Report 5

MEDICAL DATA SUMMARIES OF EVENTS OCCURRING IN THE SPRING 1960 USA-CDEC FIELD EXPERIMENT

Prepared for:

COMBAT DEVELOPMENT GROUP
U.S. MEDICAL SERVICE
BROOKE ARMY MEDICAL CENTER
FORT SAM HOUSTON, TEXAS

CONTRACT DA-49-193-MD-2169

By: Marilyn Anderson Paul Brock George W. Evans II

STANFORD RESEARCH INSTITUTE

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SRI Project No. 3694

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ABSTRACT

The purpose of SRI Project 3694 (Contract DA 49-193 MD-2169) is to summarize and analyze data collected in two medical field experiments performed at the United States Army Combat Development Experimentation Center, Fort Ord, California. This report presents statistical summaries of the casualty data collected during the Spring 1960 field experiment and listed in Report 3 of this project.

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MEDICAL DATA SUMMARIES OF EVENTS OCCURRING IN THE SPRING 1960 USA-CDEC FIELD EXPERIMENT

I INTRODUCTION

The medical experiment conducted at CDEC during the Spring of 1960 was a pure experiment. Only medical units and casualties were simulated by line troops engaged in realistic operations. During the course of the experiment 1069 casualties were generated. The casualties were generated at nine different rates, ranging from four per hour to 80 per hour. The casualties were subdivided into 75 types. The experiments were conducted over three types of terrain.

The experimental actions began with a notification by radio to a message center that a casualty was located at a given geographical position. Ambulances were dispatched for each casualty upon receipt of the notification message. A certain amount of field treatment was administered by the aid men assigned to the ambulances. These aid men then loaded the casualties into ambulances for evacuation through the medical system.

Evacuation by ambulance was provided to the ICG aid station, either directly or via the company collecting post. Removal from the aid station was accomplished by helicopter to the division air strip or by ambulance to the division field hospital. The evacuation paths that were used are schematically shown in Fig. 1 of Report 3.[1*]

The current report presents consolidated statistical information that was developed from the raw data detailed in Report 3. These statistics are presented primarily for the purpose of "examining the capabilities and limitation" of the Combat Group medical support function, particularly "in the functional areas of triage, treatment, and evacuation of personnel casualties."[2]

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*References are listed at the end of this report.

The Tegtmeyer letter (see Appendix of Report 1[3]) requests information from the experiment in much more specific terms than do the general directives. The extent of specific areas for investigation that are proposed in the letter is excessive. Furthermore, the experiment does not appear to have been geared to many of these requests. In preparing the statistics that are contained in this report, deliberation was given to the writings of Colonel Tegtmeyer. A more extensive discussion on this point is contained in the final report of the project.

Several comments that were made in prior reports bear repetition here. First, the term "to examine," used in the objectives of the experiments, is vague, leaving a wide degree of latitude to the statistical analyst to select information and prepare his breakdowns. There are a number of conditions that must be determined subjectively, that include:

(1) A reasonable limit of presented detail
(2) Appropriateness and significance of the selected information
(3) Estimates of the reliability of the data
(4) Estimates of the value of the presented procedures for subsequent application (training phase).

Second, results and references, though relating to the events of the experiment, in fact only relate to the data as reported. The data itself, being subject to errors of transcription, omissions, biases, and other distortions, presents a picture that differs from reality.

The statistical breakdowns that are presented in this report are divided into four sections. "Administrative" concerns information on the operations necessary, but preliminary, to medical assistance reaching the casualty on the field. Section III, "Removal Activities" deals with the questions of casualty transport through the medical system. This is followed by "Medical Workloads," an analysis of the buildup of casualties through the medical system and the efficiency and dispatch with which the casualties are treated. The final section, "Medical Performance," is concerned with the effectiveness on the casualties of the medical treatment throughout the system.

II ADMINISTRATIVE

Figure 2-1 indicates the processing of a casualty as a time sequence of operations. Not all the operations occurred in all cases (see Fig. 1 of Ref. 1). That part of the processing indicated on the top line of Fig. 2-1 herein is examined in this section.

The distribution of message acknowledgment time differences from the start of the experiment (H-hour) is a measure of the message center activity. The distribution of time differences between acknowledgment time and notification time presents a measure of the transmission times of messages through the communication nets.

Frequency tables for both of these distributions are presented in Table 2-2 and Table 2-3, respectively. These tables are plotted in Fig. 2-2 and Fig. 2-3.

With the tabulated information are included standard statistical functions, i.e., the sample size,minimum and maximum values indicating the range of the distribution and the average value of the range variable. As measures of the dispersion of the distribution, both the standard deviation and variance are presented, as calculated. The frequency charts are in the form of piece-wise linear graphs having point separation equal to the range interval of the table to which they refer. The value at each end point represents the totality of events throughout the adjacent but preceding time interval.

During the course of the experiments, casualties were generated at varying rates, as per Table 2-1. To determine the effect of rate of casualty generation on the medical system, the statistical breakdowns were calculated for a low rate of 20 per hour and for the highest rate of 80 per hour. For these value choices, consideration was given to the sample sizes that were involved. These particular breakdowns are contrasted with the corresponding data for all casualties emanating from the experiments. Except where noted, these three breakdowns are standard for the statistical analyses presented in this report. They are denoted by a, b, c, subdesignations for each references table or figure.

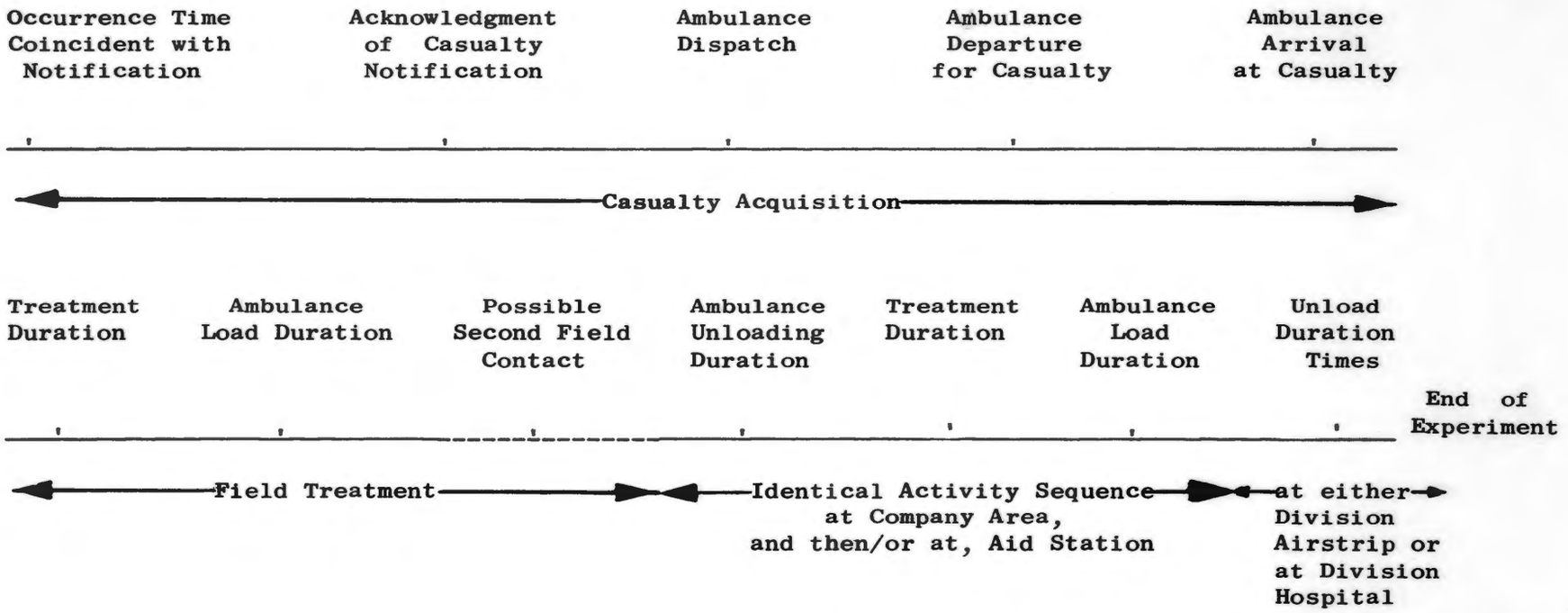


Figure 2-1: Representation of Time Sequencing of Field Experiment

Table 2-1

SIGNIFICANT PARAMETERS INVOLVED IN THE SPRING 1960 FIELD EXPERIMENT

Casualty Rate Per Hour	Frequency	No. of Hours Per Experiment	No. of Experiments	No. of Field Ambulances
4	40	4	2	6
6-2/3	40	3	2	6
10	100	5	2	6
16	160	5	2	6,7
16-2/3	150	3	3	6,7
20	220	1	11	2,5,6
26-2/3	160	3	2	7
50	50	1	1	6
80	160	1	2	6

FIG. 2-2 FREQUENCY DISTRIBUTIONS – MESSAGE CENTER ACTIVITY

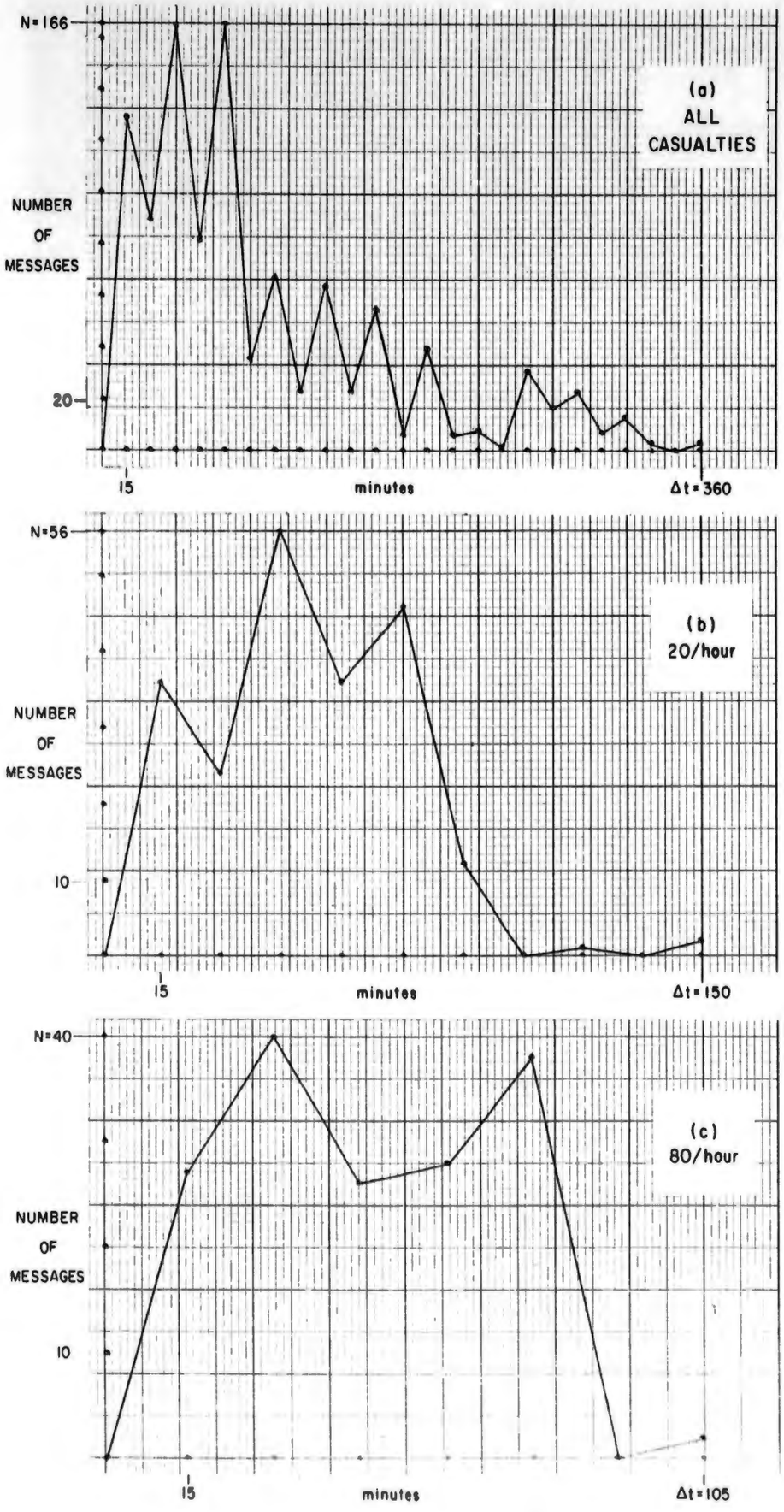


TABLE 2-2

FREQUENCY DISTRIBUTIONS – MESSAGE CENTER ACTIVITY

(a)
Δt FROM H HOUR
ALL CASUALTIES

TOTAL NO. SAMPLES	VALID SAMPLE	MIN. DELTA TIME	MAX. DELTA TIME	AVG. DELTA TIME	VAR.	DEV.
1063	1055	0000	0347	86.80	5958	77.19

FREQ. DISTRIB.

DELTA TIME INTERVAL (MINS)	NO. OF MESSAGES
000-015	0129
015-030	0089
030-045	0165
045-060	0081
060-075	0166
075-090	0035
090-105	0067
105-120	0023
120-135	0064
135-150	0023
150-165	0055
165-180	0006
180-195	0040
195-210	0006
210-225	0008
225-240	0001
240-255	0031
255-270	0017
270-285	0023
285-300	0007
300-315	0013
315-330	0003
330-345	0000
345-360	0003

(b)
Δt FROM H HOUR
20/hour DISTRIBUTION

TOTAL NO. SAMPLES	VALID SAMPLE	MIN. DELTA TIME	MAX. DELTA TIME	AVG. DELTA TIME	VAR.	DEV.
0212	0212	0000	0148	40.85	624.8	24.99

FREQ. DISTRIB.

DELTA TIME INTERVAL (MINS)	NO. OF MESSAGES
000-015	0036
015-030	0024
030-045	0056
045-060	0036
060-075	0046
075-090	0012
090-105	0000
105-120	0001
120-135	0000
135-150	0002

(c)
Δt FROM H HOUR
80/hour DISTRIBUTION

TOTAL NO. SAMPLES	VALID SAMPLE	MIN. DELTA TIME	MAX. DELTA TIME	AVG. DELTA TIME	VAR.	DEV.
0161	0161	0000	0092	37.47	456.9	21.37

FREQ. DISTRIB.

DELTA TIME INTERVAL (MINS)	NO. OF MESSAGES
000-015	0027
015-030	0040
030-045	0026
045-060	0028
060-075	0038
075-090	0000
090-105	0002

FIG. 2-3 FREQUENCY DISTRIBUTIONS – MESSAGE TRANSMISSION TIME

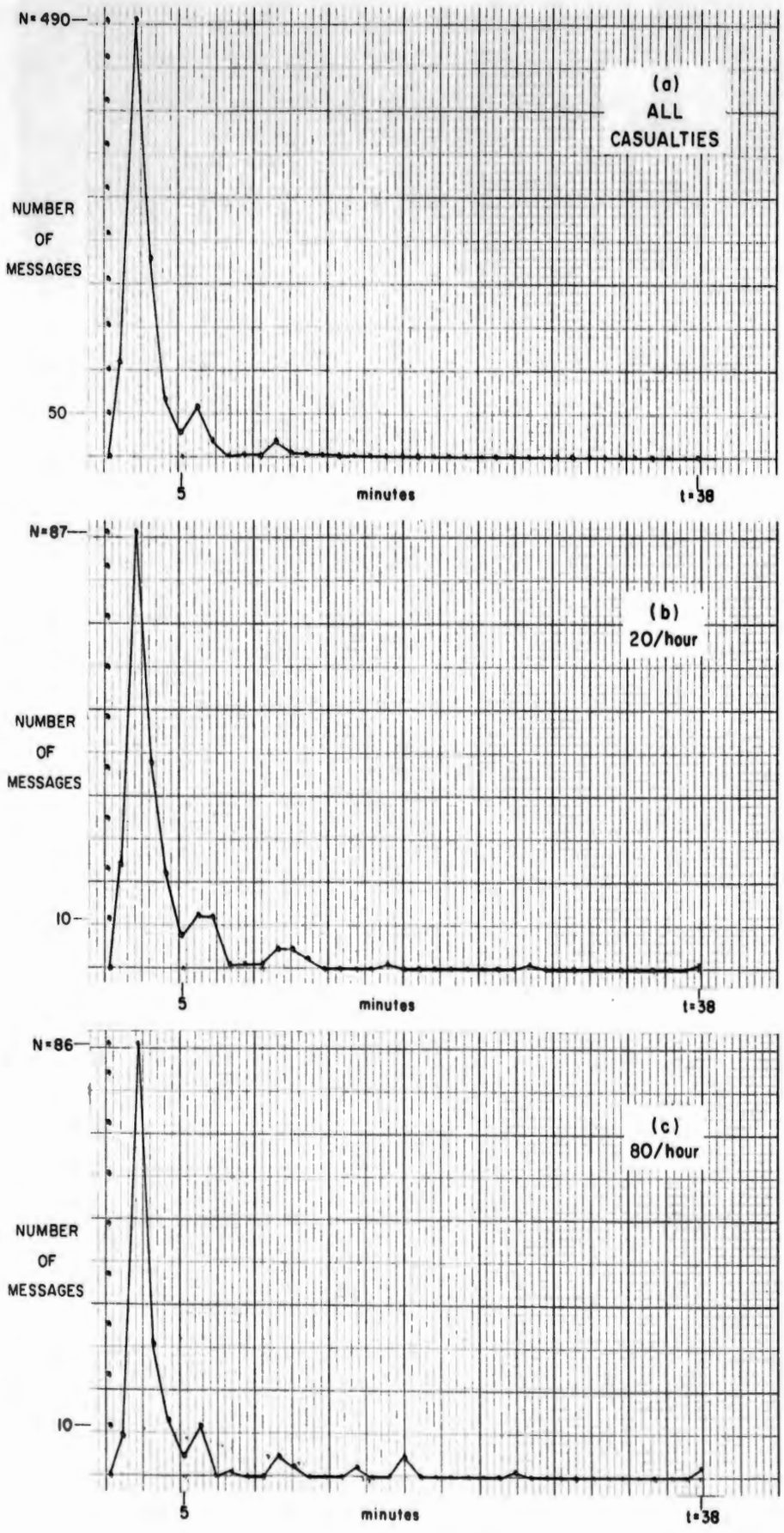


TABLE 2-3

FREQUENCY DISTRIBUTIONS – MESSAGE TRANSMISSION TIME

(a)

Δt FROM H HOUR
ALL CASUALTIES

TOTAL NO. SAMPLES	VALID SAMPLE	MIN. DELTA TIME	MAX. DELTA TIME	AVG. DELTA TIME	VAR.	DEV.
1063	1059	0000	0188	2.650	51.45	7.173

FREQ. DISTRIB.

DELTA TIME INTERVAL (MINS)	NO. OF MESSAGES
000-001	0107
001-002	0490
002-003	0223
003-004	0065
004-005	0028
005-006	0059
006-007	0019
007-008	0003
008-009	0007
009-010	0001
010-011	0019
011-012	0007
012-013	0002
013-014	0001
014-015	0001
015-016	0005
016-017	0000
017-018	0001
018-019	0004
019-020	0000
020-021	0003
021-022	0000
022-023	0001
023-024	0001
024-025	0000
025-026	0001
026-027	0001
027-037	0000
037-038	0003
038-060	0000
060-061	0001
061-062	0001
062-188	0000
188-189	0001

(b)

Δt FROM H HOUR
20/hour DISTRIBUTION

TOTAL NO. SAMPLES	VALID SAMPLE	MIN. DELTA TIME	MAX. DELTA TIME	AVG. DELTA TIME	VAR.	DEV.
0212	0212	0000	0037	2.740	19.52	3.940

FREQ. DISTRIB.

DELTA TIME INTERVAL (MINS)	NO. OF MESSAGES
000-001	0021
001-002	0087
002-003	0041
003-004	0019
004-005	0007
005-006	0011
006-007	0010
007-008	0001
008-009	0001
009-010	0001
010-011	0004
011-012	0004
012-013	0002
013-014	0000
014-015	0000
015-016	0000
016-017	0000
017-018	0001
018-019	0000
019-020	0000
020-021	0000
021-022	0000
022-023	0000
023-024	0000
024-025	0000
025-026	0000
026-027	0001
027-028	0000
028-029	0000
029-030	0000
030-031	0000
031-032	0000
032-033	0000
033-034	0000
034-035	0000
035-036	0000
036-037	0000
037-038	0001

(c)

Δt FROM H HOUR
80/hour DISTRIBUTION

TOTAL NO. SAMPLES	VALID SAMPLE	MIN. DELTA TIME	MAX. DELTA TIME	AVG. DELTA TIME	VAR.	DEV.
0161	0161	0000	0037	3.149	30.04	5.480

FREQ. DISTRIB.

DELTA TIME INTERVAL (MINS)	NO. OF MESSAGES
000-001	0008
001-002	0086
002-003	0026
003-004	0011
004-005	0004
005-006	0010
006-007	0000
007-008	0001
008-009	0000
009-010	0000
010-011	0004
011-012	0002
012-013	0000
013-014	0000
014-015	0000
015-016	0002
016-017	0000
017-018	0000
018-019	0004
019-020	0000
020-021	0000
021-022	0000
022-023	0000
023-024	0000
024-025	0000
025-026	0001
026-027	0000
027-028	0000
028-029	0000
029-030	0000
030-031	0000
031-032	0000
032-033	0000
033-034	0000
034-035	0000
035-036	0000
036-037	0000
037-038	0002

The difference between the time of ambulance dispatch and time of acknowledgment of the casualty notification message, is tabulated in Table 2-4 and graphed in Fig. 2-4. This information is presented with the same formats as the two preceding tables and figures. The delay here stems from the procedure that ambulances are dispatched only when they are free; that is, when they have reached their previous dispatch mission. Hence, this frequency breakdown gives an indication of the queueing characteristics of extensive casualty occurrences with limited ambulance capabilities. The casualty distribution rates are noted above, in Table 2-1, as are the number of participating ambulances for field pick-up.

Upon being dispatched, the actual departure time of the ambulance and mileage were recorded. The time differences between dispatch and departure was generally small. The minimum recorded difference was 0, and although the maximum recorded difference was 330 minutes, the average recorded difference was only 4.3 minutes, showing the strong skew to the left. For the entire distribution, only 17.1% of the cases were delayed in excess of 3 minutes.

The normal procedure is to travel to the casualty immediately. Since the time of arrival and ambulance mileage at arrival were recorded, a rate figure can be computed:

$$\text{ambulance rate (m.p.h.)} = \frac{60x\ (\text{mileage upon arrival at casualty--mileage at departure})}{\text{time of arrival at casualty--time of departure}}. \quad (1)$$

This statistic may be very misleading for several reasons. First, the denominator of the right-hand side of Eq. (1) may be zero or negative. Aside from the possibilities of recording errors, such values may be legitimate if the ambulance is at the casualty, or if its crew had noted and attended the casualty prior to receiving the dispatch message. Of 1069 casualties, the incidence of such recorded data is as follows:

Time of arrival at casualty coincident with departure time: 12 cases.

Time of arrival preceding departure time: 40 cases.

FIG. 2-4 FREQUENCY DISTRIBUTIONS – AMBULANCE DISPATCH DELAYS

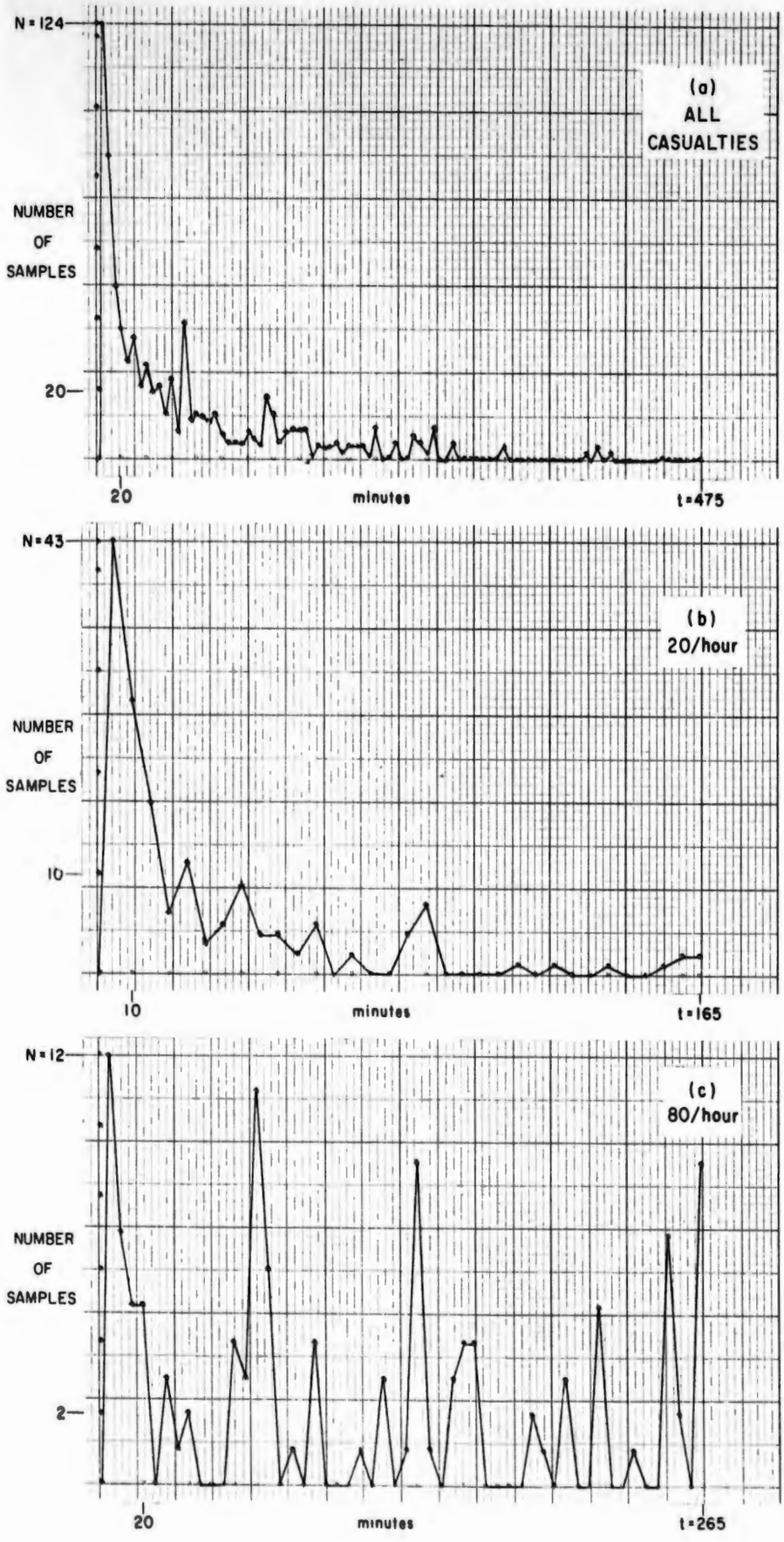


TABLE 2-4

FREQUENCY DISTRIBUTIONS – AMBULANCE DISPATCH DELAYS

(a)
Δt FROM H HOUR
ALL CASUALTIES

TOTAL NO. CAS.	VALID SAMPLE	MIN. DELTA TIME	MAX. DELTA TIME	AVG. DELTA TIME	VAR.	DEV.
1069	0790	0000	0472	68.49	4541	80.87

FREQ. DISTRIB.

DELTA TIME INTERVAL (MINS)	NO. OF CAS.
000-005	0124
005-010	0086
010-015	0049
015-020	0037
020-025	0028
025-030	0035
030-035	0021
035-040	0027
040-045	0019
045-050	0021
050-055	0013
055-060	0023
060-065	0008
065-070	0039
070-075	0011
075-080	0013
080-085	0012
085-090	0011
090-095	0013
095-100	0007
100-105	0005
105-110	0005
110-115	0004
115-120	0008
120-125	0006
125-130	0004
130-135	0018
135-140	0013
140-145	0005
145-150	0008
150-155	0009
155-160	0008
160-165	0009
165-170	0001
170-175	0004
175-180	0003
180-185	0004
185-190	0005
190-195	0002
195-200	0004
200-205	0004
205-210	0004
210-215	0001
215-220	0009
220-225	0000
225-230	0001
230-235	0005
235-240	0000
240-245	0001
245-250	0007
250-255	0005
255-260	0002
260-265	0009
265-270	0000
270-275	0000
275-280	0005
280-285	0000
285-290	0001
290-295	0000
295-300	0000
300-305	0000
305-310	0000
310-315	0000
315-320	0004
320-325	0000
325-330	0000
330-335	0000
335-340	0000
340-345	0000
345-350	0000
350-355	0000
355-360	0000
360-365	0000
365-370	0000
370-375	0000
375-380	0000
380-385	0002
385-390	0000
390-395	0004
395-400	0000
400-405	0002
405-440	0000
440-445	0001
445-470	0000
470-475	0001

(b)
Δt FROM H HOUR
20/hour DISTRIBUTION

TOTAL NO. CAS.	VALID SAMPLE	MIN. DELTA TIME	MAX. DELTA TIME	AVG. DELTA TIME	VAR.	DEV.
0218	0157	0000	0164	27.70	1319	36.32

FREQ. DISTRIB.

DELTA TIME INTERVAL (MINS)	NO. OF CAS.
000-005	0043
005-010	0027
010-015	0017
015-020	0006
020-025	0011
025-030	0003
030-035	0005
035-040	0009
040-045	0004
045-050	0004
050-055	0002
055-060	0005
060-065	0000
065-070	0002
070-075	0000
075-080	0000
080-085	0004
085-090	0007
090-095	0000
095-100	0000
100-105	0000
105-110	0000
110-115	0001
115-120	0000
120-125	0001
125-130	0000
130-135	0000
135-140	0001
140-145	0000
145-150	0000
150-155	0001
155-160	0002
160-165	0002

(c)
Δt FROM H HOUR
80/hour DISTRIBUTION

TOTAL NO. CAS.	VALID SAMPLE	DELTA TIME	DELTA TIME	DELTA TIME	VAR.	DEV.
0120	0120	0000	0264	110.2	7766	88.17

FREQ. DISTRIB.

DELTA TIME INTERVAL (MINS)	NO. OF CAS.
000-005	0012
005-010	0007
010-015	0005
015-020	0005
020-025	0000
025-030	0003
030-035	0001
035-040	0002
040-045	0000
045-050	0004
050-055	0003
055-060	0011
060-065	0006
065-070	0000
070-075	0001
075-080	0000
080-085	0004
085-090	0000
090-095	0000
095-100	0001
100-105	0000
105-110	0001
110-115	0000
115-120	0003
120-125	0000
125-130	0001
130-135	0009
135-140	0001
140-145	0000
145-150	0003
150-155	0004
155-160	0004
160-165	0000
165-185	0002
185-190	0001
190-195	0000
195-200	0003
200-205	0000
205-215	0005
215-220	0000
220-230	0001
230-235	0000
235-245	0007
245-250	0002
250-255	0000
255-260	0009

According to the experimental S.O.P., recorded time information is to the nearest minute [hence the factor, 60, in Eq. (1)] and recorded mileage is to the nearest mile. If the denominator time differential is positive, the numerator mileage differential is assumed to be at least 1 mile if the calculated value is 0. (In this situation, a negative numerator must be considered to be an error.)

Because the recorded values may be small, the measurement error due to the built-in limit of the measuring equipment, i.e., clock and odometer, may cause severe distortion. For example: An ambulance that records a distance of 2 miles over a 12 minute time period would have a nominal rate of 10 m.p.h. However, the possible range of rates is from 4.6 to 16.4 m.p.h. If the values were larger the possible deviations would be smaller. Thus, a recorded distance of 20 miles over a 120 minute time period has an error range of less than 0.6 m.p.h. Table 2-5 presents the rate distributions.

Table 2-6 represents the delay in commencing treatment of a casualty in the field, after the arrival of an ambulance at the casualty. Several negative values were noted. These may represent the possibility that aid men left their vehicle to hunt for and begin treatment on casualties, with their ambulance catching up with them subsequently. Some of the large values that were recorded, however, must be suspect to other valid or erroneous causes of this phenomenon.

FIG. 2-5 FREQUENCY DISTRIBUTIONS – RATE OF AMBULANCE TRAVEL TO CASUALTY IN BATTLEFIELD

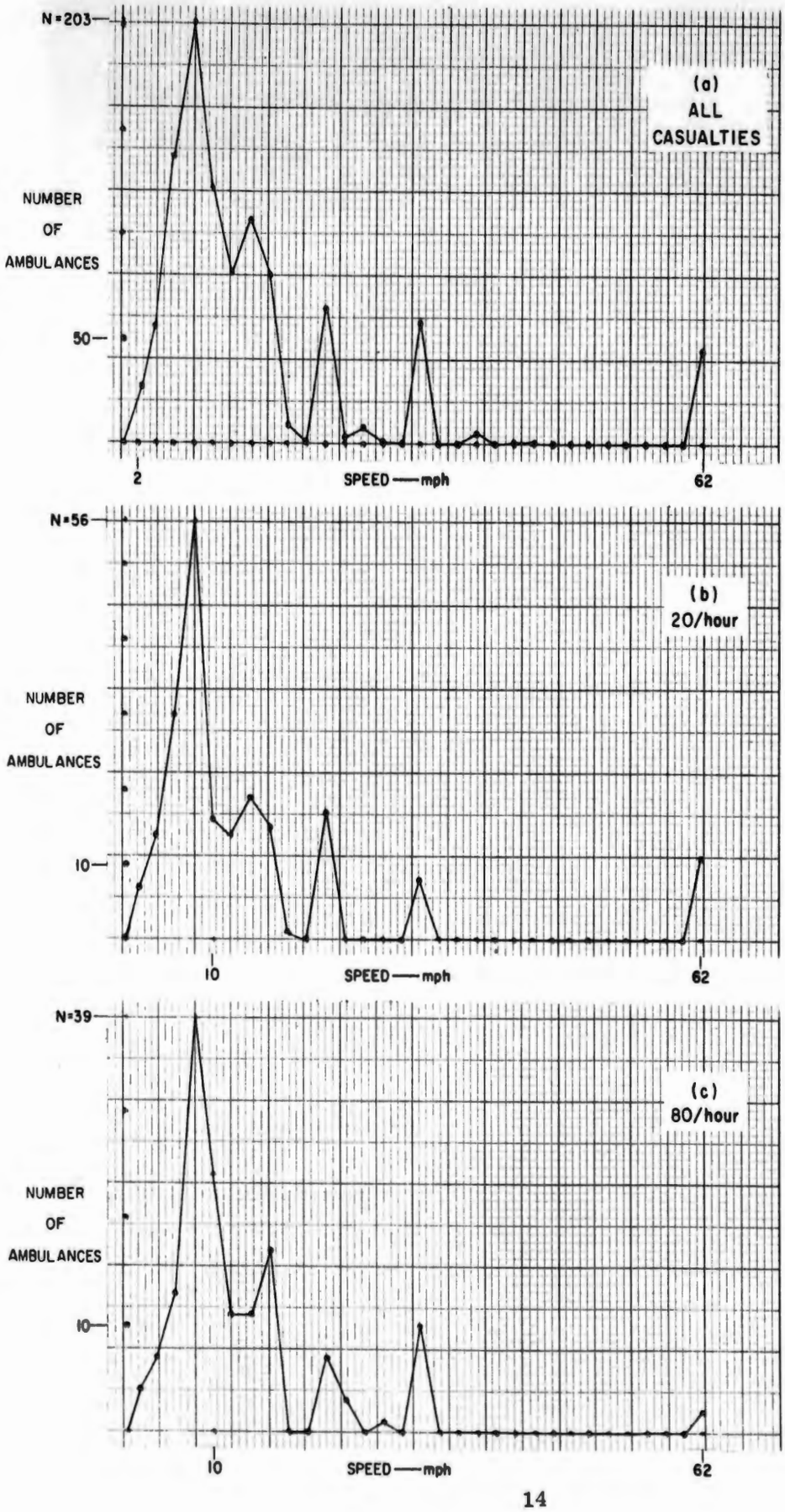


TABLE 2-5

FREQUENCY DISTRIBUTIONS – RATE OF AMBULANCE TRAVEL TO CASUALTY IN BATTLEFIELD

(a)
Δt FROM H HOUR
ALL CASUALTIES

TOTAL NO. AMB.	VALID SAMPLE	MIN. SPEED	MAX. SPEED	AVG. SPEED	VAR.	DEV.
1069	1015	0000	0130	13.32	193.4	13.91

FREQ. DISTRIB.

SPEED INTERVAL (MPH)	NO. OF AMB.
000-002	0027
002-004	0056
004-006	0137
006-008	0203
008-010	0122
010-012	0082
012-014	0107
014-016	0081
016-018	0069
018-020	0001
020-022	0065
022-024	0003
024-026	0008
026-028	0001
028-030	0000
030-032	0058
032-034	0000
034-036	0000
036-038	0005
038-040	0000
040-042	0001
042-044	0001
044-046	0000
046-048	0000
048-050	0000
050-052	0000
052-054	0000
054-056	0000
056-058	0000
058-060	0000
060-062	0045
062-130	0000
130-132	0003

(b)
Δt FROM H HOUR
20/hour DISTRIBUTION

TOTAL NO. AMB.	VALID SAMPLE	MIN. SPEED	MAX. SPEED	AVG. SPEED	VAR.	DEV.
0218	0208	0000	0060	12.97	166.	12.88

FREQ. DISTRIB.

SPEED INTERVAL (MPH)	NO. OF AMB.
000-002	0007
002-004	0014
004-006	0030
006-008	0056
008-010	0016
010-012	0014
012-014	0019
014-016	0015
016-018	0001
018-020	0000
020-022	0017
022-024	0000
024-026	0000
026-028	0000
028-030	0000
030-032	0008
032-034	0000
034-036	0000
036-038	0000
038-040	0000
040-042	0000
042-044	0000
044-046	0000
046-048	0000
048-050	0000
050-052	0000
052-054	0000
054-056	0000
056-058	0000
058-060	0000
060-062	0011

(c)
Δt FROM H HOUR
80/hour DISTRIBUTION

TOTAL NO. AMB.	VALID SAMPLE	MIN. SPEED	MAX. SPEED	AVG. SPEED	VAR.	DEV.
0161	0152	0000	0130	19.78	355.2	18.84

FREQ. DISTRIB.

SPEED INTERVAL (MPH)	NO. OF AMB.
000-002	0004
002-004	0007
004-006	0013
006-008	0039
008-010	0024
010-012	0011
012-014	0011
014-016	0017
016-018	0000
018-020	0000
020-022	0007
022-024	0003
024-026	0000
026-028	0001
028-030	0000
030-032	0010
032-034	0000
034-036	0000
036-038	0000
038-040	0000
040-042	0000
042-044	0000
044-046	0000
046-048	0000
048-050	0000
050-052	0000
052-054	0000
054-056	0000
056-058	0000
058-060	0000
060-062	0002
062-130	0000
130-132	0003

Table 2-6

FREQUENCY DISTRIBUTION/TIME DIFFERENCE,

AMBULANCE ARRIVAL AND START OF FIELD TREATMENT

Time Difference (Min.) From Ambulance Arrival to Start of Field Commencement of Treatment	Casualties	Percent of Total
less than -60	8	.75
-60 to -31	24	2.26
-30 to -1	61	5.75
0	308	29.06
+1 to +30	598	56.42
greater than +30	9	.85
invalid samples	52	4.91
	1060	100.00

III REMOVAL ACTIVITIES

This section develops information pertaining to the physical movement of casualties through the medical system. In the previous section, vehicle rate was defined. The rate distribution of travel between field and company area, field and aid station, and between company area and aid station are developed in Tables 3-1 through 3-3. The corresponding graphed distributions are Figs. 3-1 through 3-3. The corresponding information for travel from the aid station to division are unobtainable since the necessary mileages were not recorded.

Two operations that consumed uniformly small amounts of time were casualty loading and unloading. Examples are specified in Table 3-4.

Table 3-4

CASUALTY LOADING AND UNLOADING TIMES

Field, Ambulance Loading Times		Aid Station, Ambulance Unloading Times	
Maximum	27 min	Maximum	63 min
Minimum	0 min	Minimum	0 min
Average	1.8 min	Average	1.3 min
82% in less than 2 minutes		92% in less than 2 minutes	

Tables 3-5 and 3-6 indicate the ambulance loading density from the field and from the company area, respectively. For the three standard breakdowns, the number of ambulances evacuating, and the number of casualties being evacuated, over 15-minute intervals from H-hour are noted. The maximum and minimum ambulance loads during the periods are listed and the average load for each interval is computed. Table 3-7 is a coarse distribution of the number of casualties evacuated per ambulance.

There were 72 incidents of casualties being loaded in the field, then unloaded in the field, to be evacuated subsequently by a second

FIG. 3-1 FREQUENCY DISTRIBUTIONS – RATE OF CASUALTY TRAVEL, BATTLEFIELD TO COMPANY AREA

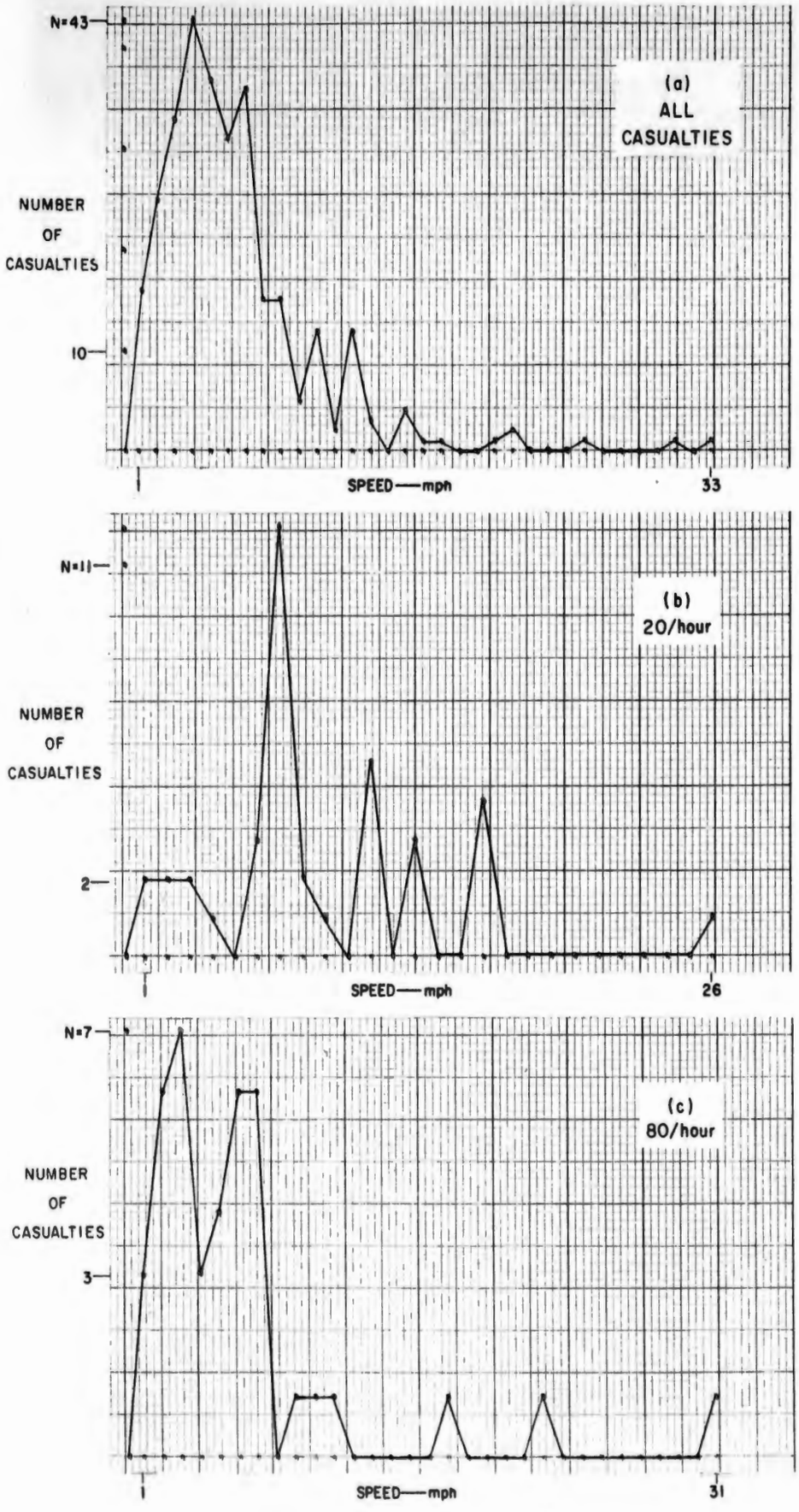


TABLE 3-1

FREQUENCY DISTRIBUTIONS – RATE OF CASUALTY TRAVEL, BATTLEFIELD TO COMPANY AREA

(a) Δt FROM H HOUR ALL CASUALTIES

TOTAL NO. CAS.	VALID SAMPLE	MIN. SPEED	MAX. SPEED	AVG. SPEED	VAR.	DEV.
0299	0299	0001	0120	6.458	106.1	10.30

FREQ. DISTRIB.

SPEED INTERVAL (MPH)	NO. OF CAS.
000-001	0016
001-002	0025
002-003	0033
003-004	0043
004-005	0037
005-006	0031
006-007	0036
007-008	0015
008-009	0015
009-010	0005
010-011	0012
011-012	0002
012-013	0012
013-014	0003
014-015	0000
015-016	0004
016-017	0001
017-018	0001
018-019	0000
019-020	0000
020-021	0001
021-022	0002
022-023	0000
023-024	0000
024-025	0000
025-026	0001
026-027	0000
027-028	0000
028-029	0000
029-030	0000
030-031	0001
031-032	0000
032-033	0001
033-120	0000
120-121	0002

(b) Δt FROM H HOUR 20/hour DISTRIBUTION

TOTAL NO. CAS.	VALID SAMPLE	MIN. SPEED	MAX. SPEED	AVG. SPEED	VAR.	DEV.
0037	0037	0001	0026	7.951	25.34	5.034

FREQ. DISTRIB.

SPEED INTERVAL (MPH)	NO. OF CAS.
000-001	0002
001-002	0002
002-003	0002
003-004	0001
004-005	0000
005-006	0003
006-007	0011
007-008	0002
008-009	0001
009-010	0000
010-011	0005
011-012	0000
012-013	0003
013-014	0000
014-015	0000
015-016	0004
016-017	0000
017-018	0000
018-019	0000
019-020	0000
020-021	0000
021-022	0000
022-023	0000
023-024	0000
024-025	0000
025-026	0001

(c) Δt FROM H HOUR 80/hour DISTRIBUTION

TOTAL NO. CAS.	VALID SAMPLE	MIN. SPEED	MAX. SPEED	AVG. SPEED	VAR.	DEV.
0041	0041	0001	0030	5.434	32.12	5.668

FREQ. DISTRIB.

SPEED INTERVAL (MPH)	NO. OF CAS.
000-001	0003
001-002	0006
002-003	0007
003-004	0003
004-005	0004
005-006	0006
006-007	0006
007-008	0000
008-009	0001
009-010	0001
010-011	0001
011-012	0000
012-013	0000
013-014	0000
014-015	0000
015-016	0000
016-017	0001
017-018	0000
018-019	0000
019-020	0000
020-021	0000
021-022	0001
022-023	0000
023-024	0000
024-025	0000
025-026	0000
026-027	0000
027-028	0000
028-029	0000
029-030	0000
030-031	0001

FIG. 3-2 FREQUENCY DISTRIBUTIONS – RATE OF CASUALTY TRAVEL, BATTLEFIELD TO AID STATION

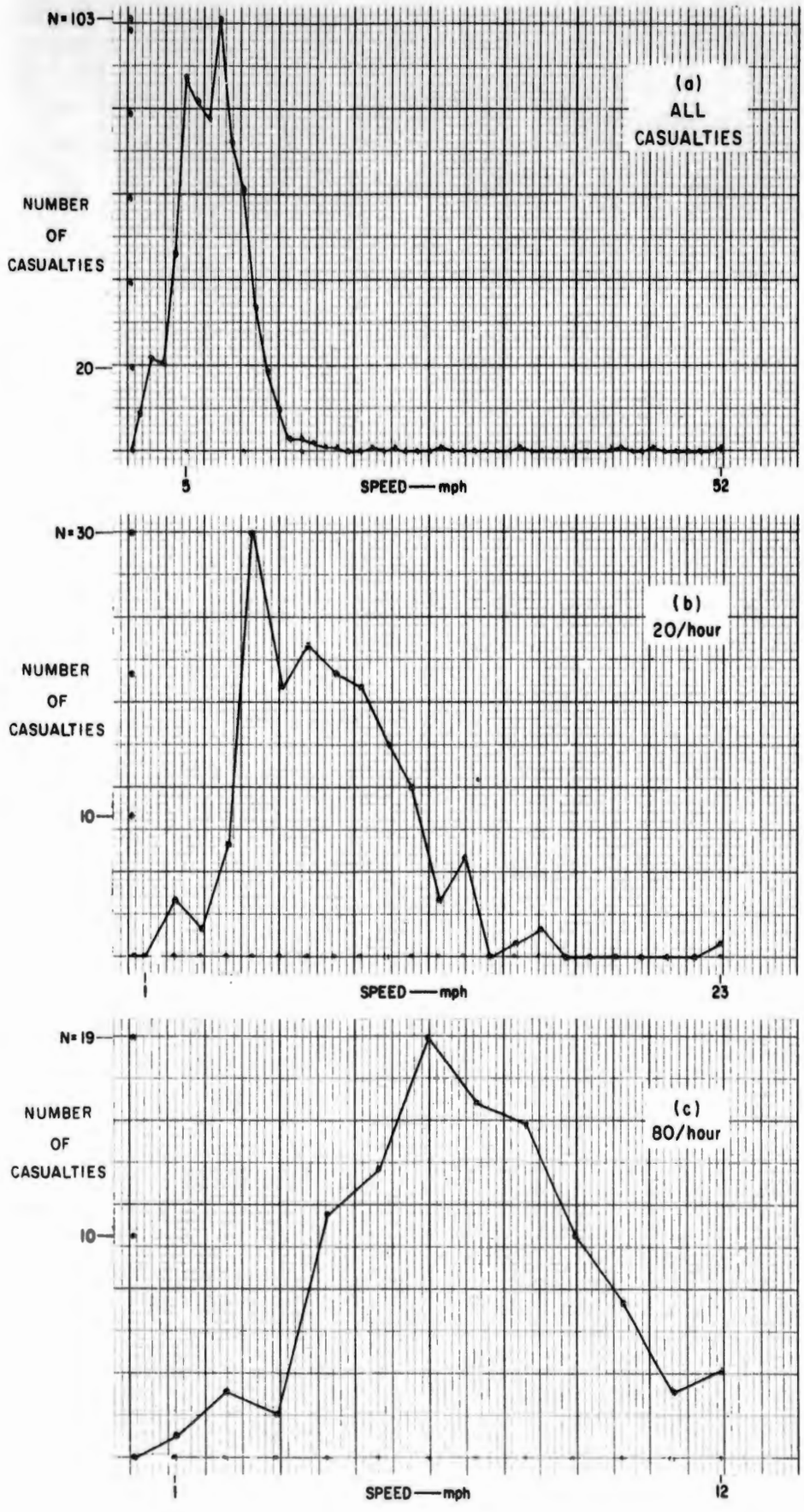


TABLE 3-2

FREQUENCY DISTRIBUTIONS – RATE OF CASUALTY TRAVEL, BATTLEFIELD TO AID STATION

(a)
Δt FROM H HOUR
ALL CASUALTIES

TOTAL NO. CAS.	VALID SAMPLE	MIN. SPEED	MAX. SPEED	AVG. SPEED	VAR.	DEV.
0669	0669	0001	0176	7.226	99.41	7.708

FREQ. DISTRIB.

SPEED INTERVAL (MPH)	NO. OF CAS.
000-001	0009
001-002	0022
002-003	0021
003-004	0047
004-005	0089
005-006	0083
006-007	0079
007-008	0103
008-009	0073
009-010	0062
010-011	0034
011-012	0019
012-013	0010
013-014	0003
014-015	0003
015-016	0002
016-017	0001
017-018	0001
018-019	0000
019-020	0000
020-021	0001
021-022	0000
022-023	0001
023-024	0000
024-025	0000
025-026	0000
026-027	0001
027-033	0000
033-034	0001
034-042	0000
042-043	0001
043-044	0000
044-045	0000
045-046	0001
046-051	0000
051-052	0001
052-176	0000
176-177	0001

(b)
Δt FROM H HOUR
20/hour DISTRIBUTION

TOTAL NO. CAS.	VALID SAMPLE	MIN. SPEED	MAX. SPEED	AVG. SPEED	VAR.	DEV.
0167	0167	0001	0051	7.425	20.27	4.502

FREQ. DISTRIB.

SPEED INTERVAL (MPH)	NO. OF CAS.
000-001	0000
001-002	0004
002-003	0002
003-004	0008
004-005	0030
005-006	0019
006-007	0022
007-008	0020
008-009	0019
009-010	0015
010-011	0012
011-012	0004
012-013	0007
013-014	0000
014-015	0001
015-016	0002
016-017	0000
017-018	0000
018-019	0000
019-020	0000
020-021	0000
021-022	0000
022-023	0001
023-051	0000
051-052	0001

(c)
Δt FROM H HOUR
80/hour DISTRIBUTION

TOTAL NO. CAS.	VALID SAMPLE	MIN. SPEED	MAX. SPEED	AVG. SPEED	VAR.	DEV.
0104	0104	0001	0011	6.232		2.370

FREQ. DISTRIB.

SPEED INTERVAL (MPH)	NO. OF CAS.
000-001	0001
001-002	0003
002-003	0002
003-004	0011
004-005	0013
005-006	0019
006-007	0016
007-008	0015
008-009	0010
009-010	0007
010-011	0003
011-012	0004

FIG. 3-3 FREQUENCY DISTRIBUTIONS – RATE OF CASUALTY TRAVEL, COMPANY AREA TO AID STATION

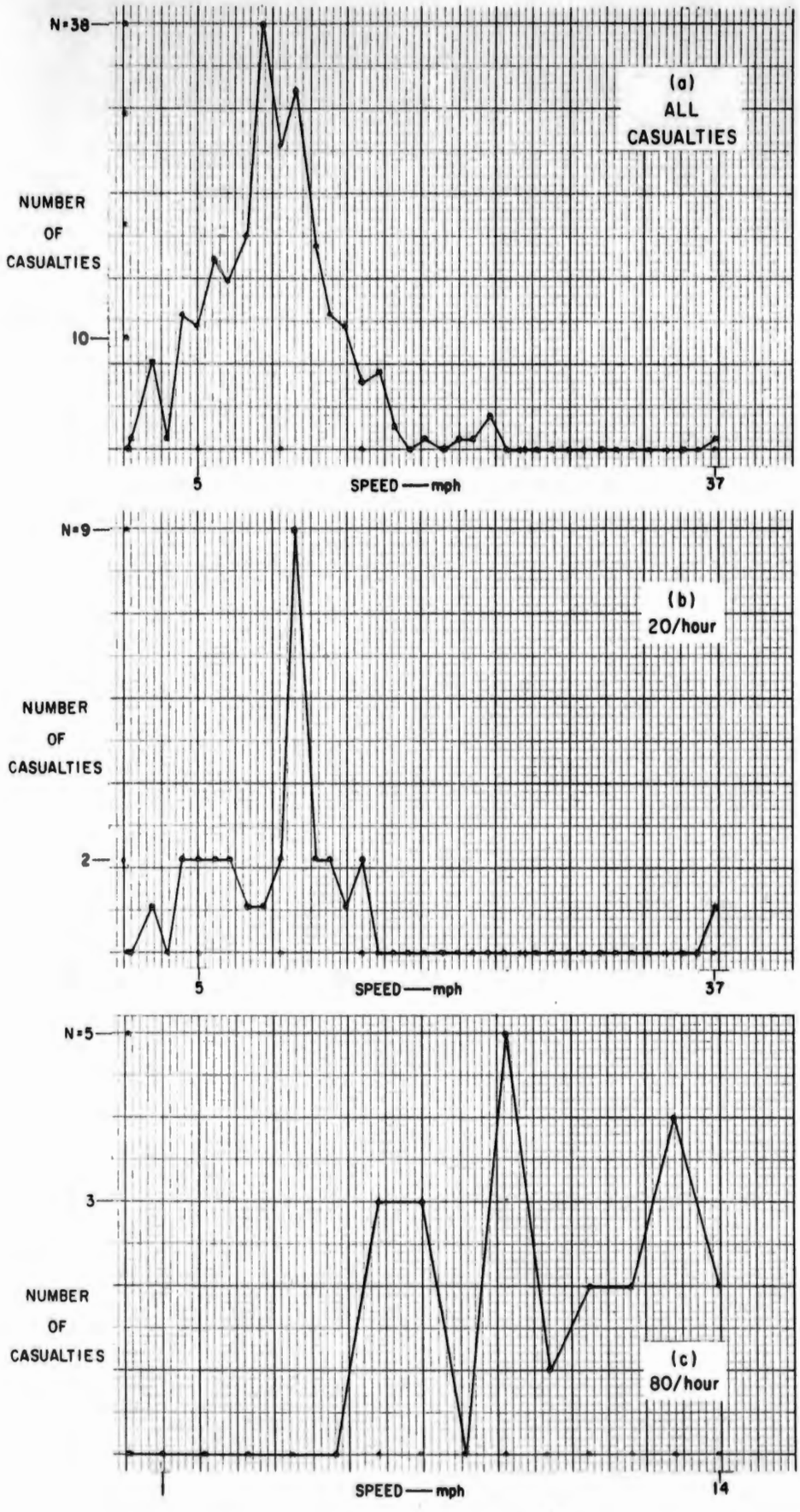


TABLE 3-3

FREQUENCY DISTRIBUTIONS – RATE OF CASUALTY TRAVEL, COMPANY AREA TO AID STATION

(a) Δt FROM H HOUR ALL CASUALTIES

TOTAL NO. CAS.	VALID SAMPLE	MIN. SPEED	MAX. SPEED	AVG. SPEED	VAR.	DEV.
0080	0030	0001	0036	9.893	35.48	5.957

FREQ. DISTRIB.

SPEED INTERVAL (MPH)	NO. OF CAS.
000-001	0000
001-002	0001
002-003	0000
003-004	0002
004-005	0002
005-006	0002
006-007	0002
007-008	0001
008-009	0001
009-010	0002
010-011	0009
011-012	0002
012-013	0002
013-014	0001
014-015	0002
015-016	0000
016-017	0000
017-018	0000
018-019	0000
019-020	0000
020-021	0000
021-022	0000
022-023	0000
023-024	0000
024-025	0000
025-026	0000
026-027	0000
027-028	0000
028-029	0000
029-030	0000
030-031	0000
031-032	0000
032-033	0000
033-034	0000
034-035	0000
035-036	0000
036-037	0001

(b) Δt FROM H HOUR 20/hour DISTRIBUTION

TOTAL NO. CAS.	VALID SAMPLE	MIN. SPEED	MAX. SPEED	AVG. SPEED	VAR.	DEV.
0247	0247	0000	0300	11.76	620.7	24.91

FREQ. DISTRIB.

SPEED INTERVAL (MPH)	NO. OF CAS.
000-001	0001
001-002	0008
002-003	0001
003-004	0012
004-005	0011
005-006	0017
006-007	0015
007-008	0019
008-009	0038
009-010	0027
010-011	0032
011-012	0018
012-013	0012
013-014	0011
014-015	0006
015-016	0007
016-017	0002
017-018	0000
018-019	0001
019-020	0000
020-021	0001
021-022	0001
022-023	0003
023-036	0000
036-037	0001
037-120	0000
120-121	0001
121-240	0000
240-241	0001
241-300	0000
300-301	0001

(c) Δt FROM H HOUR 80/hour DISTRIBUTION

TOTAL NO. CAS.	VALID SAMPLE	MIN. SPEED	MAX. SPEED	AVG. SPEED	VAR.	DEV.
0022	0022	0005	0013	9.563		2.749

FREQ. DISTRIB.

SPEED INTERVAL (MPH)	NO. OF CAS.
000-001	0000
001-002	0000
002-003	0000
003-004	0000
004-005	0000
005-006	0003
006-007	0003
007-008	0000
008-009	0005
009-010	0001
010-011	0002
011-012	0002
012-013	0004
013-014	0002

TABLE 3-5

AMBULANCE LOADING FROM THE FIELD

TIME INTERVAL (MINS)	ALL CASUALTIES (a) TOTAL NO. AMB	TOTAL NO. CAS	AMBULANCE LOADS MIN	MAX	AVG	20/HOUR DISTRIB. (b) TOTAL NO. AMB	TOTAL NO. CAS	AMBULANCE LOADS MIN	MAX	AVG	80/HOUR DISTRIB. (c) TOTAL NO. AMB	TOTAL NO. CAS	AMBULANCE LOADS MIN	MAX	AVG
000-015	01	01	1	1	1.0	01	01	1	1	1.0					
015-030	06	11	1	4	1.8	04	09	1	4	2.3					
030-045	10	22	1	6	2.2						02	08	2	6	4.0
045-060	21	59	1	5	2.8	06	15	2	4	2.5	04	16	3	5	4.0
060-075	13	43	1	5	3.3	06	14	1	4	2.3					
075-090	27	78	1	6	2.9	14	44	1	5	3.1	01	05	5	5	5.0
090-105	16	47	1	6	2.9	08	22	1	5	2.8	02	10	6	4	5.0
105-120	25	74	1	7	3.0	12	38	2	6	3.2	01	07	7	7	7.0
120-135	21	70	1	6	2.4	10	30	1	6	3.0	01	04	4	4	4.0
135-150	17	54	1	5	3.2	06	16	1	4	2.7	01	04	4	4	4.0
150-165	09	40	1	6	4.4	02	07	3	4	3.5					
165-180	11	41	2	6	3.7	01	03	3	3	3.0	02	11	5	6	5.5
180-195	11	36	1	8	3.3	03	06	1	3	2.0	01	08	8	8	8.0
195-210	08	30	1	6	3.8	03	07	2	3	2.3	02	11	5	6	5.5
210-225	09	28	1	6	3.1										
225-240	08	23	1	5	2.9	01	01	1	1	1.0	01	03	3	3	3.0
240-255	14	44	1	5	3.1	02	07	3	4	3.5	01	04	4	4	4.0
255-270	04	16	4	4	4.0						01	04	4	4	4.0
270-285	07	21	1	7	3.0						01	07	7	7	7.0
285-300	13	48	1	6	3.7						03	09	1	4	3.0
300-315	04	16	3	5	4.0						01	05	5	5	5.0
315-330	08	29	1	6	3.6										
330-345	04	18	4	5	4.5						01	04	4	4	4.0
345-360	04	12	2	5	3.0						01	05	5	5	5.0
360-375	03	10	2	5	3.3										
375-390	03	14	4	5	4.7						01	05	5	5	5.0
390-405	05	13	1	4	2.6						01	03	3	3	3.0
405-420	02	05	2	3	2.5										
420-435	03	07	2	3	2.3										
435-450	03	12	4	4	4.0						01	04	4	4	4.0
450-465	01	04	4	4	4.0										
465-480	03	12	3	5	4.0										
480-495	03	13	3	6	4.3						01	04	4	4	4.0
495-510	04	10	1	4	2.5						01	03	3	3	3.0
510-525	01	04	4	4	4.0										
525-540	02	06	2	4	3.0										
540-555	00	00	0	0	0.0										
555-570	02	06	1	5	3.0										
OVERALL	306	977	1	8	3.2	79	220	1	6	2.8	32	144	1	8	4.5

TABLE 3-6

AMBULANCE LOADING FROM COMPANY AREA

TIME INTERVAL (MINS)	ALL CASUALTIES (a)					20/HOUR DISTRIB. (b)					80/HOUR DISTRIB. (c)				
	TOTAL NO. AMB	TOTAL NO. CAS	AMBULANCE LOADS MIN	MAX	AVG	TOTAL NO. AMB	TOTAL NO. CAS	AMBULANCE LOADS MIN	MAX	AVG	TOTAL NO. AMB	TOTAL NO. CAS	AMBULANCE LOADS MIN	MAX	AVG
000-015															
015-030															
030-045															
045-060	04	14	1	5	3.5	01	05	5	5	5.0					
060-075	03	14	4	6	4.7	01	06	6	6	6.0	01	04	4	4	4.0
075-090	07	26	3	4	3.7	02	08	4	4	4.0					
090-105	05	19	3	5	3.8	02	07	4	3	3.5	01	05	5	5	5.0
105-120	06	24	3	5	4.0	03	13	4	5	4.3					
120-135	07	25	1	5	3.6	02	09	4	5	4.5					
135-150	06	23	1	5	3.8	01	05	5	5	5.0	01	01	1	1	1.0
150-165	09	35	1	5	3.9	01	06	6	6	6.0	01	05	5	5	5.0
165-180	06	26	2	7	4.3										
180-195	01	04	4	4	4.0										
195-210	06	27	3	6	4.5	01	06	6	6	6.0					
210-225	06	16	1	6	2.7	01	03	3	3	3.0	05	13	1	6	2.6
225-240	05	21	4	5	4.2	01	04	4	4	4.0					
240-255	04	19	4	6	4.8	01	05	5	5	5.0					
255-270	03	12	2	7	4.0										
270-285	05	19	1	6	3.8						02	07	1	6	3.5
285-300	06	22	1	5	3.7										
300-315	05	26	1	8	5.2						01	08	8	8	8.0
315-330	02	14	5	9	7.0										
330-345	02	12	6	6	6.0										
345-360	03	16	5	6	5.3										
360-375	01	04	4	4	4.0						01	04	4	4	4.0
375-390	02	11	4	7	5.5										
390-405	02	11	5	6	5.5										
405-420	01	06	6	6	6.0						01	06	6	6	6.0
420-435	02	14	7	7	7.0										
435-450	04	22	4	6	5.5						01	06	6	6	6.0
450-465															
465-480	01	07	7	7	7.0										
480-495	01	04	4	4	4.0										
495-510	01	04	4	4	4.0										
510-525															
525-540	03	12	1	8	4.0						01	08	8	8	8.0
540-645															
645-660	01	01	1	1	1.0						01	01	1	1	1.0
OVERALL	120	510	1	9	4.3	17	77	3	6	4.5	17	68	1	8	4.0

ambulance. Presumably this occurred when personnel of loaded ambulances were forced to assign priority on the basis of criticalness of wound. We note the distribution of wound classes of the priority-delayed casualties.

Table 3-7

AMBULANCE LOADING FROM FIELD

Evacuees Per Ambulance	Total	Number of Ambulances	
		20/Hr.	80/Hr.
1	42	11	1
2	68	27	1
3	58	16	5
4	86	20	10
5	35	3	8
6	14	2	4
7	2	0	2
8	1	0	1

Table 3-8

PRIORITY DELAYED CASUALTIES, BY WOUND CLASS

Wound Class	Number	Percent
Immediate	8	11.1
Emergency	22	30.6
Delayed	42	58.3

The rate tables, 3-1 through 3-3, present a measure of ambulance efficiency, but do not permit a vision of the actual times involved. The remaining tables in this section, Tables 3-9 through 3-11, elapsed time and distance summaries, are similar to the corresponding tables in the preceding report (Report 4, Section 3). Table 3-9 is concerned with all casualties, while 3-10 and 3-11 refer to the 20/hr and 80/hr distributions, respectively. These summaries differ from the ones in the

prior report in that distances, being based on ambulance odometer readings, were recorded and are therefore summarized also. One should note that in comparing these values with the previous set of rate statistics that a measure of rate is not equal to the same measure of distance divided by that measure of time; measure being minimum, maximum, or average. In general, for average values:

$$\frac{1}{n}\sum_{i=1}^{n}\frac{\Delta d_i}{\Delta t_i} \neq \frac{\frac{1}{n}\sum_{i=1}^{n}\Delta d_i}{\frac{1}{n}\sum_{i=1}^{n}\Delta t_i} \quad . \tag{2}$$

These summaries are compiled for the following direct movements:

Field treatment area to company area

Field treatment area to aid station

Company area to aid station

Aid station to division.

Table 3-9

ELAPSED TIME AND DISTANCE SUMMARY--ALL CASUALTIES

Event	Workload (Delta Time from H-Hr)											
	No. of Samples		Minimum		Maximum		Average		Variance		Deviation	
	Δt (min)	Distance (miles)	Δt (min)	Distance (miles)	Δt (min)	Distance (miles)	Δt (min)	Distance (miles)	Δt (min)	Distance (miles)	Δt (min)	Distance (miles)
Battlefield to Company Area												
Depart (Battlefield)	303	266	15	1	458	11	130.5	2.4	9074.0	3.3	95.26	1.81
Arrive (Company Area)	304		19		485		161.4		9799.0		98.99	
Battlefield to Aid Station												
Depart (Battlefield)	744	670	11	1	562	978	202.6	9.3	16873.7	2518.9	129.90	50.19
Arrive (Aid Station)	735		45		595		256.3		16609.8		128.08	
Company Area to Aid Station												
Depart (Company Area)	284	256	41	1	620	11	250.0	4.6	17200.2	3.0	131.15	1.72
Arrive (Aid Station)	300		72		567		278.2		16240.1		127.44	
**Aid Station to Division												
Depart (Aid Station)	670	*	66	*	602	*	294.2	*	15252.3	*	123.50	*
Arrive (Division)	652		96		655		348.2		15825.6		125.80	

*No mileage recorded for travel between these points.

**Division defined as either the airstrip or hospital.

Table 3-10

ELAPSED TIME AND DISTANCE SUMMARY--20 PER HOUR DISTRIBUTION

Event	Workload (Delta Time from H-Hr)											
	No. of Samples		Minimum		Maximum		Average		Variance		Deviation	
	Δt (min)	Distance (miles)	Δt (min)	Distance (miles)	Δt (min)	Distance (miles)	Δt (min)	Distance (miles)	Δt (min)	Distance (miles)	Δt (min)	Distance (miles)
Battlefield to Company Area												
Depart (Battlefield)	34	28	15	1	154	7	67.2	2.0	1451.7	2.5	38.10	1.60
Arrive (Company Area)	35		19		158		89.6		1345.3		36.67	
Battlefield to Aid Station												
Depart (Battlefield)	173	168	11	1	251	15	99.1	5.6	2087.4	4.6	45.69	2.15
Arrive (Aid Station)	177		70		274		150.1		1886.0		43.42	
Company Area to Aid Station												
Depart (Company Area)	32	31	41	2	620	9	140.2	4.8	9850.3	4.6	99.25	2.14
Arrive (Aid Station)	34		72		255		155.1		2422.2		49.21	
**Aid Station to Division												
Depart (Aid Station)	33	*	101	*	286	*	189.4	*	3096.3	*	55.64	*
Arrive (Division)	34		177		458		254.5		4104.0		64.06	

*No mileage recorded for travel between these points.

**Division defined as either the airstrip or hospital.

Table 3-11

ELAPSED TIME AND DISTANCE SUMMARY--80 PER HOUR DISTRIBUTION

Event	Workload (Delta Time from H-Hr)											
	No. of Samples		Minimum		Maximum		Average		Variance		Deviation	
	Δt (min)	Distance (miles)	Δt (min)	Distance (miles)	Δt (min)	Distance (miles)	Δt (min)	Distance (miles)	Δt (min)	Distance (miles)	Δt (min)	Distance (miles)
Battlefield to Company Area												
Depart (Battlefield)	43	41	18	1	343	9	136.2	2.6	9486.0	4.8	97.40	2.20
Arrive (Company Area)	41		40		372		177.1		10457.0		102.26	
Battlefield to Aid Station												
Depart (Battlefield)	117	98	22	3	500	10	223.4	5.5	16754.2	1.5	129.44	1.24
Arrive (Aid Station)	117		90		558		282.7		16548.0		128.64	
Company Area to Aid Station												
Depart (Company Area)	34	25	68	3	528	9	300.9	4.7	19924.5	2.1	141.15	1.43
Arrive (Aid Station)	39		100		558		312.1		19339.7		139.07	
**Aid Station to Division												
Depart (Aid Station)	114	*	116	*	567	*	308.6	*	15540.2	*	124.66	*
Arrive (Division)	102		151		625		361.8		15798.0		125.69	

*No mileage recorded for travel between these points.

**Division defined as either the airstrip or hospital.

IV MEDICAL WORKLOAD

The workload of the medical personnel through the medical system can be documented by the number of casualties that are treated, how these casualties are distributed in time, and the amount of treatment rendered to the casualties. The time distributions of casualty arrivals at the various echelons of the system are presented in tabular form in Tables 4-1 through 4-4. Both the frequency and cumulative distributions are presented. Figures 4-1 through 4-4 graph the tables and depict an approximating polynomial for the normalized cumulative curve. The normalized overlay that is used in Report 4 is applicable to this set of graphs.

Table and Fig. 4-1 are concerned with casualty occurrence. Tables and Figs. 4-2 and 4-3 present the distribution of casualty arrivals at the company area and aid station, respectively. Table and Fig. 4-4 are the combined arrival information at the air strip and at the field hospital. Geographically, the air strip was very close to the field hospital. The casualties evacuated by air are presumably destined for the field hospital. Hence, the arrivals at the air strip are essentially both in fact and in time the responsibility and the workload of the field hospital.

The extent of treatment as measured by the time expended is presented in the next set of results. Table 4-5 is the distribution of treatment times per casualty in the field. For casualties that are treated several times in the field, the sum of these times is considered as the field treatment time for the casualty.

The cumulative treatment times versus time is presented in Table 4-6. Graphical representations of these two distributions are presented as Figs. 4-5 and 4-6. Tables 4-7 and 4-8, and Figs. 4-7 and 4-8 present the same information for the aid station.

FIG. 4-1 CUMULATIVE DISTRIBUTIONS – CASUALTY OCCURRENCE

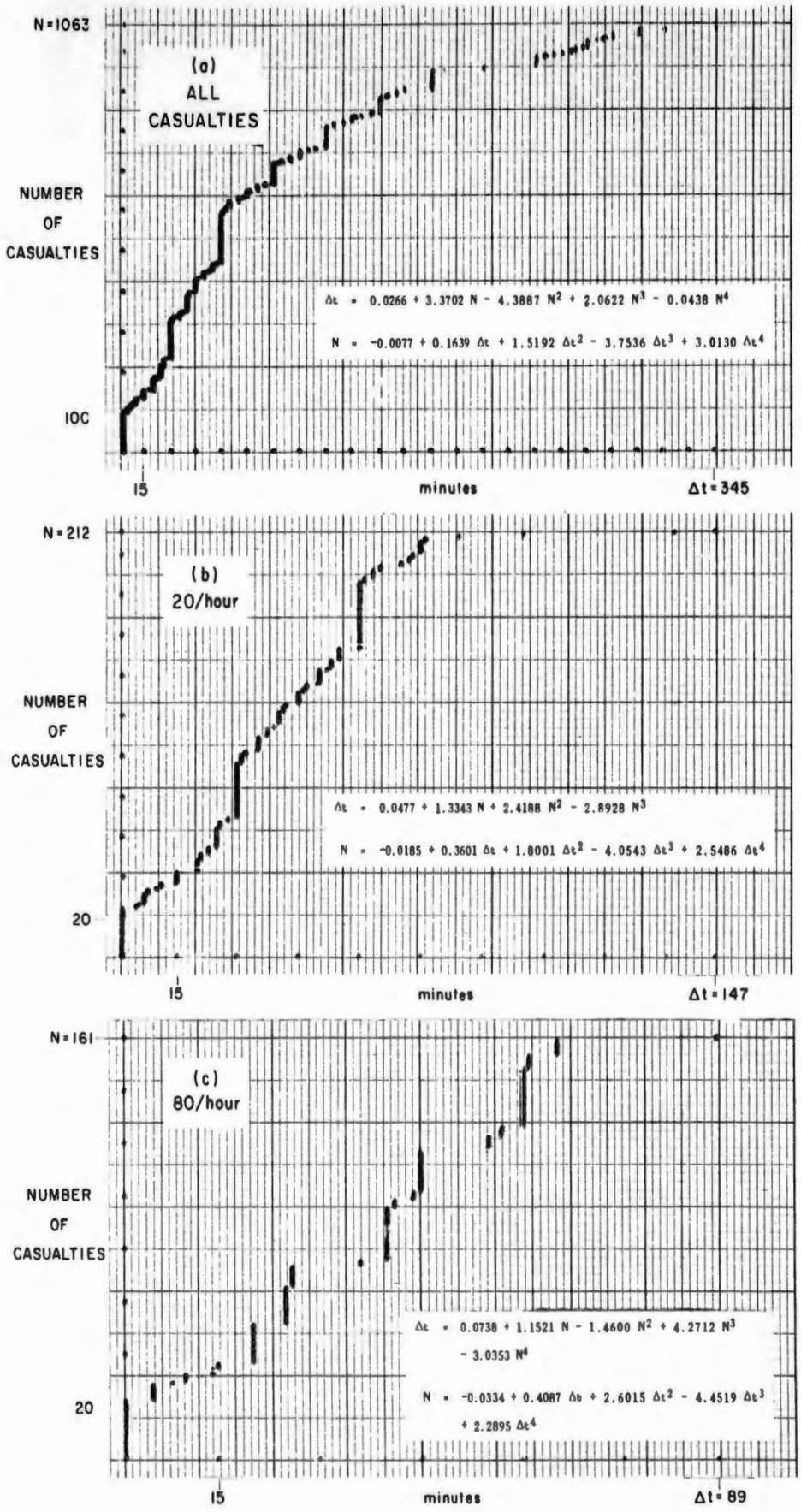


TABLE 4-1

FREQUENCY AND CUMULATIVE DISTRIBUTIONS – CASUALTY OCCURRENCE

(a)
WORKLOAD (Δt FROM H HOUR)
ALL CASUALTIES

TOTAL NO. CAS.	VALID SAMPLE	MIN. DELTA TIME	MAX. DELTA TIME	AVG. DELTA TIME	VAR.	DEV.
1069	1063	0000	0345	84.32	6021	77.59

FREQ. DISTRIB. CUMUL. DISTRIB.

DELTA TIME INTERVAL (MINS)	NO. OF CAS.	DELTA TIME (MINS.	NO. OF CAS.
000-015	0142	015	0142
015-030	0096	030	0238
030-045	0168	045	0406
045-060	0070	060	0476
060-075	0162	075	0638
075-090	0034	090	0672
090-105	0067	105	0739
105-120	0023	120	0762
120-135	0066	135	0828
135-150	0021	150	0849
150-165	0055	165	0904
165-180	0006	180	0910
180-195	0045	195	0955
195-210	0000	210	0955
210-225	0009	225	0964
225-240	0000	240	0964
240-255	0032	255	0996
255-270	0017	270	1013
270-285	0024	285	1037
285-300	0007	300	1044
300-315	0013	315	1057
315-330	0003	330	1060
330-345	0000	345	1060
345-360	0003	360	1063

(b)
WORKLOAD (Δt FROM H HOUR)
20/hour DISTRIBUTION

TOTAL NO. CAS.	VALID SAMPLE	MIN. DELTA TIME	MAX. DELTA TIME	AVG. DELTA TIME	VAR.	DEV.
0210	0212	0000	0147	38.11	604.1	24.57

FREQ. DISTRIB. CUMUL. DISTRIB.

DELTA TIME INTERVAL (MINS)	NO. OF CAS.	DELTA TIME (MINS.	NO. OF CAS.
000-015	0036	015	0036
015-030	0033	030	0069
030-045	0056	045	0125
045-060	0028	060	0153
060-075	0047	075	0200
075-090	0009	090	0209
090-105	0001	105	0210
105-120	0000	120	0210
120-135	0000	135	0210
135-150	0002	150	0212

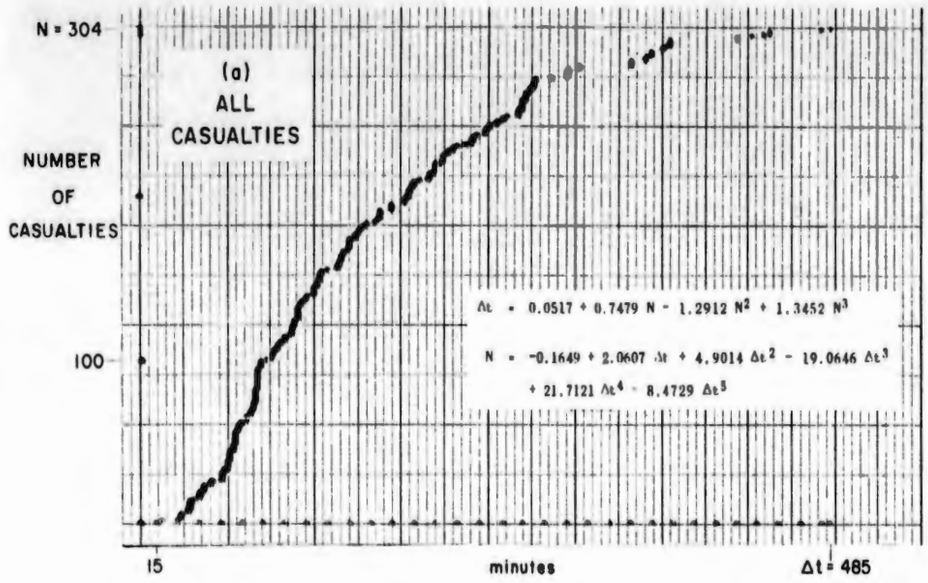
(c)
WORKLOAD (Δt FROM H HOUR)
80/hour DISTRIBUTION

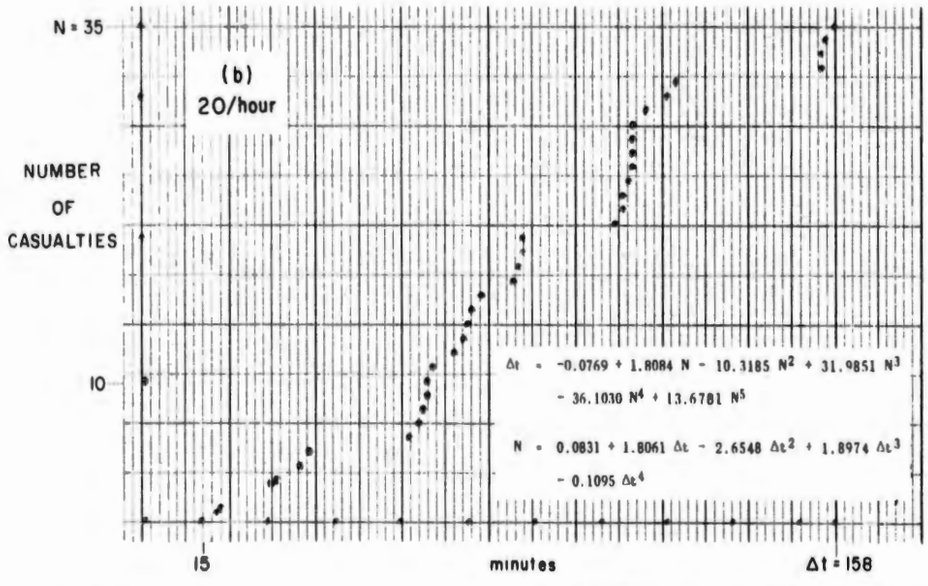
TOTAL NO. CAS.	VALID SAMPLE	MIN. DELTA TIME	MAX. DELTA TIME	AVG. DELTA TIME	VAR.	DEV.
0161	0161	0000	0089	34.32	479.6	21.89

FREQ. DISTRIB. CUMUL. DISTRIB.

DELTA TIME INTERVAL (MINS)	NO. OF CAS.	DELTA TIME (MINS.	NO. OF CAS.
000-015	0034	015	0034
015-030	0039	030	0073
030-045	0028	045	0101
045-060	0025	060	0126
060-075	0033	075	0159
075-090	0002	090	0161

FIG. 4-2 CUMULATIVE DISTRIBUTIONS – CASUALTY ARRIVAL AT COMPANY AREA





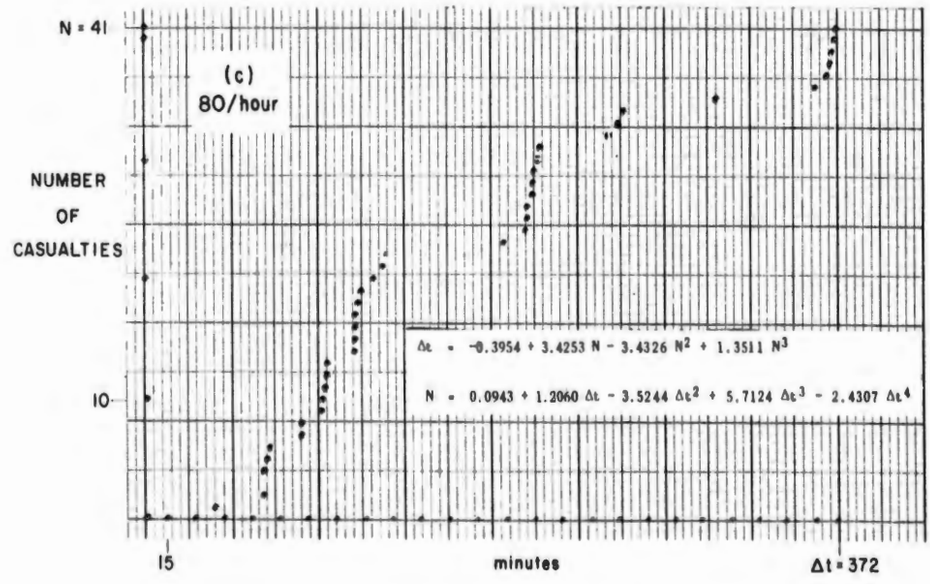


TABLE 4-2

FREQUENCY AND CUMULATIVE DISTRIBUTIONS – CASUALTY ARRIVAL AT COMPANY AREA

(a)
WORKLOAD (Δt FROM H HOUR)
ALL CASUALTIES

TOTAL NO. CAS.	VALID SAMPLE	MIN. DELTA TIME	MAX. DELTA TIME	AVG. DELTA TIME	VAR.	DEV.
0309	0304	0019	0485	161.4	9800	98.99

FREQ. DISTRIB.

DELTA TIME INTERVAL (MINS)	NO. OF CAS.
000-015	0000
015-030	0001
030-045	0014
045-060	0011
060-075	0035
075-090	0036
090-105	0014
105-120	0025
120-135	0018
135-150	0013
150-165	0016
165-180	0010
180-195	0014
195-210	0008
210-225	0015
225-240	0008
240-255	0008
255-270	0010
270-285	0016
285-300	0001
300-315	0007
315-330	0000
330-345	0000
345-360	0008
360-375	0008
375-390	0000
390-405	0000
405-420	0000
420-435	0003
435-450	0003
450-465	0000
465-480	0001
480-495	0001

CUMUL. DISTRIB.

DELTA TIME (MINS.	NO. OF CAS.
015	0000
030	0001
045	0015
060	0026
075	0061
090	0097
105	0111
120	0136
135	0154
150	0167
165	0183
180	0193
195	0207
210	0215
225	0230
240	0238
255	0246
270	0256
285	0272
300	0273
315	0280
330	0280
345	0280
360	0288
375	0296
390	0296
405	0296
420	0296
435	0299
450	0302
465	0302
480	0303
495	0304

(b)
WORKLOAD (Δt FROM H HOUR)
20/hour DISTRIBUTION

TOTAL NO. CAS.	VALID SAMPLE	MIN. DELTA TIME	MAX. DELTA TIME	AVG. DELTA TIME	VAR.	DEV.
0043	0041	0040	0372	177.1	10456	102.2

FREQ. DISTRIB.

DELTA TIME INTERVAL (MINS)	NO. OF CAS.
000-015	0000
015-030	0000
030-045	0001
045-060	0000
060-075	0005
075-090	0002
090-105	0005
105-120	0006
120-135	0003
135-150	0000
150-165	0000
165-180	0000
180-195	0001
195-210	0004
210-225	0004
225-240	0000
240-255	0001
255-270	0002
270-285	0000
285-300	0000
300-315	0001
315-330	0000
330-345	0000
345-360	0000
360-375	0006

CUMUL. DISTRIB.

DELTA TIME (MINS.	NO. OF CAS.
015	0000
030	0000
045	0001
060	0001
075	0006
090	0008
105	0013
120	0019
135	0022
150	0022
165	0022
180	0022
195	0023
210	0027
225	0031
240	0031
255	0032
270	0034
285	0034
300	0034
315	0035
330	0035
345	0035
360	0035
375	0041

(c)
WORKLOAD (Δt FROM H HOUR)
80/hour DISTRIBUTION

TOTAL NO. CAS.	VALID SAMPLE	MIN. DELTA TIME	MAX. DELTA TIME	AVG. DELTA TIME	VAR.	DEV.
0035	0035	0019	0158	89.60	1345	36.67

FREQ. DISTRIB.

DELTA TIME INTERVAL (MINS)	NO. OF CAS.
000-015	0000
015-030	0001
030-045	0004
045-060	0000
060-075	0008
075-090	0007
090-105	0000
105-120	0009
120-135	0002
135-150	0000
150-165	0004

CUMUL. DISTRIB.

DELTA TIME (MINS.	NO. OF CAS.
015	0000
030	0001
045	0005
060	0005
075	0013
090	0020
105	0020
120	0029
135	0031
150	0031
165	0035

FIG. 4-3 CUMULATIVE DISTRIBUTIONS – CASUALTY ARRIVAL AT AID STATION

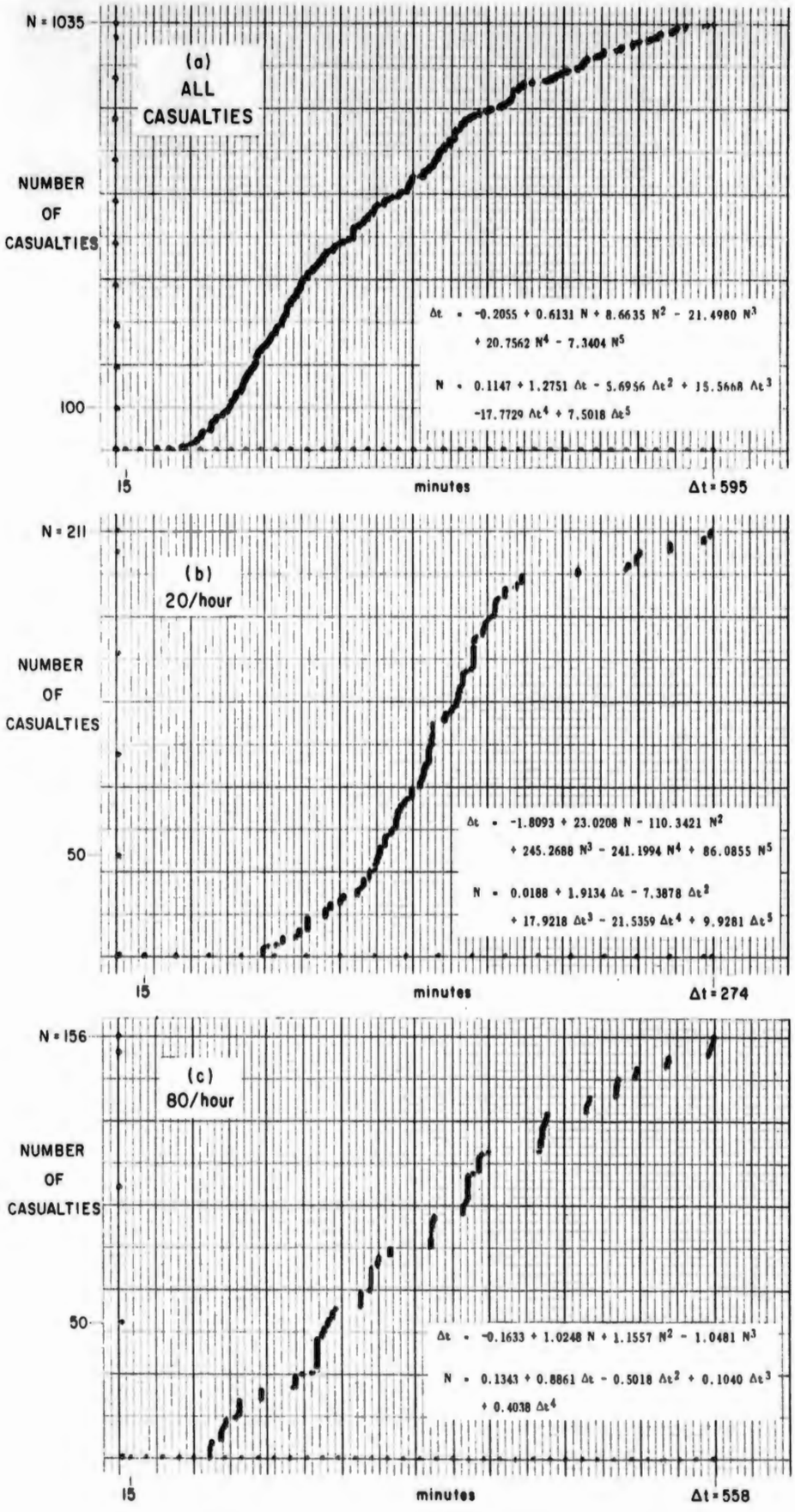


TABLE 4-3

FREQUENCY AND CUMULATIVE DISTRIBUTIONS – CASUALTY ARRIVAL AT AID STATION

(a)
WORKLOAD (Δt FROM H HOUR)
ALL CASUALTIES

TOTAL NO. CAS.	VALID SAMPLE	MIN. DELTA TIME	MAX. DELTA TIME	AVG. DELTA TIME	VAR.	DEV.
1067	1039	0045	0595	262.6	16586	128.7

FREQ. DISTRIB.

DELTA TIME INTERVAL (MINS)	NO. OF CAS.
000-015	0000
015-030	0000
030-045	0000
045-060	0004
060-075	0005
075-090	0018
090-105	0045
105-120	0039
120-135	0063
135-150	0069
150-165	0044
165-180	0066
180-195	0066
195-210	0044
210-225	0039
225-240	0018
240-255	0048
255-270	0032
270-285	0020
285-300	0047
300-315	0017
315-330	0051
330-345	0053
345-360	0029
360-375	0012
375-390	0013
390-405	0043
405-420	0014
420-435	0004
435-450	0022
450-465	0010
465-480	0024
480-495	0018
495-510	0010
510-525	0013
525-540	0012
540-555	0012
555-570	0014
570-585	0000
585-600	0005

CUMUL. DISTRIB.

DELTA TIME (MINS.	NO. OF CAS.
015	0000
030	0000
045	0000
060	0004
075	0009
090	0027
105	0072
120	0107
135	0170
150	0239
165	0283
180	0349
195	0415
210	0459
225	0494
240	0512
255	0560
270	0592
285	0612
300	0659
315	0676
330	0727
345	0780
360	0809
375	0821
390	0834
405	0877
420	0891
435	0895
450	0917
465	0927
480	0951
495	0969
510	0979
525	0992
540	1004
555	1016
570	1030
585	1030
600	1035

(b)
WORKLOAD (Δt FROM H HOUR)
20/hour DISTRIBUTION

TOTAL NO. CAS.	VALID SAMPLE	MIN. DELTA TIME	MAX. DELTA TIME	AVG. DELTA TIME	VAR.	DEV.
0212	0211	0070	0274	150.9	1964	44.32

FREQ. DISTRIB.

DELTA TIME INTERVAL (MINS)	NO. OF CAS.
000-015	0000
015-030	0000
030-045	0000
045-060	0000
060-075	0005
075-090	0008
090-105	0013
105-120	0017
120-135	0034
135-150	0038
150-165	0027
165-180	0035
180-195	0011
195-210	0000
210-225	0003
225-240	0003
240-255	0006
255-270	0004
270-285	0007

CUMUL. DISTRIB.

DELTA TIME (MINS.	NO. OF CAS.
015	0000
030	0000
045	0000
060	0000
075	0005
090	0013
105	0026
120	0043
135	0077
150	0115
165	0142
180	0177
195	0188
210	0188
225	0191
240	0194
255	0200
270	0204
285	0211

(c)
WORKLOAD (Δt FROM H HOUR)
80/hour DISTRIBUTION

TOTAL NO. CAS.	VALID SAMPLE	MIN. DELTA TIME	MAX. DELTA TIME	AVG. DELTA TIME	VAR.	DEV.
0161	0156	0090	0558	290.0	17288	131.4

FREQ. DISTRIB.

DELTA TIME INTERVAL (MINS)	NO. OF CAS.
000-015	0000
015-030	0000
030-045	0000
045-060	0000
060-075	0000
075-090	0000
090-105	0012
105-120	0009
120-135	0000
135-150	0004
150-165	0000
165-180	0006
180-195	0013
195-210	0011
210-225	0000
225-240	0007
240-255	0012
255-270	0003
270-285	0000
285-300	0012
300-315	0000
315-330	0006
330-345	0017
345-360	0001
360-375	0000
375-390	0000
390-405	0014
405-420	0000
420-435	0000
435-450	0006
450-465	0000
465-480	0007
480-495	0004
495-510	0000
510-525	0004
525-540	0000
540-555	0003
555-570	0005

CUMUL. DISTRIB.

DELTA TIME (MINS.	NO. OF CAS.
015	0000
030	0000
045	0000
060	0000
075	0000
090	0000
105	0012
120	0021
135	0021
150	0025
165	0025
180	0031
195	0044
210	0055
225	0055
240	0062
255	0074
270	0077
285	0077
300	0089
315	0089
330	0095
345	0112
360	0113
375	0113
390	0113
405	0127
420	0127
435	0127
450	0133
465	0133
480	0140
495	0144
510	0144
525	0148
540	0148
555	0151
570	0156

FIG. 4-4 CUMULATIVE DISTRIBUTIONS – CASUALTY ARRIVAL AT DIVISION

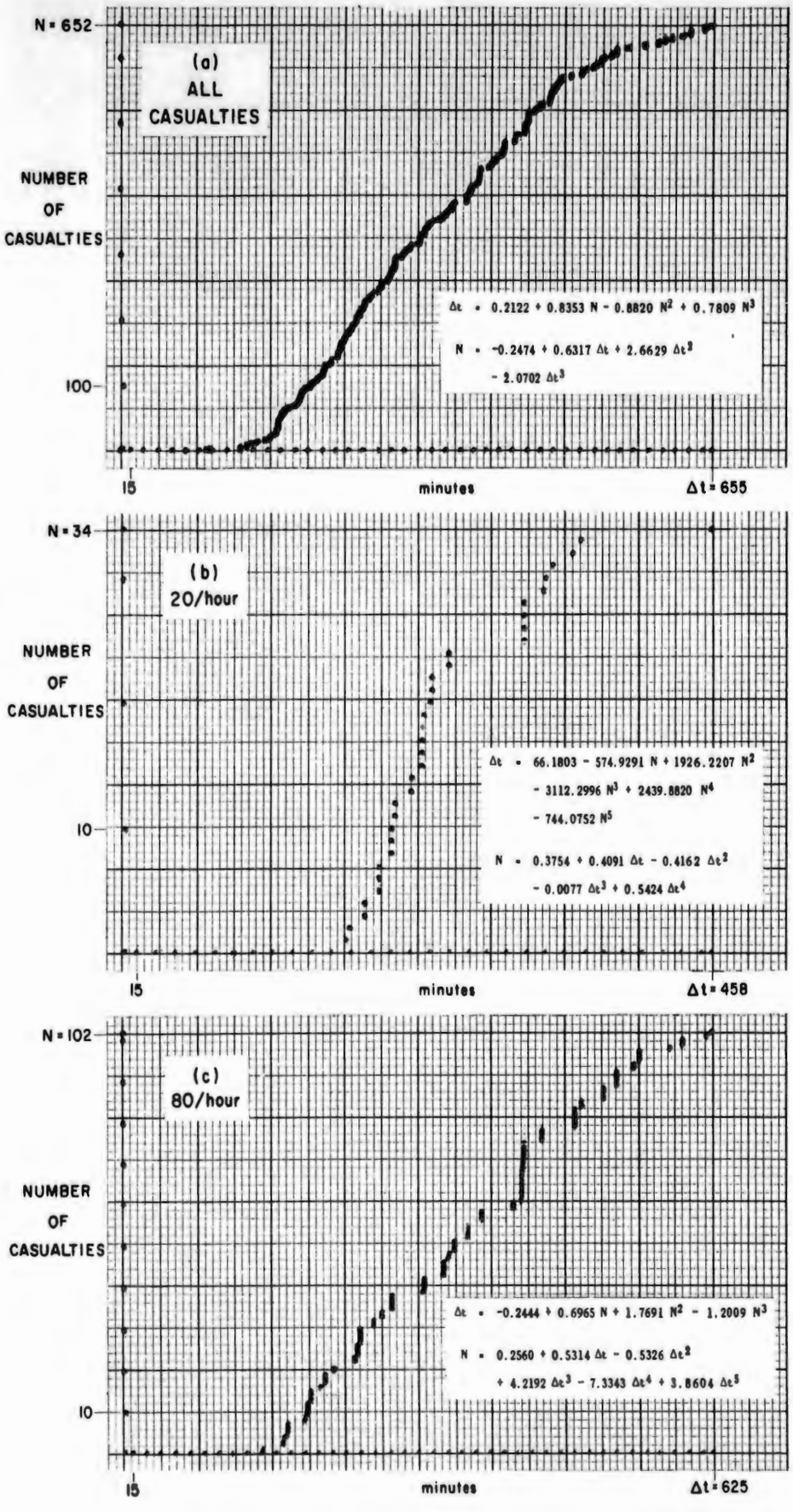


TABLE 4-4

FREQUENCY AND CUMULATIVE DISTRIBUTIONS – CASUALTY ARRIVAL AT DIVISION

(a)
WORKLOAD (Δt FROM H HOUR)
ALL CASUALTIES

TOTAL NO. CAS.	VALID SAMPLE	MIN. DELTA TIME	MAX. DELTA TIME	AVG. DELTA TIME	VAR.	DEV.
0653	0652	0096	0655	348.2	15826	125.8

FREQ. DISTRIB.

DELTA TIME INTERVAL (MINS)	NO. OF CAS.
000-015	0000
015-030	0000
030-045	0000
045-060	0000
060-075	0000
075-090	0000
090-105	0003
105-120	0000
120-135	0000
135-150	0008
150-165	0006
165-180	0038
180-195	0014
195-210	0027
210-225	0021
225-240	0022
240-255	0044
255-270	0032
270-285	0027
285-300	0027
300-315	0033
315-330	0014
330-345	0032
345-360	0010
360-375	0020
375-390	0025
390-405	0027
405-420	0018
420-435	0022
435-450	0028
450-465	0029
465-480	0020
480-495	0023
495-510	0003
510-525	0014
525-540	0015
540-555	0012
555-570	0003
570-585	0004
585-600	0005
600-615	0007
615-630	0003
630-645	0008
645-660	0008

CUMUL. DISTRIB.

DELTA TIME (MINS.	NO. OF CAS.
015	0000
030	0000
045	0000
060	0000
075	0000
090	0000
105	0003
120	0003
135	0003
150	0011
165	0017
180	0055
195	0069
210	0096
225	0117
240	0139
255	0183
270	0215
285	0242
300	0269
315	0302
330	0316
345	0348
360	0358
375	0378
390	0403
405	0430
420	0448
435	0470
450	0498
465	0527
480	0547
495	0570
510	0573
525	0587
540	0602
555	0614
570	0617
585	0621
600	0626
615	0633
630	0636
645	0644
660	0652

(b)
WORKLOAD (Δt FROM H HOUR)
20/hour DISTRIBUTION

TOTAL NO. CAS.	VALID SAMPLE	MIN. DELTA TIME	MAX. DELTA TIME	AVG. DELTA TIME	VAR.	DEV.
0034	0034	0177	0458	254.5	4104	64.06

FREQ. DISTRIB.

DELTA TIME INTERVAL (MINS)	NO. OF CAS.
000-015	0000
015-030	0000
030-045	0000
045-060	0000
060-075	0000
075-090	0000
090-105	0000
105-120	0000
120-135	0000
135-150	0000
150-165	0000
165-180	0002
180-195	0002
195-210	0003
210-225	0005
225-240	0007
240-255	0005
255-270	0000
270-285	0000
285-300	0000
300-315	0004
315-330	0001
330-345	0002
345-360	0002
360-375	0000
375-390	0000
390-405	0000
405-420	0000
420-435	0000
435-450	0000
450-465	0001

CUMUL. DISTRIB.

DELTA TIME (MINS.	NO. OF CAS.
015	0000
030	0000
045	0000
060	0000
075	0000
090	0000
105	0000
120	0000
135	0000
150	0000
165	0000
180	0002
195	0004
210	0007
225	0012
240	0019
255	0024
270	0024
285	0024
300	0024
315	0028
330	0029
345	0031
360	0033
375	0033
390	0033
405	0033
420	0033
435	0033
450	0033
465	0034

(c)
WORKLOAD (Δt FROM H HOUR)
80/hour DISTRIBUTION

TOTAL NO. CAS.	VALID SAMPLE	MIN. DELTA TIME	MAX. DELTA TIME	AVG. DELTA TIME	VAR.	DEV.
0102	0102	0191	0625	361.8	15799	125.6

FREQ. DISTRIB.

DELTA TIME INTERVAL (MINS)	NO. OF CAS.
000-015	0000
015-030	0000
030-045	0000
045-060	0000
060-075	0000
075-090	0000
090-105	0000
105-120	0000
120-135	0000
135-150	0000
150-165	0001
165-180	0006
180-195	0001
195-210	0007
210-225	0004
225-240	0002
240-255	0009
255-270	0002
270-285	0002
285-300	0004
300-315	0000
315-330	0004
330-345	0004
345-360	0005
360-375	0004
375-390	0003
390-405	0000
405-420	0002
420-435	0015
435-450	0003
450-465	0000
465-480	0000
480-495	0007
495-510	0000
510-525	0003
525-540	0004
540-555	0005
555-570	0000
570-585	0001
585-600	0002
600-615	0000
615-630	0002

CUMUL. DISTRIB.

DELTA TIME (MINS.	NO. OF CAS.
015	0000
030	0000
045	0000
060	0000
075	0000
090	0000
105	0000
120	0000
135	0000
150	0000
165	0001
180	0007
195	0008
210	0015
225	0019
240	0021
255	0030
270	0032
285	0034
300	0038
315	0038
330	0042
345	0046
360	0051
375	0055
390	0058
405	0058
420	0060
435	0075
450	0078
465	0078
480	0078
495	0085
510	0085
525	0088
540	0092
555	0097
570	0097
585	0098
600	0100
615	0100
630	0102

FIG. 4-5 FREQUENCY DISTRIBUTIONS – TREATMENT TIMES PER CASUALTY IN THE FIELD

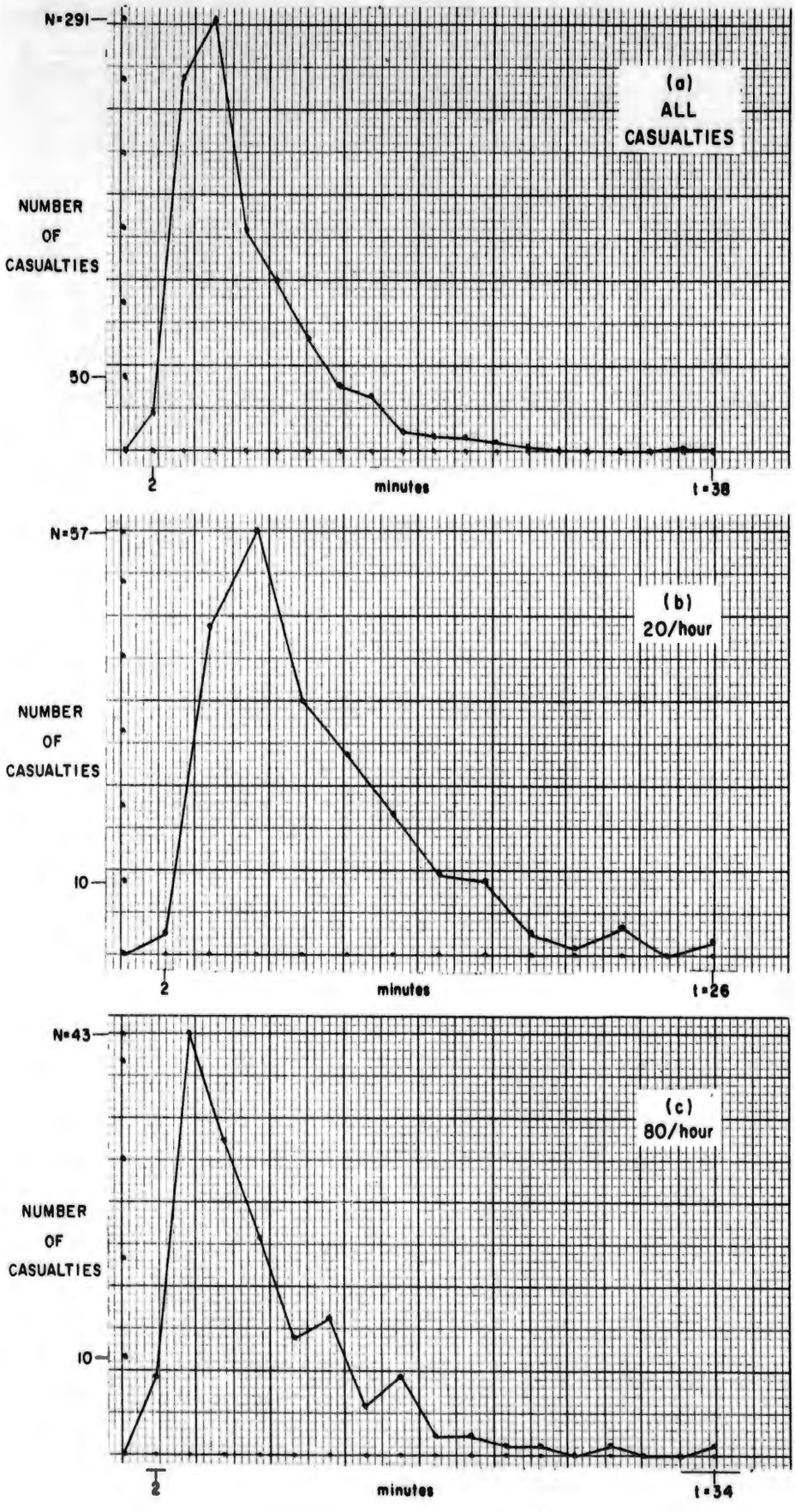


TABLE 4-5

FREQUENCY DISTRIBUTION – TREATMENT TIMES PER CASUALTY IN THE FIELD

TOTAL NO. CAS.	VALID SAMPLE	MIN. DELTA TIME	MAX. DELTA TIME	AVG. DELTA TIME	VAR.	DEV.
1060	1041	0001	0124	6.844	46.22	6.798

FREQ. DISTRIB.

DELTA TIME INTERVAL (MINS)	NO. OF CAS.
000-002	0026
002-004	0252
004-006	0291
006-008	0148
008-010	0115
010-012	0076
012-014	0044
014-016	0037
016-018	0013
018-020	0010
020-022	0009
022-024	0006
024-026	0003
026-028	0001
028-030	0000
030-032	0001
032-034	0001
034-036	0003
036-038	0001
038-040	0000
040-042	0000
042-044	0000
044-046	0000
046-048	0000
048-050	0000
050-052	0000
052-054	0000
054-056	0000
056-058	0000
058-060	0000
060-062	0000
062-064	0001
064-066	0001
066-068	0000
068-070	0000
070-072	0001
072-124	0000
124-126	0001

TOTAL NO. CAS.	VALID SAMPLE	MIN. DELTA TIME	MAX. DELTA TIME	AVG. DELTA TIME	VAR.	DEV.
0217	0215	0001	0025	6.958	20.4	4.517

FREQ. DISTRIB.

DELTA TIME INTERVAL (MINS)	NO. OF CAS.
000-002	0003
002-004	0044
004-006	0057
006-008	0034
008-010	0027
010-012	0019
012-014	0011
014-016	0010
016-018	0003
018-020	0001
020-022	0004
022-024	0000
024-026	0002

TOTAL NO. CAS.	VALID SAMPLE	MIN. DELTA TIME	MAX. DELTA TIME	AVG. DELTA TIME	VAR.	DEV.
0156	0152	0001	0033	6.618	27.61	5.255

FREQ. DISTRIB.

DELTA TIME INTERVAL (MINS)	NO. OF CAS.
000-002	0008
002-004	0043
004-006	0032
006-008	0022
008-010	0012
010-012	0014
012-014	0005
014-016	0008
016-018	0002
018-020	0002
020-022	0001
022-024	0001
024-026	0000
026-028	0001
028-030	0000
030-032	0000
032-034	0001

FIG. 4-6 CUMULATIVE TREATMENT TIME vs. TIME, FIELD

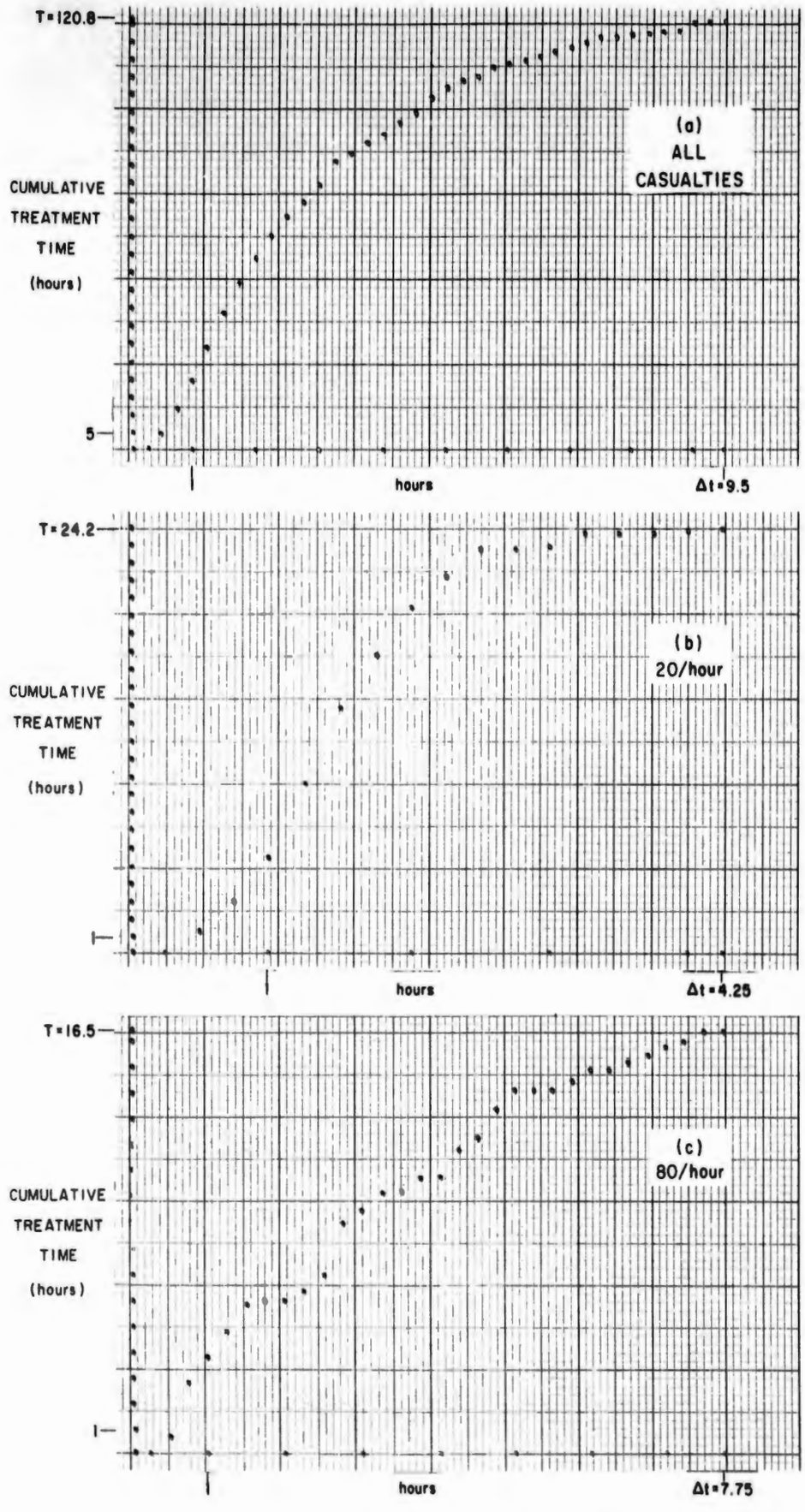


TABLE 4-6

CUMULATIVE TREATMENT TIME vs. TIME, FIELD

(a)

Δt FROM H HOUR
ALL CASUALTIES

FREQ. DISTRIB. DELTA TIME INTERVAL (MINS)	NO. OF CAS. TREATED	CUMULATIVE TREATMENT TIME MINUTES
000-015	0003	0016
015-030	0048	0274
030-045	0069	0708
045-060	0072	1173
060-075	0076	1737
075-090	0075	2315
090-105	0066	2819
105-120	0060	3245
120-135	0061	3621
135-150	0044	3937
150-165	0035	4179
165-180	0039	4474
180-195	0036	4879
195-210	0029	5017
210-225	0032	5194
225-240	0025	5330
240-255	0030	5539
255-270	0027	5694
270-285	0035	5959
285-300	0024	6129
300-315	0017	6245
315-330	0011	6309
330-345	0024	6465
345-360	0010	6530
360-375	0006	6574
375-390	0012	6651
390-405	0006	6719
405-420	0015	6805
420-435	0012	6888
435-450	0014	6976
450-465	0005	6990
465-480	0006	7031
480-495	0003	7048
495-510	0007	7083
510-525	0002	7091
525-540	0004	7236
540-555	0007	7246
555-570	0002	7249

(b)

Δt FROM H HOUR
20/hour DISTRIBUTION

FREQ. DISTRIB. DELTA TIME INTERVAL (MINS)	NO. OF CAS. TREATED	CUMULATIVE TREATMENT TIME MINUTES
000-015	0002	0009
015-030	0011	0083
030-045	0014	0181
045-060	0024	0328
060-075	0034	0579
075-090	0034	0830
090-105	0027	1004
105-120	0023	1170
120-135	0016	1276
135-150	0009	1366
150-165	0002	1375
165-180	0003	1383
180-195	0004	1422
195-210	0001	1429
210-225	0001	1431
225-240	0003	1445
240-255	0001	1450

(c)

Δt FROM H HOUR
80/hour DISTRIBUTION

FREQ. DISTRIB. DELTA TIME INTERVAL (MINS)	NO. OF CAS. TREATED	CUMULATIVE TREATMENT TIME MINUTES
000-015	0000	0000
015-030	0010	0042
030-045	0022	0166
045-060	0009	0230
060-075	0006	0289
075-090	0011	0350
090-105	0002	0361
105-120	0002	0361
120-135	0004	0378
135-150	0005	0418
150-165	0014	0534
165-180	0006	0564
180-195	0005	0607
195-210	0002	0614
210-225	0005	0640
225-240	0001	0649
240-255	0007	0707
255-270	0003	0734
270-285	0010	0802
285-300	0007	0844
300-315	0000	0844
315-330	0000	0844
330-345	0005	0871
345-360	0003	0896
360-375	0001	0899
375-390	0002	0918
390-405	0002	0937
405-420	0001	0952
420-435	0002	0968
435-450	0004	0989
450-465	0001	0992

FIG. 4-7 FREQUENCY DISTRIBUTIONS – TREATMENT TIMES PER CASUALTY AT AID STATION

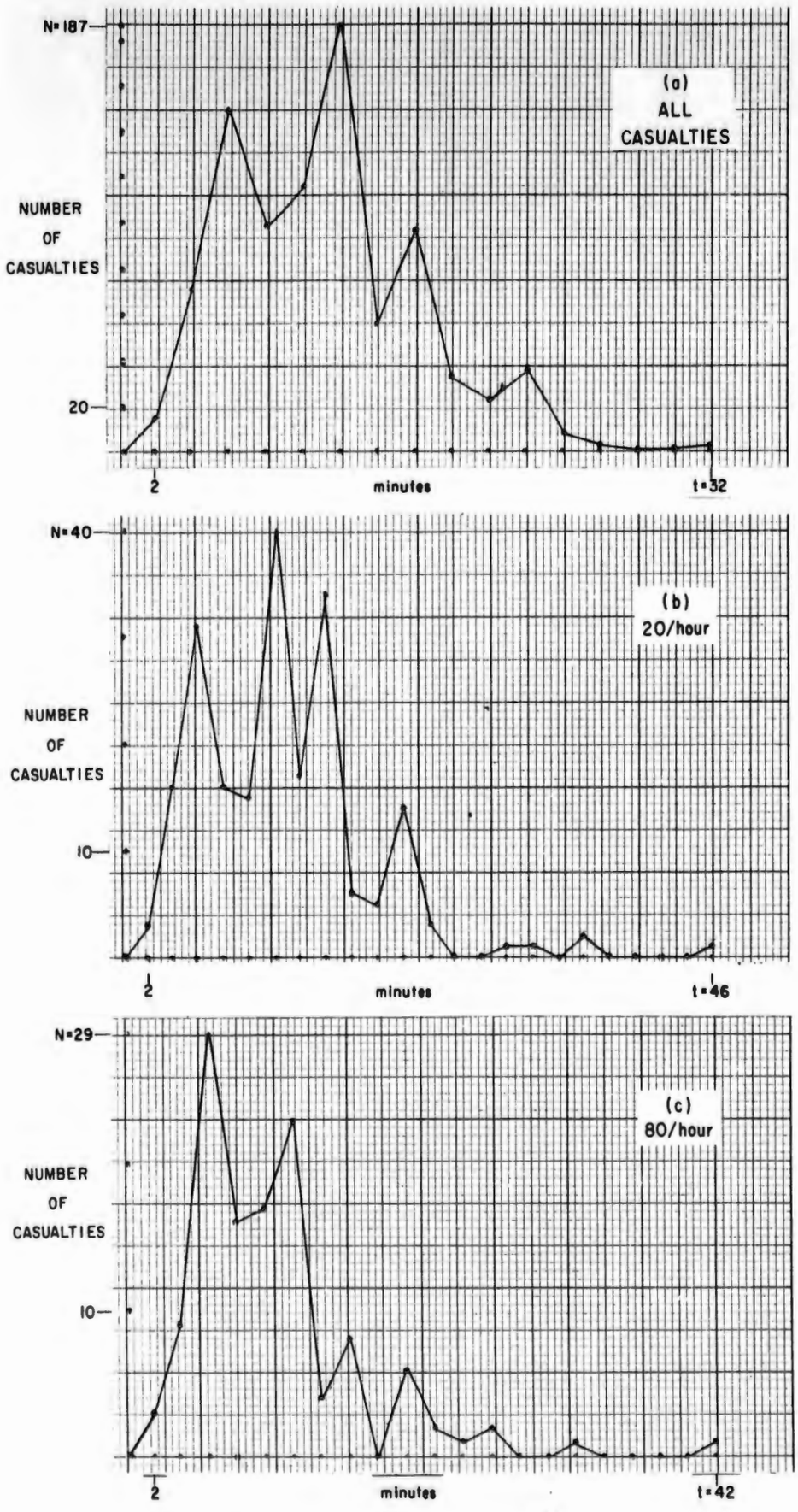


TABLE 4-7

FREQUENCY DISTRIBUTIONS – TREATMENT TIMES PER CASUALTY AT AID STATION

TOTAL NO. CAS.	VALID SAMPLE	MIN. DELTA TIME	MAX. DELTA TIME	AVG. DELTA TIME	VAR.	DEV.
1069	0909	0001	0110	10.18	131.8	11.48

FREQ. DISTRIB.

DELTA TIME INTERVAL (MINS)	NO. OF CAS.
000-002	0015
002-004	0071
004-006	0150
006-008	0099
008-010	0116
010-012	0187
012-014	0056
014-016	0097
016-018	0033
018-020	0023
020-022	0036
022-024	0008
024-026	0003
026-028	0001
028-030	0002
030-032	0003
[illegible]	0003
034-036	[illegible]
036-038	0000
038-040	0001
040-042	0001
042-044	0000
044-046	0001
046-310	0000
310-312	0001

TOTAL NO. CAS.	VALID SAMPLE	MIN. DELTA TIME	MAX. DELTA TIME	AVG. DELTA TIME	VAR.	DEV.
0218	0205	0001	0045	10.93	42.9	6.550

FREQ. DISTRIB.

DELTA TIME INTERVAL (MINS)	NO. OF CAS.
002-004	0016
004-006	0031
006-008	0016
008-010	0015
010-012	0040
012-014	0017
014-016	0034
016-018	0006
018-020	0005
020-022	0014
022-024	0003
024-026	0000
026-028	0000
028-030	0001
030-032	0001
032-034	0000
034-036	0002
036-038	0000
038-040	0000
040-042	0000
042-044	0000
044-046	0001

TOTAL NO. CAS.	VALID SAMPLE	MIN. DELTA TIME	MAX. DELTA TIME	AVG. DELTA TIME	VAR.	DEV.
0161	0122	0001	0040	9.032	36.82	6.068

FREQ. DISTRIB.

DELTA TIME INTERVAL (MINS)	NO. OF CAS.
000-002	0003
002-004	0009
004-006	0029
006-008	0016
008-010	0017
010-012	0029
012-014	0004
014-016	0008
016-018	0000
018-020	0006
020-022	0002
022-024	0001
024-026	0002
026-028	0000
028-030	0000
030-032	0001
032-034	0000
034-036	0000
036-038	0000
038-040	0000
040-042	0001

FIG. 4-8 CUMULATIVE TREATMENT TIMES vs. TIME AID STATION

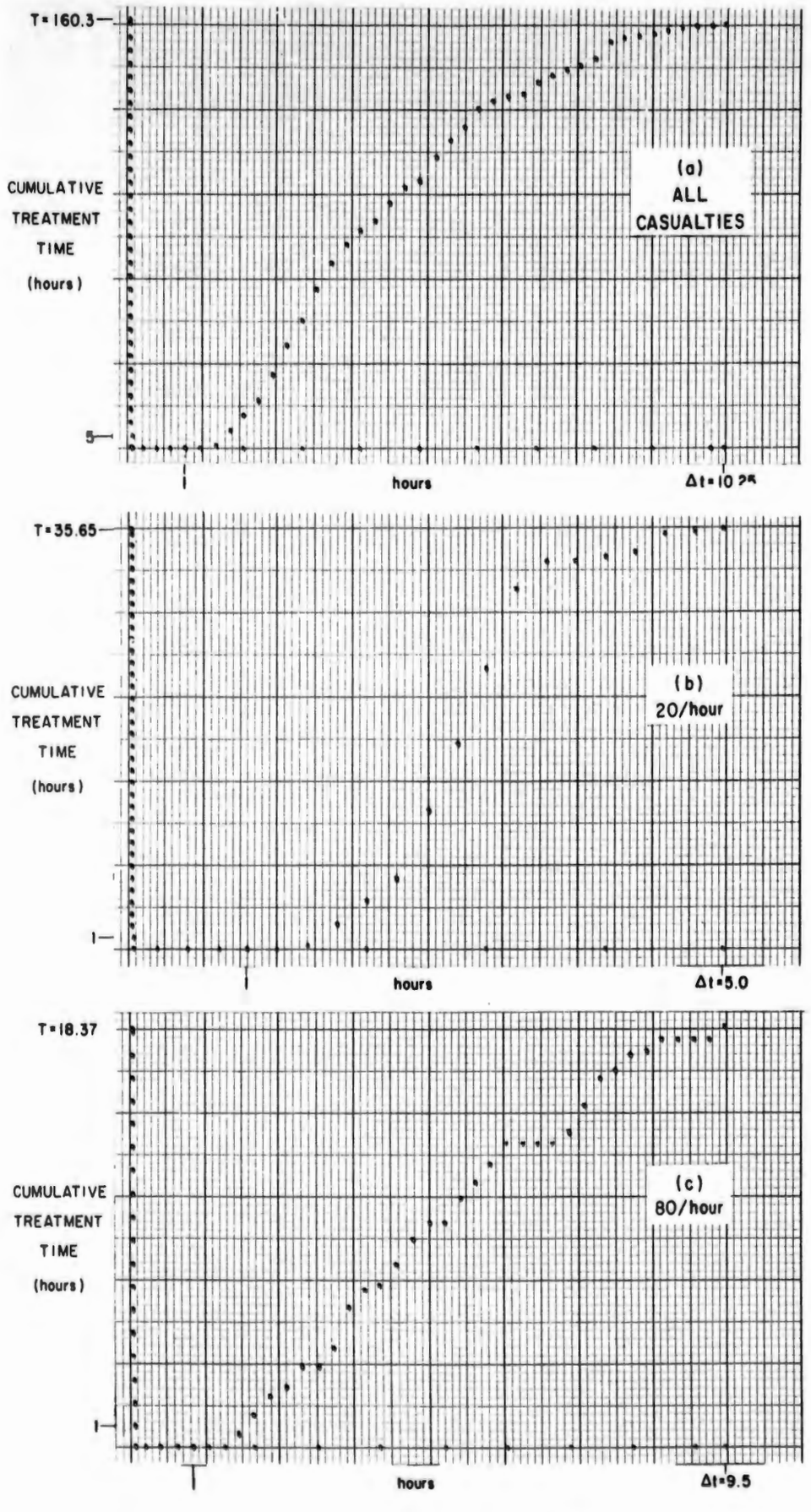


TABLE 4-8

CUMULATIVE TREATMENT TIMES vs. TIME, AID STATION

(a)
Δt FROM H HOUR
ALL CASUALTIES

FREQ. DISTRIB.		CUMULATIVE TREATMENT TIME
DELTA TIME INTERVAL (MINS)	NO. OF CAS. TREATED	MINUTES
000-015	0000	0000
015-030	0000	0000
030-045	0000	0000
045-060	0001	0009
060-075	0002	0020
075-090	0006	0085
090-105	0024	0417
105-120	0038	0769
120-135	0031	1096
135-150	0060	1681
150-165	0060	2352
165-180	0052	2916
180-195	0064	3608
195-210	0065	4202
210-225	0038	4618
225-240	0029	4918
240-255	0027	5144
255-270	0035	5541
270-285	0031	5895
285-300	0016	6045
300-315	0022	6601
315-330	0043	7002
330-345	0036	7276
345-360	0043	7689
360-375	0020	7856
375-390	0012	7960
390-405	0008	8024
405-420	0031	8289
420-435	0010	8433
435-450	0010	8561
450-465	0009	8673
465-480	0020	8825
480-495	0015	9218
495-510	0011	9308
510-525	0005	9341
525-540	0008	9401
540-555	0014	9490
555-570	0007	9548
570-585	0005	9584
585-600	0002	9596
600-615	0002	9618

(b)
Δt FROM H HOUR
20/hour DISTRIBUTION

FREQ. DISTRIB.		CUMULATIVE TREATMENT TIME
DELTA TIME INTERVAL (MINS)	NO. OF CAS. TREATED	MINUTES
000-015	0000	0000
015-030	0000	0000
030-045	0000	0000
045-060	0000	0000
060-075	0001	0000
075-090	0004	0033
090-105	0010	0138
105-120	0015	0254
120-135	0010	0366
135-150	0033	0698
150-165	0032	1032
165-180	0035	1408
180-195	0032	1802
195-210	0010	1951
210-225	0001	1956
225-240	0002	1981
240-255	0005	2015
255-270	0004	2090
270-285	0006	2129
285-300	0001	2139

(c)
Δt FROM H HOUR
80/hour DISTRIBUTION

FREQ. DISTRIB.		CUMULATIVE TREATMENT TIME
DELTA TIME INTERVAL (MINS)	NO. OF CAS. TREATED	MINUTES
000-015	0000	0000
015-030	0000	0000
030-045	0000	0000
045-060	0000	0000
060-075	0000	0000
075-090	0000	0000
090-105	0004	0036
105-120	0007	0089
120-135	0005	0138
135-150	0002	0159
150-165	0004	0214
165-180	0001	0217
180-195	0004	0262
195-210	0018	0368
210-225	0005	0411
225-240	0005	0427
240-255	0007	0480
255-270	0005	0545
270-285	0003	0585
285-300	0001	0586
300-315	0008	0652
315-330	0002	0688
330-345	0010	0735
345-360	0007	0795
360-375	0000	0795
375-390	0000	0795
390-405	0000	0795
405-420	0009	0821
420-435	0004	0888
435-450	0002	0958
450-465	0003	0988
465-480	0003	1023
480-495	0004	1044
495-510	0001	1067
510-525	0001	1072
525-540	0000	1072
540-555	0000	1072
555-570	0004	1102

Although a number of casualties went through the company area, there was no formal treatment at this point. Of the 314 casualties that were processed through the company area, treatment was reported for 20.

Table 4-9

TREATMENT TIMES, COMPANY AREA

Minimum treatment time:	2 minutes
Maximum treatment time:	24 minutes
Average treatment time:	9.35 minutes

Total treatment time for the 20 casualties: 187 minutes.

The cumulative information is useful to help determine the number of medical personnel required and the extent of their overload and slack time. Figure 4-9 illustrates the point. Assume that a doctor can reasonably spend 3/4 of an hour out of every hour rendering treatment to casualties. The graph shows that two doctors assigned to treat casualties whose cumulative treatment time per time is represented, will have slack time for the first hour, then will be overloaded for the next three hours. The casualty queue is finally eliminated, but during this time casualty treatment must be delayed. The dotted line shows that the number of doctors that must be assigned to prevent any delay in treatment is three.

Note that not only are the doctors' continued treatment capability per hour assumed, but so too are the linear aspect of their efforts. The intent is purely illustrative of the type of information that may be deduced here.

The distribution of treatment times reflects the types of casualties that have been sustained and may be directly related to the performance chart in Sec. V of this report.

One further statistic of interest is the use of the time that aid men spend in the field. From the arrival of an ambulance at its first field casualty until the time that it leaves the field with its casualty load, a certain time τ(hrs) is consumed. During this time, σ(hrs) is

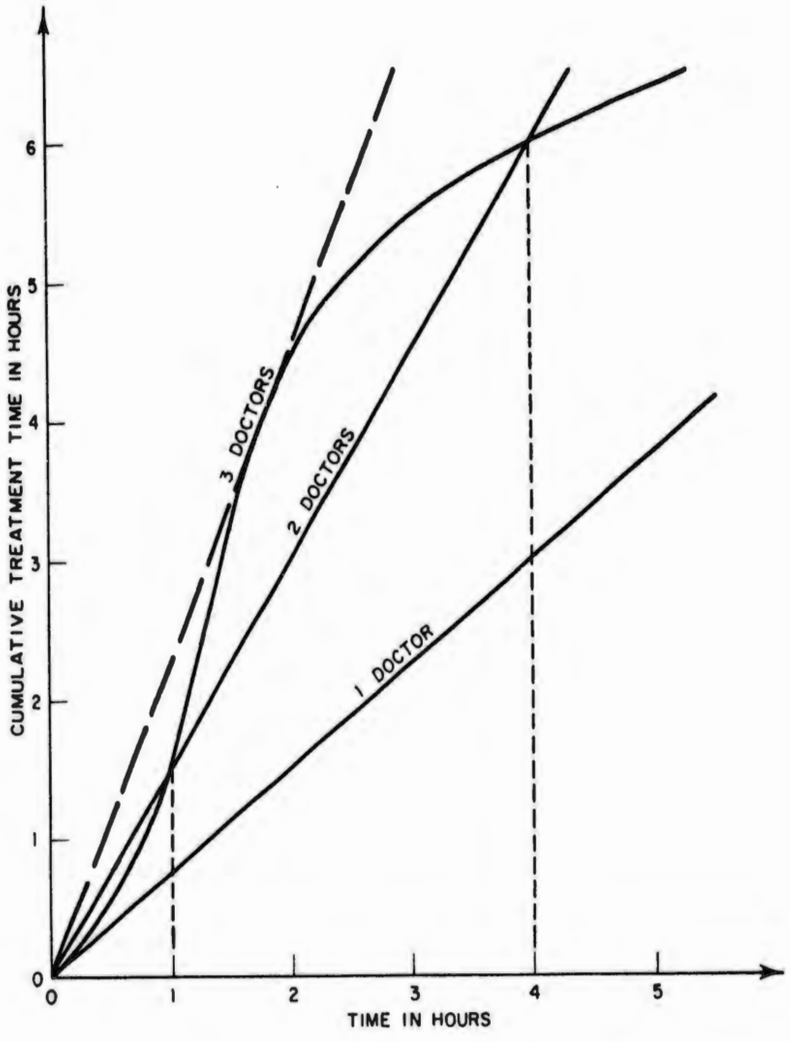


FIG. 4-9 MEDICAL PERSONNEL LOAD – ILLUSTRATIVE

the sum of contiguous times spent treating casualties. Then $(\tau-\sigma)$, as a distribution against time for all ambulance field trips, yields what may be called the ambulance search time.

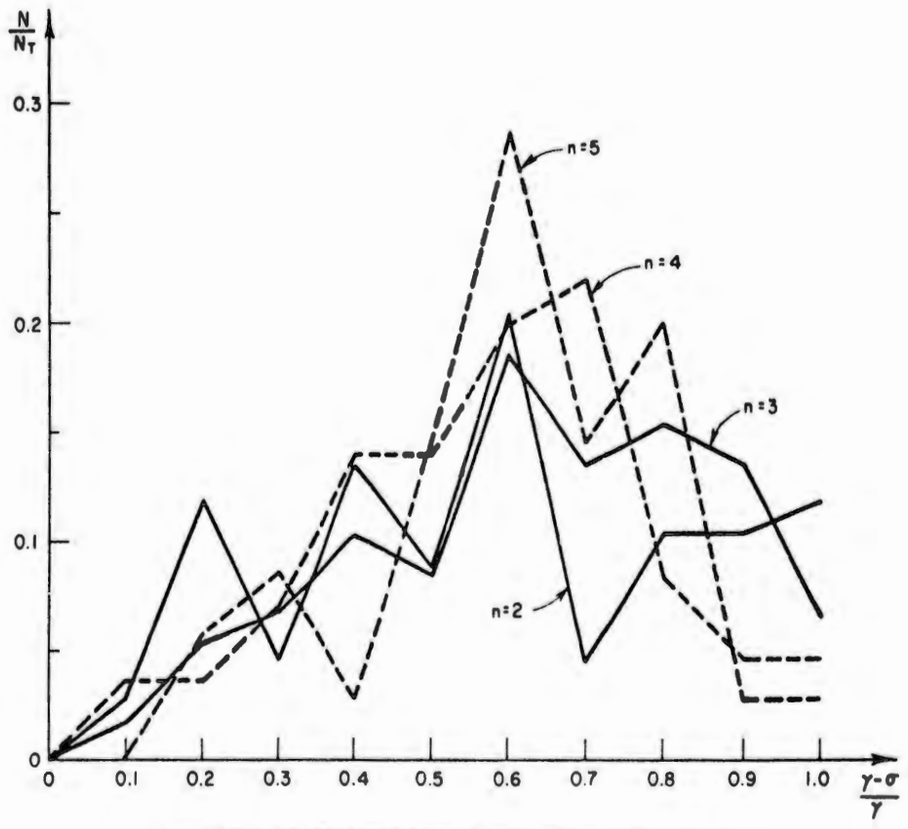
If n casualties are treated on one field trip, the search times must be independently studied for the difference values of n, i.e., $n = 2, 3, \ldots, 8$. For $n = 1$, by the definitions of τ and σ as chosen, the search time should be small (see Tables 2-6, 3-4). The search time distributions are graphed parametrically for $n = 2, 3, 4,$ and 5 in Fig. 4-10, based on the data that is tabulated in Table 4-10.

Table 4-10

AMBULANCE SEARCH TIME IN THE FIELD

$\frac{\tau-\sigma}{\tau}$	Number of Casualties Treated					
	1	2	3	4	5	6
	Number of Ambulances					
.0-.1	4	2	1	3	0	1
.1-.2	7	8	3	3	2	1
.2-.3	7	3	4	6	3	2
.3-.4	6	9	6	12	1	2
.4-.5	5	6	5	12	5	1
.5-.6	2	14	11	17	10	3
.6-.7	3	3	8	18	5	2
.7-.8	3	7	9	7	7	1
.8-.9	0	7	8	4	1	1
.9-1.0	3	8	4	4	1	0
Total No. Ambulance	40	67	59	86	35	14

The $(\tau-\sigma)$ search time value is somewhat ambiguous. Since σ is the sum of contiguous treatment times, it does not reflect the total number of treatment man hours. Normally, two aid men are assigned to an ambulance, and the driver too is able to give medical aid. Thus, it is conceivable that three casualties may be treated simultaneously or several aid men may attend one casualty together. Correspondingly,



N_T = TOTAL NO. OF AMBULANCE TRIPS WITH n CASUALTIES

N = NO. OF AMBULANCE TRIPS WITH n CASUALTIES HAVING SEARCH TIME RATIO $(\gamma-\sigma)/\gamma$

FIG. 4-10 AMBULANCE SEARCH TIME IN THE FIELD

τ represents ambulance time in the field. The ambulance treatment capabilities are more closely approximated by a value between τ and 3τ.

V MEDICAL PERFORMANCE

In the Phase III, Spring 1960 experiment, the casualties were typed upon generation by indication of symptoms. Part of the simulated realism consisted of diagnosis, triage, and appropriate treatment predicated on the symptoms. Casualties were divided into Immediate, Emergency, and Delayed categories consisting respectively of 15, 25, and 35 types.[4] The diagnostic procedures and the expected times of treatment are referred to in Table II of Ref. 1.

No medical diagnostic information was recorded, but extent of treatment times were recorded. Table 5-1 essentially duplicates the Table II referred to above, using actual treatment times in the field and at the aid station. For each class-type the sample size is listed. For each collected statistic, the sample size upon which it is based is also recorded. Because of omissions and other errors, these two sample sizes may differ. The statistics on treatment times are the minimum, maximum, and average treatment times for the group.

In addition, columns have been appended to the table to indicate the delays suffered by the casualty as he was processed through the medical system. Thus, the time delay before initial arrival of an ambulance is listed. So too are the times for the casualty to reach the aid station. If the casualty was processed through the company area an indication of this delay is detailed. As was demonstrated in Table 4-5, treatment at the company being unauthorized, was minor, and has been omitted from Table 5-1 as a relevant or significant statistic.

One class of recorded information that has not been statistically analyzed in this report is the rank of the individuals performing treatment. In the field and at the aid station, these personnel, for the most part, were enlisted men. It would seem that a reasonable correllation may exist between effectiveness of treatment and experience of the person involved. But it was felt that this had little relation to

rank. Hence, it was decided to defer such an analysis, in the spirit of General F. W. Gibb, who on the occasion of being faced with a similar situation to compare Majors versus Captains in an experimental environment, remarked, "If the Majors win, I'll promote all of my Captains."

TABLE 5-1

MEDICAL PERFORMANCE BY CASUALTY TYPE

			BATTLEFIELD								COMPANY AREA								AID STATION							
			AMB. ARRIVAL AT CAS. (ΔT FROM OCCURRENCE)				TOTAL TREATMENT TIME (MINUTES)				CASUALTY ARRIVAL (ΔT FROM OCCURRENCE)				CASUALTY DEPARTURE (ΔT FROM OCCURRENCE)				CASUALTY ARRIVAL (ΔT FROM OCCURRENCE)				TOTAL TREATMENT TIME (MINUTES)			
	TYPE	TOTAL NO CAS.	NO.	MIN.	MAX.	AVG.	NO.	MIN.	MAX.	AVG.	NO.	MIN.	MAX.	AVG.	NO.	MIN.	MAX.	AVG.	NO.	MIN.	MAX.	AVG.	NO.	MIN.	MAX.	AVG.
IMMEDIATE	1	13	11	000	285	98.1	13	002	013	7.0	03	030	119	78.3	03	051	146	96.3	12	075	353	161.0	06	010	018	14.0
	2	18	18	007	315	96.1	17	004	015	8.7	03	051	210	117.4	03	056	264	138.3	17	047	383	186.8	08	005	016	10.2
	3	19	19	001	197	48.3	19	004	023	16.1	02	042	043	42.5	02	064	071	67.5	19	068	276	130.5	16	008	035	13.0
	4	16	15	006	242	72.5	16	002	021	5.1	02	059	089	74.0	02	059	093	76.0	15	045	261	124.3	11	002	020	9.0
	5	20	18	005	096	37.4	19	003	013	7.5	01	089	089	89.0	01	118	118	118.0	18	054	205	115.6	15	002	020	12.6
	6	13	13	003	209	73.4	13	004	012	6.4	01	071	071	71.0					10	055	289	137.1	04	010	030	18.7
	7	11	10	018	485	126.6	11	005	014	9.9	02	075	136	105.5	02	080	142	111.0	10	087	525	194.3	05	004	016	8.4
	8	15	14	003	425	102.7	15	002	010	4.4	03	063	067	65.3	02	074	080	77.0	14	074	465	168.3	10	002	020	10.1
	9	17	17	006	233	56.4	16	002	071	9.1	02	043	069	56.0	02	071	116	93.5	16	047	298	127.0	11	005	017	11.9
	10	15	14	012	222	89.4	15	002	019	6.9	01	327	327	327.0	01	330	330	330.0	13	050	357	132.6	11	007	018	12.3
	11	17	16	005	338	96.2	16	002	009	4.1	04	096	712	96.7	03	096	218	111.0	16	057	391	148.7	13	002	019	10.0
	12	12	10	012	170	65.4	12	005	015	9.0									12	042	237	135.6	06	005	014	10.1
	13	14	11	005	250	57.3	13	003	019	9.3	02	076	085	80.5	02	080	087	83.5	13	061	312	157.7	11	007	020	12.9
	14	15	15	006	248	61.8	15	002	033	12.9	02	043	069	56.0	02	051	078	64.5	15	059	385	147.4	11	004	026	10.5
	15	13	11	000	213	58.6	13	002	013	6.6	02	085	116	100.5	02	088	133	110.5	13	058	390	147.2	10	007	045	14.9
EMERGENCY	1	17	17	006	192	52.1	17	001	012	5.4	05	026	104	56.8	05	050	298	123.4	17	058	331	134.6	16	004	015	9.8
	2	15	14	004	197	41.7	15	002	010	3.8	08	016	104	51.0	07	048	412	119.1	15	068	443	139.0	14	004	038	10.4
	3	16	16	004	243	74.8	16	001	007	3.3	09	018	263	87.1	09	028	284	139.4	16	053	553	204.1	16	003	033	9.3
	4	17	15	019	490	152.4	17	001	009	2.8	05	056	315	126.4	05	115	483	245.2	16	055	510	219.8	15	004	020	11.5
	5	14	13	006	465	127.8	14	002	011	6.6	03	037	329	147.3	03	065	401	182.6	12	098	427	186.4	11	001	015	8.7
	6	16	16	011	338	68.0	16	002	006	3.6	05	042	116	74.0	05	059	154	100.8	16	094	429	152.0	16	003	015	8.1
	7	16	15	003	289	108.9	16	002	029	8.0	03	103	209	144.0	03	120	315	185.6	16	053	340	182.7	15	005	029	11.6
	8	10	10	007	338	99.7	10	004	011	6.7	02	068	157	112.5	02	074	163	118.5	10	082	391	186.8	10	006	015	10.0
	9	13	11	011	222	76.3	13	002	013	6.7	02	042	159	100.5	02	147	233	190.0	13	060	280	175.6	13	002	018	8.8
	10	15	15	001	273	79.0	15	007	037	18.3	03	064	125	102.0	02	070	140	105.0	14	100	357	171.7	10	002	021	9.4
	11	14	13	015	338	87.0	14	008	035	17.0	01	066	066	66.0	01	136	136	136.0	14	093	428	184.5	13	003	014	7.0
	12	17	16	003	338	91.1	16	003	014	7.3	03	040	240	111.6	02	045	057	51.0	15	077	430	157.4	12	005	024	15.0
	13	15	15	006	185	80.0	15	002	007	4.2	09	020	218	107.3	09	087	442	216.8	15	085	470	217.4	13	006	019	10.6
	14	14	13	015	267	107.8	14	002	009	3.7	06	019	249	89.5	06	064	360	161.0	14	072	388	189.7	14	004	020	10.6
	15	14	13	003	285	87.6	14	002	011	5.7	05	046	202	114.6	04	074	219	143.7	13	088	353	168.0	12	006	021	14.0
	16	11	11	013	213	99.7	11	002	012	5.9	02	024	113	68.5	02	025	352	188.5	11	053	383	219.7	10	004	011	8.2
	17	11	11	006	425	85.4	11	007	023	13.2	02	047	125	86.0	02	075	136	105.5	11	093	459	171.0	10	002	022	12.0
	18	13	13	001	160	46.3	12	003	015	7.0	03	030	159	80.3	03	060	164	96.3	13	060	191	109.6	12	007	020	12.1
	19	11	10	040	425	178.1	09	005	011	8.2									10	102	459	220.2	09	010	020	13.6
	20	14	13	013	310	101.3	14	003	014	9.0	01	054	054	54.0	01	076	076	76.0	14	068	383	175.0	11	002	020	11.8
	21	14	14	004	127	30.5	14	001	030	6.1	09	032	085	50.6	03	082	120	104.3	14	045	225	116.5	14	004	030	10.0
	22	14	14	007	280	96.2	14	001	009	4.5	02	058	078	68.0	03	030	121	70.0	13	060	379	146.7	11	001	017	7.8
	23	18	18	092	266	81.6	18	003	020	10.3	01	240	240	240.0					17	046	297	148.7	17	002	032	10.6
	24	13	12	025	222	93.2	13	004	013	7.1	02	169	181	175.0	02	170	186	178.0	13	086	287	160.9	12	001	020	9.0
	25	10	10	012	180	56.1	10	001	007	3.6	02	045	076	60.5	02	341	507	429.0	10	047	534	239.2	08	002	020	9.1
DELAYED	1	13	13	022	177	97.4	13	003	014	7.3	03	114	185	139.3	03	188	239	219.6	13	092	281	193.8	13	003	021	11.4
	2	10	10	000	135	42.0	10	005	020	10.8	06	042	161	83.6	05	107	253	185.6	10	086	276	173.9	09	003	019	9.4
	3	12	11	005	167	60.0	12	001	008	4.9	07	037	181	84.4	07	106	527	234.4	12	105	567	240.0	12	002	008	4.9
	4	18	18	005	110	45.3	17	001	013	4.9	07	040	164	78.7	07	071	378	206.2	18	054	417	166.1	18	001	018	8.6
	5	16	16	005	275	77.3	15	002	009	4.3	04	045	090	67.5	03	176	408	255.3	16	072	447	191.8	15	002	025	7.3
	6	10	10	005	130	40.6	10	002	011	4.8	08	026	154	90.8	08	086	279	167.1	10	039	310	167.8	10	002	018	9.1
	7	13	12	009	220	79.2	13	002	015	6.7	05	025	126	54.0	05	050	393	234.8	13	079	425	213.8	13	004	035	12.4
	8	12	12	004	249	83.4	11	002	011	6.0	05	030	272	110.6	05	061	307	171.4	12	083	414	221.7	12	003	020	9.0
	9	15	15	006	173	53.1	15	001	006	3.4	09	040	223	100.2	09	071	359	212.6	15	070	380	201.2	13	003	010	5.9
	10	14	14	000	338	75.7	13	003	027	10.0	04	038	110	80.0	04	147	268	180.5	14	070	430	195.7	14	001	022	9.4
	11	15	14	008	167	60.8	15	005	062	12.4	06	054	140	90.8	05	095	381	221.0	15	055	414	200.0	15	003	015	8.8
	12	16	16	004	275	60.2	15	002	015	7.6	03	030	151	71.0	03	048	162	83.3	16	048	315	127.7	16	004	030	11.7
	13	15	15	009	471	114.9	14	001	007	2.7	06	027	096	64.0	06	106	590	270.1	15	075	558	263.6	12	003	016	7.6
	14	15	15	000	233	68.5	13	001	008	3.6	07	030	148	93.4	04	217	378	279.0	14	068	520	246.4	08	004	023	8.5
	15	18	17	010	315	63.5	18	002	020	5.5	04	026	063	46.5	04	041	256	153.2	18	066	379	155.2	17	003	028	10.8
	16	14	11	003	465	102.9	14	001	014	3.9	07	045	161	94.0	07	092	163	130.1	14	056	535	200.2	13	004	018	9.8
	17	12	09	003	030	14.0	10	002	008	4.9	07	023	100	49.4	07	046	422	140.8	11	070	450	186.0	10	005	310	39.3
	18	14	12	003	342	95.5	13	002	009	4.6	09	036	347	133.4	08	036	416	242.6	12	131	442	271.7	13	003	018	9.7
	19	14	14	010	286	66.1	14	002	013	5.5	07	019	130	74.7	07	138	301	177.4	14	097	528	226.2	12	005	020	10.0
	20	14	13	006	250	66.0	14	001	013	3.9	06	050	238	132.6	05	160	387	285.6	14	069	424	245.0	12	001	017	5.8
	21	15	15	010	425	129.4	15	002	014	5.1	05	031	253	129.8	06	136	298	200.5	15	092	460	232.8	14	001	020	9.5
	22	12	12	009	218	82.9	12	001	009	3.6	03	100	328	179.6	04	075	400	264.7	12	075	428	210.3	12	003	015	9.0
	23	14	13	003	202	49.0	14	002	064	8.2	06	027	117	75.5	05	087	440	215.6	14	090	467	180.1	10	001	023	10.7
	24	13	13	015	290	81.0	13	002	124	14.0	04	045	308	146.7	04	089	312	203.5	13	073	350	166.4	13	004	033	12.4
	25	11	09	024	280	115.5	11	003	010	6.0	06	018	182	83.5	05	069	329	150.2	11	089	555	267.3	10	003	015	9.2
	26	16	15	006	303	67.9	16	001	007	3.8	05	030	162	66.0	05	036	162	110.2	15	070	403	155.1	15	003	012	7.5
	27	15	15	000	192	79.6	14	002	013	4.8	02	034	157	95.5	01	070	070	70.0	15	080	255	153.6	15	001	015	7.3
	28	12	12	005	191	69.0	11	003	013	7.1	01	100	100	100.0	01	127	127	127.0	12	059	307	162.0	11	001	020	11.8
	29	13	12	000	279	86.9	13	002	014	6.8	06	035	103	66.6	06	072	172	113.3	13	081	375	175.0	12	003	015	8.5
	30	13	12	009	225	56.9	13	001	005	3.0	03	031	082	64.3	03	160	311	245.6	13	077	345	173.6	11	002	012	5.7
	31	16	16	007	151	50.0	14	001	009	5.0	04	039	112	66.5	03	062	367	181.3	16	060	397	161.1	14	001	017	5.5
	32	17	16	001	245	63.8	16	003	022	7.8	05	019	147	71.2	03	324	506	413.0	15	070	543	241.0	16	003	015	6.6
	33	14	13	000	194	90.6	13	002	006	3.4	09	032	346	110.1	09	050	503	254.4	14	042	533	258.4	13	001	014	5.9
	34	13	13	010	160	49.2	12	002	016	5.1	03	104	195	134.6	03	123	267	210.6	13	070	385	156.7	13	003	017	7.3
	35	15	14	009	273	75.3	14	001	016	5.7	05	023	151	76.4	04	081	436	276.7	13	075	467	232.7	11	005	040	13.3

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