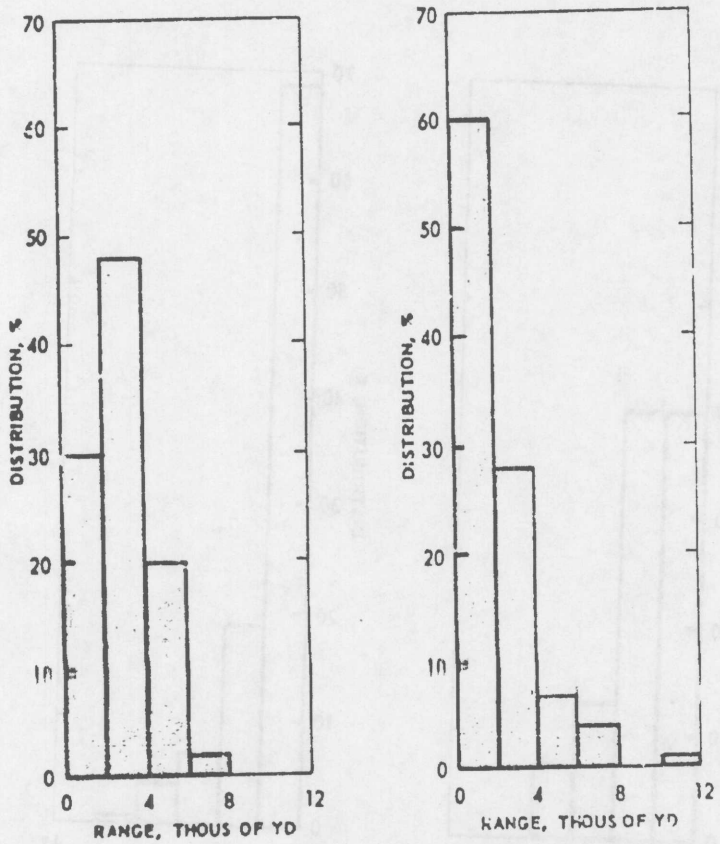
b. Combined Attack and Movement Phases

Fig. D1—Range Distribution from Front Line to Soft Area Targets

Table D10

RANGE DISTRIBUTION FROM FRONT LINES TO HARD AREA AND POINT TARGETS

Range, thous of yd	In static phase, %	In attack phase, %	In movement phase, %	In combined phases, %
0–2	30	59	54	60
2–4	48	23	39	28
4–6	20	13	7	7
6–8	2	4	—	4
8–10	—	—	—	—
10–12	—	1	—	1
Average range, yd	2900	2300	2100	2200



a. Static Phase

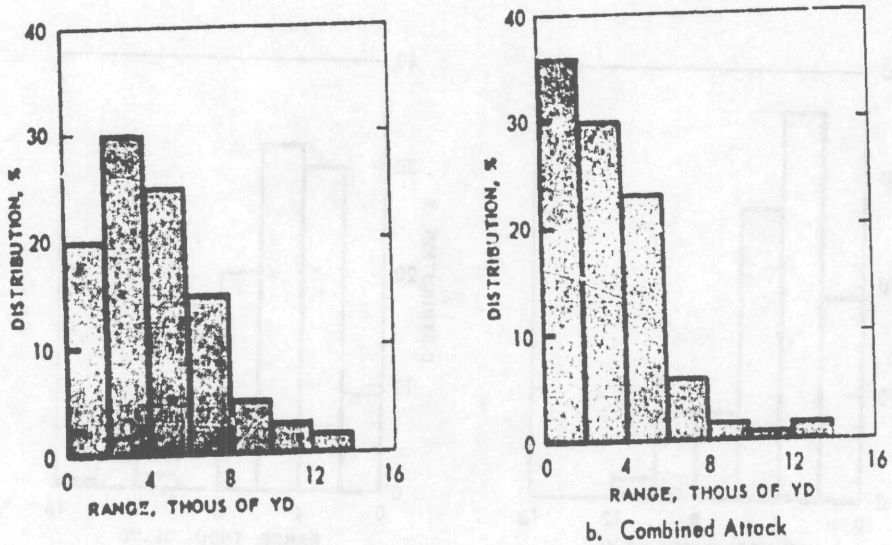
b. Combined Attack and Movement Phases

Fig. D2—Range Distribution from Front Line to Hard Area and Point Targets

Table D11

RANGE DISTRIBUTION FROM FRONT LINES TO MOBILE TARGETS

Range, thous of yd	In static phase, %	In attack phase, %	In movement phase, %	In combined phases, %
0–2	20	33	40	36
2–4	30	31	28	30
4–6	25	21	26	23
6–8	15	10	2	6
8–10	5	4	—	2
10–12	3	—	2	1
12–14	2	1	2	2
Average range, yd	4400	3500	3200	3400



a. Static Phase

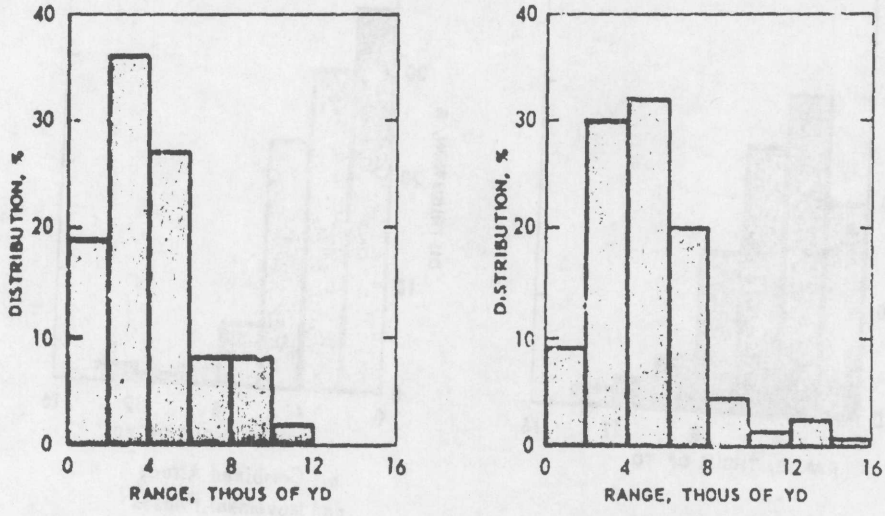
b. Combined Attack and Movement Phases

Fig. D3—Range Distribution from Front Line to Mobile Targets

Table D12

RANGE DISTRIBUTION FROM FRONT LINES TO COUNTERBATTERY TARGETS

Range, thous of yd	In static phase, %	In attack phase, %	In movement phase, %	In combined phases, %
0–2	5	13	19	9
2–4	32	28	36	30
4–6	35	29	27	32
6–8	22	18	8	20
8–10	4	5	8	4.5
10–12	1	2	2	1.5
12–14	1	4	—	2.5
14–16	—	1	—	0.5
Average range, yd	4900	5000	4100	4960



a. Movement Phase

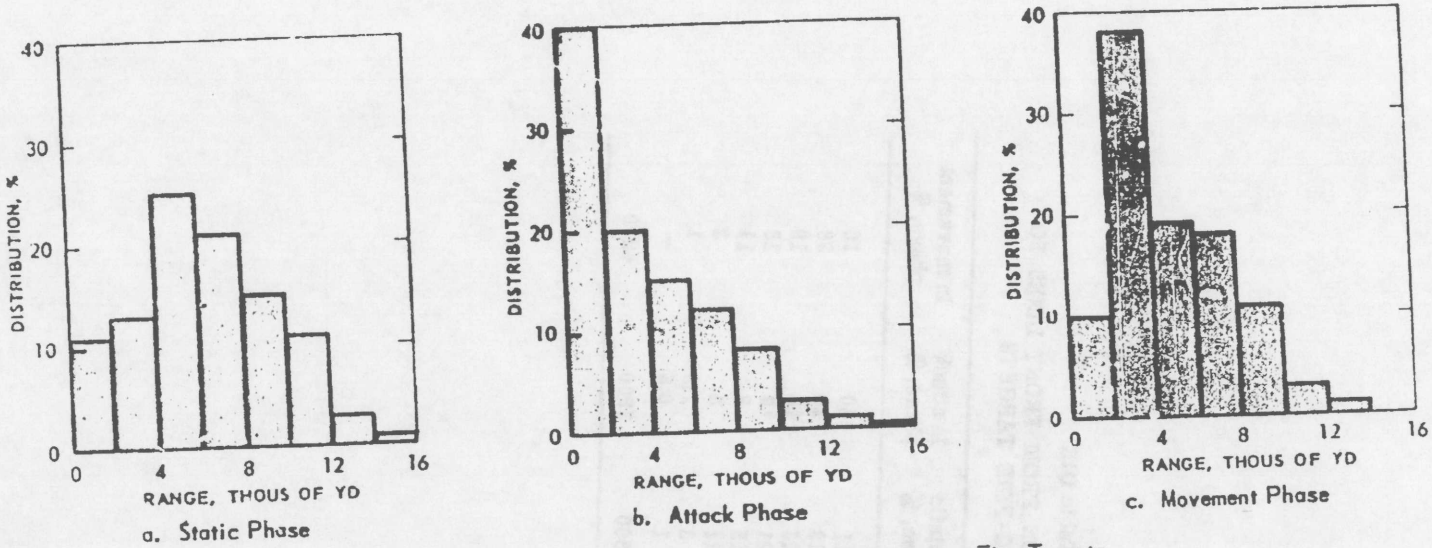
b. Combined Attack and Static Phases

Fig. D4—Range Distribution from Front Line to Counterbattery Targets

Table D13

RANGE DISTRIBUTION FROM FRONT LINES TO HARASSING-FIRE TARGETS

Range, thous of yd	In static phase, %	In attack phase, %	In movement phase, %
0–2	11	40	10
2–4	13	20	38
4–6	25	15	19
6–8	21	12	18
8–10	15	8	11
10–12	11	3	3
12–14	3	1.5	1
14–16	1	0.5	—
Average range, yd	6300	3900	4900



a. Static Phase

b. Attack Phase

c. Movement Phase

Fig. D5—Range Distribution from Front Line to Harassing-Fire Targets

Table D14

TARGET SIZE DISTRIBUTION

Target size, yd	In attack phase, %				In movement phase, %			
	Soft area target	Hard area target	Mobile target	Counter-battery target	Soft area target	Hard area target	Mobile target	Counter-battery target
100 × 100	49	78	67	75	75	77	80	82
200 × 200	13	6	12	9	7	—	4	4
300 × 300	12	7	10	11	8	5	11	4
500 × 500	13	4	11	4	8	14	5	8
750 × 750	5	4	—	1	2	4	—	2
1000 × 1000	5	3	—	—	—	—	—	—
1500 × 1500	—	1	—	—	—	—	—	—
2000 × 1500	2	—	—	—	—	—	—	—
3000 × 1500	1	—	—	—	—	—	—	—
Average area, sq yd	24×10^4	9.4×10^4	4.8×10^4	3.8×10^4	5×10^4	6.8×10^4	3.2×10^4	4.5×10^4
Average size, yd	500 × 500	300 × 300	220 × 220	200 × 200	230 × 230	250 × 250	180 × 180	210 × 210
Average no. of targets on a 10,000-yd front	10.4	7.7	5.6	32	4.0	4.7	5.0	4.0

Table D15

AVERAGE AND MEDIAN VALUES OF DISTRIBUTION OF TONNAGE ON ALL TARGETS

Target size, yd	Static phase, tons	Attack phase, tons	Movement phase, tons
	Average Values		
100 x 100	0.81	2.36	1.41
200 x 200	0.82	2.48	1.45
500 x 500	0.83	2.79	1.54
	Median Values		
100 x 100	0.53	1.21	0.79
200 x 200	0.55	1.25	0.86
500 x 500	0.56	1.30	0.94

Table D16

DISTRIBUTION OF TONNAGE FIRED ON ALL TARGETS 100 BY 100 YD

Ammunition fired, tons	Static phase, %	Attack phase, %	Movement phase, %
0.01–0.20	8.8	5.4	9.2
0.21–0.40	24.0	11.1	16.2
0.41–0.60	22.1	14.3	12.5
0.61–0.80	11.6	6.7	10.0
0.81–1.00	9.4	6.3	7.7
1.01–1.20	6.4	6.7	6.6
1.21–1.40	3.7	4.3	4.4
1.41–1.60	2.5	4.3	4.7
1.61–1.80	2.7	5.0	2.4
1.81–2.00	2.4	1.4	3.8
2.01–2.50	2.5	8.3	9.5
2.51–3.00	1.0	3.9	3.6
3.01–3.50	1.6	2.6	1.5
3.51–4.00	—	3.8	2.1
4.01–4.50	0.3	2.1	1.4
4.51–5.00	—	2.7	1.3
5.01–5.50	0.2	1.6	0.5
5.51–6.00	0.3	0.8	0.4
6.01–6.50	—	0.3	0.4
6.51–7.00	—	0.7	0.3
7.01–7.50	0.3	1.4	0.3
7.51–8.00	0.2	0.7	0.3
8.01–8.50	—	0.4	0.2
8.51–9.00	—	0.8	—
9.01–9.50	—	0.1	—
9.51–10.00	—	1.0	0.1
10.01–15.00	—	2.0	0.3
15.01–20.00	—	0.4	0.1
20.01–25.00	—	0.4	—
25.01–30.00	—	0.4	—
30.01–35.00	—	0.1	0.2
Average	0.81	2.36	1.41
Median	0.53	1.21	0.79

Table D17

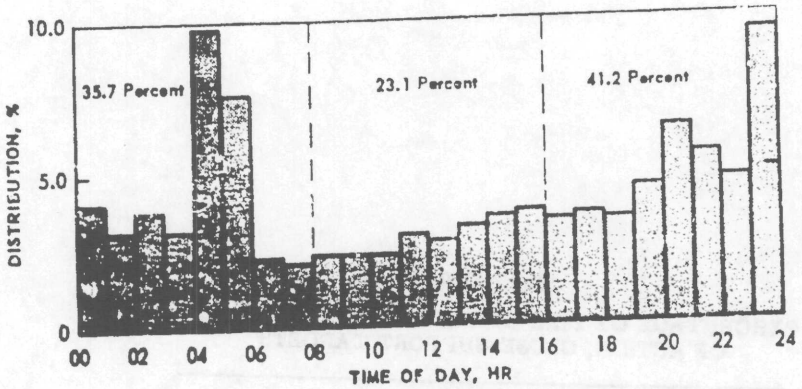
PERCENTAGE DISTRIBUTION OF TONNAGE RECEIVED BY TARGETS 100 BY 100 YD

Ammunition fired, kms	Soft area targets, %			Hard area targets, %			Point targets, %			Mobile targets, %			Counterbattery targets, %			Preparation fire, %			Harassing fire, %		
	Static phase	Attack phase	Movement phase	Static phase	Attack phase	Movement phase	Static phase	Attack phase	Movement phase	Static phase	Attack phase	Movement phase	Static phase	Attack phase	Movement phase	Static phase	Attack phase	Movement phase	Static phase	Attack phase	Movement phase
0.01-0.20	14.8	4.3	13.4	3.1	7.4	38.8	–	5.3	6.9	13.0	4.9	5.0	3.2	3.0	5.6	6.2	3.3	3.2	6.5	6.2	4.8
0.21-0.40	18.5	13.5	7.1	34.4	14.8	16.7	9.5	15.8	17.1	8.7	8.2	14.0	13.8	8.9	6.9	71.9	8.2	22.6	30.3	12.5	16.6
0.41-0.60	22.3	15.2	15.2	21.9	–	12.9	4.7	5.2	7.3	30.5	.8	7.4	17.8	16.8	13.9	6.3	14.7	12.9	34.8	12.1	12.3
0.61-0.80	14.8	1.4	12.5	9.4	14.8	4.3	9.5	10.5	7.3	17.4	5.0	10.8	17.4	6.9	11.1	3.1	4.9	12.9	6.5	2.7	11.2
0.81-1.00	11.1	7.0	7.2	12.5	11.2	12.5	18.8	5.3	4.9	4.3	–	7.4	9.7	6.0	8.3	6.3	8.2	3.2	9.6	4.9	10.2
1.01-1.20	3.7	4.1	9.8	–	18.5	4.3	18.0	5.3	12.2	8.7	9.8	9.1	11.4	8.9	12.5	–	5.0	–	2.6	3.1	1.6
1.21-1.40	3.7	–	4.4	9.3	3.7	–	–	10.5	2.4	13.1	6.6	7.5	5.7	4.9	11.1	3.1	–	–	–	6.3	3.7
1.41-1.60	3.7	–	0.9	–	–	12.5	14.3	–	4.9	–	3.2	5.7	2.8	5.5	4.2	–	4.9	–	2.6	6.2	7.5
1.61-1.80	7.4	13.9	3.6	3.3	11.1	–	–	5.3	9.7	–	4.9	2.5	3.6	4.5	5.6	–	8.2	–	2.6	2.7	0.5
1.81-2.00	–	1.4	2.7	3.1	–	4.2	14.3	–	9.8	4.3	1.7	3.3	3.7	0.4	–	–	4.9	3.3	0.6	1.3	6.4
2.01-2.50	–	4.3	8.9	3.1	11.1	–	4.7	5.3	2.4	–	13.1	15.7	6.4	12.4	15.2	–	14.3	9.6	2.0	4.9	9.1
2.51-3.00	–	4.1	5.4	–	–	8.3	4.7	5.3	2.5	–	8.2	3.3	1.2	5.5	1.4	–	4.9	3.3	0.6	2.3	4.8
3.01-3.50	–	7.0	0.9	–	–	4.2	9.5	5.2	4.8	–	6.6	1.7	2.9	2.2	2.8	3.1	1.7	3.2	–	1.3	0.6
3.51-4.00	–	5.6	0.9	–	7.4	–	–	–	7.4	–	1.6	2.5	–	3.0	–	–	1.6	6.4	–	6.7	2.7
4.01-4.50	–	2.7	2.6	–	–	–	–	–	–	–	4.9	0.8	0.4	0.6	1.4	–	1.5	9.7	–	4.0	0.6
4.51-5.00	–	–	2.7	–	–	–	–	–	2.4	–	1.6	0.8	–	2.5	–	–	3.1	–	–	5.4	2.1
5.01-5.50	–	2.8	–	–	–	–	–	–	–	–	1.7	0.9	0.4	0.5	–	–	–	3.3	0.7	3.6	0.5
5.51-6.00	–	1.4	–	–	–	–	–	5.3	–	–	–	–	0.8	–	–	–	–	3.2	–	1.7	1.1
6.01-6.50	–	–	–	–	–	–	–	5.3	–	–	1.6	0.8	–	–	–	–	–	–	–	–	0.6
6.51-7.00	–	2.8	0.9	–	–	–	–	–	–	–	–	–	–	1.0	–	–	–	–	–	0.5	0.5
7.01-7.50	–	–	–	–	–	–	–	10.5	–	–	3.3	0.8	3.4	1.4	–	–	1.7	–	0.6	1.8	0.5
7.51-8.00	–	–	–	–	–	–	–	–	–	–	1.6	–	0.4	–	–	–	1.7	–	–	1.3	1.1
8.01-8.50	–	–	0.9	–	–	–	–	–	–	–	–	–	–	–	–	–	1.7	–	–	0.9	–
8.51-9.00	–	1.4	–	–	–	–	–	–	–	–	–	–	–	1.5	–	–	1.6	–	–	0.5	–
9.01-9.50	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.4	–
9.51-10.00	–	2.5	–	–	–	–	–	–	–	–	–	–	–	0.5	–	–	3.2	3.2	–	1.3	–
10.01-15.00	–	1.3	–	–	–	–	–	–	–	–	–	–	–	3.5	–	–	1.7	–	–	2.7	1.0
15.01-20.00	–	–	–	–	–	–	–	–	–	–	1.7	–	–	–	–	–	–	–	–	0.9	0.6
20.01-25.00	–	2.8	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.5	–
25.01-30.00	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1.3	–
30.01-35.00	–	1.4	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.5
Average	0.66	3.28	1.34	0.70	1.22	0.95	1.43	1.94	1.45	0.70	2.38	1.44	1.08	2.12	1.22	0.47	2.38	2.05	0.67	3.10	1.84
Median	0.53	1.50	0.87	0.50	0.87	0.55	1.00	1.35	1.00	0.54	1.45	1.00	0.78	1.55	1.00	0.22	1.45	1.25	0.41	1.65	1.05

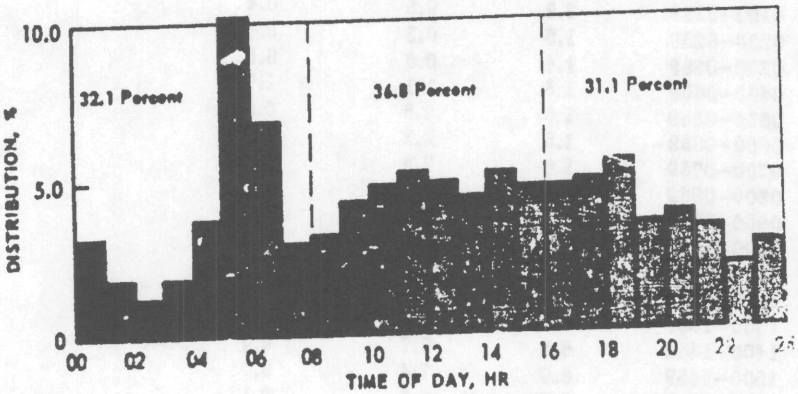
Table D18

PERCENTAGE OF FIRE BY TIME OF DAY AND TYPE OF ACTION, ALL TARGETS INCLUDED

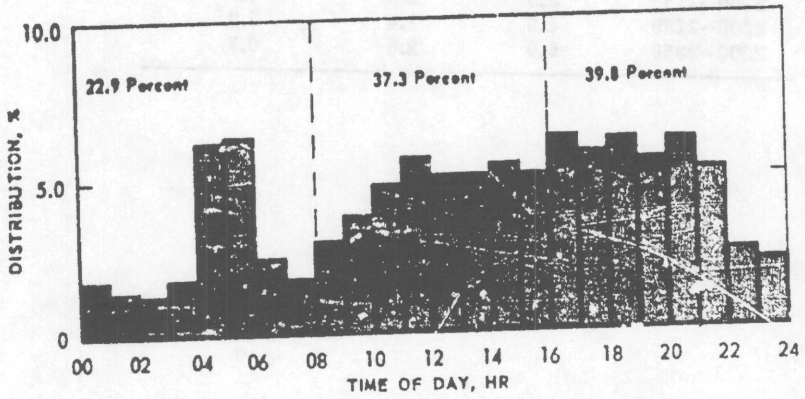
Time of fire	In static phase, %	In attack phase, %	In movement phase, %
2400–0059	4.1	3.2	1.7
0100–0159	3.1	1.9	1.4
0200–0259	3.8	1.2	1.3
0300–0359	3.1	1.9	1.8
0400–0459	9.7	3.8	6.2
0500–0559	7.6	1.02	6.3
0600–0659	2.2	5.9	2.5
0700–0759	2.1	3.0	1.7
0800–0859	2.3	3.3	3.0
0900–0959	2.3	4.3	3.7
1000–1059	2.3	4.8	4.7
1100–1159	3.0	5.2	5.6
1200–1259	2.8	4.9	5.0
1300–1359	3.2	4.4	5.0
1400–1459	3.5	5.2	5.3
1500–1559	3.7	4.7	5.0
1600–1659	3.4	4.7	6.2
1700–1759	3.6	4.9	5.8
1800–1859	3.5	5.5	6.1
1900–1959	4.5	3.6	5.5
2000–2059	6.4	3.9	6.1
2100–2159	5.6	3.4	5.2
2200–2259	4.7	2.2	2.6
2300–2359	9.5	2.9	2.3



a. Static Phase



b. Attack Phase



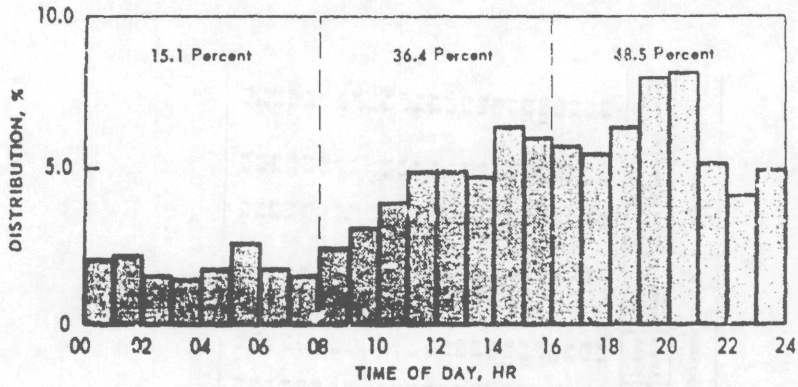
c. Movement Phase

Fig. D6—Distribution of Missions by Time of Day, All Targets Included

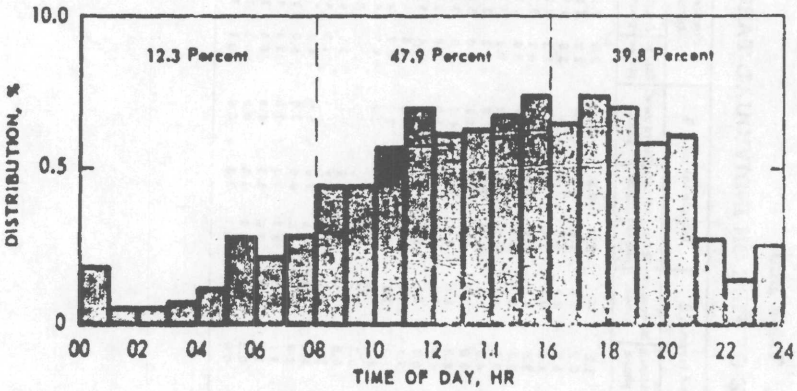
Table D19

PERCENTAGE OF FIRE BY TIME OF DAY AND TYPE OF ACTION, CLOSE-SUPPORT TARGETS

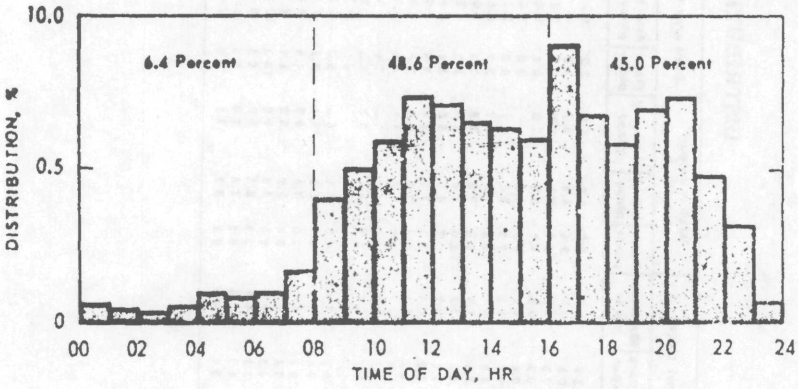
Time of fire	In static phase, %	In attack phase, %	In movement phase, %
2400–0059	2.1	1.9	0.6
0100–0159	2.2	0.5	0.4
0200–0259	1.6	0.5	0.3
0300–0359	1.4	0.6	0.5
0400–0459	1.8	1.1	1.0
0500–0559	2.6	2.8	0.9
0600–0659	1.8	2.1	1.0
0700–0759	1.6	2.8	1.7
0800–0859	2.5	4.4	4.1
0900–0959	3.1	4.4	5.0
1000–1059	3.9	5.7	5.9
1100–1159	4.9	7.0	7.4
1200–1259	4.9	6.1	7.2
1300–1359	4.7	6.2	6.6
1400–1459	6.4	6.7	6.4
1500–1559	6.0	7.4	6.0
1600–1659	5.8	6.6	9.1
1700–1759	5.6	7.4	6.8
1800–1859	6.4	7.0	5.9
1900–1959	8.0	5.9	7.0
2000–2059	8.1	6.1	7.4
2100–2159	5.3	2.8	4.9
2200–2259	4.3	1.4	3.2
2300–2359	5.0	2.6	0.7



a. Static Phase



b. Attack Phase



c. Movement Phase

Fig. D/—Distribution of Missions by Time of Day, Close-Support Targets

Table D20

DISTRIBUTION OF TIME OF FIRE ON INDIVIDUAL TARGETS

Time of fire	Personnel targets, %			Infantry support targets, %			Hard area targets, %			Point targets, %			Mobile targets, %			Counterbattery targets, %			Preparation fire, %			Harassing fire, %		
	Static phase	Attack phase	Movement phase	Static phase	Attack phase	Movement phase	Static phase	Attack phase	Movement phase	Static phase	Attack phase	Movement phase	Static phase	Attack phase	Movement phase	Static phase	Attack phase	Movement phase	Static phase	Attack phase	Movement phase	Static phase	Attack phase	Movement phase
2400-0059	3.5	2.9	1.5	2.7	1.6	1.1	2.2	1.9	0.7	1.1	1.3	—	2.0	0.8	0.1	2.8	3.1	1.8	3.7	1.8	2.3	7.5	4.7	3.1
0100-0159	2.1	0.9	0.7	3.4	4.3	0.5	3.0	—	—	1.6	0.8	0.3	1.6	0.1	0.5	2.2	3.0	1.4	3.1	1.3	3.0	5.2	2.1	2.7
0200-0259	1.7	0.5	0.3	0.7	1.1	1.0	2.2	0.4	0.3	1.1	1.5	0.3	1.2	0.3	—	3.8	1.1	1.0	4.2	0.8	0.4	5.3	1.9	3.5
0300-0359	0.9	0.9	0.9	4.1	0.5	1.8	2.2	0.4	0.3	0.5	1.5	0.3	1.8	—	0.1	2.2	3.0	0.6	3.6	0.5	1.0	5.5	2.2	4.5
0400-0459	1.8	0.9	1.1	8.2	5.0	—	3.0	0.4	0.7	0.9	2.8	1.1	1.0	1.0	0.4	4.1	3.1	2.4	10.9	7.0	2.3	23.5	5.7	17.0
0500-0559	3.0	4.8	1.1	7.5	5.1	3.1	4.2	2.3	1.0	1.8	2.3	0.9	0.4	0.8	0.3	5.9	7.6	1.7	6.6	18.8	8.3	13.8	16.2	16.8
0600-0659	2.0	2.2	0.7	10.2	4.3	3.7	3.0	0.4	1.3	0.3	7.0	1.2	1.2	1.3	1.0	2.1	6.3	1.4	1.6	11.9	16.1	2.9	10.0	3.1
0700-0759	2.7	3.1	1.7	1.4	7.8	5.2	1.3	1.9	3.0	0.7	4.6	1.4	1.4	2.4	1.8	3.2	3.4	1.8	1.6	5.8	0.8	0.9	2.0	1.5
0800-0859	2.9	4.8	5.2	2.0	3.9	1.8	1.5	4.2	4.7	3.7	3.9	3.0	2.2	4.2	3.6	3.0	3.4	1.3	3.6	3.6	2.9	0.7	2.3	1.6
-0959	3.5	3.1	5.4	0.7	4.0	6.3	3.1	3.8	2.0	4.2	8.2	5.8	1.6	4.9	4.3	2.9	5.0	[illegible]	2.8	4.9	5.1	0.6	3.4	2.2
059	3.8	3.9	6.7	2.1	3.1	2.6	2.8	7.0	4.4	4.6	6.7	5.6	4.7	7.0	5.9	[illegible]	6.0	4.3	0.2	4.5	2.3	0.7	3.1	3.1
[illegible]	[illegible]	6.9	[illegible]	2.7	7.1	2.6	[illegible]	8.0	[illegible]	5.8	5.4	7.1	5.7	[illegible]	[illegible]	[illegible]	4.8	[illegible]	1.6	[illegible]	[illegible]	1.3	4.6	3.4
[illegible]	[illegible]	[illegible]	[illegible]	0.7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	6.4	7.5	[illegible]	[illegible]	[illegible]	7.5	[illegible]	[illegible]	[illegible]	1.6	[illegible]	[illegible]	[illegible]	[illegible]	2.1
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	7.6	[illegible]	3.4	[illegible]	[illegible]	7.1	[illegible]	5.5	[illegible]	3.7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.9	3.0
[illegible]	[illegible]	[illegible]	[illegible]	2.7	9.2	[illegible]	4.6	[illegible]	[illegible]	[illegible]	[illegible]	7.3	7.5		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	4.1	[illegible]	4.6	3.4
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	5.2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.6	[illegible]	[illegible]
[illegible]	[illegible]	6.2	[illegible]	[illegible]	[illegible]	[illegible]	5.0	6.1	[illegible]	[illegible]	4.6	10.5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1700-[illegible]	[illegible]	9.4	[illegible]	—	3.9	14.1	3.1	7.7		6.4	3.1	6.1	[illegible]	7.2	[illegible]	[illegible]	[illegible]	5.5	1.1	[illegible]	7.5	[illegible]	[illegible]	3.4
1800-[illegible]	[illegible]	6.9	6.0	2.0	3.4	6.3	4.8	7.0	[illegible]	7.0	4.6	4.4	[illegible]	7.9	[illegible]	4.0	[illegible]	5.6	1.9	[illegible]	[illegible]	1.1	4.9	[illegible]
1900-[illegible]	[illegible]	7.4	6.5	6.1	3.9	6.3	8.7	2.7	[illegible]	7.9	2.3	7.0	[illegible]	6.6	7.6	5.0	[illegible]	6.3	2.9	[illegible]	2.8	[illegible]	2.1	[illegible]
2000-[illegible]	[illegible]	4.3	3.5	4.1	5.6	5.8	10.2	10.3	[illegible]	8.1	3.1	6.3	8.3	7.5	7.8	7.8	[illegible]	7.3	8.4	[illegible]	[illegible]	2.8	[illegible]	3.0
2100-[illegible]	[illegible]	3.3	4.8	3.4	3.5	5.8	6.5	5.4	[illegible]	3.0	1.0	4.9	3.6	1.5	4.8	6.6	[illegible]	13.1	10.1	6.1	[illegible]	3.2	3.9	2.5
2200-[illegible]	[illegible]	1.7	2.6	9.5	3.6	2.6	5.9	1.5	6.3	1.9	0.5	4.2	5.9	1.4	0.9	4.3	1.6	4.4	5.8	[illegible]	2.8	[illegible]	2.9	[illegible]
2300-[illegible]	[illegible]	3.4	0.9	8.2	2.3	2.1	7.6	4.8	[illegible]	1.6	0.8	0.5	5.7	1.3	0.6	10.8	3.0	3.4	10.7	[illegible]	1.0	10.1	3.5	4.7

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