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DIGITAL COMMUNICATIONS IN POLICE OPERATIONS: THE POTENTIAL IN THE LOS ANGELES POLICE DEPARTMENT

JACOB H. PARNESS

MARCH 1975

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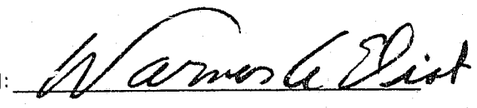
and Project Approval: 

ABSTRACT

This is a report of a study of voice radio traffic between mobile units and base stations in the Los Angeles, California, Police Department. It identifies the types of messages involved and provides measures of the frequency of use and length of air time. It derives measures of the efficiency of use of channel capacity and the message queuing that results from channel loading. Finally, it discusses the potential improvement which can be realized by converting to digital transmission techniques.

ACKNOWLEDGEMENTS

Substantial assistance has been provided by members of the Los Angeles Police Department, particularly, M. Hayes and M. Shapran of the Scientific Investigative Division, Captain Shelly, Officer Kenney and Officer Flournoy of the Communications Center, and Marcel Gallegos of the Department of Public Utilities and Transportation. Thanks are also due Sergeant I. Rosenblum of the Product Evaluation Unit, Sergeant H. Ebersole, Emergency Command Control Communications System project director, and Charles Holdt, Staff Engineering, for valuable discussions on this and related topics during the period of the study. Thanks also are due to Sylvia Halpern and John Strack for their invaluable assistance in the preparation of this report.

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EXECUTIVE SUMMARY

This paper reports findings of a study of voice radio traffic in a large urban police department (Los Angeles, California) performed under the auspices of the Equipment Systems Improvement Program of the LEAA/ National Institute of Law Enforcement and Criminal Justice. The purpose of the analysis was to determine the number and type of voice traffic messages that would be suitable for transmission through a digital communications system. More than 2,700 individual messages were analyzed to determine that a composite average percentage (CAP) of approximately 84 percent of call traffic (accounting for a CAP of 72 percent of the air time used) and more than 98 percent of all base station calls could be coded for digital transmissions.

It was determined that the data needed for this analysis included types and numbers of messages, message timing, channel loading and the number of requests for information from the data base. The data on message timing and channel loading were obtained with the aid of mechanical timing devices.

The first step in the mobile traffic analysis was to determine the percentage of the total represented by each type of call and the percentage of air time each type occupied. To simplify the determination the calls were divided into the following categories:

- Data base inquiries
- Status type calls
- Alphanumeric type calls.

These three types of calls comprise the 84 percent that are technically amenable to digital transmission. The remaining 16 percent are non-standard conversations.

Base station traffic analysis proceeded along similar lines. Calls were divided into four categories:

- Data base replies
- Calls-for-service and status dispatching
- Status calls
- Alphanumeric calls.

These four types of calls comprise approximately 98 percent of the base-originated traffic and are technically amenable to digital transmission.

Approximately 14 percent of the mobile and 10 percent of the base station traffic are related to data base inquiries. The occupied air time for these messages is approximately 29 percent and 15 percent, respectively.

Channel loading appears to vary greatly. When it approaches and passes 100 percent, so that a queue of messages is built up, message characteristics change. At channel loadings greater than 90 percent for example, queue length is greater than 5.

Appendix I describes the Los Angeles Police Department command and control system under which the data were taken. Appendix II contains the data gathered in monitoring the frequencies used by the mobile radios. Appendix III covers the data gathered in monitoring the base frequencies.

GLOSSARY OF LAPD POLICE COMMUNICATIONS SYSTEM MESSAGES AND TERMS

Code 1	Come in
Code 3	Use lights and siren and proceed to given location
Code 4	No further assistance needed
Code 6	Officer leaving patrol area for investigation
Code 7	Officer leaving patrol area to eat
Code 30	Burglar alarm
Code Z	Unit is writing a report within earshot of his radio
211	Robbery
211 Silent	Silent Robbery Alarm
415	Disturbing the peace by following
459 Now	Burglary in progress
459 Report	Burglary report
484	Theft call (e.g., purse snatch, shoplift, etc.)
586	Illegally parked vehicle
ADW Progress	Assault with a dangerous weapon in progress
Air Time (AT)	The amount of time that a transmitter is broadcasting on a radio channel
Alphanumeric call	Message involving non-routine exchange of information involving a combination of numbers, letters, and words (e.g., a name and address)
Ambulance shooting	Shooting occurred, ambulance on the way
Ambulance traffic	Ambulance is on the way to the following address
Assigned stolen	The following vehicle is assigned as a stolen vehicle
Backup	Backup the following unit on a specific call
Base station communication	Call originating from headquarters
Call Watch Commander	Please call supervisor at the station
Call	Synonomous with message
Cancel	Delete the previous message
Car racing	Speeding vehicle has been spotted
Channel Loading	The ratio of channel usage time to available time
Clear	Unit is ready to accept another assignment
Data Base Inquiry	Request for information concerning individuals or vehicles from police or Department of Motor Vehicle records
DMV	Department of Motor Vehicles
ETA	Estimated time of arrival

Frequency clear	Frequency is now available for any mobile unit
Go ahead	Proceed with your message
Go ahead with second	Go ahead with second request for information from the data base
GTA	Grand theft automobile
GTA report	Grand theft automobile report
Handling	Accepted assignment
Hit	Computer response indicating that the person or vehicle is connected with an outstanding want/warrant or the vehicle is reported stolen
Hotshot	High priority call (e.g., criminal at the scene right now)
Identify	Indicate unit designation
Impound	Vehicle at following location
Meet TAC 2	Unit requests RTO to ask another unit to call on tactical frequency 2
Message	Data on information to be transmitted between persons or equipment
Message time	Air time required for transmission of a single call
Miscellaneous dispatch	Unspecified assignment
Miscellaneous information request	An information request that does not fit into any frequently used category
Miscellaneous information supplied	Information that does not fit into any frequently used category has been supplied
No Want/Warrant	A negative response on a Want/Warrant check
No Want/ Warrant DMV	A negative response from the Department of Motor Vehicles on a check
Out to hospital	Officer is leaving the patrol area to go to hospital
Out to station	Officer is leaving the patrol area for station
Percentage Air Time (%AT)	The percentage time out of the total available time that a transmitter is broadcasting on a radio channel
Polled transmission configuration	A system design whereby each vehicle is asked to give its message at a given time
RTO	Radio telephone operator
Random transmission configuration	System design whereby each vehicle transmits its message
Request backup	Officer requests additional help
Request frequency	Unit requests frequency for a broadcast

Request reassign call	Unable to respond. Please assign another unit
Request supervisor	Request supervisor at the following location or on tactical frequency
Request tow	Request two truck at following location
Roger	Unit acknowledges
Show handling	Indicate that this unit is handling the following call
Simulcasts	Dispatcher broadcasts simultaneously on several radio channels
Station call	Unit is going on a station assigned call
Status call	Call reporting status of units; e.g., Code 7
Suspect data	Unit gives description of information known about a suspect to RTO
S/W	Southwest Division
System configuration	Technical system design, its operating elements and their relationships
Teletype to station	Teletype a suspect's record to the applicable station
Time and mileage	Unit asks RTO to verify the time and mileage while transporting females
To station	Unit is requested to go to station
Traffic accident	Traffic accident at following location
Verify	Repeat, please
Want/Warrant (w/w)	A request entered into a data base system to determine if a person is wanted by any law enforcement agency for investigation or if a warrant has been issued for a person's arrest
Want/Warrant (license)	A request entered into a data base system to determine whether a license number has been connected with a stolen vehicle or a crime
Will back up	Unit will provide support to another unit on a specific call
Yes Want/Warrant	Positive response on a Want/Warrant check

I. INTRODUCTION

This paper reports results of a study of the characteristics of police mobile radio traffic as measured in the Los Angeles Police Department (LAPD). The study sought to determine the parameters and channel loading characteristics of routine types of traffic that might be implemented in a digital radio system in a way that would reduce the channel loading and speed the traffic. It concludes that roughly ten percent of the calls* between base stations and mobile units are data base inquiries that occupy approximately 15 percent of the base station air time and 30 percent of the mobile air time. It also concludes that more than 80 percent of all mobile-initiated calls and approximately 99 percent of all base-station calls could be transmitted through a suitable digital radio system.

The report describes the approach used in gathering and analyzing the data (Section II). It summarizes data collected from both mobile and base station transmissions (Sections III and IV) and presents an analysis of message distribution and channel loading data (Sections V and VI). Section VI also presents a consideration of the impact of the loading statistics on dispatching queues. A brief overview of the LAPD command and control system under which the data were taken and lists of the data collected are given in Appendices.

The study was conducted under the auspices of the National Institute of Law Enforcement and Criminal Justice, Law Enforcement Assistance Administration, with the assistance and support of the LAPD.

*Throughout this paper the terms "call", "message" and "transmission" are used interchangeably.

II. APPROACH

Three specific concerns related to mobile-initiated data base requests were identified:

- Volume of traffic
- Type of traffic
- Percentage of this traffic that would lend itself to transmission by digital means.

Most of the above data did not exist or were not easily available in the LAPD; the data that did exist concerned the number of data base inquiries processed in the computerized systems. Gathering message traffic data required a considerable amount of "direct monitoring" of the communication system* to determine the following:

- Types of messages sent from the base stations and mobiles
- Message counts for various time periods such as:
  - Quiet hours
  - Average hours
  - Busy hours
- Time required to transmit each type of message
- Channel loading for both base and mobile frequencies during the above time periods
- Number of computer data base requests categorized by:
  - Channel
  - Type of request
  - Type of reply.

In addition, it was necessary to determine the number of mobiles in service during these periods.

Types of messages

Listing of both mobile and base messages by type. (These data can be derived by listening to live broadcasts -- at Headquarters; at a mobile; at the radio shop; or via a monitor radio.)

Message Counts

Numbers of each of the types of messages transmitted as measured from live transmissions (one-hour periods at a time) or tape playbacks. (More than one channel should be monitored to provide data from both low and high crime areas.)

*See Appendix I for a description of the LAPD command and control system.

Message Timing

The length of messages in time. (There is a difference between "message time" and "air time." Often police and industry personnel specify requirements by saying, for example, "Perhaps 70 percent of our traffic could be put on a digital channel," when in fact, this refers to 70 percent of the messages and only 25 percent of the air time used.)

Channel Loading

The percentage ratio of channel usage time to available time. (This can be determined through the use of a timing device measuring either the "on" or the "off" time of transmitters on the channel. Alternatively, a voice-activated tape recorder can be used to measure the amount of voice traffic in a measured time interval (say one or two hours). Again, several hour-long periods during the various times of day and day of week should be analyzed.)

Computer Requests and Number of Vehicles

Number of data base requests from the field and number of vehicles in service. (These types of data can be obtained from LAPD files.)

DATA COLLECTION

Message timing was measured with a pedal-operated electrical timer with a mechanical reset. This provided a timing accuracy of approximately 0.1 seconds.

Channel loading data were measured with a voice-operated switch in conjunction with an event counter, a running time meter, and a tape recorder.

Monitoring the base and mobile channels was accomplished at selected intervals for one-hour periods. With the help of several radio telephone operators on each of the base station frequencies (there are four base frequencies and 17 mobile frequencies), several base frequencies were monitored during "average", "quiet" and "busy" hours.* Facilities at the Parker Center Communication facility were used for the "live" listening periods. Peak weekend hours were monitored using "24-hour tapes." Mobile monitoring and nighttime monitoring were accomplished with a VHF scanning radio. A total of 2,729 messages were monitored during the performance of this study.

*"Average" - daytime weekday hours (175 citizen calls/hours);
"Quiet" - early morning weekday hours (50 citizen calls/hour);
"Busy" - nighttime weekend hours (300 citizen calls/hour).
Communications Center manning is roughly proportional to these call rates.

COMPUTER INQUIRY

Computer inquiry data were obtained from LAPD and are discussed in Section V.

ANALYSIS OF DATA

The analysis of data was aimed at extracting information concerning the percentages of calls and air times occupied by various categories of messages.

The first step in the analysis was to determine the percentage of each particular type of call (e.g., Code 4, "No further assistance needed," see Glossary). Next, based upon an earlier measurement of the average time to verbalize that call, the percentage air time occupied by that type of call was computed. These calculations were repeated for the 52 different base station calls and 29 different mobile calls. The calls are listed in the following section in categories according to the characteristics of the message.

The percentage air times were computed from the following equation:

$$K = \frac{M_i T_i}{A} \times 100,$$

where: K = % air time

M_i = total number of message type i during the one-hour monitor period,

T_i = average of measured transmission times for message type i,

A = total amount of air time computed from the $\sum_{i=1}^{n} (M_i T_i)$,

where n is equal to the number of individual messages transmitted by the base or mobile stations.

Summaries of these calculations are provided in Appendices II and III.

REPORT OF RESULTS

Using the above results, groupings of particular data (concerning e.g., data base inquiries, status messages) were extracted. These are discussed in detail in the following two sections.

One method used to characterize the use of air time was to express the proportion of traffic represented by each type of message as a percentage of the total number of messages noted (% CALLS) and as a percentage of the air time used (% AT) during each monitoring period. This permitted the analysis to focus on a useful communications parameter, the ratio % AT/% CALLS that can be viewed as an index of efficiency. Thus, many short calls would have a low index (e.g., .0.3) while a few long calls would have a high index (e.g., 3.0). The transmission-time compression made possible through digitalization would, therefore, lead to low index numbers, indicating high efficiency.

A second statistic used during the study was an average of the percentage of calls of each type and of the air time used by each type. The resulting figure is termed a "Composite Average Percentage" (CAP). The CAP is an unweighted average that may vary from the absolute averages of air time and proportions of calls.

III. MOBILE DATA

MONITORING INTERVALS

The mobile-initiated message data presented in this section were derived from nine one-hour monitoring periods conducted during March, 1973, in four LAPD divisions: 77th, Rampart, Southwest, and Hollywood. Three categories of message were identified: data base inquiries, status calls, and alphanumeric calls. Table I summarizes the data collected (details are given in Appendix II).

DATA BASE INQUIRIES

Data base inquiries are largely information retrievals regarding persons or vehicles. Four types were identified:

- Request for want/warrant (W/W) on a license
- Request for W/W on a person
- Request for W/W and Department of Motor Vehicles (DMV) information on a license
- Request for DMV information only.

A CAP of approximately 14 percent of mobile-originated calls are database inquiries, however, they account for a CAP of 29 percent of the air time usage, for an overall efficiency index of approximately 2.0 (Table I, Column A.).

STATUS TYPE CALLS

Status calls are incidental reports concerning vehicle and officer location and readiness, as well as acknowledgments and communications protocol responses. They include such transmissions as Roger, Clear, Out to Station, Go Ahead, Repeat, Disregard, Request Supervisor (Meet on Tactical Frequency #2), Out to Hospital, Teletype Record to Station, Call for Help, and Call for Assistance: Table I, Column B, summarizes the status traffic measured during the monitoring period. Status call traffic accounts for a CAP of approximately 55 percent of mobile-initiated traffic, however, because of their briefness and routine character, the CAP of air time used is only 23 percent. The overall usage index is approximately 0.5.

ALPHANUMERIC CALLS

The third category of mobile-initiated call involves the exchange of non-standard, non-routine information calling for words or numbers, or both, in addition to routine message components. Typical alphanumeric calls would

TABLE I
MOBILE CALL TOTALS

FREQUENCY TIME	A. DATA BASE			B. STATUS			C. ALPHANUMERIC			D. TOTAL	
	% CALLS	% AT	EFFICIENCY INDEX	% CALLS	% AT	EFFICIENCY INDEX	% CALLS	% AT	EFFICIENCY INDEX	% CALLS	% AT
77 SATURDAY 9:50 PM	6	13	2.2	54	27	0.5	26	39	1.5	86	79
RAMP TUESDAY 11:30 AM	19	36	1.9	62	17	0.3	15	12	0.8	96	65
RAMP MONDAY 3:30 PM	14	31	2.2	64	34	0.5	10	14	1.4	88	79
S/W FRIDAY 10:00 PM	10	26	2.6	49	18	0.4	20	25	1.3	79	69
S/W MONDAY 11:30 AM	24	29	1.2	47	16	0.3	8	11	1.3	79	55
HOL. SUNDAY 8:15 PM	6	19	3.2	58	28	0.5	9	16	1.8	73	64
HOL. FRIDAY 8:50 PM	23	54	2.0	51	17	0.3	18	22	1.2	92	92
HOL MONDAY 7:45 PM	12	25	2.3	47	17	0.4	18	24	1.3	77	65
HOL. MONDAY 2:00 PM	12	30	2.5	61	32	0.5	13	16	1.2	86	72
CAP*	14	29		55	23		15	20		84	

*COMPOSITE AVERAGE PERCENTAGE.

involve the various "Code" (4, 6, 7, etc.) messages, as well as requests for vehicle tow, estimated time of arrival notification, station calls, time and mileage, names and addresses, etc. Table I, Column C, summarizes the statistics for alphanumeric calls, which account for a CAP of approximately 15 percent of traffic and 20 percent of the air time used, for an efficiency ratio of approximately 1.3.

TOTALS

As Table I, Column D, indicates, the three standard mobile message categories account for a CAP of 84 percent of calls and occupy a CAP of 72 percent of the air time used. These types of messages, because of their routine character, appear to be most suitable for digital transmission. The remaining 16 percent are non-standard conversations that require voice links. With the improvement in air time utilization that would be available with currently available and proposed digital equipment, it would appear possible to reduce the 72 percent by a factor of between 5 and 15.*

*The improvement of air time utilization achievable by conversion to digital transmission can be determined by calculating the ratio of the average verbal message length to the "digital equivalent" air time using currently available and proposed digital communication systems (e.g., RCA, Kustom Data System, Motorola, Atlantic Research, etc.). Improvement factors are expected to vary between 5 and 15 depending upon the detailed system design, propagation effects, retransmission requirements and polling delays. (See also BIBLIOGRAPHY, Reference 2.)

IV. BASE STATION DATA

In the LAPD communications system, three or more police division Radio Telephone Operators (RTOs) time-share a single base station, consequently, the total number of base station messages reflects the workload in at least three divisions. During the monitoring period, three hour-long samples of base-station communications traffic were measured. Two samples were taken on the "C" frequency involving the 77th St., Southwest, and Harbor divisions and one was taken on the "E" frequency involving the Wilshire, Venice and West L.A. divisions (see Appendix I for divisional identification). As with the mobile data monitoring, traffic could be categorized under a small number of headings: data base replies, calls-for-service and status dispatching, status-type calls, and alphanumeric calls. Table II summarizes the data collected (see Appendix III for details).

DATA BASE REPLIES

Data base replies are responses to mobile-initiated data base inquiries. They include the following messages as determined from the RTO on-line data terminal: No (or Yes) Want/Warrant, No Want/Warrant - DMV Information, and DMV Information. As Column A, indicates, a CAP of 10 percent RTO-initiated messages relate to data base inquiries and account for a CAP of 15 percent of the air time used. Data base air time percentages are lower during the busy nighttime periods, reflecting both increased base station channel loading, which inhibits data base inquiries, and the large percentage of patrol vehicles on assigned calls during such periods.

CALLS-FOR-SERVICE AND STATUS DISPATCHING

The second category of RTO-generated calls includes all citizen calls, calls-for-service, crime broadcasts and a variety of status dispatching messages. More than 20 types of calls in this category could apparently be converted to digital transmission, however they would require alphanumeric input from an RTO and some form of mobile readout display. As Table II, Column B, indicates, these calls require substantial air time (up to 47 percent of time used during busy periods) and have the highest efficiency index (approximately 2.0).

STATUS TYPE CALLS

Status calls are routine messages that can be most conveniently digitalized (e.g., Roger, Standby, Repeat, Clear, Code 1, etc). Table II, Column C summarizes the data collected during monitoring. Status calls account for a CAP of 58 percent of the traffic, but occupy only a CAP of 29 percent of the air time used.

TABLE II

HEADQUARTERS CALL TOTALS*

FREQUENCY TIME	A. DATA BASE % CALLS	A. % AT	A. EFFICIENCY INDEX	B. CALLS FOR SERVICE % CALLS	B. % AT	B. EFFICIENCY INDEX	C. STATUS % CALLS	C. % AT	C. EFFICIENCY INDEX	D. ALPHANUMERIC % CALLS	D. % AT	D. EFFICIENCY INDEX	E. TOTAL % CALLS	E. % AT
E SATURDAY 10:00 PM	3	7	2.3	23	47	2.0	60	28	.5	14	18	1.3	100	100
C MONDAY 10:30 AM	17	25	1.5	10	17	1.7	53	28	.5	19	27	1.4	99	97
C FRIDAY 9:50 PM	9	13	1.4	15	34	2.3	61	31	.5	14	20	1.4	99	98
CAP**	10	15		16	33		58	29		16	22		99	98

*VALUES ROUNDED FOR CONVENIENCE AND MAY NOT TOTAL THE SAME AS THE AVERAGE. ACTUAL VALUES MAY DEPART FROM 100 PERCENT BY A SMALL AMOUNT.
** COMPOSITE AVERAGE PERCENTAGE.

ALPHANUMERIC CALLS

As with calls-for-service and status dispatch calls, alphanumeric calls combine routine message elements with location, name, or other information. Table II, Column D, shows that these calls comprise a CAP of 16 percent of the traffic and occupy a CAP of 22 percent of the air time used, a reversal of the status call situation.

TOTALS

Table II, Column E, summarizes the totals for all categories. It shows that approximately 98 to 99 percent of base-originated traffic are included in the four categories that are technically amenable to digital transmission.

V. MESSAGE DISTRIBUTION DATA

PERCENT CALLS, PERCENT AIR TIMES

As Column A, of Tables I and II show, CAP's of approximately 14 percent of the mobile and 10 percent of base station messages are related to data base inquiries. Similarly, the occupied air time CAP's for these messages are approximately 29 percent and 15 percent, respectively.

VOLUME OF DATA BASE INQUIRIES

The total number of mobile-initiated data base inquiries for Los Angeles per year is shown below.*

YEAR	TOTALS
1970	1,556,071
1971	2,621,129
1972	2,395,620

Typically 150,000 to 200,000 inquiries per month are made from approximately 177 patrol vehicles located in 17 geographic divisions.

MONTHLY BREAKDOWNS

A typical monthly (March 1973) breakdown of data base inquiries in some of the LAPD divisions is shown in Table III. The Los Angeles Police Department divisions are shown on the left column and the types of data base requests, the replies and hit** percentages are also shown. The numbers are based upon an average (per 24-hours) of vehicles in the field for all LAPD divisions. The number of vehicles per channel varies between approximately 15 and 40, the largest number occurring during the peak weekend hours. Specific computerized data base systems descriptions are given in Appendix I.

*From LAPD automated want/warrant system summary statistics.

**A "hit" is a computer response to an inquiry indicating that a person or vehicle is connected with an outstanding want/warrant or a vehicle is reported stolen.

TABLE III

MONTHLY BREAKDOWN OF DATA BASE REQUESTS

DIVISION	w/w PERSON HIT	w/w PERSON NO-HIT	% HIT	DMV INQUIRIES	w/w LICENSE HIT	w/w LICENSE NO-HIT	% HIT	TOTAL
HARBOR	370	2463	13.1	6926	598	4734	11.2	15,091
CENTRAL	259	1901	12.0	6866	622	4048	13.3	13,696
HOLLYWOOD	421	3059	12.1	10,055	997	6226	13.8	20,758
WILSHIRE	389	2191	15.1	8022	903	4436	16.9	15,941
WEST LA.	449	3146	12.5	9825	755	6250	10.8	20,425
RAMPART	348	2800	11.1	8339	786	6591	12.1	17,964
VLNICE	311	2416	11.4	8745	702	5391	11.5	17,565
SOUTH WEST	417	2356	15.0	8338	998	4464	18.3	16,573
NEWTON	580	2878	16.8	8125	1132	5096	18.2	17,811
77th	418	1870	18.3	9442	1140	5172	18.1	18,042
NORTHEAST	408	2984	12.0	9243	951	6176	13.3	19,762
TOTAL								193,628

VI. CHANNEL LOADING AND QUEUING DELAYS

CHANNEL LOADING

Part of this study was directed at determining channel loading for both base and mobile frequencies.

To automate the measurement of message timing, a voice-operated relay (VOR) was coupled to a monitor receiver with an event counter and a running-time meter to provide a measure of "time on" - "time off" in voice traffic. The VOR was adjusted to trigger on all audio levels above the normal "transmitter off" level. Every time a base transmitter was keyed, a verbal dispatch or background audio (in the Communications Room) would trigger the VOR to start the running-time meter and event counter.

Channel-loading measurements were made for a limited number of representative one-hour monitoring periods. Table IV below indicates the channel loading for these selected time periods.

TABLE IV - CHANNEL LOADING

Frequency	Day	Time	Channel Loading (%)
S/W (Mobile)	Friday	10:00 PM	29
S/W (Mobile)	Monday	11:30 AM	21
C (Base)	Monday	10:30 AM	75
C (Base)	Friday	10:00 PM	91
E (Base)	Tuesday	9:00 PM	51

QUEUING

When channel loading approaches and "passes" 100 percent, so that a queue is built up, message characteristics change. To analyze this effect, one can use queuing theory assuming a random distribution of messages and message lengths, to predict message delays at various loading values. The LAPD command and control system was analyzed as a single server system since several RTO's time-share a single base station radio transmitter. Message delay times, as well as numbers of messages delayed, can be predicted, given an assumed distribution of message arrival rate and broadcast time.

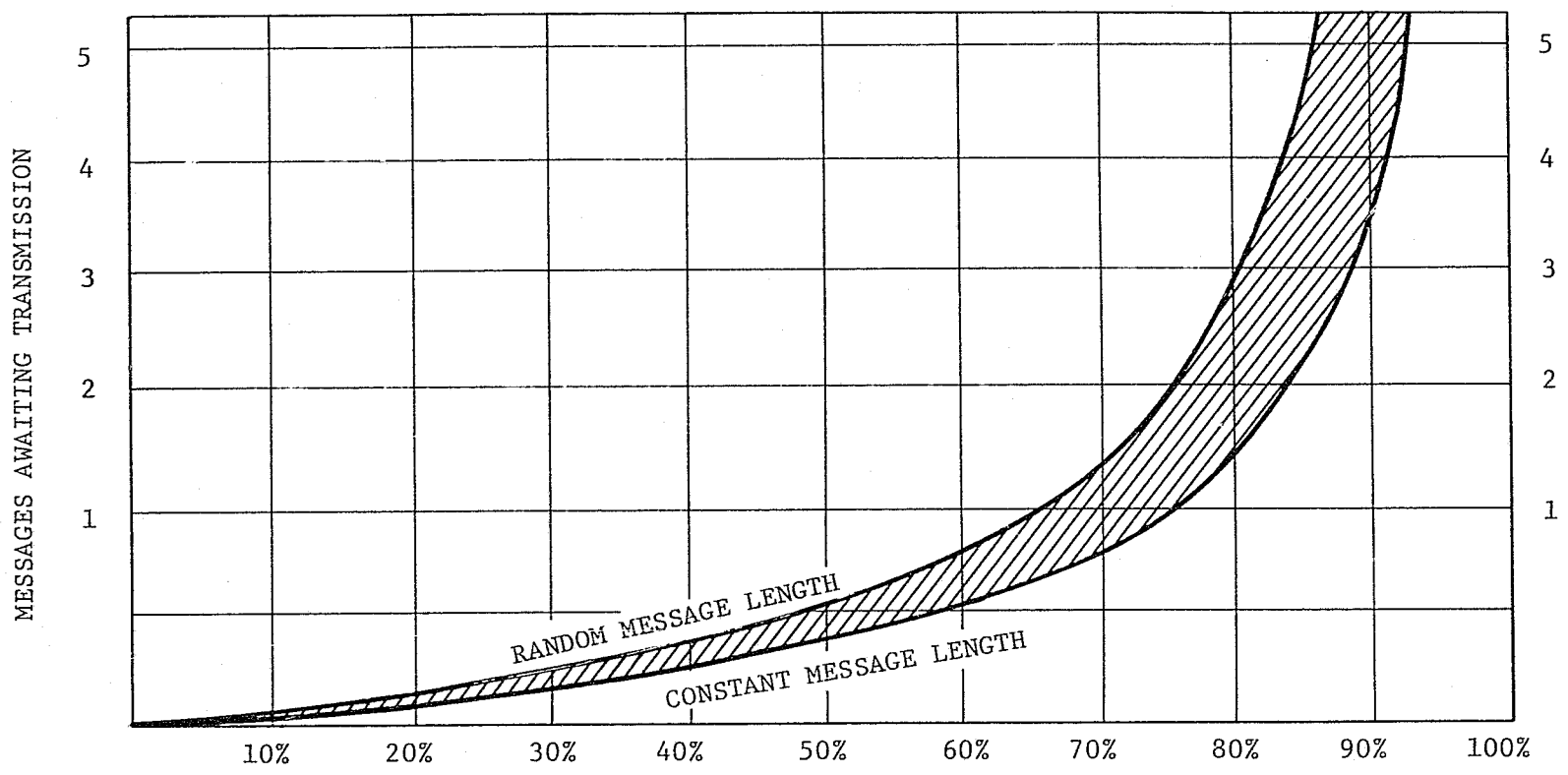
From the analysis it can be shown that at 60 percent channel loading, an average of one message is waiting in the queue to be transmitted and that the number rises exponentially with increased channel loading.* For channel loadings greater than 90 percent, the queue size is greater than five (Figure 1).

Similarly, the queuing time (the mean time spent by a message in the queue) exponentially increases from approximately two message lengths at 60 percent channel loading to six or more at 90 percent loading (Figure 2).

EFFECT OF DIGITALIZATION ON MESSAGE PROCESSING

It would appear that any reduction in message transmission times would correspondingly reduce absolute waiting times and message queuing, for a significant improvement in message-handling capacity. If average message length were reduced by a factor of 5, for example, waiting time would be the equivalent of only one current message length at 90 percent channel loading.

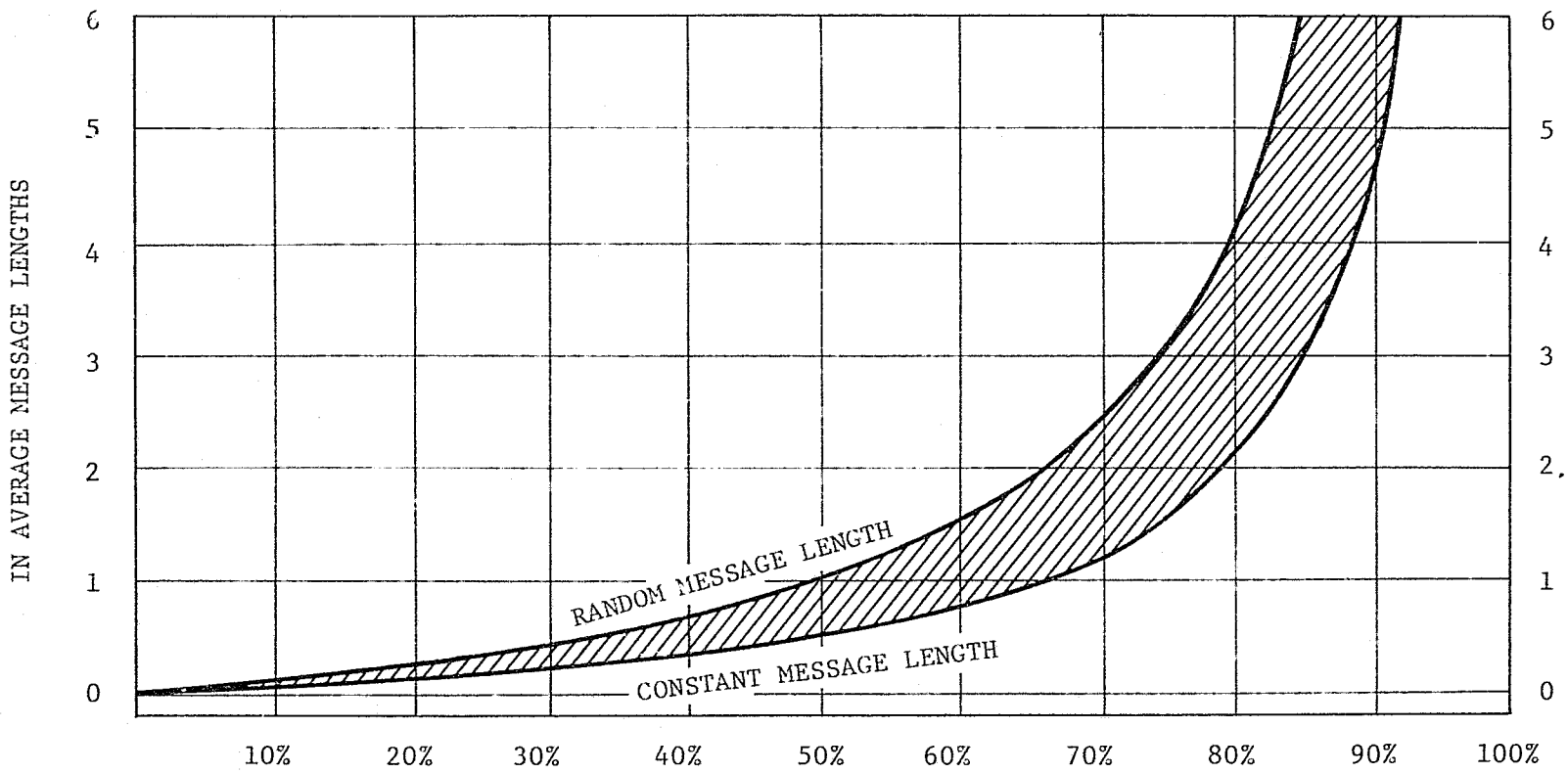
*See James Martin, Design of Real Time Computer Systems, Prentice-Hall, 1967, 372-427, for a discussion of the applicable theory.



SOURCE: JAMES MARTIN, DESIGN OF REAL TIME COMPUTER SYSTEMS, PRENTICE-HALL, 1967.

FIGURE 1

MESSAGE QUEUE LENGTH CHARACTERISTICS



SOURCE: JAMES MARTIN, DESIGN OF REAL TIME COMPUTER SYSTEMS, PRENTICE-HALL, 1967.

FIGURE 2

MESSAGE WAITING TIME CHARACTERISTICS

VII. SUMMARY AND CONCLUSIONS

In the current LAPD voice communications system it would appear that the vast majority of all mobile-initiated messages (a CAP of 84 percent of the total number) and virtually all headquarters-initiated messages (a CAP of 99 percent of the total) are of a type that could be transmitted more quickly through a suitable digital system.

The data indicated that the headquarters-to-mobile communication traffic is heavy during the peak traffic hours (90 percent channel loading), whereas the mobile-to-headquarters links are lightly loaded (30 percent channel loading) during the same time period. A heavily loaded link was shown to increase the message delays by significant amounts.

It would appear from these results that a digital communications system has potential for reducing the delay in headquarters-to-mobile communications by relieving the channel loading, and that several mobile channels might be combined without introducing mobile-to-headquarters delays.

APPENDIX I

LAPD COMMAND/CONTROL SYSTEM

GENERAL

This appendix presents a summary of the LAPD Command/Control (C/C) system. Details of the C/C system relevant to this study will be emphasized.

The Parker Center (downtown Los Angeles) LAPD C/C system is a manually operated dispatch center containing facilities to answer citizen calls, dispatch police vehicles, and provide information to patrol forces from local, state and national law enforcement data bank sources.

COMPLAINT BOARD

Incoming calls to the police department are serviced by up to 18 police officers arranged on either side of a single-track chute in the Complaint Board area of the Dispatch Center. In any major emergency, 8 additional positions can be added. Any one of several forms (called "tickets") is filled out by an officer based upon citizen information. All tickets are passed from the Complaint Board area to the Communications Room via a single chute.

COMMUNICATIONS ROOM

The Communications Room, shown in Figure 3, contains a total of 15 civilian Radio-Telephone Operators (RTOs) seated at individual consoles, arranged in a horseshoe. The RTOs utilize communication headsets and microphones and communicate with the patrol forces through the radio network. Each of the RTOs handles calls to and from cars in only one of the 12 specific divisions handled by this center. A link position allows a supervisor to coordinate and broadcast "HOTSHOT" calls and coordinate interagency communications. Each RTO utilizes a keyboard and display linked to the outline data systems discussed later in this appendix.

A similar but smaller C/C system located in Van Nuys serves the five LAPD San Fernando Valley divisions.

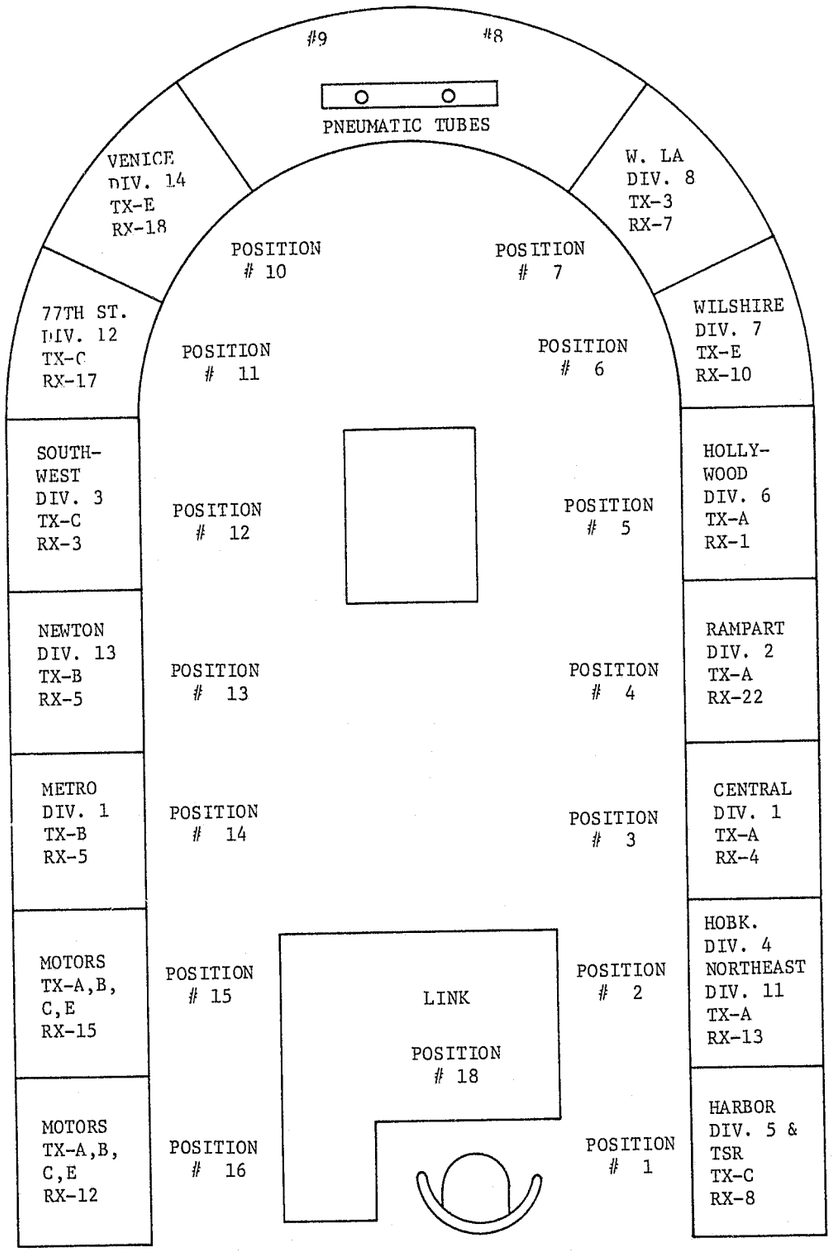


FIGURE 3
COMMUNICATIONS ROOM LAYOUT

OPERATIONS

A typical C/C operation is as follows:

- Citizen calls the police department to request assistance.
- Complaint Board operator fills out a ticket, assigns a priority to the call, and places the ticket into the chute.
- One of the several dispatchers in the Communications Room picks up the ticket and identifies the location of the call. He may use the city-wide street index if he is unfamiliar with the address.
- The dispatcher walks over to the RTO console for that LAPD division, and looks at the patrol car status buttons (two buttons on opposite ends of a rotatable shaft - one visible to the RTO, the other to the dispatcher), and determines the closest available car.
- He writes the number of the car he assigns to handle the call in the upper right of the "ticket" and hands it to the RTO for radio broadcast.
- Requests from the patrol officers can be passed back to the dispatcher via RTO originated "ticket."
- Requests for information stored in any of the online computer systems are directly processed by each RTO through the RTO keyboard and display.

Each RTO presses a foot pedal to broadcast. Three of four RTOs are connected to a base station transmitter through a selecting rotary which time-shares each base station with the RTOs. In operation, the RTO presses the pedal and waits for an "on the air" light to indicate connection to the transmitter.

A room containing tape recorders is located adjacent to the Communications Room. All outgoing and incoming messages are recorded and stored on magnetic tape.

RADIO SYSTEM

The LAPD communications network consists of a 29-channel VHF system operating between 154.65 MHz and 159.18 MHz. A UHF repeater system is available for use by staff, vice and intelligence personnel. The channel plan for the network is shown in Figure 4. As shown, several RTOs share a single base station. However, each division possesses its own mobile-to-base frequency. Frequencies A, B, C, and E are used to service the 12 LAPD divisions in the Los Angeles Basis whereas Frequency D is used to serve the five (5) San Fernando Valley Divisions (from the Van Nuys Center). Other nonpatrol users are also shown in the plan.

The North Hollywood Division is the only one using both Frequency D and its own mobile frequency for dispatch (Simplex).

Subaudible tones are used on all mobile transmissions for squelch control. Most patrol vehicles possess two (4-channel) radios to cover both Tactical and Division operations. Cheater (also called K-K) receivers are installed in 90 percent of the marked patrol cars to enable the monitoring of mobile-to-base transmissions so that each mobile can avoid transmitting while another mobile is on the air.

Transmitting and receiving facilities are located around the city at various mountain tops and station house locations. Microwave and telephone links are utilized between Parker Center and the various transmitting and receiving sites.

A backup set of transmitters and receivers is available at the Parker Center and Van Nuys facilities.

DATA BASE SYSTEM

The Automated Want Warrant System (AWWS) was designed to centralize want and warrant records. Its objective is to improve the effectiveness of law enforcement through efficient processing of want and warrant information for rapid responses to inquiries.

A Radio-Telephone Operator "types" a subject's name and other information on a computer connected keyboard to determine whether a want or a warrant is outstanding for the person. In seconds the answer is received on a cathode ray tube. The system also has the ability to access statewide files that contain data on stolen automobiles and vehicle registrations.

Specifically the AWWS contains:

- felony wants
- felony warrants

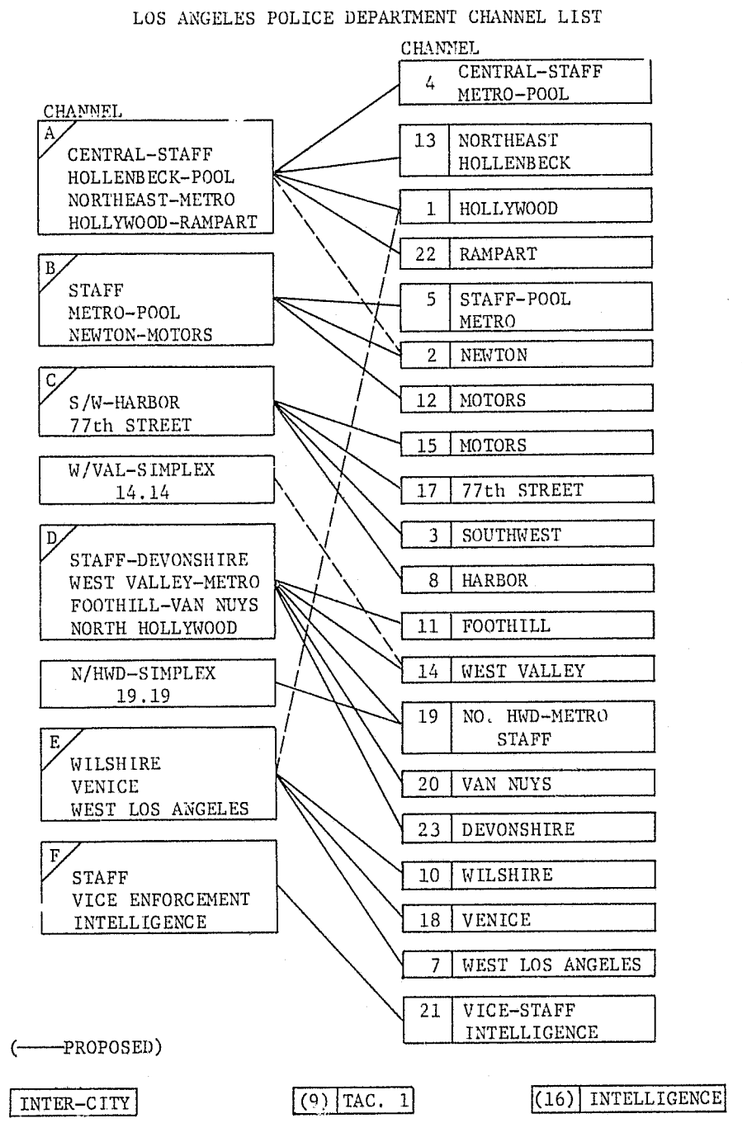


FIGURE 4

CHANNEL PLAN

- misdemeanor warrants
- traffic violation warrants.

Approximately 700,000 records from 36 police agencies are currently on file in the system. It is expected that the total will soon exceed one million.

All 50 police agencies in Los Angeles County, in addition to LAPD, access the system by means of a keyboard and CRT Terminal or teletype. Access is by any one of the following:

- name and description
- system identification number
- warrant number
- vehicle license number.

Average input time is 40 seconds. Average response time is 12 seconds.

In addition to the data available within the AWWS file, each CRT terminal on the system has direct access to the California Highway Patrol's AUTO-STATIS System which is a file of stolen, recovered, repossessed and impounded vehicles. AUTO-STATIS, in turn, interfaces with the FBI's National Crime Information Center (NCIC) Stolen Vehicle file and the California Department of Motor Vehicle's Automatic Management Information System (AMIS).

In late 1973, an interface between the California Law Enforcement Telecommunications System (CLETS) was completed allowing AWWS terminals to access the wanted person files of both the FBI and the California Department of Justice.

APPENDIX II

MOBILE DATA

The following is a summary of the data gathered in monitoring the mobile frequencies. Division, date, time and day of week (D.O.W.) are indicated. Also included are the message duration data for each of the indicated messages.

Div. 77th Time 9:50 PM - 10:50 PM

Date 5/5/73 D.O.W. Saturday

MOBILE	# Of Calls	% Calls*	Seconds Air Time	% Air Time*
Roger	17	20	22.6	7.2
Clear	9	10.5	12.2	3.9
Out to Station	14	16.4	30.8	9.9
Want/Warrant (License)	3	3.4	13.1	4.1
Want/Warrant (Person)	1	1.1	23.0	7.4
Want/Warrant DMV (License)	1	1.1	5.4	1.7
Verify	1	1.1	4.0	1.2
Repeat	2	2.3	6.8	- -
Code 6	3	3.5	10.2	- -
Code 4	2	2.3	12.8	- -
Code 7	1	1.1	5.3	1.7
Meet TAC 2	3	3.5	14.4	4.6
Meet At Location	1	1.1	1.6	0.5
What is Status				
DMV				
Show Handling	5	5.8	24.0	7.7
Request Tow				
Request Supervisor				
Go-ahead	1	1.1	1.2	0.3
Request Frequency	1	1.1	2.1	0.6
Request Reassign Call	1	1.1	9.8	3.1
Impound				
ETA				
Traffic Accident				
Station Call	1	1.1	4.1	1.3
Will back up	1	1.1	3.5	1.1
Time and Mileage	5	5.8	44.0	14.1
Show to Next Call				
Misc. Infor Request	6	7.0	29.4	9.4
Misc. Info Supplied	3	3.5	19.5	6.2
Request back up	1	1.1	5.0	1.6
Disregard	1	1.1	3.0	0.9
Code Z	1	1.1	3.0	0.9

*Throughout this appendix percentage figures have been truncated, rather than rounded, leading to an error of .1 percent in some instances. In view of the number of calls, however, the error is not significant.

Div. Rampart TIME 11:33 AM - 12:33 PM

Date 5-8-73 D.O.W. Tuesday

MOBILE	# Of Calls	% Calls	Seconds Air Time	% Air Time
Roger	28	38.8	37.2	9.8
Clear	8	11.1	5.9	1.5
Out to Station	4	5.5	8.8	2.3
Want/Warrant (License	9	12.1	38.0	10.0
Want/Warrant (Person)	4	5.5	92.0	24.4
Want/Warrant DMV (License)	1	1.3	5.4	1.4
Verify				
Repeat	1	1.3	3.4	0.9
Code 6	3	4.1	10.4	2.7
Code 4	1	1.3	6.4	1.7
Code 7	4	5.5	21.2	5.6
Meet TAC 2				
Meet At Location				
What is Status	2	2.7	5.8	1.5
DMV				
Show Handling				
Request Tow				
Request Supervisor				
Go-ahead	1	1.3	1.2	0.3
Request Frequency	2	2.7	4.2	1.1
Request Reassign Call	1	1.3	9.8	2.6
Impound				
ETA	1	1.3	2.5	0.6
Traffic Accident				
Station Call				
Will back up				
Time and Mileage				
Show to Next Call				
Misc. Infor Request	1	1.3	4.9	1.3
Misc. Info Supplied	2	2.7	13.0	3.4
Follow UP	1	1.3	5.1	1.3
Crime Broadcast	1	1.3	95.0	25.2
Out to hospital	1	1.3	6.0	1.5

Div. Rampart Time 3:30 PM - 4:30 PM

Date 5/7/73 D.O.W. Monday

MOBILE	# of Calls	% Calls	Seconds Air Time	% Air Time
Roger	16	22.8	21.3	9.9
Clear	16	22.8	21.7	10.1
Out to Station	10	14.2	22.0	10.3
Want/Warrant (License)	5	6.1	22.7	10.5
Want/Warrant (Person)	1	1.4	23.0	10.7
Want/Warrant DMV (License)	3	4.2	16.2	7.5
Verify				
Repeat	2	2.8	6.8	3.1
Code 6	3	4.2	10.2	4.7
Code 4	1	1.4	6.4	2.9
Code 7				
Meet TAC 2	1	1.4	4.8	2.2
Meet at Location				
What is Status				
DMV	1	1.4	4.9	2.2
Show Handling	1	1.4	4.8	2.2
Request Tow				
Request Supervisor				
Go-ahead				
Request Frequency	1	1.4	2.1	0.9
Request Reassign Call				
Impound				
ETA				
Traffic Accident				
Station Call	1	1.4	4.1	1.9
Will back up				
Time and Mileage				
Show to Next Call				
Misc. Infor Request	6	8.5	29.4	13.7
Misc. Info Supplies	2	2.8	13.0	6.0

Div. Southwest Time 10-11 PM

Date 5/4/73 D.O.W. Friday

MOBILE	# Of Calls	% Calls	Seconds Air Time	% Air Time
Roger	40	24.6	53.2	7.9
Clear	23	14.1	31.3	4.6
Out to Station	11	6.7	24.2	3.6
Want/Warrant (License)	7	4.3	34.3	5.8
Want/Warrant (Person)	5	3.0	115.0	17.2
Want/Warrant DMV (License)	4	2.4	21.6	3.2
Verify	2	1.2	8.0	1.2
Repeat	1	0.6	3.4	0.5
Code 6	2	1.2	6.8	1.0
Code 4	5	3.0	32.0	4.8
Code 7	6	3.7	31.8	4.7
Meet TAC 2	5	3.0	24.0	3.6
Meet at Location				
What is Status				
DMV	1	0.6	4.9	0.7
Show Handling	4	2.4	19.2	2.8
Request Tow	1	0.6	15.0	2.2
Request Supervisor				
Go-ahead				
Request Frequency	5	3.0	10.5	1.5
Request Reassign Call	2	1.2	19.6	2.9
Impound				
ETA	1	0.6	2.5	0.3
Traffic Accident				
Station Call				
Will back up	4	2.4	14.0	2.1
Time and Mileage	3	1.8	26.4	3.9
Show to Next Call	3	1.8	15.3	2.2
Misc. Infor Request	11	6.7	53.9	8.0
Misc. Info Supplied	14	8.6	91.0	13.6
Foot Pursuit	1	0.6	10.0	1.5

Div. Southwest Time 11:30 AM - 12:30 PM

Date 5/14/73 D.O.W. Monday

MOBILE	# Of Calls	% Calls	Seconds Air Time	% Air Time
Roger	24	23.0	31.9	6.8
Clear	11	10.5	8.1	1.7
Out to Station	10	9.6	22.0	4.7
Want/Warrant (License)	13	12.4	57.2	12.2
Want/Warrant (Person)	1	0.9	23.0	4.9
Want/Warrant DMV (License)	7	6.7	37.8	8.1
Verify	4	3.8	16.0	3.4
Repeat	2	1.9	6.8	1.4
Code 6	1	0.9	3.4	0.7
Code 4	1	0.9	6.4	1.3
Code 7	3	2.8	15.9	3.4
Meet TAC 2	2	1.9	9.6	2.0
Meet at Location				
What is Status				
DMV	4	3.8	19.6	4.2
Show Handling				
Request Tow				
Request Supervisor				
Go-ahead				
Request Frequency	2	1.9	4.2	0.9
Request Reassign Call				
Impound				
ETA				
Traffic Accident	1	0.9	6.8	1.4
Station Call				
Will back up				
Time and Mileage	1	0.9	8.8	1.8
Show to Next Call				
Misc. Infor Request	7	6.7	34.3	7.3
Misc. Info Supplied	9	8.6	58.5	12.5
Crime Broadcast	1	0.9	95.0	20.4

Div. Hollywood Time 8:16 - 9:13 PM

Date 5/6/73 D.O.W. Sunday

MOBILE	# Of Calls	% Calls	Seconds Air Time	% Air Time
Roger	19	22.6	25.4	8.4
Clear	13	15.4	17.7	5.9
Out to Station	9	10.7	19.8	6.6
Want/Warrant (License)	2	2.3	7.0	2.3
Want/Warrant (Person)	2	2.3	46.0	15.3
Want/Warrant DMV (License)	1	1.1	5.4	1.8
Verify	9	10.7	36.0	12.0
Repeat	5	5.9	17.0	5.6
Code 6	3	3.5	10.2	3.4
Code 4	3	3.5	19.2	6.4
Code 7				
Meet TAC 2	1	1.1	4.8	1.6
Meet at Location				
What is Status				
DMV				
Show Handling	3	3.5	14.4	4.8
Request Tow	1	1.1	15.0	5.0
Request Supervisor	1	1.1	7.0	2.3
Go-ahead	2	2.3	2.4	0.8
Request Frequency	1	1.1	2.1	0.7
Request Reassign Call	2	2.3	19.6	6.5
Impound	1	1.1	5.0	1.5
ETA				
Traffic Accident				
Station Call				
Will back up				
Time and Mileage				
Show to Next Call				
Misc. Infor Request	5	5.9	24.5	8.1
Misc. Info Supplied	1	1.1	6.5	2.1

Div. Hollywood Time 8:50-9:50 PM

Date 5/4/73 D. O. W. Friday

MOBILE	# Of Calls	% Calls	Seconds Air Time	% Air Time
Roger	28	27.1	37.2	7.6
Clear	10	9.7	13.6	2.7
Out to Station	6	5.8	13.2	2.7
Want/Warrant (License)	12	11.5	56.3	11.5
Want/Warrant (Person)	8	7.7	184.0	37.6
Want/Warrant DMv (License)	4	3.8	21.6	4.4
Verify	2	1.9	8.0	1.6
Repeat				
Code 6	3	2.9	10.4	2.1
Code 4	4	3.8	25.6	5.2
Code 7	3	2.9	15.9	3.2
Meet TAC 2	4	3.8	19.2	3.9
Meet at Location				
What is Status				
DMV				
Show Handling	1	0.9	4.8	0.9
Request Tow	1	0.9	15.0	3.0
Request Supervisor				
Go ahead	1	0.9	1.9	0.2
Request Frequency	5	4.8	10.5	2.1
Request Reassign Call				
Impound				
ETA	1	0.9	2.5	0.5
Traffic Accident				
Station Call				
Will back up				
Time and Mileage	1	0.9	8.8	1.8
Show to Next Call				
Misc. Infor Request	3	2.9	14.7	3.0
Misc. Info Supplied	1	0.9	6.5	1.3
TTY to Station	2	1.9	3.2	0.6
To Hospital	1	0.9	6.0	1.2
Code 5	5	1.9	10.0	2.0

Div. Hollywood Time 2-3 PM

Date 5/7/73 D.O.W. Monday

MOBILE	# Of Calls	% Calls	Seconds Air Time	% Air Time
Roger	27	32.9	35.9	13.4
Clear	12	14.6	16.3	6.1
Out to Station	5	6.0	11.0	4.1
Want/Warrant (License)	5	6.0	20.1	7.4
Want/Warrant (Person)	2	2.4	46.0	17.2
Want/Warrant DMV (License)	3	3.6	15.2	5.6
Verify	4	4.8	16.0	5.9
Repeat	4	4.8	13.4	5.0
Code 6	6	7.3	20.4	7.6
Code 4				
Code 7	2	2.4	10.6	3.9
Meet TAC 2				
Meet at Location				
What is Status				
DMV				
Show Handling				
Request Tow				
Request Supervisor				
Go-ahead				
Request Frequency	1	1.2	2.1	0.7
Request Reassign Call				
Impound				
ETA	1	1.2	2.5	0.9
Traffic Accident	1	1.2	6.8	2.5
Station Call	1	1.2	4.1	1.5
Will back up				
Time and Mileage				
Show to Next Call				
Misc. Infor Request	3	3.6	14.7	5.5
Misc. Info Supplied	4	4.8	26.0	9.7
Out to Hospital	1	1.2	6.0	2.2

Div. Hollywood Time 7:45 PM-8:45 PM

Date 5/7/73 D.O.W. Monday

MOBILE	# Of Calls	% Calls	Seconds Air Time	% Air Time
Roger	21	28	27.9	8.9
Clear	7	9.3	9.5	3.0
Out to Station	5	6.6	11.0	3.5
Want/Warrant (License)	6	7.9	26.2	8.3
Want/Warrant (Person)	2	2.6	46.0	14.8
Want/Warrant DMV (License)				
Verify	1	1.3	4.0	1.2
Repeat	1	1.3	3.4	1.0
Code 6	1	1.3	3.4	1.0
Code 4	2	2.6	12.8	4.1
Code 7	2	2.6	10.6	3.4
Meet TAC 2				
Meet at Location				
What is Status	2	2.6	5.8	1.8
DMV	1	1.3	4.9	1.5
Show Handling				
Request Tow				
Request Supervisor				
Go - ahead				
Request Frequency	1	1.3	2.1	0.6
Request Reassign Call	1	1.3	9.8	3.1
Impound				
ETA	1	1.3	2.5	0.8
Traffic Accident				
Station Call	1	1.3	4.1	1.3
Will back up	1	1.3	3.5	1.1
Time and Mileage	3	4.0	26.4	8.5
Show to Next Call	1	1.3	5.1	1.6
Misc. Infor Request	4	4.0	19.6	6.3
Misc. Info Supplied	11	14.6	71.5	23.0

MOBILE MESSAGE DURATION DATA

	MESSAGE AVERAGE TIME (SECS.)
Roger	1.3
Clear	1.4
Out to Station	2.2
Want/Warrant (License)	4.8
Want/Warrant (Person)	23.0
Want/Warrant DMV (License)	5.4
Verify	4.0
Repeat	3.4
Code 6	3.4
Code 4	6.4
Code 7	5.3
Meet TAC 2	4.8
Meet at Location	1.6
What is Status	2.9
DMV	4.9
Show Handling	4.8
Request Tow	15.0
Request Supervisor	7.0
Go-ahead	1.2
Request Frequency	2.1
Request Reassign Call	9.8
Impound	5.0
Crime Broadcast	95.0
ETA	2.5
Traffic Accident	6.8
Station Call	4.1
Will backup	3.5
Time and Mileage	8.8
Show to Next Call	5.1
Misc. Info. Request	4.9
Misc. Info. Supplied	6.5
Out to Hospital	6.0
Stolen Veh. Report	31.4
Impound	8.0
TTY to Station	1.6
Follow-up	5.1
Code 5	5.0
Disregard	3.0
Request Backup	5.0
Code Z	3.0

APPENDIX III

BASE DATA

The following is a summary of the data gathered in monitoring the base frequencies. Frequency, date, time, day of week (D.O.W.), and Division using that frequency are indicated. Also included are message duration data based upon timing each of the individual messages.

FREQ E TIME 9:30 - 9:40 p.m. 10:00 - 11:00 p.m. DIV. 7,8,14

DATE 5/5/73 D.O.W. Saturday p.m.

BASE	# Of Calls	% Calls*	Seconds Air Time	% Air Time*
Roger	82	17.9	114.8	6.8
Stand By	58	12.6	110.2	6.6
Repeat	65	14.2	117.0	7.0
Clear	40	8.7	60.0	3.6
No Want/Warrant	8	1.7	26.4	1.5
Code 1	10	2.1	24.0	1.4
Meet on TAC 2	16	3.5	60.8	3.6
Go-ahead	10	2.1	15.0	0.9
No Want/Warrant-DMV	6	1.3	69.0	4.1
Code 7				
Code 4	15	3.2	81.0	4.8
459 Now	2	0.4	26.0	1.5
459 Report	2	0.4	15.8	0.9
211	6	1.3	82.2	4.9
Cancel	9	1.9	67.5	4.0
Ambulance Traffic	1	0.2	7.3	0.4
Car Racing	2	0.4	14.4	0.8
Code 30	4	0.8	24.8	1.4
211 Silent	1	0.2	8.0	0.4
Code 6	7	1.5	22.4	1.3
ETA	1	0.2	4.1	0.2
ADW Progress	1	0.2	7.8	0.4
415	9	1.9	72.0	4.3
586	8	1.7	48.8	2.9
To Station	7	1.5	19.6	1.1
484	1	0.2	7.0	0.4
Ambulance Shooting	1	0.2	8.2	0.4
Did you receive call	1	0.2	2.0	0.1
Prowler	2	0.4	40.2	2.4
DMV	2	0.4	17.4	1.0
Verify	1	0.2	3.4	0.2
Yes Want/Warrant				
Call Watch Commander				
Frequency Clear	3	0.6	6.3	0.3
Suspect Data				
Location				
Status				

* Throughout this appendix percentage figures have been truncated, rather than rounded, leading to an error of .1 percent in some instances. In view of the number of calls, however, the error is not significant.

	# Of Calls	% Calls	Seconds Air Time	% Air Time
Address				
Disregard				
Handling				
GTA				
GTA Report				
Shots Fired				
Identify				
Meet at Location				
Assigned Stolen				
Misc. Dispatch	36	7.8	302.4	18.1
Misc. Info	38	8.3	167.2	10.0
Go ahead with second				
Traffic Accident	2	0.4	11.2	0.6

FREQ C TIME 10:20 - 11:20 amDIV. 12,3,11

DATE 5/14/73 D.O.W. Monday

BASE	# Of Calls	% Calls	Seconds Air Time	% Air Time
Roger	72	16.1	100.8	6.7
Stand By	47	10.5	89.3	5.9
Repeat	33	7.3	59.4	3.9
Clear	36	8.0	54.0	3.6
No Want/Warrant	50	11.1	165.0	11.0
Code 1	11	2.4	26.4	1.7
Meet on TAC 2	6	1.3	22.8	1.5
Go-ahead	17	3.8	25.5	1.7
No Want/Warrant-DMV	3	0.6	34.5	2.3
Code 7	1	0.2	5.0	0.3
Code 4	8	1.7	43.2	2.9
459 Now	1	0.2	13.0	0.8
459 Report	4	0.8	31.6	2.1
211				
Cancel				
Ambulance Traffic				
Car Racing				
Code 30				
211 Silent	2	0.4	16.0	1.0
Code 6	7	1.5	22.4	1.5
ETA	2	0.4	8.2	0.5
ADW Progress				
415				
586	1	0.2	6.1	0.4
To Station	3	0.6	8.4	0.5
484				
Ambulance Shooting				
Did you receive call				
Prowler				
DMV	16	3.5	139.2	9.3
Verify	18	4.0	61.2	4.1
Yet Want/Warrant	6	1.3	42.6	2.8
Call Watch Commander	5	1.1	22.5	1.5
Frequency Clear	9	2.0	18.9	1.2
Suspect Data				
Location	2	0.4	6.6	0.4
Status				

	# Of Calls	% Calls	Seconds Air Time	% of Air Time
Address	9	2.0	39.6	2.6
Disregard	1	0.2	2.2	0.1
Handling				
GTA				
GTA Report				
Shots Fired				
Identify	11	2.4	55.0	3.6
Meet at Location	3	0.6	22.5	1.5
Assigned Stolen	2	0.4	38.0	2.5
Misc. Dispatch	10	2.2	84.0	5.6
Misc. Info	50	11.1	220.0	14.7
Go ahead with second				
Traffic Accident	1	0.2	5.6	0.3

FREQ C TIME 9:50 - 10:50 PM DIV. 12,3,11

DATE 5/4/73 D.O.W. Friday

BASE	# Of Calls	% Calls	Seconds Air Time	% Air Time
Roger	106	16.6	148.4	6.6
Stand By	66	10.3	125.4	5.5
Repeat	59	9.2	106.2	4.7
Clear	58	9.1	87.0	3.8
No Want/Warrant	38	5.9	125.4	5.5
Code 1	16	2.5	38.4	1.7
Meet on TAC 2	6	0.9	22.8	1.0
Go-ahead	22	3.4	33.0	1.4
No Want/Warrant-DMV	6	0.9	69.0	3.0
Code 7				
Code 4	15	2.3	81.0	3.6
459 Now	7	1.1	91.0	4.0
459 Report	3	0.4	23.7	1.0
211	1	0.1	13.7	0.6
Cancel				
Ambulance Traffic	2	0.3	14.6	0.6
Car Racing				
Code 30	5	0.7	31.0	1.3
211 Silent	1	0.1	8.0	0.3
Code 6	1	0.1	3.2	0.1
ETA	1	0.1	4.2	0.1
ADW Progress	1	0.1	7.8	0.3
415	21	3.3	168.0	7.4
586				
To Station	4	0.6	11.2	0.4
484				
Ambulance Shooting				
Did you receive call	12	1.8	24.0	1.0
Prowler	3	0.4	60.3	2.6
DMV	3	0.4	26.1	1.1
Verify	6	0.9	20.4	0.9
Yes Want/Warrant	10	1.5	71.0	3.1
Call Watch Commander	9	1.4	40.5	1.8
Frequency Clear	18	2.8	37.8	1.6
Suspect Data	1	0.1	64.0	2.8
Location				
Status				

	# Of Calls	% Calls	Seconds Air Time	% Air Time
Address	24	3.7	105.6	4.7
Disregard	20	3.1	44.0	1.9
Handling	14	2.2	49.0	2.1
GTA	2	0.3	54.0	2.4
GTA Report	2	0.3	16.0	0.7
Shots Fired				
Identify	9	1.4	45.0	2.0
Meet at Location	6	0.9	45.0	2.0
Assigned Stoled				
Misc. Dispatch	17	2.6	142.8	6.3
Misc. Info	34	5.3	149.6	6.6
Go ahead with second	1	0.1	2.5	0.1
Code	1	0.1	10.0	0.4
Traffic Accident	3	0.4	16.8	0.7
Backup	1	0.1	4.0	0.1

BASE STATION MESSAGE DURATION DATA

BASE	AVERAGE MESSAGE TIME (SECS)
Roger	1.4
Stand By	1.9
Repeat	1.8
Clear	1.5
No Want/Warrant	3.3
Code 1	2.4
Meet on TAC 2	3.8
Go-ahead	1.5
No want/Warrant-DMV	11.5
Code 7	5.0
Code 4	5.4
459 Now	13.0
459 Report	7.9
211	13.7
Cancel	7.5
Ambulance Traffic	7.3
Car Racing	7.2
Code 30	6.2
211 Silent	8.0
Code 6	3.2
ETA	4.1
ADW Progress	7.8
415	8.0
586	6.1
To Station	2.8
484	7.0
Ambulance Shouting	8.2
Did you receive call	2.0
Prowler	20.1
DMV	8.7
Verify	3.4
Yes Want/Warrant	7.1
Call Watch Commander	4.5
Frequency Clear	2.1
Suspect Data	64.0
Location	3.3
Status	2.5

BASE STATION MESSAGE DURATION DATA (CONT)

	(SECS.)
Address	4.4
Disregard	2.2
Handling	3.5
GTA	27.0
GTA Report	8.0
Shots Fired	10.5
Identify	5.0
Meet at Location	7.5
Assigned Stolen	19.0
Misc. Dispatch	8.4
Misc. Info	4.4
Go ahead with second	2.5
Traffic Accident	5.6
Backup	4.0
Code 3	10.0

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END