REPORT NO: LEADER III

DALLAS POLICE DEPARTMENT

FINAL REPORT
COMMAND & CONTROL STUDY

8 FEBRUARY 1973

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PREPARED BY

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1.0 INTRODUCTION

2.0 HARDWARE SURVEY

3.0 RECOMMENDATIONS

4.0 TOTAL SYSTEM

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1.0 INTRODUCTION

1.1 SUMMARY OF PHASE I AND PHASE II

The Phase I effort of this study produced a set of documents which described the main functions performed by the Dallas Police Department. The Phase I report is the definition of the system: How the Dallas Police Department operates, its organization, and the problems associated with the information flow are treated. The Phase I report was the fundamental basis on which analysis could be performed and on which later studies could be built. This phase of the study defined the information system that existed in the Dallas Police Department.

The Phase II effort expanded on the data gathered in the Phase I effort and incorporated several techniques to analyze this data. Modeling and simulation techniques were utilized to study response characteristics and perform trade-off analyses during the Phase II effort. A great amount of effort was exerted during the Phase II effort in the area of data collection. This was necessary in order to simulate the process being modeled to a required degree of accuracy.

1.2 SCOPE OF PHASE III

The Phase III effort of this study is designed to examine hardware and software requirements for development of an integrated information system. This effort includes study of the communication network, man/machine interfaces and the information system. The Phase III effort also includes a set of implementation procedures to phase-in the recommended information system.

1.3 SUMMARY OF PHASE III

In its daily operations, the Dallas Police Department gathers a large amount of data. This data appears in the form of information on Arrest Reports, Offense/Incident Reports, Accident Reports, Intelligence Reports, time cards, property records, etc. All the data used and maintained by the Dallas Police Department is the Dallas Police Department data base. A data base represents the collection and storage of all information used by an organization.

An organization generally stores information for two purposes:

(1) To maintain a record of past events or actions taken by the organization to provide accountability for these actions

(2) To provide a researchable history of past activities so that some correlation can be established between things which have happened in the past and things which are happening currently or might happen in the future

An example of item (1) above is the filing of Arrest Reports. The courts hold the police department accountable for all arrests made; therefore, the Dallas Police Department must maintain records of all arrests. Information concerning calls for service must be maintained. If a citizen calls the Dallas Police Department a month after reporting that his/her television set was stolen, the Dallas Police Department is then held accountable by a citizen for its past actions.

An example of item (2) above is monthly and yearly crime summaries. These crime summaries are the product of research on the Dallas Police Department operational history. These summaries permit the Dallas Police Department to make some evaluation of the

department's performance and make predictions of future department operations. As another example, an officer who arrests a person for suspected burglary needs to know something about the criminal history of that person. If the arrested person has a history of burglary and a method of operation similar to that demonstrated in the burglary for which he is suspected of committing, the officer can then devote his energies to establishing proof that the arrested person committed the burglary.

In this study two on-line integrated data bases and one off-line data base are discussed. The two on-line data bases are the Law Enforcement Integrated Data Base and the Business Administrative Integrated Data Base. The following paragraphs discuss the Law Enforcement Integrated Data Base.

Now that it is established what a data base is, why it exists, and what it is used for, it should be noted that it is important to maintain the data base for the following reasons:

(1) At the current rate of growth, the Dallas Police Department data base, if not improved, will require ever increasing cost in personnel to maintain the manual filing system and it will become less and less usable as the volume increases.

(2) As the volume increases, it will become more difficult for the data base to supply detailed information requested by an officer; it may become extremely difficult to manually search the data base for specific information.

(3) If a regional police data base organization is formed which will coordinate the efforts and activities of all the police departments within the Dallas area, it will be essential that these departments share a common

data base. Due to the size of this data base and the geographical separation of the various departments using the data base, it must be a more automated data base than the Dallas Police Department data base. (It must be able to systematically provide more information faster than the present one does.)

To provide this data base, several concepts are proposed. The data base will be discussed here at the conceptual level. For further discussion of the Law Enforcement Integrated Data Base see Section 4.1 of this report.

The objectives of a Law Enforcement Integrated Data Base are to maintain information concerning crime and to allow investigators to conduct comprehensive data research rapidly. The information maintained includes the crime reports, the criminal apprehension data (data for suspected criminals), records of all property associated with a crime and all persons associated with a crime.

The information concerning a crime can be classified as:

(1) Event information

(2) Name information

(3) Property information

Additional information such as clues, fingerprints, suspect descriptions, etc. is classified as special information.

An event gives rise to creation of a permanent record, and an event can only be described by type of event (UCR code also), location and time. Each event must involve people. Property, establishments, clues, etc. may also be involved, and such data is linked together by events. These types of information are interrelated, and thus, all data concerning a person, property or an event can be retrieved from the data base in a short period of time.

The integrated data base concepts discussed in this report should allow report generation for management decision-making as well as property inventory control in relation to law enforcement activity. The investigator should be able to ask the data base a vast amount of questions. For instance, from Section 4.5.2.2.3 it can be deduced that an investigator can ask at least 121 types of questions about people. It is felt that this comprehensive interrogation potential is very important. Associations of events, property (whether stolen, lost or in inventory), people and places form the backbone of the investigative process.

The present computerized dispatch system can be interfaced with the Law Enforcement Integrated Data Base. Section 4.5.4 covers some interface topics.

The Business Administrative Integrated Data Base should allow management to keep track of all personnel and property in all organizational units. Fiscal data can also be captured to facilitate budgetary control. This data base is covered in Section 4.5.3.

Implementation of the proposed data base system is discussed in Section 5.0.

Hardware and software are dealt with in Sections 2.0, 2.1, 2.2 and Sections 4.1 through 4.4.4.

Section 3.0 contains recommendations and is submitted as a separate part of the report.

2.0 HARDWARE SURVEY

Law enforçement agencies across the country, including the Dallas Police Department, have realized the importance of automated information systems and the benefits associated with them. In order to achieve the level of sophistication needed for successful crime fighting and management decisions, the hardware must be highly reliable.

With some 100-plus hardware manufacturers in existence today offering a conglomerate of computing machinery with vast amounts of power and capability, it becomes a difficult and critical task for police departments to sort out a suitable configuration. Evaluations should account for future growth requirements and possibly decentralized operations.

2.1 AVAILABLE HARDWARE CONSIDERED APPLICABLE

The Electronic Data Processing (EDP) industry has grown and changed greatly since the beginning of the commercial computer era in 1951. The U. S. Department of Commerce statistics indicate that in the last decade EDP has been the fastest growing industry in the country. Companies which have survived and prospered through this period are those that have established themselves solidly and kept up with the ever increasing technological demands.

To fulfill the information processing needs of the Dallas Police Department the proper hardware may be selected from those manufacturers offering a general purpose computer with full service support. In the hardware area, there are nine major manufacturers of general purpose computer systems. Each of the nine companies (which will be listed later) provides teleprocessing capabilities. In addition they offer software education and technical services along with the hardware. There is a much larger number of manufacturers of special purpose computers. The special purpose category includes analog computers as well as small desk-type computers which are used mainly for scientific purposes. Peripheral device manufacturers produce a wide variety of input/output equipment and storage units. In this category are devices such as punched card readers, magnetic tape devices, high speed printers, cathode ray tube terminals (CRT terminals), magnetic disc/drum drives, optical scanners, etc. Initially these devices were sold to the major general purpose computer manufacturers who would then resell the devices as part of their system. However, the peripheral manufacturers have extended their marketing activities and now sell directly to the user of the system. Hardware manufacturers appear to be aiming for compatibility within their lines with degrees of compatibility with their older

systems and with those of other manufacturers. Many devices contain hardware logic for converting to and from the different formats and timings of other manufacturers' devices. As the industry moves forward and accepts the premise that there will be a fourth generation of computers, the manufacturers have taken note and generally agree that the fourth generation will be user oriented and will not again tolerate "change for the sake of change."

The following is a discussion of the nine major computer vendors which manufacture general purpose equipment which could fulfill the computing needs of the Dallas Police Department now and in the future.

Burroughs Corporation - Burroughs is one of the few companies which has been able to successfully challenge IBM on many fronts. With a business machine line of over 200 different models, Burroughs is still growing with its new family of computers designated the "700 Systems." The B5700, B6700 and B7700 systems are in the medium to very large scale range and represent a significant enhancement of the already outstanding features of the successful "500 Systems" family. These new computers embody some of the most advanced hardware.

Control Data Corporation - CDC's business is international in scope and a major factor in the computer industry. It is ranked first in its special field of large computers for scientific uses. These computers are noted for their speed. The Control Data 6000 series evolved into the current 7600 which is claimed to be the most powerful computer in the world. A lot of users who lease this type equipment possess a need for a quick-response terminal network spread over a wide geographical area.

Digital Equipment Corporation - DEC sells and services electronic products and equipment including digital computers. DEC is acknowledged as the largest, most soundly financed and strongest

company in the small and medium scale computer field and ranks fourth in the industry in terms of total installations. DEC is best known for its PDP (Programmed Data Processor) line and its leadership in the real time computer market and time-sharing facilities. The PDP computers are being used by law enforcement agencies to control and maintain in-car terminal devices.

General Electric Company - GE is the largest producer of electrical equipment and the second largest industrial user of computers in the United States. GE development costs for its computer efforts have been extensive. In the 1970's GE made a decision to sell and merge its computer lines with Honeywell Inc., thus withdrawing completely except for the design and manufacture of highly specialized computer systems.

Honeywell Inc. - Honeywell is one of the nation's largest makers of general purpose computer systems and related equipment. It has about 5.4% of the dollar volume of the computer market. This puts it ahead of Control Data, GE, Burroughs and National Cash Register. Only IBM with 71% and Sperry Rand with 6.6% rank ahead. Honeywell's Information System group demonstrates a definite momentum in large scale systems development. With new products being offered which include the 6000 series of computers, and major improvements in price and performance, the Honeywell and General Electric families of systems are headed toward an integrated and compatible line of state-of-the-art computers.

International Business Machines Corporation - IBM is the largest manufacturer of business machines in the world. The IBM System 360 family has been superseded by the System 370 family which was introduced in July of 1971. The 370 Models 135, 145, 158, and 168, all with monolithic circuitry, generally replace the 360 models 30, 40, 50, and 65. The 370 processing unit is designed for the implementation of

the virtual storage concept. Many regional law enforcement agencies are looking to IBM for their processing needs.

National Cash Register Company - NCR is a strong contender in the production of computer systems and a large number of peripheral devices. The Century Series of computers is NCR's contribution to third-generation equipment, and one of the most attractive features of these machines is their price. Besides the Univac 9000 line, the Century computers are the only machines in production using plated wire memories. NCR would like to rid itself of the cash register company image and move faster into the computer market and service a large cross section of government, industry, and educational institutions.

Sperry Rand Corporation - Through its Univac Division, Sperry Rand is ranked second in the computer field with its highly profitable 1107 and 1108 computers. The best Univac has to offer is its 1110, a large-scale high-performance multiprocessor computer which achieves superior performance through parallel processing, large bi-level modular storage, and other advanced concepts. This new system employs both multiprocessing and multiprogramming. The processors operate simultaneously, with each CPU handling approximately 1.7 million instructions per second. These computers are highly reliable machines.

Xerox Data Systems, Inc. - The XDS computer line consists mainly of the Sigma Series. These computers are specifically designed for real time computations with operating capabilities that include time-sharing, multiprocessing and multiprogramming. The Sigma 6 is a very competitive product designed strictly for business applications. XDS specializes in custom-engineered data processing systems.

Out of the nine manufacturers discussed, one or more could provide a system capable of meeting the needs of the Dallas Police Department on a reliable and cost-effective basis. A short list of

manufacturers whose equipment is considered suitable has been developed and is presented in Section 4.2.

2.2 HARDWARE EVALUATION

The most basic way of gaining information about a manufacturer's product is to work with or get hands-on experience with the equipment being considered. Since this is, in most cases, impossible, the next best way is to obtain, read, and thoroughly analyze the available literature. This is a challenging and difficult job, as each of the manufacturers has numerous hardware, software and application products which in turn have many options and features. The evaluation of competitive operating systems based on reading the specifications can often be misleading and the degree of credibility to be given to specifications depends on the complexity and the uniqueness of the particular product. Rather than conduct a literature search, some users ask the vendors to respond to a series of questions directed at their products. The vendor then answers the questions directly and/or appends pertinent literature. The government utilizes this technique very effectively, sometimes as a screening process to reduce the number of vendors prior to a final in-depth evaluation. By developing a questionnaire, the user gets the desired information, hopefully in a uniform manner for ease of evaluation, and nothing is omitted since the vendor will usually answer all questions specifically asked. The questionnaire must not be so specific that it tends to get very limited "yes" or "no" answers, nor must it be so general that it encourages the vendor to submit sales literature that may be neither factual, informative not useful. The following are the capabilities that should be evaluated:

(1) Speed
(2) Capacity
(3) Reliability
(4) Expandability

(5) Software

(6) Maintenance

(7) Environmental Requirements

(8) Cost Data

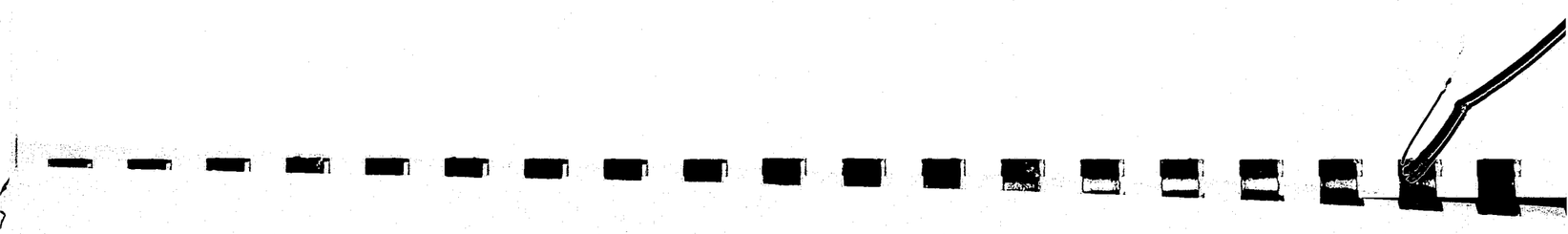
Another evaluation tool is the application benchmark technique. This involves the development of a group of applications that are indicative of the computer work load required. The benchmark specification for the applications can then be given to each computer manufacturer who expresses a desire to bid. The manufacturer works on the group of applications in order to meet the demonstration deadline established by the user. The evaluation team records the computer operating time and the total benchmark conversion process of the application and uses the comparative times and resultant costs as determinants in selecting a vendor. It is not desirable to base the entire evaluation on the benchmark. However, it can be a most valuable supplementary method and can help validate claims.

The computer is only one part of the total system. The user must try to put together the right blend of hardware, software and applications in order to gain maximum benefits. He must also be sure that the components of his system will blend.

Sections 4.2.1 through 4.2.10, Section 4.3 and Sections 4.4.1 through 4.4.4 contain a comprehensive list of features upon which an evaluation can be based.

3.0 RECOMMENDATIONS

Recommendations are presented in a separate portion of this report.



4.0 TOTAL SYSTEM DISCUSSION

In this portion of the report, hardware and software requirements are discussed and integrated data bases for law enforcement and business administration needs are treated. Section 4.1 contains an overview of the system proposed.

4.1 INFORMATION SYSTEM OVERVIEW

The proposed Dallas Police Department Information System is illustrated in Figures 4.1-1 through 4.1-8. As can be seen from Figure 4.1-1, the system consists of a centralized computer system, a mini-computer system and information. The information is contained in:

(1) A Law Enforcement Integrated Data Base which is controlled by a Data Base Management System (DBMS)

(2) A Business Administrative Integrated Data Base also controlled by a Data Base Management System

(3) An off-line file system which is closely linked to the Law Enforcement Integrated Data Base

(4) An Operations Control Data Base

(5) A Detention Services File System

(6) A regional file system which is accessed through a telecommunications network

Figure 4.1-2 illustrates the various interfaces which will be necessary for the system to operate. It should be noted that the Law Enforcement Integrated Data Base System serves as a link between the Dallas Police Department system and all external systems.

The Law Enforcement Integrated Data Base System organization is shown in Figure 4.1-3. The DBMS provides control of all operations which affect the data base, assures the security of the data and greatly facilitates additional applications using the data.

The Business Administrative Integrated Data Base, Figure 4.1-4, is designed to interface closely with the Law Enforcement Integrated Data Base. The interface is achieved through the respective DBMS for each data base.

The mini-computer message switching system will also

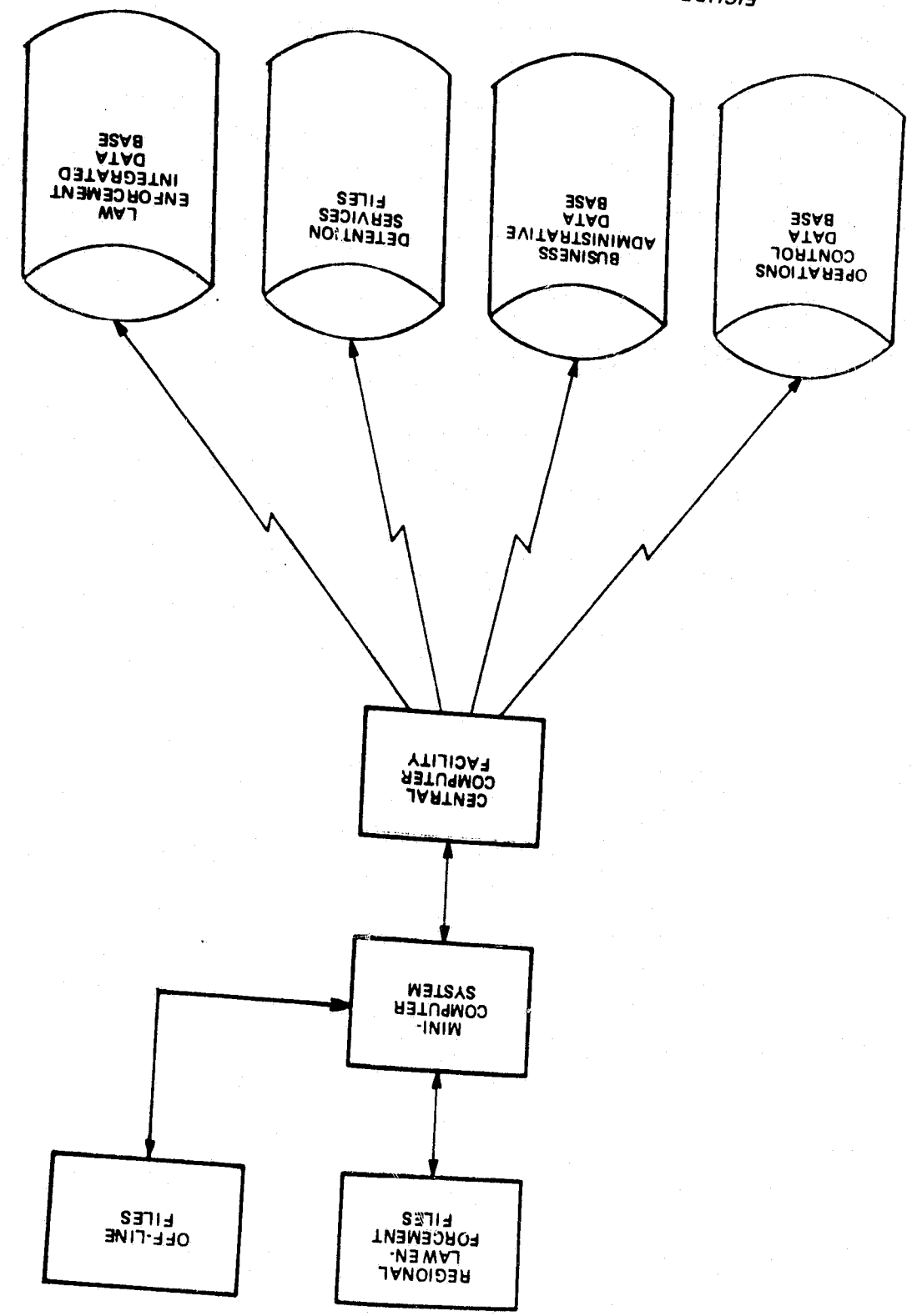
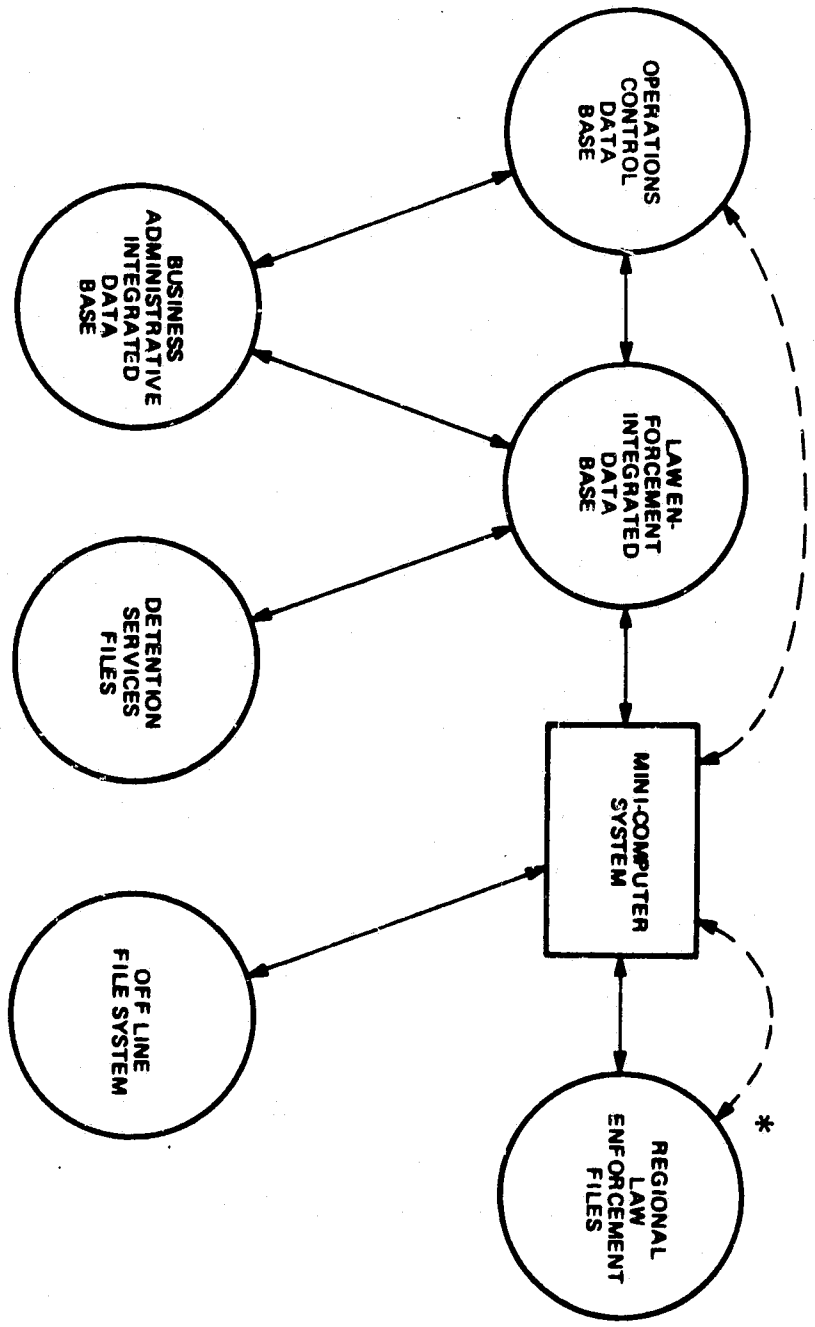


FIGURE 4.1-1. DALLAS POLICE DEPARTMENT DATA BASE SYSTEM



* POSSIBLE EXTENSION OF OPERATIONAL CONTROL TO SERVICE ENTIRE REGION.

FIGURE 4.1-2. INFORMATION SYSTEM INTERFACES

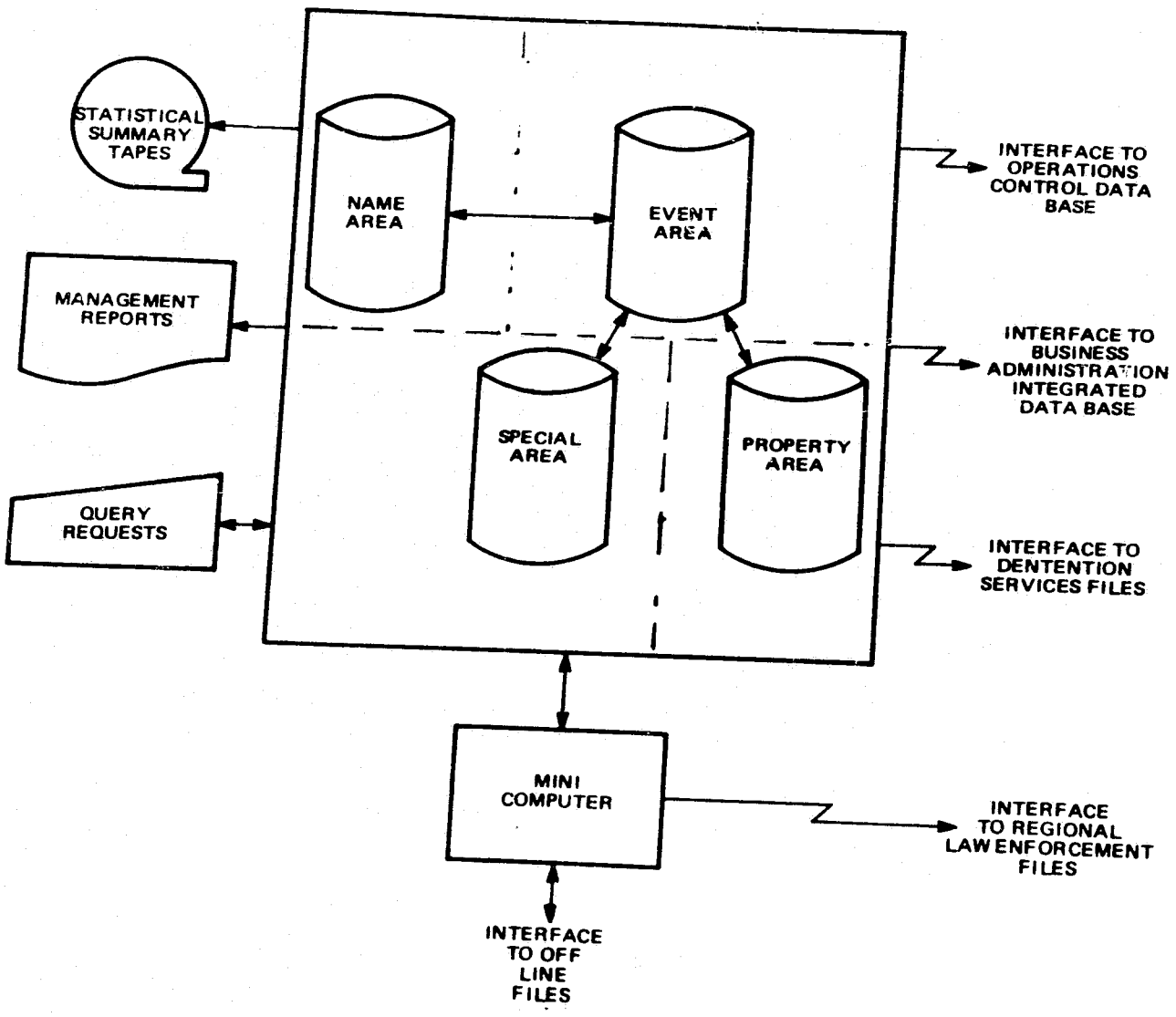


FIGURE 4.1–3. LAW ENFORCEMENT INTEGRATED DATA BASE SYSTEM

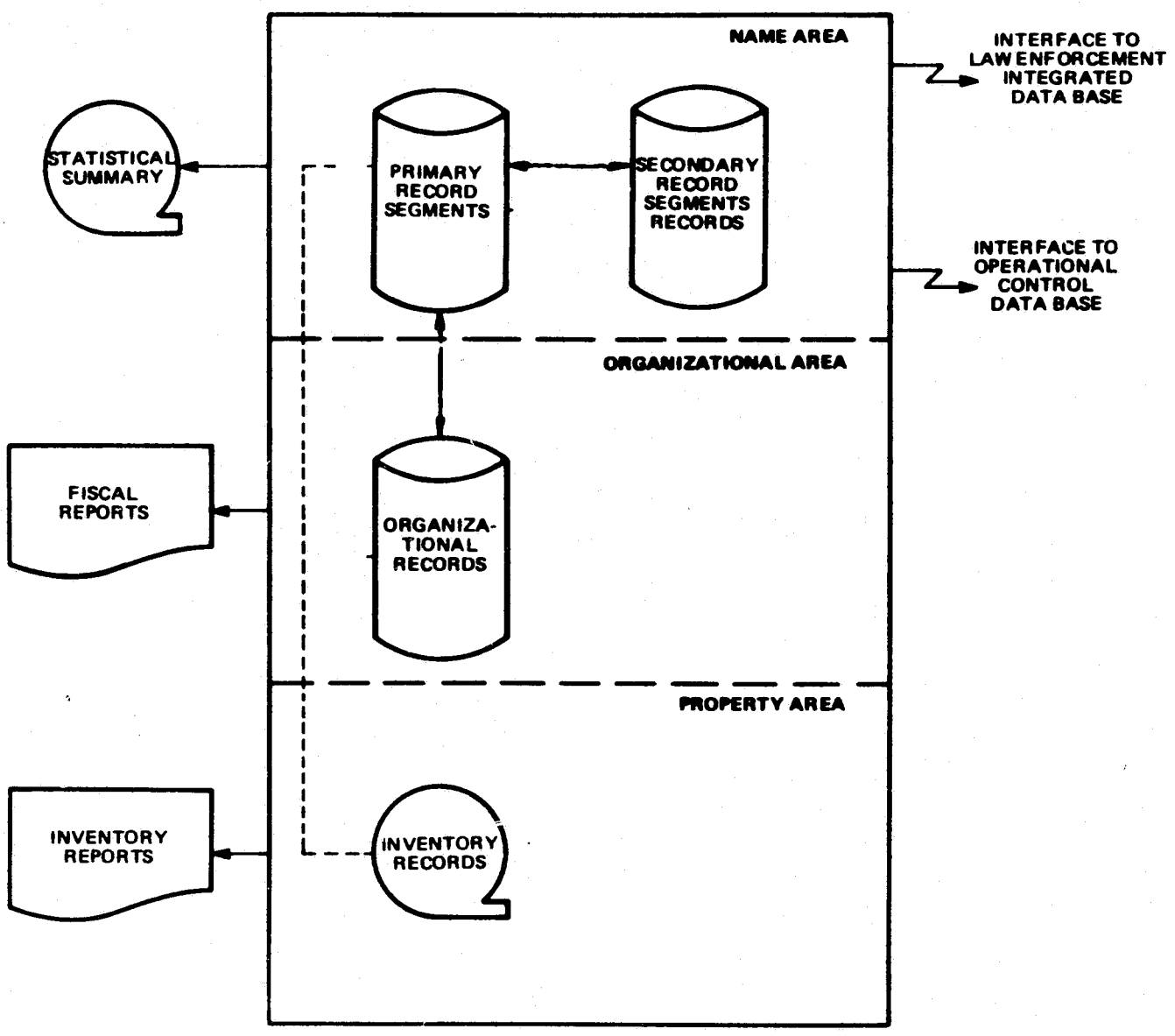


FIGURE 4.1–4. BUSINESS ADMINISTRATIVE INTEGRATED DATA BASE SYSTEM

serve as an on-line index to the off-line file system, Figure 4.1-5. By using the mini-computer, a good correlation between the information contained in the Law Enforcement Integrated Data Base and the off-line files can be maintained.

The Operations Control Data Base, as shown in Figure 4.1-6, represents a portion of the currently operating computer file system. This system will interface with the Law Enforcement Integrated Data Base, the Business Administrative Integrated Data Base and, through the mini-computer, the Regional File System.

Figure 4.1-7 represents that portion of the Regional File System which will be regularly queried by the Dallas Police Department Information System. As both systems expand, the amount of information transferred can be expected to grow rapidly.

The Detention Services File System, Figure 4.1-8, is scheduled to be on-line in the first half of 1973. An interface with this Automated Book-In System will be designed into the Law Enforcement Integrated Data Base System.

The hardware configuration for the Central Computer facility is discussed in Section 4.2. The mini-computer requirement is covered in Section 4.5.4.

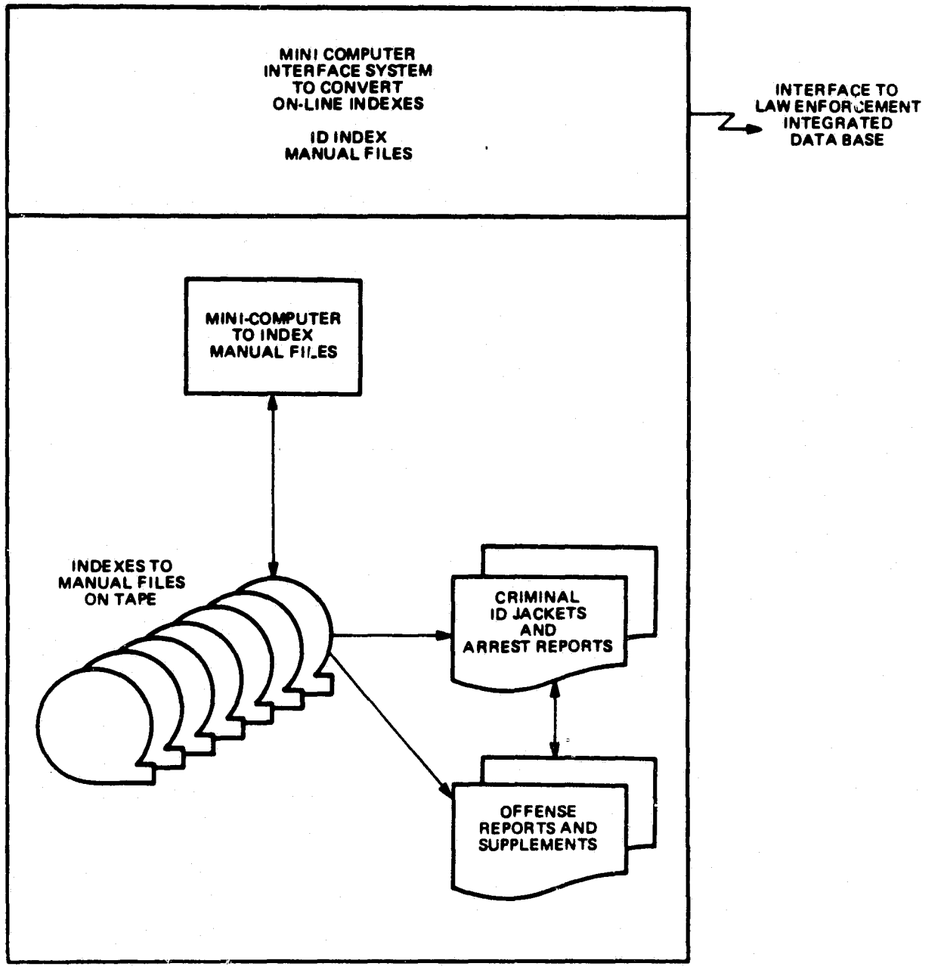


FIGURE 4.1–5. OFF-LINE FILE SYSTEM

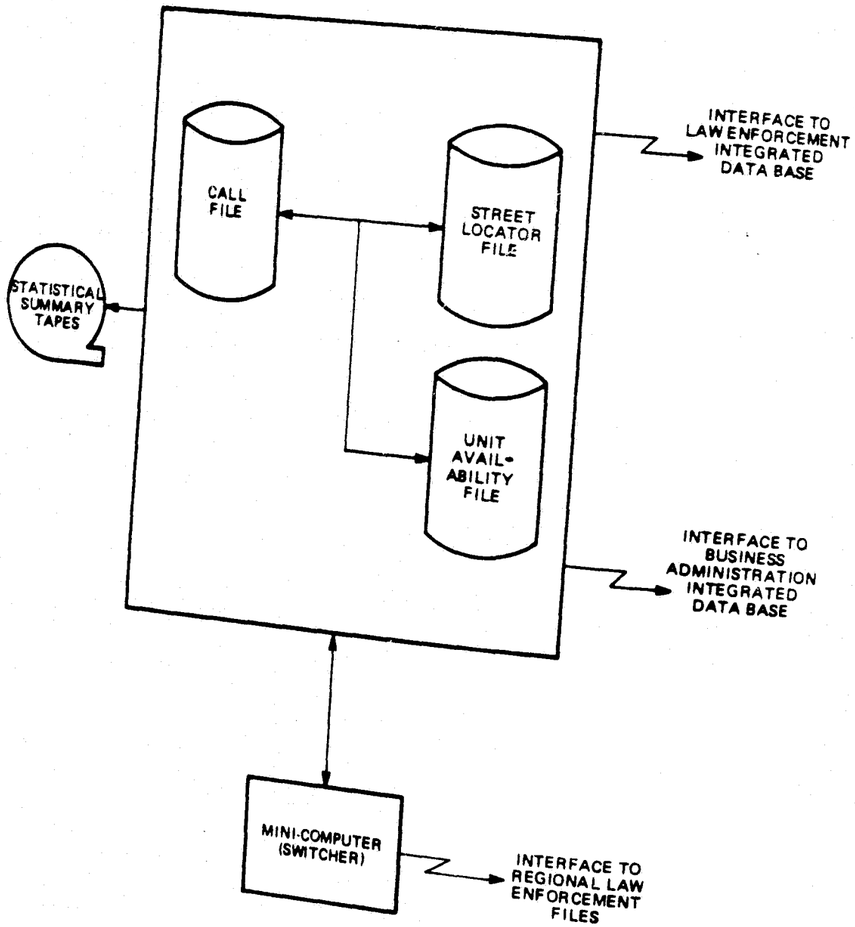


FIGURE 4.1--6. OPERATIONS CONTROL DATA BASE

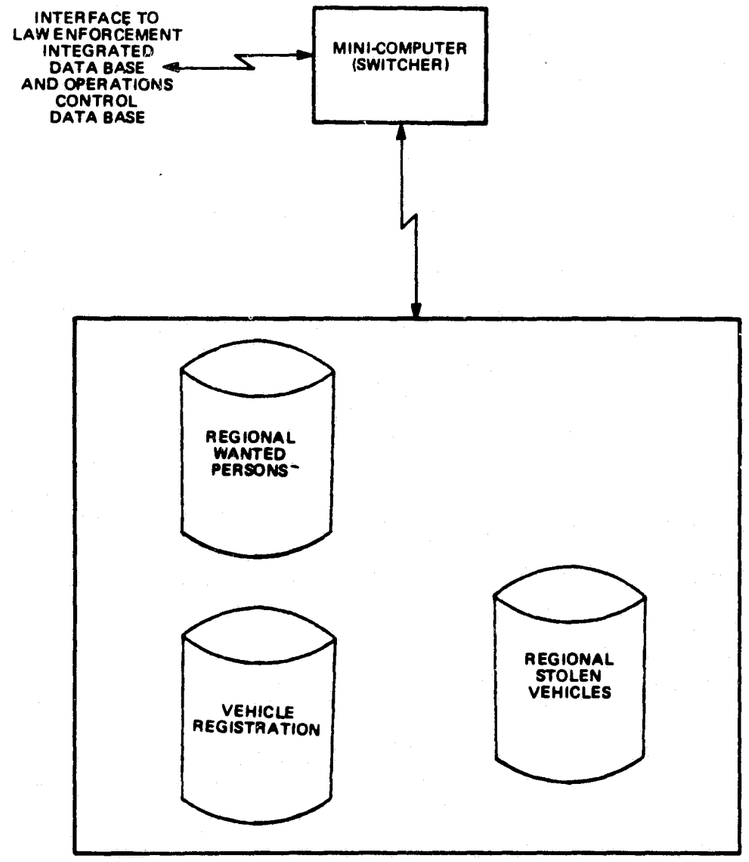


FIGURE 4.1–7. REGIONAL FILE SYSTEM

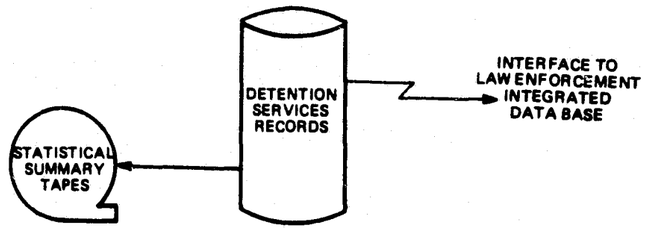


FIGURE 4.1–8. DETENTION SERVICES FILE SYSTEM

4.2 HARDWARE REQUIREMENTS

In this section some hardware requirements for support of a comprehensive law enforcement information system are considered. The hardware presently being utilized by the Dallas Police Department will be considered as the basis of the future requirements. At present the Dallas Police Department has access to the following list of IBM equipment:

- 2 System 360/50 CPU's
- 1 System 360/20 CPU
- 3 Line Printers
- 5 Disk Storage Units
- 2 Card Readers
- 1 Card Reader/ Punch
- 1 Multi-Function Card Machine
- 3 Data Adapter Units
- 1 Transmission Control Unit
- 1 Switching Unit
- 5 Terminal Control Units
- 10 Tape Drives
- 2 Tape Control Units

In addition to these available equipments, the Dallas Police Department has the following equipment attached to the system for on-line processing:

- 48 IBM Video Data Terminals
- 11 IBM Communication Terminals
- 13 Courier Video Data Terminals
- 5 Courier Communication Terminals

The future needs of the Dallas Police Department dictate that the same basic configuration, in terms of equipment, be maintained. The system must be flexible and possess the capability of expansion. Below is a list of manufacturers that are viewed as being capable of fulfilling the hardware requirements for a system that is commensurate with the present configuration:

- Burroughs Inc.
- Control Data Corporation
- Honeywell Inc.
- IBM
- Sperry Rand Corporation
- Xerox Data Systems

4.2.1 CENTRAL PROCESSING UNIT

In Section 4.2.10, high reliability is stressed. From a reliability standpoint, two or more central processor units could be more beneficial. In addition, multiple CPU's can relieve each other when a high teleprocessing loading occurs. (A communications controller is considered a CPU if it has duties other than handling line discipline.) Important considerations include first installation date, total number installed, and announcement date. In the interest of acceptable processing speed, execution times for the following operations, in microseconds, should reflect current capabilities:

- load word
- store word
- full word shift
- one bit shift
- binary fixed point add
- binary fixed point subtract
- binary fixed point multiply
- binary fixed point divide

(The magnitude of the largest representable binary fixed point number should be known.)

The following register characteristics should be looked for:

- number of fixed point binary accumulators
- number of base registers
- number of index registers
- base-registers programmable by non-privileged users
- registers performing more than one task

The internal character set of the communications controller ought to be at least a proper subset of the internal character set of the CPU. The internal and external (tape) representations of characters, card codes, and printer characters should be examined.

Important factors are level of indirect addressing and number of privileged instructions, versus maximum number of instructions possible.

In relation to interrupts the following points are important:

- number of levels of interrupt
- interrupts assignable to a particular level
- what occurs when interrupts are prevented
- number of interrupts which can be stacked during interrupt prevention if interrupts are saved
- number of instructions which must be executed to determine what event has caused an external interrupt

The following timer requirements should be met:

- internal timer (microseconds, at least)
- time of day clock (hundredths of minutes)
- watch dog timer

For business data processing purposes, the following attributes should be examined:

- decimal add execution time (microseconds)
- decimal subtract execution time (microseconds)
- decimal multiply execution time (microseconds)
- decimal divide execution time (microseconds)
- character storing compare execution time (microseconds)
- character storing move execution time (microseconds)
- single character compare execution time (microseconds)
- decimal to fixed point binary word conversion time (microseconds)

- fixed point binary word to decimal conversion time (microseconds)
- number of decimal accumulators, if any
- length of decimal accumulators, in decimal digits

For scientific data processing purposes, the following should be considered:

- FPB add execution time (microseconds)
- FPB subtract execution time (microseconds)
- FPB multiply execution time (microseconds)
- FPB divide execution time (microseconds)
- number of significant bits in single and double precision
- execution times (microseconds) for conversion operations such as single word fixed point binary to single precision floating point binary
- number of floating point accumulators
- length of accumulators

(FPB above denotes floating point binary.)

4.2.2 MEMORY

For the main memory the following should be considered:

- number of addressable memory units
- size of memory increments
- parity check on memory units
- average instructions per memory unit
- what the memory fetch yields
- full memory cycle time
- read access time
- memory buffering to CPU
- memory write protection
- memory read protection
- memory interleaving
- number of parts to memory
- type of memory

It is important to know if program execution can occur within extended memory.

4.2.3 CHANNELS

In view of the importance of computer availability to police personnel, substantial detection and recovery procedures for data loss are required. The maximum transfer rate (in characters per second) for each channel should be at least at the level currently available.

4.2.4 DIRECT ACCESS STORAGE

A predominantly disk direct access storage is envisaged, with mountable disk packs. Important disk criteria are:

- head type
- access motion time
- head selection time
- rotational delay time
- data transfer time
- transfer rate (characters/second)
- hardware error detection
- software error detection
- write check (read back and compare)
- programmed read after write error check
- hardware error correction
- software error correction
- fixed physical record size
- maximum record size (in characters)
- maximum capacity for controller
- maximum capacity of a pack
- smallest directly addressable portion of track
- length of smallest directly addressable portion in characters
- maximum number of individually addressable records per pack

4.2.5 MAGNETIC TAPE UNITS

It may be necessary to have a 7-track tape unit available if plotting is required (see Section 4.2.9). Important features are:

- number of tracks
- tape start time (milliseconds)
- tape stop time (milliseconds)
- tape read speed (inches per second)
- tape rewind speed (inches per second)
- density (characters per inch)
- transfer rate
- read backward capability
- automatic read after write error check
- shortest possible record (characters)
- longest possible record (characters)

Frequently more than one density can be handled by a tape unit. The means of controlling density selection should be examined. The densities and speeds available ought to be compatible with the densities and speeds used in the present system.

4.2.6 LINE PRINTERS

Line printer technology has developed rapidly in recent years. Presently line printers are available with print speeds up to 8,000 lines per minute. Important considerations for line printers are:

- number of printing characters
- lines per minute for 132 numeric characters per line
- lines per minute for 132 alphanumeric characters per line
- vertical lines per inch
- characters per inch in horizontal direction
- hardware error detection and correction
- software error detection and correction
- maximum and minimum width form feed
- alternative characters
- paper type
- printing method
- number of legible copies using various paper types
- mechanism (chain, etc.)

4.2.7 CARD/READERS AND CARD PUNCHES

Points to be accounted for are:

- peak speed (number of 80 character records per minute)
- hardware error detection and correction
- software error detection and correction

4.2.8 DATA COMMUNICATIONS EQUIPMENT

The communications controllers are considered CPU's if duties other than line discipline are handled. These controllers are of major importance in the data communications network, and the following ought to be examined:

- character set codes
- hardware or software conversion from one character set to another
- length of each line buffer (in characters)
- transmission mode (half-duplex, etc.)
- transmission technique (synchronous, etc.)
- aggregate data transfer rate (CPU to controller)
- maximum data transfer rate
- maximum number of lines ranked by line data transmission rate

The controller may be programmable and this leads to more flexibility. Likewise variable line transmission rates allow more flexibility. The points below are also important:

- line transmission rate clock interface
- are modems an integral part of the controller?

Teletypewriter and CRT terminals (display stations) are used to update and retrieve information. A remote batch terminal could be of use in the future because of planned decentralization for the Dallas Police Department.

It is important that the three types of devices mentioned meet foreseeable requirements with respect to:

- transmission rate (bits per second)
- transmission mode
- transmission technique
- buffer size
- character set
- automatic retransmission

Teletypewriter terminals are currently used mainly for hard copy purposes. Speed can be a drawback here when report generation is envisaged. Points to be looked for are:

- teletype versus typewriter (e.g. changeable font)
- characters per second
- keyboard layouts

CRT terminals (i.e. display stations) are currently used for operating on files. These devices should meet needs with regard to:

- screen size
- number of lines
- character size
- number of characters per line
- character generation and regeneration
- memory capacity
- keyboard layout
- part screen operations (character insert, etc.)
- auxiliary device performance

With reference to remote batch terminals, the speeds of devices (card reader, etc.) and the compatibility of these speeds with communication lines are to be emphasized. Speeds may depend on record length. Other important features are:

- compatibility between character sets and line widths (terminal printer versus other printers)
- record compression
- programmability

It would be necessary to know what occurs if card reading and card punching are to be carried out concurrently.

4.2.9 MISCELLANEOUS EQUIPMENT

Microfilm, optical scanning, plotting and paper tape equipment are considered here.

The Dallas Police Department already uses microfilm equipment for storage of "low utility" records, i.e., older records which are seldom used.

Optical alphameric reading equipment can be used to create tape records of, for instance, typewritten narratives on accident reports. If this approach is adopted the following features are important:

- type styles readable
- special characters readable
- variable number of characters per inch
- number of stackers
- speed (8 1/2" by 11" documents per hour, etc.)
- document area and thickness
- counter
- character rescan

Plotting equipment can be used for information display purposes (crime trend plots for management, etc.)

Paper tape can be used as an interface medium between the central computer system and a minicomputer functioning as a microfilm file manager. In connection with paper tape punches and readers the following features should be stressed:

- number of tracks punched
- punch speed in characters per second
- tape size
- reel and/or strip
- backspacing
- error correction methods

4.2.10 MAINTENANCE AND RELIABILITY

Reliability in the law enforcement environment can be extremely important. For instance if during a 30 day month, two hours system down time is experienced, then availability is approximately 99.7 percent. If the two hours down time is evenly distributed over the 30 day period, four minutes per day down time occurs. The following points ought to be considered:

- mean time between failures
- mean time to repair
- repair without system shutdown
- repair versus replace
- single bit error from memory detection and correction
- guaranteed repair time
- effect of device channel and CPU errors on system programs and user programs
- repair of machine refusing initial load
- local maintenance personnel versus off site personnel
- system power line isolation
- maintenance personnel power up after unexpected power off
- percent of CPU hard errors detectable by data independent diagnostics

When more than one CPU is used, the system should be able to continue running with one CPU.

The nature of police work demands that service calls be acted upon as quickly as possible. The utility of information stored in computer files can be inversely proportional to its longevity. These points underscore the need for high reliability of a computer system utilized for law enforcement information processing.

4.3 MAN/MACHINE INTERFACES

The man/machine interfaces considered here relate to:

- Output-only teletypewriters
- Two-way CRT terminals
- Remote job entry stations

Due to the nature of the Dallas Police Department information system needs there is, and will be, diverse man/machine interfacing. Some of the considerations in man/machine interface problems are:

- Dedicated or casual operators
- Form of communication equipment used (Section 4.2.8)
- Language and response structure (Section 4.4.1)
- Terminal speed
- Response time
- Availability for use
- Error control
- Privacy and security
- Space requirements
- Training
- Noise and vibration
- Safety
- Durability

The physical characteristics of the remote terminal have been discussed in Section 4.2.8 of this report and the proper selection of the terminal is largely dependent on the nature of the environment. The communication software relevant to remote terminal operation, discussed in Section 4.4.1, is related to the nature of the information being processed.

4.4 SOFTWARE REQUIREMENTS

The continued successful development of the Dallas Police Department information system is directly dependent upon the software structure described in this report. The requirements presented in this section must be considered in the design of the total software system in order to make it a useful and efficient tool. The other major development regarding logical methods of handling data is presented in Section 4.5.2.

4.4.1 OPERATING SYSTEM

The operating system must be identified by certain attributes. The identification should include the following information:

- Name and/or version
- Release date
- All updates to the system
- Stand-alone programs not run under the control of the operating system

When the operating system is received, certain steps must be taken to prepare and maintain it. The following points must be taken up:

- Time necessary to prepare system
- Procedure for systems generation
- System generation requirements when updating takes place, when the computer configuration is changed or when remote terminal configuration is changed
- Situations where complete system generation is required
- Partial system generation
- Recreation of the system and private librarians when system generation occurs
- Special techniques required for system generation or partial system generation

The system, once up, is assumed to be operational, and certain questions concerning its operator must be addressed. The following points not only concern the hardware but also the interface with the user/operator:

- Steps needed to keep the system operating after a change is made in the central or terminal configuration
- The steps necessary for a cold start
- Conditions under which a warm start is possible
- Devices used for the operating system residence
- Definition of the standard error recovery procedures for the system residence device
- The necessary steps to continue operation when the residence device becomes inoperative
- Operator inquiry as to the status of a job
- System interaction with operator when a specific unit is not usable
- System interaction with operator when certain memory is not usable
- Different messages the operator can receive from the system and different responses the operator can make
- Messages the operator can send to the system
- How the system informs the operator of required tapes prior to being needed by the system from job queue information
- Automatic assignment of peripherals such as I/O devices
- Job entry via the operator's console by the same statements as are used by the system's regular users
- System operation with the operator's console
- Number of consoles which can be used
- Diagnostic routine incorporated into the operating system to detect hardware and software malfunctions
- Use device of failure logs by the maintenance personnel

Assuming a multiprogramming environment is being considered, several aspects of system operation are important. These are

as follows:

- The number of programs allowed to operate in a multiprogramming environment (practical limit) and types (sort, update, card to tape, compilation, etc.)
- The fixed or semifixed organization of storage
- Reentrant programming
- Concurrent running of communications and batch processing programs

Regardless of the exact system configuration, an important part of the system is the control of jobs and scheduling. Some points to be considered concerning the job control and scheduling are:

- Full description of the job control language
- Description of the editing and error-checking facilities
- Services or restrictions for each specific device on which a job can be entered
- Creation of control statement libraries
- Total time restriction on a program or job
- CPU time
- I/O channel time
- Number of lines output
- Number of pages output
- Number of cards output
- The methods used to verify that all users are valid users
- Cross reference used for checking validity of project numbers and user numbers
- The priority scheduling criteria
- The scheduling algorithm
- Priority modification while in the job queue
- Program removal from the queue

- The criteria for suspending low priority jobs to allow high priority jobs immediate access to the computer
- Priority levels checking
- Comments to the operator included in the job deck
- Job streams in the major languages

When resources are allocated, the following information must be known about the system:

- The class structure of program
- Peripherals allocation to programs
- I/O routing through SPOOL storage
- Program assignment of a specific device
- When all peripherals are assigned to the program (as required or initially)
- The method for determining the amount of storage required by a program
- Storage requirements allocated during program initiation
- Dynamic storage allocation
- Method of storage allocation
- The unit on program size
- Instances when storage is allocated in contiguous blocks
- Operating system relocation and reorganization of programs in memory for space allocation
- The design of the storage protection system
- The design of the paging system
- Storage or passage of data by two programs running concurrently
- Method of establishing execution priorities
- Method of allocating CPU time to programs in storage

Statistics must be kept on job processing. The

operation log of the computer's activity, if it exists, should yield answers to the following questions:

- The identification items appearing on the log
- The related times appearing on the log
- Resource allocation items appearing on the log
- Entries appearing on the log file
- The location of the log file
- Procedures when the log file becomes filled
- Aids offered to relate the contents of the log file to improved system operation
- User access to the log file

The next important section to consider is the input-output routines of the computer system. It is important to know what controls each of the following operations - the user, the system, or the routines compiled into each user routine:

- Channel assignment and scheduling
- File open-close operation
- Peripheral record transfers
- Error detection and recovery
- Logical record block and deblocking for fixed, variable and unknown length records
- Checkpoint and restart
- Labeling of card and printer files
- Processing of nonstandard data files and labels
- The availability of checkpoint and restart facilities
- The prerequisites for restart

The file system (user and system libraries) are very important to the system. The following list of points is presented to illustrate what is necessary to determine the appropriate file organization:

- The file organization supported on direct access storage devices (sequential, indexed sequential, random, thread list or ring structure, inverted list, etc.)
- The method of updating a sequential file
- Dynamic storage on direct access storage
- Supply of additional storage beyond the original requested
- Facilities available through the file system (access by name of on-line files, access by name of interchangeable media, etc.)
- Statistics on file usage
- The naming convention for files
- Change of file retention without recreating the file
- Availability of the system's file directory for analysis
- Access of the system's file
- The program libraries that are provided
- Presence of programs in the libraries
- Method of updating a source library during compilation
- Library rebuilding after updating
- Contiguous elements in the library
- Method of space supervision upon deletion of library elements
- Extension of libraries across physical boundaries
- Devices on which libraries reside
- Library back-up
- Utilization of batch user libraries by time sharing users

The linking and loading facilities bring together certain structures in the system organization. Items concerning the link/load operations are as follows:

- Definitions of specifications such as:

- Segment, linking, loading, overlay, chain, static, dynamic
- Number of external symbols allowed
- Linker search of multiple libraries
- Program running with unresolved references
- Explicit calling of overlay
- Chaining provision
- Overlay structures specification at execution time

The utility packages that accompany a system are very important. The following points pertain to utilities:

- The input and output utility programs available
- The speed at which that device used for I/O is driven by the utility routine
- Dump routines available
- Other utility routines available

If remote terminals are to be examined, the following items should be considered:

- The type of remote terminals and their associated characteristics which are supported by the data communications routines
- The line configurations supported
- The error detections and recovery procedures for the remote terminal types
- The line concentrators or record compression facilities available
- The functions (dialing and answering, sign-on procedures, etc.) performed by the data communication routines
- Remote terminals which can be used for job processing

- The language used for terminal command and conversation
- Languages used by the remote terminal user
- Number of simultaneous users which can be handled
- The system for communication between the job entered and the terminal on which it was entered
- Operations which can be performed from a remote terminal without intervention from the central computer operator
- Method of processing messages to the system
- The facilities to which the terminal user has access
- The characteristics of the editor

The amount of memory allocated and time requirements of the system are very important. Items concerning these operations are listed below:

- The space requirements for the operating system categories
  - Fixed portion requirements
  - Variable portion requirements
  - Transitory portion requirements
  - I/O supervision fixed portion requirements
- The memory requirements for I/O control routines for device types such as tapes and disk
- The memory requirements for the other devices attached to the system
- The memory requirements for utility routines such as data conversion
- The total operating system space requirements
- The direct access storage space requirements for the operating system, utilities, job queue, etc.

- The total direct access storage requirement needed for the system
- The time required to analyze such things as job queue, priorities and investigation of new programs into care, opening of files, etc.
- The time required for:
  - Close of the system files
  - Memory allocation
  - Paging
  - Internal overhead for read, write, get and put (direct access and other devices)
- Any other times necessary in operating the system

Maintenance and reliability of the operating system software should be fully described and a relationship of hardware/software malfunctions be established. Also, the responsibility for diagnosing and correcting any given hardware or software problem or error must be established.

4.4.2 BUSINESS SOFTWARE

In business processing, one of the most important processes is that of the sort/merge package. The following items are stressed concerning such packages:

- Possible package modifications
- Control cards required to obtain a specific sort/merge option
- The maximum number of sort/merge keys
- The maximum length of each key
- Ascending and descending sequencing capability
- The character sets and collating sequences that can be used
- Sorting of records in all standard formats
- Services which can be used for intermediate merge phase storage
- Techniques which are used for merging
- What is stored on direct access storage during intermediate merge
- Formula used to calculate the minimum and optimum resource allocation
- Method for computing total sort time
- The limiting factor on the total record capacity of the sort
- Use of checkpoint/restart by the sort/merge

4.4.3 SCIENTIFIC SOFTWARE

In relation to scientific processing, special features must be examined. The following items need examination when evaluating the scientific software:

- The elements of FORTRAN which the computer accepts
- Direct access storage usage
- System and user routines names
- The sizes of the standard words
- Files readable by other programs
- The extensions to ANSI FORTRAN

4.4.4 PROGRAMMING LANGUAGES

The use of the computer constitutes the use of programming language. Features associated with the language and compilers are listed below:

- Utility packages available
- Languages available
- How the input is accepted
- What is available during compilation
- Codes accepted
- Output devices
- Diagnostics generated
- What is generated as output for total system run of a job
- Types of runs possible
- Limitation on program size
- Speed of compilation algorithm
- Trace and dump packages
- Time shared language capabilities
- The version of COBOL on which the compiler is based

4.5 INFORMATION SYSTEM REQUIREMENTS

The fundamental hardware and software support for a comprehensive data base for the Dallas Police Department has been discussed in Sections 4.2 through 4.4. In this section the data base concept will be dealt with, and an overview of a proposed data base system for the Dallas Police Department will be presented.

Corporate data processing has evolved from totally manual systems. With the advent of the computer, manual systems were automated, and eventually separate computers were used for separate applications. The next major stage in data processing development involved the concept of a centralized computer system with separate files maintained and a multiprogramming capability. Currently considerable efforts are being made to integrate file systems and produce integrated data bases. It seems that the next logical step with data processing is the regional system concept. These new data processing methods are highly applicable to police department needs.

Many data files have been designed to satisfy individual needs. For example, a filing cabinet containing a set of pawn tickets can be replaced by a computer file containing the same information. The integrated data base allows for the integrating of such sets of information in order that it can be readily shared by more users.

Advantages of an integrated data base system include the following:

(1) Elimination of redundant data
(2) Efficient file management
(3) Common programming techniques
(4) Data sharing by multiple applications
(5) Simplified programming

(6) Faster implementation of new information needs

(7) Economy of scale

In the traditional file-oriented systems, data redundancy can occur on a large scale. This can lead to redundant file maintenance. Also, individual files are frequently designed to optimize services for a particular user set without regard for other possible user sets. In some circumstances, this approach may be adequate.

When files are properly integrated efficient file management can be achieved. Maintenance can become easier and resource utilization can be improved. Also, searches of a more varied nature can be accommodated. Updating is of major importance in any file management system, and in the traditional file-oriented system updating operations may have to be carried out on many files "simultaneously" due to data redundancy. If different parties are responsible for updating, then it is possible for files to become out-of-phase. In traditional systems, queries can lead to similar searches being conducted in a set of n files. With simple queries it may be possible to maintain good response time characteristics. However, more complicated queries can be difficult or impossible to handle and can lead to excessively long response times.

The points made in the previous paragraphs can be used as an argument for common programming techniques. In the ideal integrated data base, the programmer is confronted with minimal storage problems (this should be taken care of by the data base management software). In traditional file systems there can be vast record format variations between highly redundant files which leads to considerable programming effort waste. With the integrated data base concept, programmers operate with almost non-redundant data.

The integrated data base allows for data sharing on a centralized basis in that data is in a common pool and is thus readily

accessible to authorized user sets.

The applications programmer, when interfacing with a data base, should be able to use a variety of languages and should be able to concentrate on his information selection problem rather than have to contend with storage considerations, etc.

A flexible data base system can make for faster implementation of new information needs, while economy of scale will produce additional benefits. The payoff can come about in the form of increased service for current user demands, accommodation of new services, and better resource management.

The Dallas Police Department information needs can be logically related to two types of activity:

(1) Law Enforcement

(2) Business Administration

The law enforcement activity involves many record creations, updates, and queries. From an information standpoint, it is complex and voluminous.

The business administration information needs center on personnel resume, costing and property inventory data. The activity associated with and volume of this data should be considerably less than in law enforcement activity. Figure 4.5-1 contains an overview of the major part of this on-line data base system. The remainder of this section is devoted to a discussion of Data Base Management Systems.

The following discussion will make use of both the CODASYL Systems Committee's discussion of data as defined by a user and data as it is stored by a system. The user's version of data will be designated as "data structure." The equipment's version of data will be called "storage structure." Possible data structures will be discussed first and data base software related to storage structure will be covered.

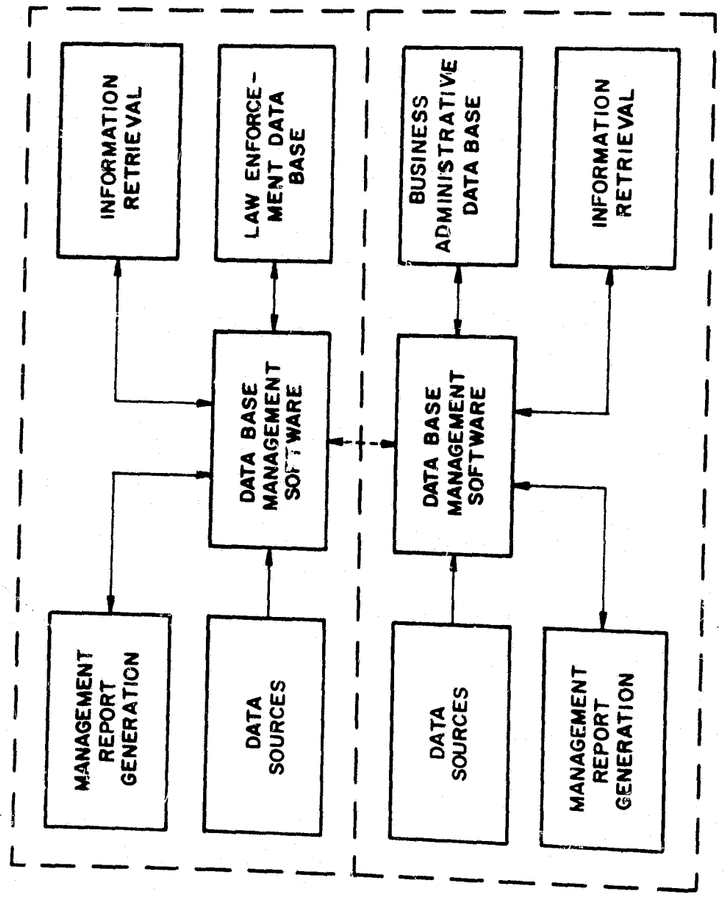


FIGURE 4.5–1. OVERVIEW OF TOTAL DATA BASE SYSTEM

The following definition of a Data Base will be employed:

> A Data Base is a collection of information which serves as:
>
> (1) A central component of an organization's service
>
> (2) A facilitator of the delivery of services
>
> (3) An aid to the management of the corporation
>
> (4) A basis for research and development

This is a very general definition. Two immediate facts should be evident: first, that a Dallas Police Department data base exists, and second, that the Dallas Police Department data base is being used at this time. The data base of today exists to a large extent in the file cabinets and index files maintained by the various divisions of the Dallas Police Department. Conversion of some parts of the data base to automated operation is taking place. However, each application is created as a stand-alone system with its own data files (data sets). The systems thus created are tailored to specific data format and hardware. This has lead to a continual change in application programs as attempts to respond to the rapid changes in the Dallas Police Department's transaction oriented environment are made. This piecemeal approach has two major defects: much of the information collected can be redundant, and no integration of the information is attempted. One of the prime requirements for an integrated Data Base Management System will be that it can handle the integration of an essentially unlimited number of data sets on a highly non-redundant basis.

Data Base Management System

A Data Base Management System (denoted DBMS) will first be defined.

A Data Base Management System is a software construction which, when properly implemented on suitable hardware, provides uniform control, management, access, protection, and use of

information pertinent to the functioning of an organization.

In Section 8.0 a logical information space is defined; a definition for a physical data space will be given here. A Physical Data Space will be considered as a set of positions in physical or natural order where a position is a set of storage device locations for holding a record. A good way of describing a physical data space is in the dumping order of the hardware device. The description of the method of moving between the logical space and physical space will be referred to as the "schema." The schema can therefore be said to be the mapping of the logical space as seen by the user onto the physical space as seen by the computer system. If a program space is defined as a collection of data as seen by a program language, then a subschema is a mapping of the schema into the program space.

DBMS Capabilities

The capabilities of a DBMS vary widely depending on system requirements and the techniques used to implement the system. There are four capabilities which are normally provided by current systems. They are:

(1) Creation

This is the ability to build the initial portion of the data base and add to it.

(2) Interrogation

This involves locating the data within the data base and making it available to a user in the format he desires.

(3) Update

This includes selection of the data to be updated, changing the value of the data and maintaining a record of the transaction.

(4) Restructuring

This includes the processes necessary to change the description of the data base and adjust the data to fit the new description.

A DBMS is basically a four-part system. The first part is the system data. It is important to remember that data is that which fulfills the requirements of all applications which access the system and that this data should be structured so as to model the natural interactions of the organization. The second part of the DBMS consists of the query programs which retrieve data elements for a user. These query programs have three primary responsibilities: they must maintain the key/value pairs which are contained in the information space; they must define the relation between the N_i (key/value) pairs and the information space; they must process the results of an inquiry into user format. The third part is the system organization schema. Current hardware enables us to use five basic organizations or combinations of these five types.

(1) General list

A chained sequential structure associated by some attribute

(2) Multi-list

A partitioned structure based on various conditions

(a) If the partition is based on internal conditions the structure will be called a multiple entry multi-list.

(b) If the partition is based on external conditions such as a specified maximum length we will call the structure a controlled length multi-list.

(c) If the partition is optimized for a hardware device we will call the structure a cellular multi-list.

(3) Partial Inversion

A chained structure based on explicit properties of the data

(4) Full Inversion

All records with a common attribute value for a specific attribute are tabulated

(5) Ring

A chained structure wherein each member points to a prior record in the list and to a subsequent record in the list

The fourth part of the system are those functions carried out to effectively manage the data contained in the system.

The CODASYL Data Base Task Group (DBTG) has developed a list of features which a Data Base Management System should provide. A list of these features will be presented. Then, as an introduction to the current "state of the art" in information systems, a discussion of existing software systems packages will indicate how they provide for these features.

The CODASYL DBTG proposed features for a DBMS are:

(1) Allow data to be structured in the manner most suitable to each application, regardless of the fact that some or all of that data may be used by other applications, such flexibility to be achieved without requiring data redundancy.

(2) Allow more than one run-unit (program) to concurrently retrieve or update the data base.

(3) Provide and permit the use of a variety of search strategies against an entire data base or portion of a data base.

(4) Provide protection of the data base against unauthorized access of data and from untoward interaction of programs.

(5) Provide for centralized capability to control the physical placement of data.

(6) Provide device independence of programs.

(7) Allow the declaration of a variety of data structures ranging from those in which no connection exists between data-items to network structures.

(8) Allow the user to interact with the data while being relieved of the mechanics of maintaining the structural associations which have been declared.

(9) Allow programs to be as independent of the data as current techniques will permit.

(10) Provide for separate descriptions of the data in the data base and of the data known to a particular program.

(11) Provide for a description of the data base which is not restricted to any particular processing language.

(12) Provide an architecture which permits the description of the data base, and the data base itself, to be interfaced by multiple processing languages.

The last two features provide for a very general system. This degree of generality is probably not needed by the Dallas Police Department. The CODASYL proposed features are given as they represent an attempt to set national standards for a Data Base Management System.

Packaged DBMS Systems

A preface to a discussion of package systems is necessary to assure that these systems are viewed in their proper light. Three very important points should be understood from the beginning.

(1) Packaged Data Base Management Systems are not a panacea for all data base problems.

(2) Although the use of the proper package, instead of a custom-built system, will in general, result in a materially shorter implementation time and a great reduction in the risk of complete system failure, they exact a price in response time for these advantages.

(3) A package DBMS system is only a tool which can be used to create a Data Base Management System. As with any tool it can be misused and/or poorly used.

Package systems generally allot the tasks of creating and restructuring the data base to a Data Description Language (DDL) and those tasks associated with interrogation and update of the data base to a Data Manipulation Language (DML). This segmented approach allows the data base as described by the DDL to be independent of the program languages which are used to process the data. The DML allows the data processing programs to be independent of changes in the data storage structure or changes the hardware configuration. The general philosophy of the package systems to be presented is they function so as to augment the data handling facilities of a host language such as COBOL, PL/1 and FORTRAN.

Three packaged systems have been studied closely. Information on these systems and on other potentially useful packages will be presented. The three primary systems studied were:

(1) IMS II - IBM; Information Management System version II

(2) TOTAL - Cincom Systems Incorporated; The total package has more users than any other DBMS.

(3) IDS - Honeywell (General Electric); Integrated Data Store; The IDS package was first offered in 1963, and

this makes it one of the oldest systems in existence.

Some vendor information was received from other software firms. One system which warrants more study is "CAIMS," a product of Public Management Services Inc. The system design and implementation was begun in 1968. The Savannah Area Law Enforcement System (SALES) which operates on a Honeywell Series 200 computer is closely related to this system. See Section 3.0 regarding copies of the brochures received from software system companies.

Honeywell Information Systems-Integrated Data Store (IDS)

Development of IDS was started by General Electric in the early 1960's; subsequently the G.E. Computer Products Division was purchased by Honeywell Information Systems. Honeywell has continued the sale, support, and development of the IDS system. In IDS the data appears to the user as a collection of linked groups with varying structural complexity. Data is defined in an essentially free form narrative format based upon COBOL. Storage structure which may be classed as a cellular multi-list is implemented through the use of forward and backward pointers to a parent record. The basic system will operate in both a batch and on-line environment on Honeywell H-6000 computer systems.

IDS augments the COBOL Data Division; data definition is done within this framework. Additional narrative statements define group relationships. The entire user program, containing the augmented statements, is compiled as a unit. Users of IDS must recompile all programs when the DDL changes or when record format changes.

An IDS file can be stored across multiple direct access devices. This physical data space is divided into different pages of equal size. Each page will contain page identification and control information and a mixture of other record groups which can contain a total of 2,000 characters. IDS files are implemented in "chains" which begin in a

"master" record and continue through any number of detail groups; the last record in the detail group will point back to the master record. The user may define any record as a master in one or more detail chains when the data base structure is generated. IDS recognizes three classes of groups: calculated groups, primary groups, and secondary groups. Calculated groups are retrieved based on the value of a data item stored within the group. Primary groups are retrieved by a pointer furnished by the user. Secondary groups are retrieved by stepping along a chain to locate the desired record. The IDS physical structure is explicitly defined by the user specification of group level and chain. The rules for the specification of the "chain" schema are in accordance with the composition rules as specified by the CODASYL Data Base Task Group. An additional schema referred to as "CALC chain" allows random access to the head of a group chain.

IDS assigns a unique internal identifier to each record group. This "reference code" is a permanent resident within the system until that group is deleted. The reference code is always available to a user program, and this allows checks to establish the current contents of buffer storage. The system also maintains a "chain table" of parent, prior, current, and next addresses for the group relation chain presently in use. Proper use of these "chain tables" can reduce retrieval time and speed message processing significantly.

The operating system environment with which IDS must be used is called "GECOS." Assuming this operating system and IDS implemented on a H-6000 series computer, we could expect the system to use approximately 320K bytes of core, not including system buffer area. Table 4.5-1 is a summarization of the IDS system.

Cincom Systems, Incorporated. "TOTAL" Data Base Management System

SYSTEM----------	IDS
COMPANY----------	Honeywell Information Systems
COMPUTERS----------	H (GE) 200, 400, 600 H - 6000
CORE----------	2K Monitor 10K Words/Partition 20K Words for TP or 15 K Words for TS/Data Query
USER LANGUAGES----------	COBOL, FORTRAN, GMAP
DATA STRUCTURE----------	Hierarchy, Networks, Inverted Lists, Ring Structured Chains
FILE ORGANIZATION----------	Random Direct Ring, Pointers, Cellular - Multi - List
INSTALLATIONS 9/72----------	100 USA 200 Worldwide
COST----------	Lease - Bundled Purchase

TABLE 4.5-1. SUMMARIZATION OF IDS SYSTEM.

Cincom Systems was founded in 1968. Its DBMS "TOTAL" is one of the most successful in existence having over two hundred and fifty users. The system has grown from a batch process system into an on-line teleprocessor system, TOTAL 5/6 ENVIRON/1. The design philosophy of the TOTAL system agrees well with the requirements of the CODASYL Data Base Task Group. To a TOTAL user data structure appears as a network, therefore physical access paths may diverge significantly from logical paths. Data is defined in a Data Description Language which is imbedded in a user program written in COBOL, FORTRAN, Assembly Language, or PL/1. Storage structure may be characterized as a Partial-Inversion on user defined attributes. The storage structure is searched by random access on key value through a tabular index to a master record with multi-thread pointers leading to variable entry detail records. Cincom Systems quotes an average of 1.1 head movements per record retrieval.

The TOTAL data base is composed of multiple data sets. Groups of both master records and variable entry records can be established as a data set. Linkages between master records can be created to a limited extent. Linkages between master records and the variable entry records are free from restriction but must be defined when the data base is built. This is the biggest limitation of the TOTAL package: once defined, the structure is fixed. Records can be added to and deleted from any existing data set; however, new data sets cannot be added nor can new linkage paths be established without at least a partial regeneration of the data base. The same restriction applies to expansion of disk storage area.

The Partial Inverted Structure used by the TOTAL system allows the user the ability to process inquiries in direct ratio to complexity of the question. This ability is achieved by maintaining the chains

in ordered sequence and adding remaining chain length to the record. The added information in the record plus the ability to choose the shorter of any two lists to process combine to achieve the dramatic reduction in response time.

The ENVIRON/1 communications monitor/task manager is marketed as a separate program product by Cincom Systems. Both the ENVIRON/1 package and the TOTAL 5/6 package are required for support of an on-line data base management system. The ENVIRON/1 package uses a paged or "virtual memory" concept both for itself and for assembly language and COBOL programs. Only about 33K bytes of core are used for the ENVIRON code. Studies by Cincom Systems indicated that a memory page size of 512 bytes would be adequate for most applications. User programs are allowed up to 10K bytes per program module. A significant aspect of the ENVIRON/1 system is that it uses special file access methods which are not compatible with IBM's ISAM and SAM files. Conversion from ISAM or SAM files to ENVIRON/1 files can be a serious problem. This problem does not arise if the TOTAL/ENVIRON packages are being used as a stand-alone system without need of compatibility with IBM. The system has many good features:

- Access methods are several times faster than IBM's ISAM.
- Automatic audit trail and checkpoint/restart.
- The system will operate under both OS and DOS on any 360/25 to 370/195.
- System usage statistics on resource utilization are compiled and maintained.

User statistics indicate that the average time required for TOTAL to find and transmit a block of data is 42 milliseconds.

A TOTAL/ENVIRON package implemented on a 360 can be

expected to require the following system resources:

OS/MVT	150K	400K bytes
HASP	60K	
TOTAL	15K	165K
TP Monitor (ENVIRON or Intercomm)	150K	

The cost of a TOTAL/ENVIRON package will be approximately $70,000.00. See Table 4.5-2 for summarization.

International Business Machines - Information Management System/II

The IBM DBMS approach differs from that outlined by the CODASYL Data Base Task Group. To an application user of IMS all data appears as an unlinked tree structure. The trees which are available to application programs are defined when the data base is created. The data administrator sees the data as a linked structure. The system was designed to augment OS/360 and to provide an easy-to-use data interface for application programmers. Because of its close association with OS/360 some of the capabilities normally associated with a DBMS are lacking in IMS. The IMS system has been in a continual state of change since its original release in 1969; the capabilities of the system are improving rapidly. IMS 2.2 allows the user to specify any of four storage structure classes for each data set contained within the data base. The storage structures are sequential, indexed sequential, direct, and indexed direct. Data sets are linked via chain pointers.

The basic block of the IMS data base is a segment. IBM defines segment as: "A data element of fixed length, containing one or more logically related data fields. A Segment is the basic data element that interfaces between the application program and Data Language/I and upon which the user defines his sensitivity." Group relations are

SYSTEM----------	TOTAL/ENVIRON
COMPANY----------	Cincom Systems Inc. 2181 Victory Parkway Cincinnati, Ohio 45206
COMPUTERS----------	IBM/360/370, H - 200/2000, Univac Series 70
CORE----------	165 K bytes
USER LANGUAGES----------	COBOL, FORTRAN, PL/1, BAL
DATA STRUCTURE----------	Networks
FILE ORGANIZATION----------	Direct Access Chains, Sequential
INSTALLATIONS 9/72----------	250 *
COST----------	Lease - $2,050.00 Purchase - $70,000.00

* Most installations of any.

TABLE 4.5-2. SUMMARIZATION OF TOTAL/ENVIRON SYSTEM.

referred to as a hierarchical tree of segments. This tree is based in a root segment which also names the tree. The system provides for fifteen levels in the hierarchy with a maximum of 255 segment types in any tree. Notice this does not limit the total number of segments to 255, only the number of segment types.

The data administrator (IMS system programmer) sees the individual trees as part of one logical data structure, a linked network. Segments which are a part of more than one tree actually reside in physical storage only once. IMS maintains direct pointers between individual trees to allow retrieval of the desired segment. The direct pointers are always bi-directional allowing all segments related to a given segment to be located.

Data definition is specified with a special data description language (DDL). A group schema description, a set of statements defining each tree structure, and a set of statements defining each group are run as a data definition job. When this data definition job is processed the operating system creates linkages to storage space allocated on direct access devices. One of the features of IMS is that segments may be added to the lowest level of the hierarchy without a complete redefinition of the data base. As the data definition job serves to create a table, which is used to resolve symbolic program references, the effect of additions at the lowest level of the hierarchy is to place new symbolic references at the end of the table. As all data is located through the use of a common symbolic program linkage, changes in the physical storage of the data do not require that application programs be recompiled.

IMS maintains information about the records retrieved in a "Program Specification Block" (PSB). The "PSB" is generated prior to program execution. It describes the program, the files to which the program is sensitive, devices to which the program is sensitive and an entity

referred to as the "Program Communication Block" (PCB). The PCB will contain the following information:

(1) File name
(2) Group schema to which this program is bound
(3) Processing mode
(4) Error control word
(5) Name of last processed group
(6) Hierarchy level of group
(7) Key length
(8) Concatenated identifiers for all groups from the "root" segment down to the present segment

This information allows the user program to decide for itself if a new data retrieval is necessary before processing is initiated.

It can be seen that IMS allows the user great flexibility. Unfortunately this flexibility has been obtained at the cost of system speed. All user statistics indicate that IMS is slower than TOTAL by a factor of 2 to 3. Average time to read and transmit a data block is approximately 111 milliseconds. This picture is changing rapidly as IBM continues to work on the system. The implementation of multi-thread search techniques should improve IMS response time considerably.

IMS has some of the best utility features found with any DBMS. They include:

- Automatic checkpoint facility as well as manual checkpoint
- Telecommunications and Message Scheduling based upon que priority
- Controlled restart and recovery functions based on system transaction log, logging of updates cannot be suppressed
- Specification of up to fifteen transaction priority levels

As might be expected, the core storage used by IMS is also rather large. The following are minimum usages not including storage buffer area:

OS/MVT	150K		560K bytes
HASP	60K		
IMS/DC	200K	350K	
TP MON	150K		

The minimum system this configuration can be expected to run on would be a 360/50. The IMS/DC system can be leased from IBM for approximately $1,175.00 per month. See Table 4.5-3 for summarization.

PRC Public Management Services, Inc.

Communications and Information Management System (CAIMS)

Development of the CAIMS system was begun in 1968 by Systems Science Development Corporation. The company has become a member of the Planning Research Corporation Company and is now known as Public Management Services, Inc. Public Management Services appears to be attempting to concentrate its efforts in the community services and law enforcement areas.

In the CAIMS system data appears to the user as a collection of linked records. Data is defined in a macro language GPL based upon COBOL, the language in which CAIMS is written. A particular record in the data base is located through a fully inverted index structure. The minimum memory environment which can support a CAIMS system is 131K bytes. Vendor documentation in this area is, however, rather sparse. See Table 4.5-4 for summarization.

CAIMS is designed as a modular system. The CAIMS modules are run as tasks scheduled by the Operating System. Within the CAIMS system a System Control Module also controls the other CAIMS modules by passing execution requests to the Operating System. The

SYSTEM----------	IMS - DC
COMPANY----------	IBM
COMPUTERS----------	IBM 360/370
CORE----------	250K bytes
USER LANGUAGES----------	COBOL, PL/1, BAL
DATA STRUCTURE----------	Trees
FILE ORGANIZATION----------	HISAM HIDAM HDAM HSAM
INSTALLATIONS 9/72----------	20
COST----------	Lease - $1,175.00 (Both) Purchase

TABLE 4.5-3. SUMMARIZATION OF IMS-DC SYSTEM.

SYSTEM----------	CAIMS (SALES)
COMPANY----------	Public Management Services, Inc.
COMPUTERS----------	RCA Spectra 70, RCA 2, 3, 6, 7 IBM 360, IBM 370
CORE----------	131K bytes
USER LANGUAGES----------	COBOL, CAIMS Macro
DATA STRUCTURE----------	Chains
FILE ORGANIZATION----------	Fully Inverted Index
INSTALLATIONS 1/73----------	7
COST----------	Lease Purchase

TABLE 4.5-4. SUMMARIZATION OF CAIMS (SALES) SYSTEM.

vendor admits that the complete system has not at present been implemented by any of the seven listed users. In spite of this fact, estimated system throughput rates are given. The presentation of this type of information casts doubt on the validity of all performance ststistics presented in the vendor documents.

As the system has been designed as a communications monitor as well as an information management system, some of its capabilities are unique. The system supports directly both video terminals and teletype as well as message switching and broadcasting operations. These are functions normally supported by a teleprocessing monitor. A number of utility programs are supplied which are rather specialized as would be expected of a system designed for a limited number of users. In most other respects the system appears to be a standard though limited data base management system.

Additional Systems Summaries

Tabular summaries of three other systems are presented for comparison and to indicate the variety of system features available. If a decision is made to implement a package system further in-depth analysis of each of the systems mentioned will be necessary.

ADABAS, produced by a German firm, Software ag, is relatively new to the United States. The system has some of the most impressive features and specifications received. It is the only system which uses data compression to save storage space. The vendors of the system encourage benchmark tests with customer files. See Table 4.5-5.

System 2000 marketed by MRI Systems Corporation is a descendant of ADEPT-50 and TDMS. The ADEPT system was developed for the Army; TDMS was a commercial version of the system. Both were implemented in FORTRAN. System 2000 has been implemented by the New York Police Department. See Table 4.5-6.

Generalized Information Management (GIM) is a product of

SYSTEM----------	ADABAS
COMPANY----------	Software ag 12124 Basset Lane Reston, Virginia 22070 (703) 471-5098
COMPUTERS----------	IBM 360/370 Univac Series 70
CORE----------	110K bytes
USER LANGUAGES----------	PL/1, COBOL, FORTRAN, Assembler Own Language
DATA STRUCTURE----------	Fully Inverted Index
FILE ORGANIZATION----------	Inverted ISAM IDAM Compressed Strings
INSTALLATIONS 9/72----------	5 USA 25 Worldwide
COST----------	Lease - $4, 500. 00 Purchase - $120, 000. 00

TABLE 4.5-5. SUMMARIZATION OF ADABAS SYSTEM.

SYSTEM----------	System 2000 *
COMPANY----------	MRI Systems Corporation 12575 Research Blvd. Austin, Texas 78766
COMPUTERS----------	IBM 360/370 Univac 1106/1108 CDC 6000/Cyber 70
CORE----------	130K bytes
USER LANGUAGES----------	COBOL, FORTRAN, BAL, PL/1
DATA STRUCTURE----------	
FILE ORGANIZATION----------	Sequential, Inverted, List
INSTALLATIONS 9/72----------	60
COST----------	Lease Purchase - $35, 000. 00 to $130, 000. 00

* Both DBMS and TP
Descendant of TDMS

TABLE 4.5-6. SUMMARIZATION OF SYSTEM 2000.

TRW Systems. GIM was originally developed for sale to the military. Discussion with TRW personnel indicated that although they felt a custom-designed system would better fit the needs of the Dallas Police Department, GIM could be used to implement the required data base management system. See Table 4.5-7 for summarization.

An Integrated Data Base for the Dallas Police Department needs will be discussed in Section 4.5.2. Any packaged DBMS would have to be flexible enough to handle the structure presented in that section.

SYSTEM----------	GIM
COMPANY----------	TRW Systems 1 Space Park El Segundo, California 90245
COMPUTERS----------	IBM 360/370 Univac 1100
CORE----------	50K bytes *
USER LANGUAGES----------	Procedure Word Structure Assembler
DATA STRUCTURE----------	
FILE ORGANIZATION----------	Hierarchical Logic
INSTALLATIONS 9/72----------	20
COST----------	Lease - $2,100.00 Purchase ($13,000.00 installation)

* Must use GIM TP

TABLE 4.5-7. SUMMARIZATION OF GIM SYSTEM.

4.5.1 BACKGROUND

In this section, the present file structure is studied and its various properties are examined. The manual file system is discussed in Section 4.5.1.2, and the on-line file system is dealt with in Section 4.5.1.3.

4.5.1.1 INTRODUCTION

Some nomenclature pertinent to a discussion of the present file structures will now be introduced.

Data Sets

A short abstract discussion of the terms and concepts to be used in the following section will serve to introduce information structures. Three assumptions are needed:

(1) Data entities exist independently of the language used to describe them.

(2) Data entities represent aspects of real operations.

(3) Data processing is a modeling of real operations.

A data set will be defined as a named collection of similar data entities. A data set will be called ordered if a rule for describing the order is known. Two things should be noted at this time:

(1) Set order need not be based upon the "values" of the data items contained in the set.

(2) An ordered set may contain useful information based on the set order.

As the various functions of a real world organization are highly interactive, it follows that the same relationships should be modeled in the software system. A diagram which can indicate the associations which exist between functional elements of an organization can be used as an aid to understanding the organization. A common type of diagram used for this purpose is a procedural flow chart. A similar diagram will be used to describe the relationships which exist between data sets. As this diagram will indicate the logical associations of the data sets, it will be called a logical structural diagram.

Basically the structural diagram will consist of two elements: they are the rectangle and the arrow. The rectangle will indicate the existence of a set of data entities. The arrow will indicate the possibility of an association existing between the elements of two sets. The arrow does not guarantee the existence of an association between any given element in Set 1 with any element in Set 2. Figure 4.5.1-1 will be used in conjunction with the following discussion.

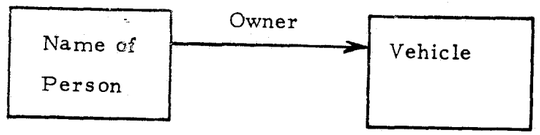


FIGURE 4.5.1-1 PERSONS/VEHICLE RELATIONSHIP

The diagram will be considered to express the following:

(1) There are two and only two sets that exist in the space under consideration.

(2) There is an association of persons and vehicles.

(3) A person can own any number of vehicles.

(4) A vehicle can have only one person as owner and will have an owner if it exists.

If the arrow were two-headed it would indicate that either of the sets could act as owner of elements in the other set. The structural diagram is then simply a way of expressing the logical interrelation of data sets.

Data Structures

Three general types of logical structure can be built with data sets:

Sequential Structures

Trees

Networks

A. Sequential Data Structures

A sequential data structure implies that each set in the structure, except the first and the last, will have only one successor set and only one predecessor set. Sequential structures indicate that there is a one-to-one relationship between member and owner records.

See Figure 4.5.1-2 and 3 for illustrations of sequential data structures.

B. Tree Data Structures

A tree data structure implies that each set in the structure except the first or highest set may be related to N sets below it but will have only one predecessor set. It is well to remember that each set may contain many data entities. With this in mind it can be seen that a tree may be a quite complex structure.

Figure 4.5.1-4 and 5 are diagrams of a tree structure.

C. Network Data Structures

In a network structure each set may have multiple predecessor sets and multiple successor sets. A network is the most general kind of data structure. The network represents the possibility of an N to M relationship: this leads to the possibility of cyclic association wherein a sequence of different data entities are related in a manner such that the last entity in the sequence is a member of a set which is an owner of the first record in the sequence. The cycle is determined by a unique sequence of associations among the data elements; a change in the sequence will therefore change the cycle.

Figure 4.5.1-6 and 7 are diagrams of network structure; Figure 4.5.1-8 shows a cyclic network.

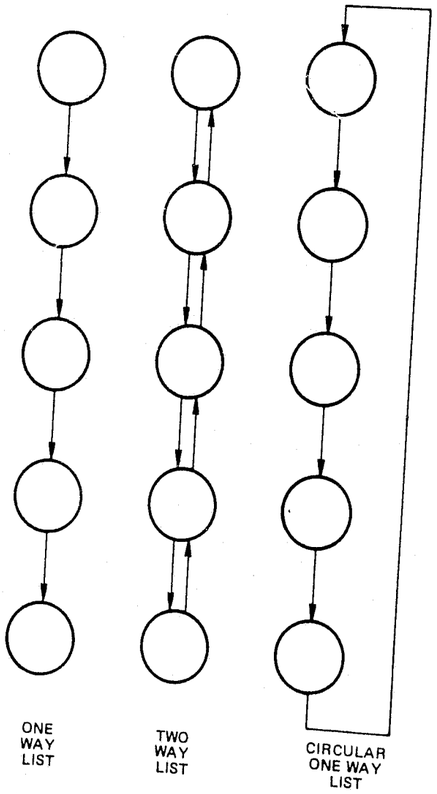


FIGURE 4.5.1–2. SEQUENTIAL STRUCTURES

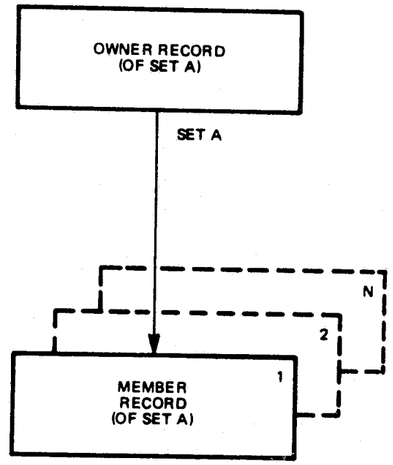


FIGURE 4.5.1–3. SET REPRESENTATION OF A SEQUENTIAL STRUCTURE

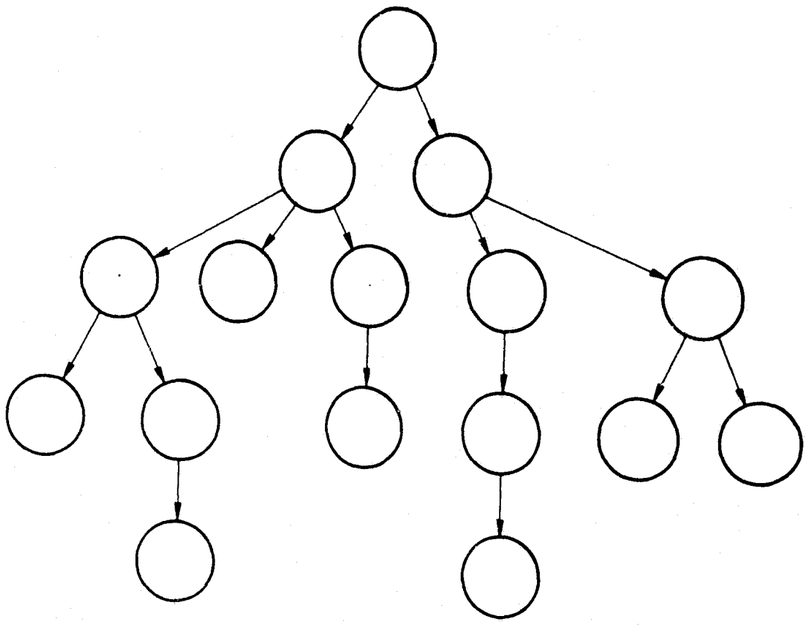


FIGURE 4.5.1–4. TREE STRUCTURE

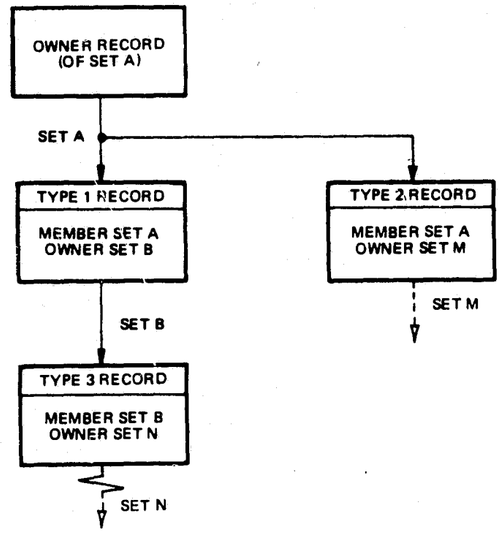


FIGURE 4.5.1–5. SET REPRESENTATION OF A TREE STRUCTURE

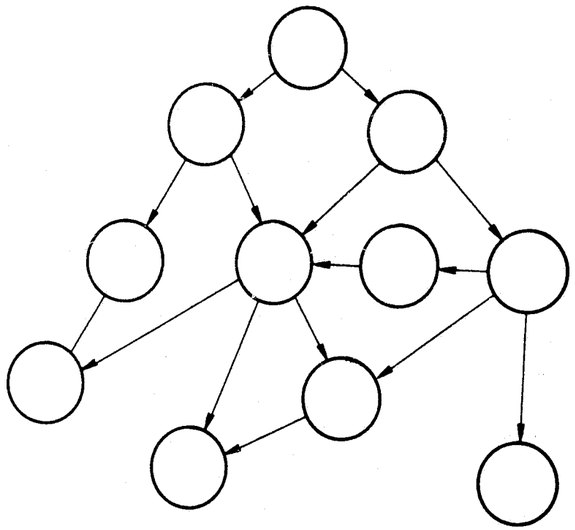


FIGURE 4.5.1–6. NETWORK STRUCTURES

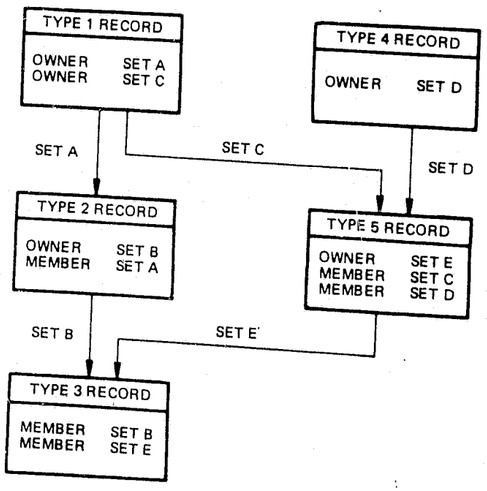


FIGURE 4.5.1–7. SET REPRESENTATION OF A NETWORK STRUCTURE

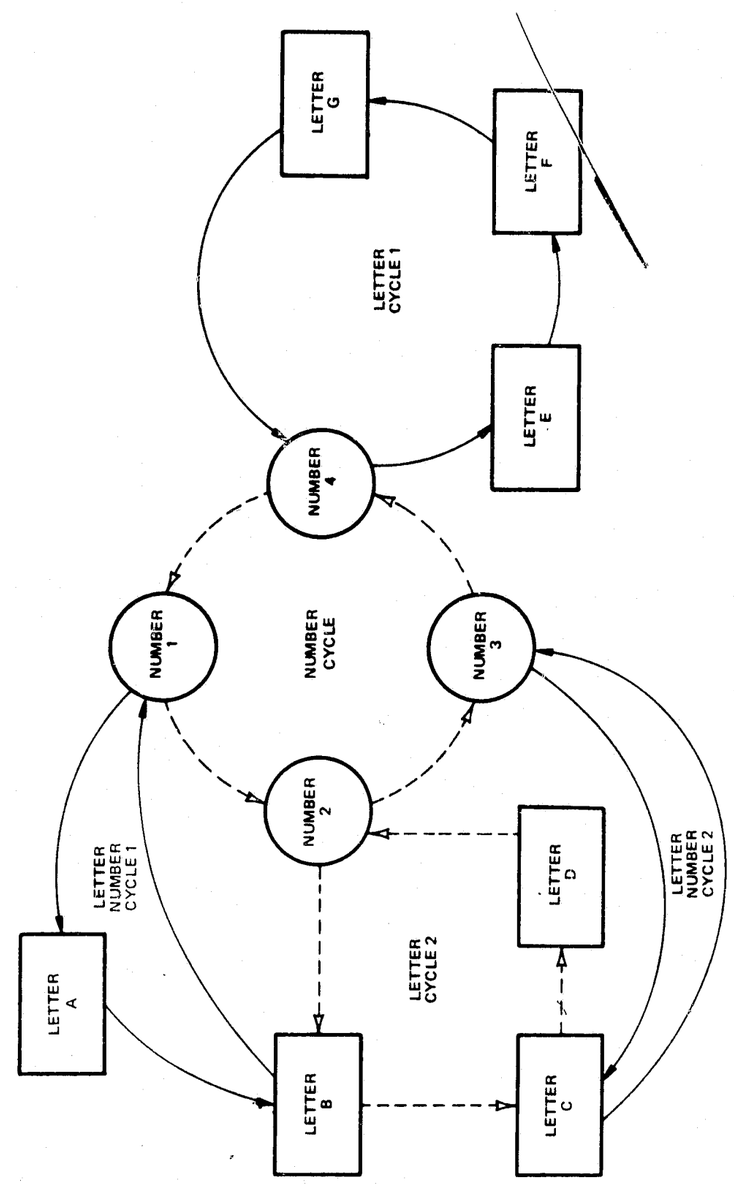


FIGURE 4.5.1–8. CYCLIC STRUCTURES

Logical Indexing

Using the concepts developed in the preceding section, the organization of a collection of data elements will now be described. The data entities which make up a set have not yet been explicitly defined. A definition for the data entities will be given here. A segment will be a data element of fixed length, containing one or more logically related data fields. The names of the fields contained in the segment will be referred to as the attributes of the data segment. Attribute value will refer to the content of a specific field of a particular segment. An example of the attributes of an entity would be the make, model, year and color of a vehicle. A value of the attribute color could be red. In logical structures the relationships will normally be a function of attribute or attribute value. A data element may be described in terms of its attribute/value pairs. If one or more of the attribute/value pairs of a data element is unique it may be used to specifically identify that element possessing it. In cases where no one attribute/value pair can uniquely identify a data element it is possible that a set of attribute/value pairs will identify the element and establish its relation to other data elements. This process is analagous to describing the location of a point in a three-dimensional space. In this case the position of a point P is described by its X, Y and Z coordinates. In a like manner, one can think of the collection of data elements as a data space (a sub-space of the space containing all data elements).

An Ordinal Key will be considered to specify an attribute whose values can be used to impose a sequential order on a set of data elements. An example of this is the ordering of the data set, Offense/Incident Reports, by the value of their attribute service number. In particular this will be called Spatial Sequential Order or a Sequential Index. Figure 4.5.1-9 shows a logical diagram of this ordered set (data space).

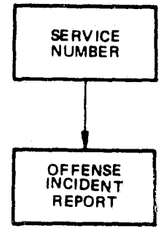


FIGURE 4.5.1–9. SEQUENTIALLY INDEXED DATA SET

Refer to Figure 4.5.1-1 for a review of the implications of this diagram. It should be noted that Figure 4.5.1-9 describes a one-dimensional space. Mass storage devices currently in use are essentially one-dimensional also. Unfortunately, logical data spaces are normally multi-dimensional. That is, they are made up of more than one class of data entity. Each entity class will have a separate, but not necessarily distinct, set of attributes. Each attribute set may have multiple values.

In a data space having a sequential order, one discovers the attribute/value pairs which exist for a data element by determining the elements identity and proceeding along the sequence until that element is reached. If the identity of an element is not known, the complete sequence must be searched in order to determine if the element exists and what its attributes are. If the attribute/value pairs of a data element are known, it is possible, in a multi-dimensional space, to determine the identity of the data element. This process which will be called Logical Indexing is the inverse of Sequential Indexing.

Figure 4.5.1-10 shows a diagram of an inverted index. Specifically, the structure is inverted on the attributes:

Offense Type

Accident Type

Date

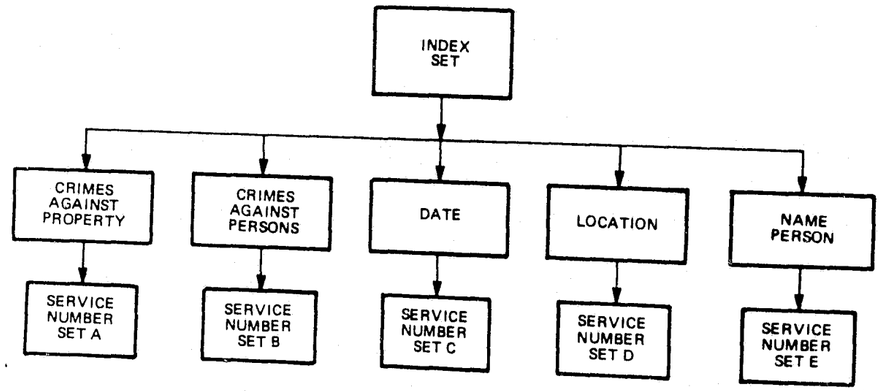


FIGURE 4.5.1–10. INVERTED INDEX STRUCTURE

Name Persons

Location

Notice that our original set has been divided into five possible subsets. It has not been guaranteed that a service number will occur in any given set nor has a service number been restricted from appearing in more than one set.

The five subsets actually represent five different relationships that may exist between the data elements in our data space. It should be obvious that if certain attribute/value pairs are known that one need only look in the service number sets which relate to those attribute/value pairs. If only one service number is found to exist in the intersection of these service number sets, this indicates the Offense/Incident Report sought has been located. The index set then can be said to exist solely to facilitate the retrieval of a particualr data element. A diagram can be drawn representing the integration of the structures of Figures 4.5.1-9 and 10 into one logical data structure. Figure 4.5.1-11 is a representation of this data space.

Correlation of Logical Structure to Physical Structure

The discussion has been concerned with theoretical data structures. This section will attempt to relate logical structure to physical structure. Our definition of segment indicates the possibility of the physical existence of a data element. A logical record is defined as a set of related segments of one or more segment types. An Offense/Incident Report can be thought of as a collection of one or more logical records. With this in mind one can implement the sequential structure of Figure 4.5.1-1 as a file cabinet of Offense/Incident Report forms in service number sequence. The inverted index structure could be implemented as sets of index cards which simply list the service number of reports which fit the description of the set type. If complete copies of the Offense/Incident

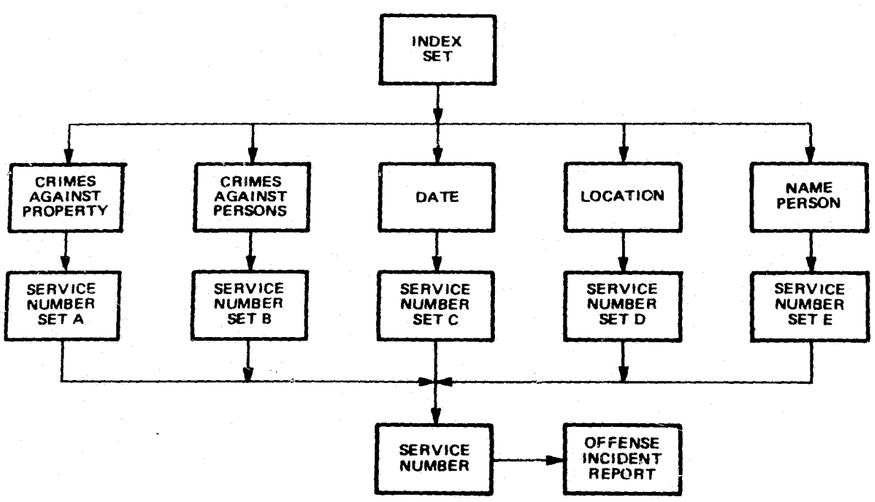


FIGURE 4.5.1–11. INTEGRATION OF INVERTED AND SEQUENTIAL DATA SETS

Reports were filed in a sequence based upon the value of the attribute describing set type, one would have the same data set but a different rule to establish the order of the set. With this in mind consider the paper or manual files maintained by the Dallas Police Department.

4.5.1.2 ORGANIZATION OF DALLAS POLICE DEPARTMENT MANUAL FILES

The paper files relating to the operational functions of the Dallas Police Department will be presented in the order assigned in the Operation LEADER Phase I Report. When helpful, diagrams of the file structures will be presented. Multiple occurrences of the same data set will not be indicated in a diagram. The file structures are discussed as they existed at the completion of Phase I. Note should be made that the existing automated files and indices to manual files are expanding rapidly. On-line files will be discussed in Section 4.5.1.3.

Table 4.5.1-1 is a compilation of the manual files maintained by the various bureaus and divisions which make up the Dallas Police Department. The Table was made up in part from data presented in the Operation LEADER Phase I Report. The Table consists of:

(1) A file name

(2) A file ID code based upon the bureau, division, and section

(3) Ordinal Key which is used to access the information

(4) Number of accesses per month

(5) Form Number indicating the primary type of form stored in the file

(6) When available, additions and deletions per month

The manual file code identifies the location of the file within the Dallas Police Department down to the section level and identifies the individual file by a sequentially assigned number (from 01 to 99).

TABLE 4.5.1-1. MANUAL FILES OF THE DALLAS POLICE DEPARTMENT

Name of File	File ID Code	Keyword Attribute	Accesses/ Month	Contains (Form No)	Add or Delete/ Month
Master File	**ABA-01**	**Type of Offense**		F433	
LIEU Card	ABA-02	**Name**	30	F427	
Subject Card File	ABA-03	**Name**		F428	
Telephone Number Card	ABA-04	**Location (Suspect)**		F429	
License Number File Known Offender and Suspect	ABA-05	**Vehicle License (Known Offender)**	400	F430	
Known Offender License Bulletin	ABA-06	**Name (Known Offender)**			
Street Address File Known Offender and Suspect	ABA-07	**Location (Street Address Known Offender)**	100	F431	
Name Index File	ABA-08	**Name**	9000	F432	
Log Book Index (Subject)	ABA-09	**Number**		F434	
Name File	ABB-01	**Name (Known Subversive)**			
Telephone Number Index	ABC-01	**Telephone Number**			

TABLE 4.5.1-1. MANUAL FILES OF THE DALLAS POLICE DEPARTMENT (CON'T)

Name of File	File ID Code	Keyword Attribute	Accesses/ Month	Contains (Form No)	Add or Delete/ Month
Address Index	ABC-02	Street Name			
License Number Index	ABC-03	Vehicle License			
Automobile Model	ABC-04	Automobile Model			
Automobile Color	ABC-05	Automobile Color			
Automobile File	ABC-06	Name (of Driver)			
Subject File	ABC-07	Name (of Subject)			
Name	ABF-01	Name, Type of Offense			
Location File	ABF-02	Location, Type of Offense			
Picture File	ABF-03	Name, Type of Offense			
Nickname File	ABF-04	Name, Type of Offense			
Trick List	ABF-05	Name, Type of Offense			
Height File (Prostitute)	ABF-06	Height (Suspect)			

TABLE 4.5.1-1. MANUAL FILES OF THE DALLAS POLICE DEPARTMENT (CON'T)

Name of File	File ID Code	Keyword Attribute	Accesses/ Month	Contains (Form No)	Add or Delete/ Month
Murder Folder	CAC-01	Type of Offense, Name (Victim)	750		250
Murder Folder	CAC-02	Type of Offense, Name (Victim)	250		250
Murder (Unsolved)	CAC-03	Type of Offense, Name (Victim)	300		
Property Invoices	CAC-04	Type of Offense, Number (Invoice)	300		350
Arraignment Forms	CAC-05	Type of Offense, Name (Defendant)	300		4800
Arrest Reports	CAC-06	Type of Offense, Name (Arrestee)	750		960
ABC Offense File	CAC-07	Type of Offense, Number (Service)	2175		3220
M. O. File	CAC-08	Type of Offense, Location of Offense	3000		6786
Bank Robbery	CAC-09	Type of Offense,	150		35
Deaths in Jail	CAC-10	Type of Offense, Name (Arrestee)	90		50

TABLE 4.5.1-1. MANUAL FILES OF THE DALLAS POLICE DEPARTMENT (CON'T)

Name of File	File ID Code	Keyword Attribute	Accesses/ Month	Contains (Form No)	Add or Delete/ Month
Complainant	CAC-11	Type of Offense, Name (Complainant)	1050		4000
Defendant Cards	CAC-12	Type of Offense, Name (Defendant)	1050		4000
Prosecution Report	CAC-13	Type of Offense, Number (Service)	600	F35	600
Arrest Report	CAD-01	Type of Offense, Name (Arrestee)	1500	F4	500
Suspend, Offense	CAD-02	Type of Offense,			
Assignments File	CAD-03	Type of Offense,	3000		2500
Prosecution Report	CAD-04	Type of Offense, Name (Defendant)		F35	375
Name Card	CAD-05	Type of Offense, Name			300
Supplement	CAD-06	Type of Offense, Number (Service)	4000		4000
Writ File	CAD-07	Type of Offense,	100		50

TABLE 4.5.1-1. MANUAL FILES OF THE DALLAS POLICE DEPARTMENT (CON'T)

Name of File	File ID Code	Keyword Attribute	Accesses/ Month	Contains (Form No)	Add or Delete/ Month
Open Offense Report	CAD-08	Type of Offense, Number (Service)			
Book M. O. File	CAD-09	Type of Offense, Location			4000
Arrest Reports	CAD-10	Type of Offense, Name (Arrestee)	720		240
Automobile Active File	CAD-11	Type of Offense, Name (Owner)	1800		600
Automobile Theft Offense By Date	CAD-12	Type of Offense, Date (Offense)	1200		600
Automobile Theft Offense By Beat	CAD-13	Type of Offense, Location (Offense)	1200		600
Automobile Access By District	CAD-14	Type of Offense, Location		—	800
Automobile Access By Name	CAD-15	Type of Offense, Name (Victim)	600		
Vehicle Identification Number Card	CAD-16	Type of Offense, Number (Vehicle)	1200		600
Investigative Personal Offense	CAD-17	Type of Offense, Name (Complainant)	2400		600

TABLE 4.5.1-1. MANUAL FILES OF THE DALLAS POLICE DEPARTMENT (CON'T)

Name of File	File ID Code	Keyword Attribute	Accesses/ Month	Contains (Form No)	Add or Delete/ Month
Prosecution Report	CAD-18	Type of Offense, Name (Defendant)	120		40
Automobile Cleared/ Unfounded	CAD-19	Type of Offense,			
Automobile Pending	CAD-20	Type of Offense,			
Automobile Book File	CAD-21	Type of Offense, Location			600
Pawn Shop Tickets	CAD-22	Type of Offense, Name		F1	700
Offense Reports	CAD-23	Type of Offense,		F1	
Letters and Teletype	CAD-24	Type of Offense, Date			
Serial Number Card	CAD-25	Type of Offense, Number (Serial)			
Property Description Card	CAD-26	Type of Offense, Number (Property)			
Offense Supplement Book	CAD-27	Type of Offense, Number (Service)			

TABLE 4.5.1-1. MANUAL FILES OF THE DALLAS POLICE DEPARTMENT (CON'T)

Name of File	File ID Code	Keyword Attribute	Accesses/ Month	Contains (Form No)	Add or Delete/ Month
Jewelry	CAD-28	Type of Offense, Number (Service)			
Jail Audit	CAD-29	Type of Offense, Name (Arrestee)	180		90
Property Invoices	CAD-30	Type of Offense, Number (Invoice)			
Property Disposition	CAD-31	Type of Offense, Number (Invoice)	150		50
Stolen Card File	CAD-32	Type of Offense, Number (Invoice)	400		100
Pending File	CAD-33	Type of Offense, Name			475
Pound Tickets	CAD-34	Type of Offense, Number (Pound Ticket)	200		200
Frame Number	CAD-35	Type of Offense,			
License Number	CAD-36	Type of Offense,			
Offense Report	CAE-01	Type of Offense, Number (Service)	800		550

TABLE 4.5.1-1. MANUAL FILES OF THE DALLAS POLICE DEPARTMENT (CON'T)

Name of File	File ID Code	Keyword Attribute	Accesses/ Month	Contains (Form No)	Add or Delete/ Month
Arrest Report	CAE-02	Type of Offense, Name (Arrestee), Date	1200	F4	1080
Jail Audit	CAE-03	Type of Offense, Name (Prisoner)	180		90
Cases Filed	CAE-04	Type of Offense,	320		160
Prosecution Report	CAE-05	Type of Offense, Name	600		300
Property Card (No Release)	CAE-06	Type of Offense, Number (Invoice)	400		200
Active Check File	CAE-07	Type of Offense,	1700		500
Check File	CAE-08	Type of Offense,	240		30
Check Card File	CAE-09	Type of Offense, Name (Defendant), Name (Complainant)	1200		400
Picture File	CAE-10	Type of Offense, Name			90
Stolen Check	CAE-11	Type of Offense,			

TABLE 4.5.1-1. MANUAL FILES OF THE DALLAS POLICE DEPARTMENT (CON'T)

Name of File	File ID Code	Keyword Attribute	Accesses/ Month	Contains (Form No)	Add or Delete/ Month
Wanted Persons (48 Hours)	CAE-12	Type of Offense, Name	300		150
Wanted Persons	CAE-13	Type of Offense, Name	300		200
Wanted Persons Card	CAE-14	Type of Offense, Name	35		400
Cancelled Wanted Persons Card	CAE-15	Type of Offense, Name	300		300
Wanted Persons Cancelled/Cleared	CAE-16	Type of Offense, Name	300		300
Dallas Parolees	CAE-17	Type of Offense, Name	40		20
Character Name Cross Reference	CAE-18	Type of Offense, Name	200		200
License Number	CAE-19	Type of Offense, Number (License)	60		20
Picture Card	CAE-20	Type of Offense, Name	60		200
Activity Folder	CAE-21	Type of Offense,	45		30

TABLE 4.5.1-1. MANUAL FILES OF THE DALLAS POLICE DEPARTMENT (CON'T)

Name of File	File ID Code	Keyword Attribute	Accesses/ Month	Contains (Form No)	Add or Delete/ Month
Daily Activity	CAE-22	Type of Offense,	1		1
NCIC Hits	CAE-23	Type of Offense,	0		3
Intelligence Report	CAE-24	Type of Offense,	10		3
Picture Jacket	CAE-25	Type of Offense,	3		10
Crime/Persons and Property Daily Activity	CAE-26	Type of Offense,	2		2
Arrest Copies	CAE-27	Type of Offense, Name (Arrestee)	2		2
NCIC Misses	CAE-28	Type of Offense,	2		
Known Swindlers	CAE-29	Type of Offense, Name (Suspect)			
Nicknames	CAE-30	Type of Offense, Name (Alias)			
Fraudulent Companies	CAE-31	Type of Offense,			

TABLE 4.5.1-1. MANUAL FILES OF THE DALLAS POLICE DEPARTMENT (CON'T)

Name of File	File ID Code	Keyword Attribute	Accesses/ Month	Contains (Form No)	Add or Delete/ Month
Swindle Offenses	CAE-32	Type of Offense, Number (Service)			
Swindle Arrest	CAE-33	Type of Offense, Number (Service)			
Picture File	CAE-34	Type of Offense, Number			
Check File	CAE-35	Type of Offense, Number (Internal)			
Defendant Index	CAE-36	Type of Offense, Name (Defendant)			
Complainant Index	CAE-37	Type of Offense, Name (Complainant)			
Forge/Firm Index	CAE-38	Type of Offense, Name (Business)			
Wanted Persons	CAE-39	Type of Offense, Name			
Wanted Persons Index	CAE-40	Type of Offense, Name			
Arrest Sheet	CAE-41	Type of Offense, Name (Arrestee)			

TABLE 4.5.1-1. MANUAL FILES OF THE DALLAS POLICE DEPARTMENT (CON'T)

Name of File	File ID Code	Keyword Attribute	Accesses/ Month	Contains (Form No)	Add or Delete/ Month
Cancelled Wanted Persons	CAE-42	Type of Offense, Name			
Information Card	CAE-43	Type of Offense, Name			
Individual Name File	CAE-44	Type of Offense, Name			
License Number File	CAE-45	Type of Offense, Number (License)			
Bad Hit File	CAE-46	Type of Offense, Name (Arrestee)			
Parolee Name File	CAE-47	Type of Offense, Name (Parolee)			
Picture Card Index	CAE-48	Type of Offense, Name			
Picture Jacket	CAE-49	Type of Offense, Number (Internal)			
Problem File	CBB-01	Date			
Problem/Return File	CBB-02	Date	20		20
Problem/Return File	CBB-03	Date	15		15

TABLE 4.5.1-1. MANUAL FILES OF THE DALLAS POLICE DEPARTMENT (CON'T)

Name of File	File ID Code	Keyword Attribute	Accesses/ Month	Contains (Form No)	Add or Delete/ Month
Offense Report	CBB-04	Number (Service)		F1	
Canine Activity	CBB-05	Date	1		1
Contains 30 Day	CBB-06	Date	1		1
30 Day Activity Letter	CBB-07	Date	1		1
Accident Report	CBB-08	Date	3		2
Crime Control Team Activity	CBB-09	Date	30		30
Operations Plan and Critiques	CBC-01	Type of Event	40		4
Monthly Activity Report	CBC-02	Date	2		1
Commission Application	CBC-03	Name (Applicant)	350		350
Agency Registration	CBC-04	Name (Agency)	30		85
Location Sheet File	CBD-01	Location (Street Name Alpha)		F509	

TABLE 4.5.1-1. MANUAL FILES OF THE DALLAS POLICE DEPARTMENT (CON'T)

Name of File	File ID Code	Keyword Attribute	Accesses/ Month	Contains (Form No)	Add or Delete/ Month
Location File	CBD-02	Number (Internal), Type of Premises (Sale of Alcohol)		F1, F4, F35, F520, F522	
Billiard Hall (No Beer)	CBD-03	Type of Premises (No Alcohol), Number			
Name File	CBD-04	Name (Business or Location/Alpha)		3 x 5 Card	
Street File	CBD-05	Street Name/ Alpha		3 x 5 Card	
Picture File	CBD-06	Name (Person)		F146	
Applicant Report-Billiard Hall	CBD-07	Name (Business)		App. for Lic.	
Billiard Hall Fire Marshall Reports	CBD-08	Name (Business)		F505	
Billiard Hall Health Department Report	CBD-09	Name (Business)		F506	
Billiard Hall Building Inspection Report	CBD-10	Name (Business)		F507	

TABLE 4.5.1-1. MANUAL FILES OF THE DALLAS POLICE DEPARTMENT (CON'T)

Name of File	File ID Code	Keyword Attribute	Accesses/ Month	Contains (Form No)	Add or Delete/ Month
Billiard Hall Notice to Vice Control	CBD-11	Name (Business)		F508	
Public Hall/Dance School License Application	CBD-12	Name (Business)		F496	
Public Hall/Dance School License Renewal Application	CBD-13	Name (Business)		F497	
Public Dance Hall Application Report	CBD-14	Name (Business)		F498	
License Dance Hall Single Dance Permit Application	CBD-15	Name (Business)		F499	
Dance Hall Supervisor Application	CBD-16	Name (Applicant)		F500	
Renewal Letter	CBD-17	Name (Applicant)		F501	
Billiard Hall License Renewal Application	CBD-18	Name (Business)		F502	
Billiard Hall License Application	CBD-19	Name (Business)		F503	
Special Dance Hall License Approval	CBD-20	Location		F510	

TABLE 4.5.1-1. MANUAL FILES OF THE DALLAS POLICE DEPARTMENT (CON'T)

Name of File	File ID Code	Keyword Attribute	Accesses/ Month	Contains (Form No)	Add or Delete/ Month
Dance Hall Supervisor Approval	CBD-21	**Location**		**F511**	
Billiard Hall License Approval	CBD-22	**Location**			
Property Invoice File	CBD-23	**Date**		**F438**	
Pornographic Movie House	CBD-24	**Name**			

TABLE 4.5.1-1. MANUAL FILES OF THE DALLAS POLICE DEPARTMENT (CON'T)

Name of File	File ID Code	Keyword Attribute	Accesses/ Month	Contains (Form No)	Add or Delete/ Month
Juvenile Arrest Record File	CEB-01	**Name (Juvenile), Date (D. O. B.)**			
Juvenile Arrest Report File	CEB-02	**Number (Juvenile ID), Date (D. O. B.)**			
5 Day File	CEB-03	**Date (Last 5 Days), Name (Juvenile), Date (D. O. B.)**			
Adult Arrest File	CEB-04	**Type of Case, Name (Adult), Date (D. O. B.)**		**F4**	
Assignment Log	CEC-01	**Number (Service)**			
Teletype File	CEC-02	**Name (Missing Person)**			**1500**
Outstanding Missing Persons Report File	CEC-03	**Name (Missing Person)**			
Department Procedure	CEC-04	**Subject**			
Name File	CFB-01	**Type of Offense, Name (Suspect)**		F398	1000
Location File	CFB-02	**Type of Offense, Location (Drug Activity)**		F399	1000

TABLE 4.5.1-1. MANUAL FILES OF THE DALLAS POLICE DEPARTMENT (CON'T)

Name of File	File ID Code	Keyword Attribute	Accesses/ Month	Contains (Form No)	Add or Delete/ Month
Telephone Number	CFB-03	Type of Offense, Number (Telephone)		F400	200
Nickname File	CFB-04	Type of Offense, Name (Alpha)		F402	100
Automobile File	CFB-05	Type of Offense, Name		F401	100
Automobile File	CFB-06	Type of Offense, Number (License)		F401	100
Automobile File	CFB-07	Type of Offense, Make, Model		F401	100
Personal History and Picture File	CFB-08	Type of Offense, Name (Suspect)		F405	
Prosecution Report File	CFB-09	Type of Offense, Name (Defendant)		F35	

TABLE 4.5.1-1. MANUAL FILES OF THE DALLAS POLICE DEPARTMENT (CON'T)

Name of File	File ID Code	Keyword Attribute	Accesses/ Month	Contains (Form No)	Add or Delete/ Month
Teletype Log	DAB-01	Date		F39	
NCIC Card File	DAB-02	Number			
Teletype Request File	DAB-03	Date			
Clear/Cancelled	DAB-04	Number			
Offense/Incident	DAB-05	Number (Service)		F1, F2, F526	53,000
Accident	DAB-06				
Traffic Ticket	DAB-07	Number (Traffic Ticket)		F8	12,600
Telephone Number Index	DAB-08	Name (Police Officer)		F523	800
Arrest Number Log	DAB-09	Number (Arrest)		F524	
Name Index File	DAC-01	Name (Known Offender), Name (Alias)	7500	F484	
Arrest Card File	DAC-02	Name (Arrestee)	7500	F369, F368	

TABLE 4.5.1-1. MANUAL FILES OF THE DALLAS POLICE DEPARTMENT (CON'T)

Name of File	File ID Code	Keyword Attribute	Accesses/ Month	Contains (Form No)	Add or Delete/ Month
				F4, F9, F10, F481, F482, F479, F480, F434	
Arrest Report File	DAC-03	Number (Arrest)			
Clearance Letters	DAC-04	Date			
				F464, F378, F35, F376, F377, F383, F11, & Other	
Criminal ID Jacket	DAC-05	Dallas Police Department Number			
Prosecution Report	DAC-06	Name (Defendant)		F35	
Disposition Index	DAC-07	Name (Defendant)			
Prisoner Activity File	DAC-08	Name (Prisoner)		F12, F13	
Probation Report File	DAC-09	Number (Probation)		F376, F377	
Job Application Log	DAC-10	Number (Log)		F196 F386	

TABLE 4.5.1-1. MANUAL FILES OF THE DALLAS POLICE DEPARTMENT (CON'T)

Name of File	File ID Code	Keyword Attribute	Accesses/ Month	Contains (Form No)	Add or Delete/ Month
Fingerprint File	DAC-11	Henry Class		F464, F196, F195	1500
Fingerprint Log	DAC-12	Names, ID Numbers			
Crime Index File	DAC-13	Name (Victim)		3 x 5 Card	
Major Accident File	DAC-14	Name (Victim)		3 x 5 Card	
Latent Print File	DAC-15	Type of Offense, Date of Offense		F487	
Crime Scene Search Jacket File	DAC-16	Number (CSS Internal)		F1, F[illegible], F460, F462, Other	
Palm Print File	DAC-17	Name (Subject)		F464	
Monthly Report File	DAC-18	Date of Report			
Microfilm File	DAC-19	Dallas Police Department Number		F1, F4, F2, F369, F35, F368, F31, F8, Other	

TABLE 4.5.1-1. MANUAL FILES OF THE DALLAS POLICE DEPARTMENT (CON'T)

Name of File	File ID Code	Keyword Attribute	Accesses/ Month	Contains (Form No)	Add or Delete/ Month
Red Log Book	DAC-20	Number (CSS)			
Evidence Box	DAC-21	Number (CSS)		F462	
Polygraph Test File	DAC-22	Number (Test)		F459, Misc.	110
Polygraph Test Log	DAC-23	Number (Test)			110
Evidence Room	DAC-24	Number (CSS)		Physical Evidence	
Daily Posting	DAE-01	Type of Offense, Location of Offense			
Crime Statistics and Charts	DAE-02	Type of Offense			
Alias Name File	DAE-03	Name (Alias)		3 x 5 Card	
Nickname File	DAE-04	Name (Nickname)			
Offense/Incident Report File	DAE-05	Type of Offense, Location (Beat), Date of Offense		F1	
Miscellaneous Fence	DAE-06	Location (Fence)			
Automobile File	DAE-07	Make of Vehicle		3 x 5 Card	

TABLE 4.5.1-1. MANUAL FILES OF THE DALLAS POLICE DEPARTMENT (CON'T)

Name of File	File ID Code	Keyword Attribute	Accesses/ Month	Contains (Form No)	Add or Delete/ Month
Murder File	DAE-08	Type of Offense		F1, F4	
Property Tag Log Book	DBA-01	Number (Property Tag)			
Property Invoice File	DBA-02	Number (Property Invoice)		F438, F439	1500
Dead Gun Card File	DBA-03	Serial Number of Property (Handgun)		F439	1500
Dead Property File	DBA-04	Name (Claimant)		F438	
Dead Release Authorization for Court File	DBA-05	Name (Claimant)		F442	
Active Release Card File	DBA-06	Name (Claimant)		F32	
Stores Release Card File	DBA-07	Name (Claimant - Business)		F32	
Suspense Disposition Request File	DBA-08	Date (Invoice)		F123	
Property Release Cards	DBA-09	Name (Claimant)		F32	
Active Property Index Card File	DBA-10	Name (Claimant), Number (Service)	1850	F439	

TABLE 4.5.1-1. MANUAL FILES OF THE DALLAS POLICE DEPARTMENT (CON'T)

Name of File	File ID Code	Keyword Attribute	Accesses/ Month	Contains (Form No)	Add or Delete/ Month
Current Gun Card File	DBA-11	Serial Number of Gun		F438	
Found Item Card File	DBA-12	Name (Claimant)		F438	
Minor-In-Possession File	DBA-13	Name (Claimant)		F438	
Active F and G File	DBA-14	Number (Invoice)		F438	
Disposition Request Card File	DBA-15	Name (Claimant)		F123	
Release Authorization File	DBA-16	Date of Invoice, Name (Claimant)		F442	
Partial Release Form File	DBA-17	Number (Form)		F451	
Invoice Yellow Copy File	DBA-18	Number (Invoice)		F438	1500
Dead Release Authorization File	DBA-19	Name (Claimant), Date of Invoice		Misc. Papers	
Inactive Partial Release File	DBA-20	Number (Form)		F451	
Dead Release Card File	DBA-21	Name (Claimant)		F32	

TABLE 4.5.1-1. MANUAL FILES OF THE DALLAS POLICE DEPARTMENT (CON'T)

Name of File	File ID Code	Keyword Attribute	Accesses/ Month	Contains (Form No)	Add or Delete/ Month
Uniform Issue File	DBA-22	Badge Number of Officer, Employee Number		F440, F443, F444	288
Inventory Control File	DBA-23	Equipment Serial Number		F452	
City Audit Form File	DBA-24	Equipment Serial Number		F452	
Section File	DBA-25	Section, Equipment Serial Number		F452	
Dallas Police Department Control Number (Shotguns)	DBA-26	Brand Name, Equipment Serial Number		F452	
Gun Inventory File (Shotguns)	DBA-27	Equipment Serial Number		Punch Card	
Director's General File	DBA-28	Date, Name (Employee)		Misc.	
Director's Contract File	DBA-29	Name (Material)		Contract	
Property Supervisors File	DBA-30	Date		Misc. Adm. Papers	

TABLE 4.5.1-1. MANUAL FILES OF THE DALLAS POLICE DEPARTMENT (CON'T)

Name of File	File ID Code	Keyword Attribute	Accesses/ Month	Contains (Form No)	Add or Delete/ Month
Section Inventory	DBA-31	Section		Misc. Papers	
Civilian Issue	DBA-32	Name (Employee)		F440, Misc.	
Yellow Pound Ticket Hold File	DBB-01	Number (Pound)		F31	
Yellow Pound Ticket Letter File	DBB-02	Make of Vehicle, Number (Pound)		F31	
Vehicle Identification Number (Motor Card File)	DBB-03	Number (Vehicle Identification)		3 x 5 Card	360
Return Envelope/ Signed Receipt	DBB-04	Name (Owner/ Lienholder)		F347	
Hold-Harmless File (Repossessed Release)	DBB-05	Date		F348	
City Wrecker Log	DBB-06	Date of Activity		F352	
Daily Contract Wrecker Log	DBB-07	Date of Activity		F76	
Pound Ticket File (White)	DBB-08	Number (Pound)		F31	3000

TABLE 4.5.1-1. MANUAL FILES OF THE DALLAS POLICE DEPARTMENT (CON'T)

Name of File	File ID Code	Keyword Attribute	Accesses/ Month	Contains (Form No)	Add or Delete/ Month
Pound Ticket File (Manila)	DBB-09	Make, Date		F31, F457	3000
Property Invoice File (Removed from Vehicle)	DBB-10	Number (Invoice)		F336	80
Cash Receipt File	DBB-11	Number (Receipt)		F337, F339, F119	1750
Daily Automobile Pound Report File (Auditing)	DBB-12	Date		F351	
Daily Cash Report File (Auditing)	DBB-13	Date		F342	
Parking Ticket Report File	DBB-14	Date		F340	30
Keycase File	DBB-15	Number (Pound Ticket)		F453	1200
Bicycle Pound Ticket	DBB-16	Number (Pound Ticket)			

TABLE 4.5.1-1. MANUAL FILES OF THE DALLAS POLICE DEPARTMENT (CON'T)

Name of File	File ID Code	Keyword Attribute	Accesses/ Month	Contains (Form No)	Add or Delete/ Month
Payroll Record File	DCA-01	Number (Dallas Police Department Personnel)	7000	F78, F62, F281, F283, F284, F285, F286, F287, F288, F289, F290, F292, F293	
Metro Fund File	DCA-02	Date of Request		Memo Request	
Travel Revolving Account	DCA-03	Date of Request, Department		Memo Request	
Petty Cash	DCA-04	Activity Code		Memo Request	
Budget Analysis	DCB-01	Division, Date		Budget Memos	
Purchasing	DCC-01	Section, Number (Purchase Order)		Memos, Invoice, Purch. Orders	

TABLE 4.5.1-1. MANUAL FILES OF THE DALLAS POLICE DEPARTMENT (CON'T)

Name of File	File ID Code	Keyword Attribute	Accesses/ Month	Contains (Form No)	Add or Delete/ Month
External Funding Administration	DCD-01	Name (Grant Agency)			
Service Center Log Book	DDA-01	Date			
Section Personnel File	DDA-02	Number (Dallas Police Department)		F139	
Operationsl Files	DDA-03	Date			
Pamphlet Material Files	DDA-04	Subject			
Information Development File	DDA-05	Date		F140	
Beat Committee Activity File	DDA-06	Location (Beat)		F136	
Project File	DDB-01	Name (Project)			
Alcohol Commitment File	DDC-01	Name (Patient)		F132	20
Judgement Agreement File	DDC-02	Name (Person Under Judgement)		F131	30
Casework Log	DDC-03	Type of Case			

TABLE 4.5.1-1. MANUAL FILES OF THE DALLAS POLICE DEPARTMENT (CON'T)

Name of File	File ID Code	Keyword Attribute	Accesses/ Month	Contains (Form No)	Add or Delete/ Month
Casework Files	DDC-04	Name (Victim/ Offender)		F134, F135	40
Request for Tour	DDD-01	Date		F122	8
Press Release File	DDD-02	Date of Issue			479
Police News File	DDD-03	Date of Issue			
Police Report Film Short File	DDD-04	Subject			
Press Pass File	DDD-05	Number (Pass)			9
Procedure Files	DEA-01	Division			
Directive Files	DEA-02	Subject of Directive			
Administrative File	DEA-03	Subject			
Inspection Files	DEB-01				
Notification Files	DEB-02	Section Inspected			
Monthly Activity Report	DEB-03	Section Inspected			
Delinquent Report File	DEB-04	Number (Service), Date			

TABLE 4.5.1-1. MANUAL FILES OF THE DALLAS POLICE DEPARTMENT (CON'T)

Name of File	File ID Code	Keyword Attribute	Accesses/ Month	Contains (Form No)	Add or Delete/ Month
Service Evaluation File	DEB-05	Beat			
Safety Record Card File	DED-01	Number (Dallas Police Department ID), Name (Employee)		F424	
Safety Involvement Record Card	DED-02	Name (Supervisor)		F412	
Research Files	DED-03	Subject			
Monthly Industrial Injury Report	DED-04	Date (Month)	1	F415	
National Fleet Safety Contest Report	DED-05	Date (Month)		F421	
Verification Report File	DED-06	Date (Month)			
Active Prisoner File (Booking Card)	DF-01	Name (Prisoner), Charge (City, Investigative, Trustee)		F477, F478	6400
Court List	DF-02	Date			
Jail Check List	DF-03	Date			

TABLE 4.5.1-1. MANUAL FILES OF THE DALLAS POLICE DEPARTMENT (CON'T)

Name of File	File ID Code	Keyword Attribute	Accesses/ Month	Contains (Form No)	Add or Delete/ Month
Jail Audit File	**DF-04**	**Date**			
Prisoner Ready for Transfer	**DF-05**	**Name (Prisoner)**			
Trustee List	**DF-06**	**Date**			
Prisoner Property File	**DF-07**	**Name (Prisoner)**			**6400**
Prisoner Activity Report File	**DF-08**	**Name (Prisoner)**		**F13, F11, F10, F112, F12, F30, F43, F54, F37**	**6400**
Arrest Report	**DF-09**	**Name (Prisoner), Type of Case**		**F4**	
Daily Jail Statistics File	**DF-10**	**Date**		**F116**	

TABLE 4.5.1-1. MANUAL FILES OF THE DALLAS POLICE DEPARTMENT (CON'T)

Name of File	File ID Code	Keyword Attribute	Accesses/ Month	Contains (Form No)	Add or Delete/ Month
				F62, F63, F65, F66, F70, F262, F263, F265, F267, F269, F270, F96, F192, F257, F260, F261	
Personnel Jacket	**EA-01**	**Number (Badge), Type of Personal Data**			
Educational Jacket File	**EB-01**	**Number (Badge)**		**F63, F324, F326, F327, F328, F335, F330, F334**	

a a a mm

- mm: Sequential section file number (01 to 99)
- a: Alpha denoting section within the division
- a: Alpha denoting division within the bureau
- a: Alpha denoting bureau within the department

Intelligence Division (AB)

The Intelligence Division maintains a comprehensive file system containing information about all facets of crime in Dallas. The Intelligence Division files are maintained as a rather complicated logical structure due to interrelation and correlation of the data elements. Notice that both index data sets and report data sets are maintained. In most cases, subsets of each set type are maintained so as to facilitate access by the user. Files with ID codes ABA-01 - ABF-06 are maintained by this department.

Entries of new data into the system are catalogued in a logbook by subject and category. This logbook serves as a master file directory. Index data sets currently maintained are: a name index which contains entries for both persons and businesses, a location index, a vehicle license index, and a telephone number index. Two subsets of the name data set are ordered on ID number. They may be regarded as indices to the name data set. The report data set is subdivided into Narrative Reports, Offense/Incident Reports, Arrest Reports, and Accident Reports. The network type structure of Figure 4.5.1-12 represents the organization of the Intelligence Division files.

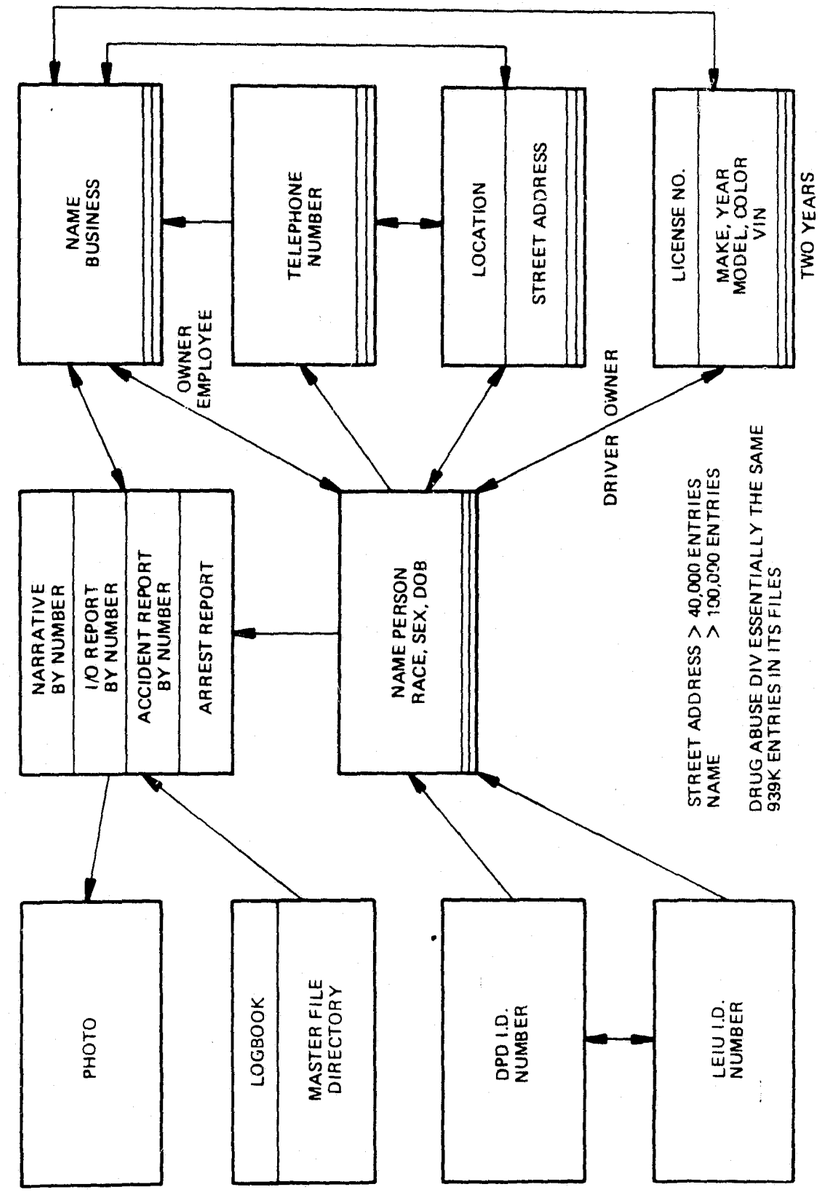


FIGURE 4.5.1-12. INTELLIGENCE DIVISION FILE STRUCTURE

Internal Affairs Division (AC)

The files maintained by the Internal Affairs Division contain information pertaining to complaints against Police Officers. Due to the limited size, confidential nature and restricted access to these files, their automation at this time does not seem warranted.

Patrol Bureau (B)

The Patrol Bureau maintains administrative and statistical files on Dallas Police Department sworn personnel. These files will not be considered for automation at this time.

Criminal Investigation Division (CA)

CID is organized into three sections: Crimes Against Persons, Crimes Against Property, and General Assignments. The files maintained by CID have file ID numbers CAC-01 through CAE-98. The files maintained are similar in content to files maintained by the Reports Section. They are maintained in CID to ease access by the investigators. The files residing in each section reflect the differences in their areas of interest, however, there are many similarities. The Report Data Sets contain Offense/Incident Reports and their supplements, Arrest Reports, Prosecution Reports, Criminal Case Histories, and Property Invoices. These reports are ordered by service number, arrest number, or property invoice number. In some cases subsets of these reports are refiled in different order sequences. For example, murder reports are filed alphabetically on victim's name by date. This type of filing eases access to information but creates massive files which are difficult to update.

Various index data sets are maintained to aid the investigators in their researches. As with other divisions, the name data set is quite extensive. Subsets of the set name are discussed in Section 4.5.1.3 which deals with the redundancy analysis performed on Dallas Police Department forms and on-line files. A location index is organized

alphabetically by street name and by year; pointers are maintained to events, persons, and businesses. A unique type of file maintained by CID is based on types of offenses (Modus Operandi). These files can be used to indicate criminals who operate with a set pattern. Property indices are actually a separate system which has a very close interface with CID. Figure 4.5.1-13 is a diagram of this file structure. Notice that M.O. indices are shown in two parts: one for Crimes Against Property; one for Crimes Against Persons. The Property Index is divided into General Property, Weapons, and Vehicles. This reflects the view of property from CID's standpoint; it does not necessarily represent the Property Division's view of property files.

Special Operations Division (CB)

The Special Operations Division is organized into three main sections: Special Details, Tactical Section, and Alcohol and License Section. The files maintained by this Division have file ID codes CBB-01 through CBD-37. As can be seen by file ID code sections CBB and CBC, the files maintained by Special Details and Tactical Sections are rather limited. The files maintained by the Alcohol and License Section under file ID code CBD appear at first glance to be rather voluminous. Their structure, however, is rather simple. The Alcohol and License Section is concerned with the regulation of Billiard Halls and Public Dance-Halls. The data sets concerned with this process are subdivided into very small subsets, each of which is ordered by the same rule. Files CBD-20 through CBD-35 are all ordered alphabetically by location name; these files are a report data set. Indices to this report data set are: a name index, a street index, and a picture index. Other files maintained by the Section include a Location Jacket File of businesses licensed to sell alcohol and an index to it, Location Sheet Index (Name Index), a Property Invoice File, and a Pornographic Movie House File. Figure 4.5.1-14 is a

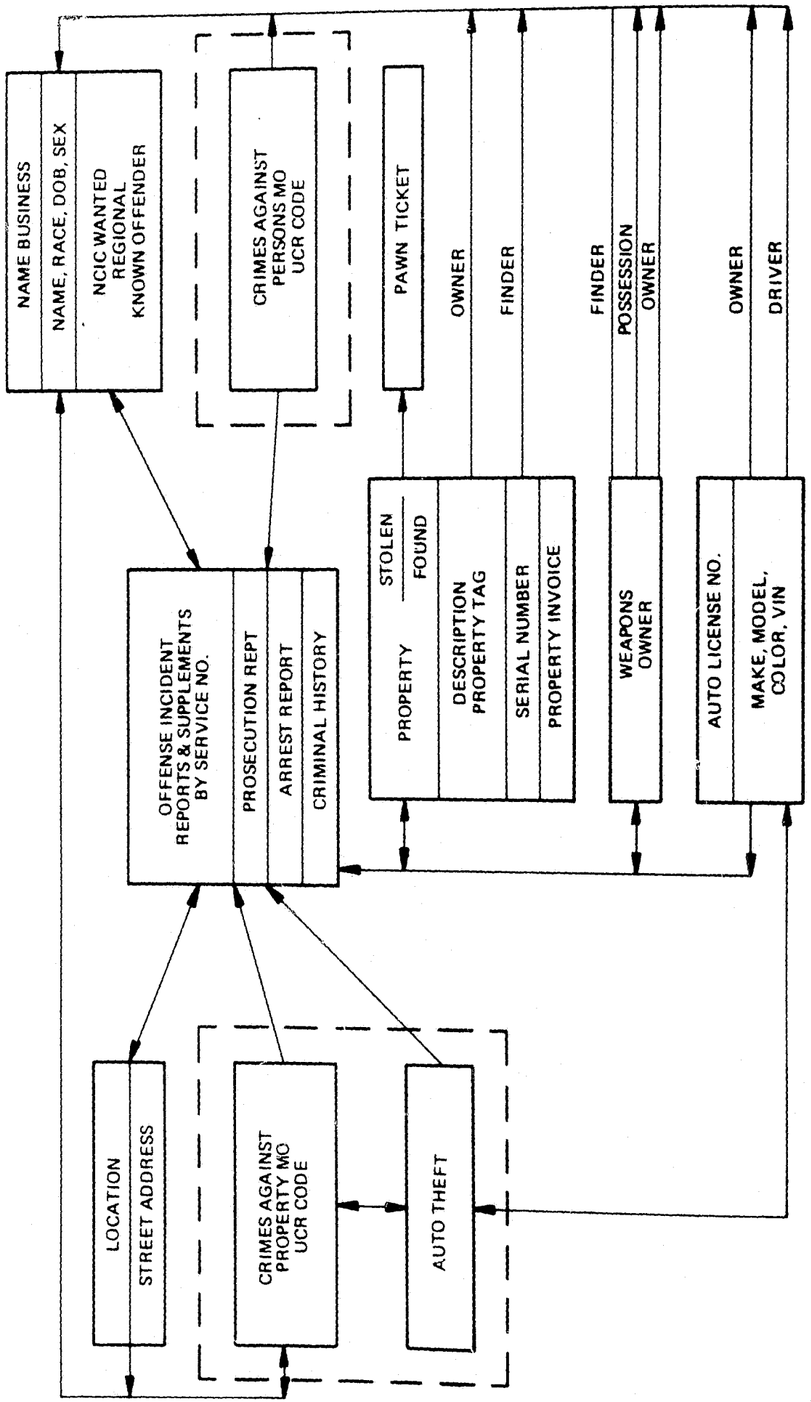


FIGURE 4.5.1–13. CID FILE STRUCTURE

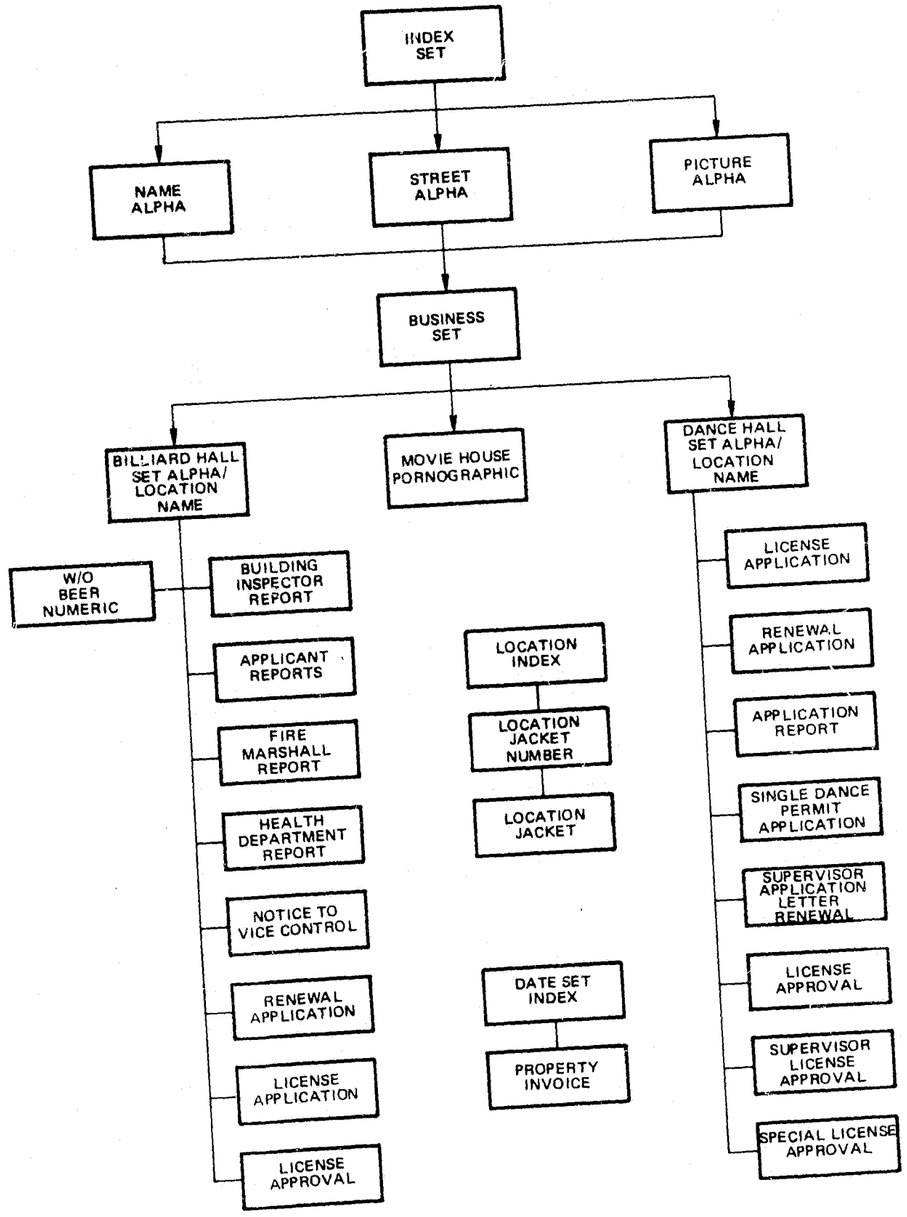


FIGURE 4.5.1–14. ALCOHOL AND LICENSE SECTION FILE STRUCTURE

diagram of this file system based on the data sets contained in the files. Notice that the structural diagram suggests an alternate solution to the file structure. As currently implemented, the structure results in twenty-four files. However, it is possible to implement this same structure as nine files. This is an example of the simplification which can be brought about by a method for easily describing file structure.

Traffic Division (CC)

The files maintained by the Traffic Division, with file ID codes CCA-01 through CCA-17, reflect the mission of this division. The files are of relatively low bulk due to short retention time of data items. The files are organized as a series of stand-alone sequential data sets with little integration between the sets. Records may be located by a person's name, a date, a service number, a citation number or by accident type depending upon the file searched. Much of the information which is contained in these files will be captured as part of the data base. It is reasonable to expect these files to become even smaller in the future.

Youth Division (CE)

The Youth Division keeps records on all criminal activity where the perpetrator of the acts is found to be under age. The Division is organized around three operational units, Youth Development Section, Operations Section I, and Operations Section II. The operational files maintained by this unit have file ID codes CEA-01 through CEA-08. The Juvenile Arrest Record serves as an index to the Juvenile Arrest Report (Juvenile ID Jacket). The other files maintained are not greatly integrated and therefore have a very uncomplicated structure.

Drug Abuse Division (CF)

See Intelligence Division

The Intelligence Files were copied from Drug Abuse Division after the 29 March 1972 reorganization. Hence they are very similar

in format and content. Some changes may have occurred in the period 29 March 1972 to the present. Drug Abuse Files have ID codes CFB-01 through CFB-09.

Technical Services Division (DA)

This discussion will deal with all units of the Technical Services Division except the Data Processing section which will be discussed in a later section. The Technical Services Division includes Reports Section and ID Section. Between them, these two units maintain the primary repository for information used by the Dallas Police Department. The files maintained for the department have file ID codes DAB-01 through DAE-08. Indices for some of these files are maintained on-line in the City Data Services computer. For this reason, portions of the system may be considered a hybrid of manual and automated functions. The on-line indices include person's name index, type of occurrence index, a location (beat and address) index, and by implication date of occurrence. Date of occurrence is considered implicit as a group of service numbers assigned on or about any given date will be returned. The report data set is made up of Accident Reports, Offense/Incident Reports, and Arrest Reports filed in numerical sequence. The on-line indices form an inverted index to this report data set. Criminal Case Histories (ID Jackets) are maintained in file DAC-05 on approximately 200,000 persons. The Name Index File (DAC-01) and Arrest Index File (DAC-02) serve as indices to the Criminal ID Jacket Files. The Arrest Index will also indicate the Arrest Report number so that a particular report may be found in file DAC-03 and fingerprint classification so that a Fingerprint Card may be located in file DAC-11. As records become outdated, they are placed on microfilm; Table 4.5.1-2 is a list of records on microfilm.

A comparison of the Files listed in Table 4.5.1-2 shows that in most cases the same documents (data sets) are filed under more

TABLE 4.5.1-2 MICROFILM FILE (DAC 19)

The following is a recent list of all available records on microfilm:

Accidents	1943 thru 1945	14 rolls	Alpha by year
Accidents	1945 thru 1968	301 rolls	Numerical by year
Accidents (individual)	1950 thru 1968	16 rolls	By date
Accident Charge Account	1966 thru 1967	7 rolls	Alpha by Company's name by year
Accident Index Cards	1943 thru 1968	81 rolls	Alpha by location by year
Accident Index Cards	1970	1 roll	Alpha by location
Accident Index Cards	1943 thru 1968	84 rolls	Alpha by name by year
Bulletins	1970	2 rolls	Alpha by name
Case Reports	thru 1967	7 rolls	By date
Details	1933 thru 1971	72 rolls	Alpha by year
Dispositions	thru 1971	76 rolls	By date
Dispositions	1931 thru 1945	138 rolls	Alpha by year
Dispatch Sheets	1946 thru 1970	221 rolls	Numerical by year
Gun Cards	1963 thru May 1968	108 rolls	By date
Gun Cards	1957 thru 1966	4 rolls	Alpha
Gun Cards	1957 thru 1966	7 rolls	Numerical by Master card number
Gun Cards	1957 thru 1966	2 rolls	Numerical by Serial number
Impound Tickets	1963 thru 1968	2 rolls	By make and caliber of gun
Information Sheets	1956 thru 1968	120 rolls	Numerical
Mark Outs	1965 thru May 1968	50 rolls	Numerical by year
Murder Files	1962 thru 1969	109 rolls	By date
Murder Files	1962 thru 1969	9 rolls	Alpha
Offenses	1933 thru 1944	8 rolls	Alpha by year
Offenses	1945 thru 1970	47 rolls	Alpha by year
Offense Index Cards	1943 thru 1968	891 rolls	Numerical by year
		98 rolls	Alpha by location by year

TABLE 4.5.1-2 MICROFILM FILE (DAC 19) (CON'T)

Offenses Index Cards	1943 thru 1968	95 rolls	Alpha by name by year
Offenses OT's	1949 thru 1968	28 rolls	Numerical by year
Onion Skins	1961 thru 1966	28 rolls	Numerical by year
Prisioner Activity Report	1969 thru 1971	32 rolls	Alpha by year
Property Cards	1947 thru 1968	355 rolls	Alpha by year
Property Invoices	thru 1968	15 rolls	Numerical by Invoice number
Radio Calls	1958 thru 1968	535 rolls	Alpha by location by year
Traffic Fatilities	1958 thru 1968	10 rolls	Numerical by Fatility number
Traffic Tickets	1943 thru 1970	483 rolls	Alpha by year
Work sheets	1939 thru 1948	52 rolls	Alpha by year
Work sheets	1949 thru 1971	699 rolls	Numerical by year

than one sort sequence (order rule). In each case each data set is organized as if the other like sets did not exist. This redundancy makes the files hard to use, as little correlation of people and events for cross reference purposes exists.

Property Division (DB)

The Property Division is organized into two subdivisions, the Property Section and the Automobile Pound. The Property Section functions to receive, invoice, and store all property for which the Dallas Police Department is responsible. The Automobile Pound functions to transport, store and process impounded motor vehicles and bicycles.

The problems which confront the Property Division are those of inventory management rather than law enforcement. Property Division Files (file ID numbers DBA-01 through DBB-48) confirm this observation. The files are organized in invoice number sequence, property tag number sequence, serial number sequence, and alphabetical order on person's name.

The property area of the law enforcement integrated data base will be covered further in Section 4.5.3.

Fiscal Affairs Division (DC)

The Fiscal Affairs Division handles all Dallas Police Department financial transactions and is responsible for budget analysis and control. The Division maintains files on personnel payroll and petty cash disbursements. These functions pertain to the Dallas Police Department accounting system and will therefore be discussed as part of the Business Data Base. See file ID codes DCA-01 through DCD-01 for a listing of Fiscal Affairs Division files.

Community Services Division (DD)

This division attempts to improve the overall relationship of the Dallas Police Department to the citizens of Dallas. The Division

at times uses the files maintained by other bureaus of the Dallas Police Department. The files maintained by the division itself are small and varied. As such they are not readily amenable to automation. For a more detailed discussion of this division see Report Leader I Volume II, Section 6.4.

Inspection Division (DE)

The function of the Inspection Division is to insure the quality of personnel, material resources, and procedures of the Dallas Police Department. The units of this division maintain records of the reports they generate. Due to the diversity of the studies undertaken by the Inspection Division, it is difficult to predict the type of data and statistics they will require in the future. This division's files are therefore not considered for automation at this time. Report Leader I Volume II, Section 6.5, contains a detailed discussion of this division.

Detention Services Division (DF)

The functions of Detention Services is to administrate and operate the jail facilities of the City of Dallas and to assume the responsibility for the prisoners kept therein. Records are kept so as to assure the proper performance of these duties. The operations and records of this division may be grouped into three broad classes:

Booking and Detention of Prisoners

Feeding and Care of Prisoners in Custody

Release of Prisoners and Return of Their Property

These files are shown under file ID codes DF-01 through DF-10. An automated Prisoner Book-in System has recently been brought on-line; further automation does not appear to be profitable at this time.

Redundancy of the Manual Files

The problem of the redundancy of the Manual Files maintained by the Dallas Police Department was studied during Phase I of Operation

LEADER. The findings of this study were presented in the Phase I Report. A summary of these findings will be presented as an indication of the magnitude of the problems involved in maintaining large manual files. Three forms will be used to illustrate the paper explosion which has taken place. They are : Offense/Incident Form, Accident Form, and the Arrest Form.

Each Offense/Incident Form created will be copied at least eight times and may be copied as many as nineteen times. These copies are sent to most of the Bureaus of the Dallas Police Department; in many cases multiple copies are distributed. As each of these copies will be placed in a file, we may say that the redundancy factor for Offense/Incident Forms is at least eight. However, the mean number of copies of the Offense/Incident Form produced is thirteen, and from this a higher redundancy factor can be implied. Four of these copies will go to the Criminal Investigation Division; this implies a redundancy factor of three within the CID files alone.

Accident Reports are reproduced at least five times and in serious cases ten times. Three of the ten copies will be sent to other City Departments; the other seven copies remain within the Dallas Police Department. The redundancy factor for Accident Reports will be at least four.

A similar situation exists for Arrest Reports. Depending on the type of crime a person was arrested for, as many as seven copies may be made by the Reproduction Unit of the Report Section. Copies of the Arrest Form will be sent to Planning and Research, Municipal Court, Arrest/ID, and Intelligence. Four copies of the report will be sent to the Youth Division if a juvenile was involved. A redundancy factor of at least three is indicated for Arrest Reports.

The levels of redundant storage of information do not take into account additional copies of forms which may be made in each

department, nor is the common case of the same information being stored on different forms covered. Figure 4.5.1-15 contains a list of redundant files for various forms.

Form Name	Phase I Form Number	Bureau A	Bureau C	Bureau D
Offense/Incident	F1	ABB-01 ABC-07 ABF-01	CAC-01 CAC-07 CAC-08 CAE-01 CBB-04 CBD-02	DAB-05 DAC-16 DAC-19 DAE-08 DAE-38
Arrest Report	F4	ABB-01 ABC-07 ABF-01	CAC-06 CAD-01 CAE-01 CBD-02 CEA-04	DAC-03 DF-09
Prosecution Report	F35	ABC-07 ABF-01	CAC-13 CAD-04 CAE-54 CBD-02 CFB-09	DAC-05 DAC-06 DAC-19
Property Tag	F25	ABC-07 ABF-01	CAC-04 CAD-31 CAE-55	
Property Invoice	F438		CBD-36	DBA-02 DBA-04 DBA-11 DBA-12 DBA-13 DBA-14 DBA-18
Pound Ticket	F31			DAC-19 DBB-01 DBB-02 DBB-08 DBB-09

FIGURE 4.5.1-15. LOCATION OF FORMS IN MANUAL FILES

4.5.1.3 EXISTING AND PROPOSED ON-LINE FILES

The purpose of the on-line file analysis is to examine Dallas Police Department information which resides, or will reside, in a computer system. This study will address the needs of the user, the problems relevant to the Police Data Processing Section, and the needs of those who generate the information being stored.

Reference will be made to existing and proposed files. The term "existing" is applied to those Dallas Police Department files which are now on-line. The term "proposed" applies to those files which are:

(1) In the process of being designed, or

(2) Will possibly be implemented in the near future.

For discussion purposes, files have been assigned ID code numbers. See Table 4.5.1-2A.

Those on-line files associated with law enforcement activity can generally be separated into operations control, name, property and special categories. See Table 4.5.1-3. The operations control category encompasses:

(1) Recording the information necessary for a call-for-service

(2) Making those calculations necessary for computer-aided dispatch

(3) Providing a historical record of police activities

(4) Providing additional statistics for management information

The on-line files in the name category contain an inventory of facts surrounding the name of persons, businesses, or organizations involved in an incident which is documented by the Dallas Police Department. One additional category of file necessary to mention here is Special. An example of this type of file is the clue file.

TABLE 4.5.1-2A. ON-LINE FILES (EXISTING AND PROPOSED)

File ID Code	File Name	Status
O1	Call	E
O2	Unit Availability	E
O3	Markout	E
O4	Ambulance	E
O5	Street Locator	E
O6	Assigned/Unassigned	E
O7	Offense Statistical Record (OSR)	E
O8	Supplemental Statistical Record (SSR)	E
O9	Accident Statistical Record (ASR)	E
O10	Supplemental Accident Record (SAR)	E
O11	Youth	P
O12	Arrest	P
O13	Wanted Person	E
O14	Traffic Citation	P
O15	Parking Citation	P
O16	Suspect	P
O17	Intelligence	P
O18	Known Offender	E
O19	Exceptional Person	E
O20	Criminal Case History	P
O21	Contact	P
O22	Computer Identification System (CIS)	E
O23	Loss	E
O24	Pawn Ticket	P
O25	Property	P
O26	Stolen Vehicle	E
O27	Stolen Article	E
O28	Evidence	P
O29	Clue	P
O30	Police Personnel	E
E=Existing P=Proposed		

TABLE 4.5.1-3. CATEGORIES OF ON-LINE FILES FOR LAW ENFORCEMENT

Categories	Existing	Proposed
Operations Control	O1-O6	-
Name	O7-O10, O12, O13, O18, O19	O11, O14-O17, O20, O21
Property	O22, O23	O24, O25, O28
Special	O26, O27	O29

The personnel file (designated O30) is a business administration type of file and bears little relation to law enforcement activity. It is the only such on-line file. The remainder of this section will deal exclusively with law enforcement on-line files.

Reduction of redundancy can result from an integrated file structure. Tables 4.5.1-4 to 4.5.1-6 show the level of redundancy for files in each of the categories mentioned.

There also exist record format variations as can be seen from Table 4.5.1-7. The entries in this table are ordered triples of the form (p, q, r), where p is the starting position of the field, q is the length of the field and r denotes the type of field. Thus, r=P implies a packed decimal field, and r=C implies character field.

The keyword attributes of the existing files are presented in Table 4.5.1-8. These attributes are required for searching the files and retrieving data. A large portion of the data is arranged by service number.

Retrieval strategy is based upon the index sequential organization of the data in each file. Present operational procedure is to initiate the execution of a unique application program for each search. The selection of the proper program requires extensive knowledge of the on-line file system. Depending on the type of search to be executed, the user enters the proper information in correct format to the system, and the computer sequentially searches the records and develops a list of selections that may contain the keyword value of the unique record to be retrieved. The user then selects the keyword value from the list and requests execution of another application program. At this point a primary record may be retrieved and be presented to the user. Should additional information on this transaction be necessary the supplemental records may be called up one at a time as needed.

TABLE 4.5.1-4. ON-LINE FILE REDUNDANCY, OPERATIONS CONTROL CATEGORY

Data Element	File Number					
	O1	O2	O3	O4	O5	O6
Name:						
Complainant	1			1		
Location:						
Dispatched To	1	1	1	1		
Beat	1				1	
Reporting Area	1				1	
Numbers:						
Dispatched Element	1	1	1			
Backup Element	1	1				
Service	1	1		1		
Status	1	1				
Signal	1	1	1	1		
Telephone Number of Complainant	1	1		1		
Date:						
Call Received	1	1		1		
Time:						
Call Received	1			1		
Dispatched	1	1				
Code 6	1			1		
Cleared	1	1	1	1		
Comments	1	1	1			
Unused Blanks	1	1	1	1		

TABLE 4.5.1-5. ON-LINE FILE REDUNDANCY, NAME CATEGORY

Data Element	File Number						
	O7	O8	O9	O10	O11	O12	O13
Name:							
Defendant							
Known Offender							
Location:							
Dispatched To	1		1				
Beat	1		1			1	
Reporting Area	1		1			1	
Defendant Residence							
Known Offender							
Residence							
Offense							
Numbers:							
Service	1	1	1	1	1		
UCR Code	1	1			1		
Status	1	1					
Cross Reference	1	1	1	1			
File Key	1	1	1	1			
Crime Code	1	1					1
Operator ID	1	1	1	1			
Arrest					1	1	
DPD ID Number							
FBI Number							
Driver License Number							
Social Security Number							
Date:							
Offense			1	1			
Birth					1	1	
Call Received	1		1				
Time:							
Offense	1	1					
Physical Characteristics:							
Age at Arrest		1			1		
Age at Contact					1	1	
Sex of Arrestee		1				1	
Unused Blanks	1	1		1			1

TABLE 4.5.1-5. ON-LINE FILE REDUNDANCY, NAME CATEGORY (CON'T)

Data Element	File Number							
	O14	O15	O16	O17	O18	O19	O20	O21
Name:								
Defendant	1	1			1		1	
Known Offender					1		1	
Location:								
Dispatched To								
Beat								
Reporting Area								
Defendant Residence	1	1						
Known Offender					1		1	
Residence								
Offense	1	1						
Numbers:								
Service								
UCR Code			1				1	
Status								
Cross Reference								
File Key								
Crime Code								
Operator ID								
Arrest								
DPD ID Number			1		1			1
FBI Number			1		1			1
Driver License Number	1		1		1			1
Social Security Number			1		1			1
Date:								
Offense	1	1						
Birth			1		1			1
Call Received								
Time:								
Offense								
Physical Characteristics:								
Age at Arrest								
Age at Contact								
Sex of Arrestee								
Unused Blanks								

TABLE 4.5.1-6. ON-LINE FILE REDUNDANCY, PROPERTY CATEGORY.

Data Element	File Number						
	O22	O23	O24	O25	O26	O27	O28
Name:							
Locating Agency				1	1	1	
Numbers:							
CIS Record	1	1		1		1	
Service		1		1	1	1	
Serial				1			
Model							
Loss File Record							
Date:							
Theft		1					
Recovery		1					

TABLE 4.5.1-7. FORMAT VARIATION OF REDUNDANT DATA ELEMENTS

Data Element	On-Line Files						
	O1	O2	O3	O4	O5	O7	O8
Element Dispatched	132, 3, P	1, 4, C	6, 3, P				
Backup Element	150, 2, P	72, 2, P					
Accident Arrest Code	239, 4, C						
Time:							
Call Received	103, 5, P			60, 3, P			
Dispatched	108, 3, P	52, 3, P					
Code 6	111, 3, P						
Cleared	114, 3, P	55, 3, P		69, 3, P			
Offense	99, 3, P			63, 3, P		103, 3, P	
Date:							
Call Received	120, 4, P	58, 4, P		72, 4, P		91, 4, P	
Offense	124, 4, P					95, 4, P	
Supplement				23, 1, C		140, 4, P	69, 4, C
Birth							
Theft							
Recovery							
Day of Week (Offense)						87, 1, C	39, 1, C
Physical Characteristics: Age at Arrest							
Age (Arrestee)							24, 2, C
Race/Sex (Arrestee)							23, 1, C
Race/Sex (Complainant)	236, 1, C					88, 1, C	
Age (Complainant)	237, 2, C					89, 2, C	
Unused Blanks	247, 5, C	104, 17, C	73, 8, C	123, 8, C		153, 3, C	80, 1, C
Comments	183, 50, C	38, 14, C	53, 20, C				

TABLE 4.5.1-7. FORMAT VARIATION OF REDUNDANT DATA ELEMENTS (CON'T)

Data Element	On-Line Files						
	O1	O2	O3	O4	O5	O7	O8
Names:							
Complainant	53, 35, C			79, -, C		51, 35, C	
Location:							
Dispatched To	10, 34, C	9, 29, C	11, 29, C	15, 34, C		17, 29, C	
Beat	44, 2, P				26, 2, P	46, 2, P	
Reporting Area	46, 3, P				1, 3, P	48, 3, P	
Defendant							
Known Offender							
Offense							
Numbers:							
Service	1, 8, C	91, 4, P		119, 4, P		9, 8, C	10, 8, C
Status	9, 1, C	90, 1, C				114, 1, C	9, 1, C
Telephone (Dispatched To)	88, 7, C	38, 7, C		44, 7, C			
Signal (Dispatched To)	49, 2, C	5, 2, C	9, 2, C	11, 2, C			
UCR	154, 5, C					109, 5, C	18, 5, P
Cross Reference Number	164, 4, P					115, 4, P	73, 4, P
File Key						1, 7, C	1, 7, C
Crime						8, 1, C	8, 1, C
Property Attacked						127, 3, C	27, 3, C
Property Class						130, 1, C	30, 1, C
Operator ID	180, 3, C					124, 3, C	77, 3, C
Investigating Officer ID						119, 4, C	
Arrest							
CIS Alpha Prefix							
CIS Numerical Suffix							
DPD ID Number							
Reporting Officer ID							65, 4, C

TABLE 4.5.1-7. FORMAT VARIATION OF REDUNDANT DATA ELEMENTS (CON'T)

Data Element	On-Line Files						
	O9	O10	O11	O12	O13	O22	O23
Element Dispatched							
Backup Element							
Accident Arrest Code		65, 4, C					
Time:							
Call Received	58, 3, P						
Dispatched							
Code 6							
Cleared							
Offense							
Date:							
Call Received	54, 4, P						
Offense							
Supplement			40, 6, C	113, 4, P			
Birth							
Theft							
Recovery							
Day of Week (Offense)							
Physical Characteristics:							
Age at Arrest			117, 2, C	111, 2, C			
Age (Arrestee)							
Race/Sex (Arrestee)				109, 2, C			
Race/Sex (Complainant)							
Age (Complainant)					56, 25, C		
Unused Blanks		105, 21, C					
Comments							

TABLE 4.5.1-7. FORMAT VARIATION OF REDUNDANT DATA ELEMENTS (CON'T)

Data Element	On-Line Files						
	O9	O10	O11	O12	O13	O22	O23
Names: Complainant							
Location: Dispatched To	16, 29, C						
Beat	45, 2, P			222, 2, P			
Reporting Area	47, 3, P			224, 3, P			
Defendant							
Known Offender							
Offense							
Numbers: Service	8, 8, C	8, 8, C	95, 8, C			5, 8, C	
Status							
Telephone (Dispatched To)							
Signal (Dispatched To)							
UCR			128, 10, C				88, 3, P
Cross Reference Number	153, 4, P	90, 4, P					
File Key	1, 7, C	1, 7, C	1, 6, C		52, 4, P		1, 4, P
Crime							
Property Attacked							
Property Class							
Operator ID	67, 3, C	94, 3, C					
Investigating Officer ID			123, 5, C				
Arrest			103, 8, C	1, 5, P			
CIS Alpha Prefix						1, 2, C	96, 2, C
CIS Numerical Suffix						3, 4, P	98, 4, P
DPD ID Number				304, 7, C	40, 9, C		
Reporting Officer ID	63, 4, C						

TABLE 4.5.1-8. KEYWORD ATTRIBUTE LIST FOR EXISTING ON-LINE FILES

Keyword Attributes	Files
Service Number	Call, Ambulance, OSR, SSR, ASR, SAR
Dallas Police Department ID Number	Youth
C.I.S. Number	C.I.S. Loss
Arrest Number	Active Arrest Record

The search method just discussed has a serious drawback in that it requires considerable format knowledge on the part of the operator. Tables 4.5.1-9 and 4.5.1-10 contain a list of data sources and users of the on-line file system. It would seem more efficient to allow for easier terminal operation because of the relatively large user population.

Increased use of the computer by the Dallas Police Department will be a major factor in crime-solving. Under the present method of organization it can be seen that the number of files and the amount of storage space required to support this increased use will be ever growing. An estimate of the direct access storage space is shown in Table 4.5.1-11. Where possible, the storage space requirement for proposed files is estimated. The functional type file organization with little or no interrelation of data will quickly generate an inefficient system both from the standpoint of speed and storage requirement.

Utilization of Current Disk Storage

An analysis was performed to determine the utilization of disk storage. Currently Dallas Police Department files maintained on disks contain fixed-length records. There may be fields within the record which are not used. When this occurs, the field in the disk storage space remains filled with blanks. If this occurs frequently, disk storage is improperly utilized and consideration should be given to alternate file structures. The degree of utilization which can be achieved is a direct function of the data processing system and the user demands made upon it. Utilization of disk storage space is seldom 100 percent. However, it should be held to a maximum.

A sample of records was taken from the Call File, Offense Statistical File, and the Accident Statistical File. A PL/1 computer program was written to scan each record and sum the number of unused fields. A field was considered used if it contained any non-blank

TABLE 4.5.1-9. DATA SOURCES FOR EXISTING AND PROPOSED AUTOMATED FILES

File Name	File Code	Bureau A	Bureau B	Bureau C	Bureau D	Misc.
Call	O1				DAB, DAD	
Unit Availability	O2				DAD	
Markout	O3				DAD	
Ambulance	O4				DAD	
Street Locator	O5				DAA	
Assigned/Unassigned	O6				Internal Record Only	
Offense Statistical Record (OSR)	O7		BC	CAC, CAD, CAE	DAB	
Supplemental Statistical Record (SSR)	O8				DAB	
Accident Statistical Record (ASR)	O9				DAB	
Supplemental Accident Record (SSR)	O10				DAB	

TABLE 4.5.1-9. DATA SOURCES FOR EXISTING AND PROPOSED AUTOMATED FILES (CON'T)

File Name	File Code	Bureau A	Bureau B	Bureau C	Bureau D	Misc.
Youth	O11		BA, BB, BC, BD, BE, BF	CE		
Arrest	O12			CC, CE	DAC, DF	
Wanted Persons	O13				DAB	Other Agencies
Traffic Citation	O14					City Data Services
Parking Citation	O15					City Data Services
Suspect	O16 *				DAB	Internally from Other Files
Intelligence	O17	ACB				Other Agencies
Known Offender	O18	ABD			DAA	Other Agencies

* Under Test

TABLE 4.5.1-9. DATA SOURCES FOR EXISTING AND PROPOSED AUTOMATED FILES (CON'T)

File Name	File Code	Bureau A	Bureau B	Bureau C	Bureau D	Misc.
Exceptional Person	O19				DAA, DAB	Other Agencies
Criminal Case History	O20				DAC	Other Agencies
Contact	O21				DAB	
Computer Identification System (CIS)	O22				DAA, DAB	Other Agencies
Loss	O23				DAB	Other Agencies
Pawn Ticket	O24			CA		
Property	O25				DACB, DBA, DBB	
Stolen Vehicle	O26				DAB	Other Agencies
Stolen Article	O27				DAB	Other Agencies

TABLE 4.5.1-9. DATA SOURCES FOR EXISTING AND PROPOSED AUTOMATED FILES (CON'T)

File Name	File Code	Bureau A	Bureau B	Bureau C	Bureau D	Misc.
Evidence	O28 *				DAB, DACB	Forensic Labs
Clue	O29					Internally from Other Files
Police Personnel	O30				DAA, DAB	

* Under Test

TABLE 4.5.1-10. USER POPULATION FOR EXISTING AND PROJECTED AUTOMATED FILES

File Name	File Code	Bureau A	Bureau B	Bureau C	Bureau D	
Call	O1	ABD, AC,	BA, BB, BC, BD, BE, BF.	CA, CC, CE, CF	DAA, DAB, DAC, DACB, DAD, DAE, DE, DF	EB
Unit Availability	O2	AB, AC	BA, BB, BC, BD, BE, BF		DAA, DAD, DAE, DE	
Markout	O3	AB, AG	BA, BB, BC, BD, BE, BF		DAA, DAD, DAE, DE	
Ambulance	O4	AB, AC	BA, BB, BG, BD, BE, BF		DAA, DAD, DAE, DE	
Street Locator	O5	AB, AC	BA, BB, BC, BD, BE, BF		DAA, DAD, DAE, DE	
Assign/Unassign	O6	AB, AC	BA, BB, BC BD, BE, BF		DAA, DAD, DAE, DB, DE	
Offense Statistical Record	O7	AB, AC		CA, CB, CC, CE, CF	DAA, DAB, DAE, DB, DE, DF	
Supplemental Statistical Record	O8	AB, AC		CA, CB, CC, CE, CF	DAA, DAB, DAE, DB, DE, DF	
Accident Statistical Record	O9	AB, AC	BA, BB, BC, BD, BE, BF	CA, CC, CF	DAA, DAB, DAE, DE	
Supplemental Accident Record	O10	AB, AC	BA, BB, BC, BD, BE, BF	CA, CC, CF	DAA, DAB, DAE, DE	

TABLE 4.5.1-10. USER POPULATION FOR EXISTING AND PROJECTED AUTOMATED FILES (CON'T)

File Name	File Code	Bureau A	Bureau B	Bureau C	Bureau D	Misc.
Youth	O11	AB, AC	BA, BB, BC, BD, BE, BF	CA, CC, CE, CF	DAA, DAE, DE	
Arrest	O12	AB, AC	BA, BB, BC, BD, BE, BF	CA, CB, CC, CE, CF	DAA, DACB, DAE, DF, DE,	Other Agencies
Wanted Person	O13	AB, AC		CA, CE	DAA, DAE, DE, DF	Other Agencies
Traffic Citation	O14	AB, AC	BA, BB, BC, BD, BE, BF	CA, CC, CF	DAA, DAE, DE	
Parking Citation	O15	AB, AC	BA, BB, BC, BD, BE, BF	CA, CC, CF	DAA, DAB, DAE, DE	
Suspect	O16	AB, AC		CA, CB, CC CF	DAA, DACB, DAE, DE, DF	
Intelligence	O17	AB, AC		CA, CF	DAA, DAE, DE, DF	Other Agencies
Known Offender	O18			CA, CF	DAA, DAE, DE, DF	Other Agencies
Exceptional Persons	O19	AB, AC	BA, BB, BC, BD, BE, BF	CA, CC, CF	DAA, DAE, DE, DF	Other
Criminal Case History	O20	AB, AC		CA, CF	DAA, DAC, DAE, DE	Other Agencies
Contact	O21	AB, AC	BA, BB, BC BD, BE, BF	CA, CC	DAA, DACB, DAE, DE, DF	Other Agencies
Computer Identification	O22	AB, AC		CA, CF	DAA, DAB, DAE, DE	Other Agencies

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TABLE 4.5.1-10. USER POPULATION FOR EXISTING AND PROJECTED AUTOMATED FILES (CON'T)

File Name	File Code	Bureau A	Bureau B	Bureau C	Bureau D	Misc.
Loss	O23	AB, AC		CA, CF	DAA, DAB, DAE, DE	
Pawn Ticket	O24	AB, AC	BA, BB, BC, BD, BE, BF	CA, CC, CF	DAA, DAB, DAE, DE	
Property	O25	AB, AC	BA, BB, BC, BD, BE, BF	CA, CC, CE, CF	DAA, DACB, DAE, DB, DE	
Stolen Vehicle	O26	AB, AC	BA, BB, BC BD, BE, BF	CA, CC, CF	DAA, DACB DAE, DE, DF	Other Agencies
Stolen Article	O27	AB, AC	BA, BB, BC, BD, BE, BF	CA, CC, CF	DAA, DACB, DAE, DE, DF	Other Agencies
Evidence	O28	AB, AC		CA, CB, CC, CE, CF	DAA, DACB, DAE, DB, DE, DF	Other Agencies
Clue	O29	AB, AC		CA, CB, CC, CE, CF	DAA, DACB, DAE, DE, DF	
Police Personnel	O30				DAA, DAB	

TABLE 4.5.1-11. POLICE ON-LINE DISK STORAGE REQUIREMENTS

File ID	File Name	Estimated No. Records	Record Length In Bytes	Space (Tracks)
A. Operations Control				
O1	Call	90,000	300	4060
O2	Unit Avail.	60,000	120	161
O3	Markout	60,000	80	721
O4	Ambulance	24,650	130	481
O5	Street Locator (Non-Intersection)	31,000	34	210
O6	Intersection Locator	38,200	42	241
B. Name				
O7	Offense Statistical Record	73,000	155	1703
O8	Offense Cross Reference			101
	Offense Statistical Supplement Record	100,000	80	1203
	Offense Supplement Cross Reference			41
O9	Accident Statistical Record	12,980	175	341
O10	Accident Statistical Supplement Record	12,800	125	241
O11	Youth			
O12	Arrest	1,800	368	100
O13	Wanted Person	15,000	900	2,030
	Wanted Person Index	168,500	80	2,023
O14	Traffic Citation			1,197
O15	Parking Citation	150,000	175	3,950
O16	Suspect	25,000	152	57
O17	Intelligence	1,100	246	41
O18	Known Offender		168	202
O19	Exceptional Person	1,650	168	41
O20	Criminal Case History	600	220	20
O21	Contact	8,500	244	31

TABLE 4.5.1-11. POLICE ON-LINE DISK STORAGE REQUIREMENTS (CON'T).

File ID	File Name	Estimated No. Records	Record Length In Bytes	Space (Tracks)
C. Property				
O22	Computer Identification System (C. I. S.)	11,700	120	2,156
O23	C. I. S. Loss File	6,550	120	122
O24	Pawn Ticket	53,000	248	1,975
O25	Property	150,000	250	5,625
O26	Stolen Vehicle Index	15,000	240	536
O27	Stolen Article Index	3,500	100	530
O28	Evidence	32,000	250	1,200
D. Other				
O29	Clue	5,000	250	190
O30	Police Personnel	3,500	160	841
O31	Originating Case, Agency File			200

characters.

The sample taken from the Call File consisted of 28, 856 records, all of which were created during November, 1972. See Table 4.5.1-12 for the results of the Call File analysis.

The sample taken from the Offense Statistical File consisted of 3, 000 records. These records were created during June, 1972. See Table 4.5.1-13 for the results of the Offense Statistical File analysis.

The sample taken from the Accident Statistical File consisted of 10, 000 records. These records were created during November, 1972. See Table 4.5.1-14 for the results of the Accident Statistical File analysis.

In the above tables, C in Column III denotes a character field, while P denotes a packed decimal field. Due to time available file utilization data was collected for only three files.

TABLE 4.5.1-12. CALL FILE UTILIZATION

Total Records Surveyed 28, 856

Record Length x 300

Total Bytes of Storage 8, 656, 800

I Field Number	II Description	III Field Length	IV Times Blank	V Total Blank Bytes
1	Service Number	C-8	0	0
2	Status	C-1	12274	12274
3	Street Name or Second Street of Intersection	C-14	2	28
4	Street Direction	C-1	22432	22432
5	Block or First Street of	C-14	1	14
6	Apartment Number	C-5	26032	130160
7	Beat	P-2	1	2
8	Report Area Number	P-3	10	30
9	Signal 1	C-2	1	2
10	Signal 2	C-2	25224	50448
11	Complainant	C-35	13	455
12	Telephone Number	C-7	12058	84460
13	Telephone Extension	C-4	28047	112188
14	Time of Offense One	P-3	272	816
15	Time of Offense Two	P-3	24366	73098
16	Time Call Received	P-3	1	3
17	Time Call Dispatched	P-3	908	2724
18	Time Call Code 6	P-3	14491	43473
19	Time Call Cleared	P-3	9	27
20	Time Report Received	P-3	272	816
21	Date Call Originated	P-4	1	4
22	Date of Offense 1	P-4	272	1088
23	Date of Offense 2	P-4	26875	107500
24	Element 1	P-3	908	2721
25	Element 2	P-3	23331	69993
26	Element 3	P-3	28117	84351
27	Element 4	P-3	28747	86241
28	Element 5	P-3	28837	86511
29	Element 6	P-3	28851	86553
30	Blanks	4	28856	115424
31	UCR Code Number	C-5	20702	103510

TABLE 4.5.1-12 CALL FILE UTILIZATION (CON'T)

I Field Number	II Description	III Field Length	IV Times Blank	V Total Blank Bytes
32	Community Radio Watch	P-5	28637	143185
33	Cross Reference Offense	P-4	20702	82808
34	Cross Reference Original	P-4	0	0
35	Cross Reference Before	P-4	0	0
36	Cross Reference After	P-4	0	0
37	Operator's ID	C-3	76	228
38	Comments	C-50	4603	230150
39	Staff Review Operator	C-3	272	816
40	Complainant Race/Sex	C-1	19028	19028
41	Complainant Age	C-2	19484	38968
42	Accident Cross Reference Number	P-4	25014	100056
43	Accident Code	C-4	25014	100056
44	Staff Review Operator ID	C-3	28856	86568
45	Watch	C-1	11220	11220
46	Backup Element 1	P-3	3545	10635
47	Backup Element 2	P-3	3545	10635
48	Property Attached	C-3	7217	21651
49	Blanks	41	28856	1,183,096
	Total			3,315,446

3,315,446/8,656,800 * 100= 38.29% of the reserved disc storage is not utilized

TABLE 4.5.1-13. OFFENSE STATISTICAL FILE UTILIZATION

Total Record Surveyed 3,000

Record Length x 155

Total Bytes of Storage 465,000

I Field Number	II Description	III Field Length	IV Times Blank	V Total Blank Bytes
1	File Key	C-7	0	0
2	Crime Code	C-1	0	0
3	Service Number	C-8	0	0
4	Street Name	C-14	0	0
5	Street Direction	C-1	2335	2335
6	Block Number	C-14	0	0
7	Beat Number	C or P-2	0	0
8	Reporting Area Number	P-3	0	0
9	Complainant's Name	C-35	0	0
10	Watch	C-1	0	0
11	Day of Week	C-1	1	1
12	Race/Sex	C-1	810	810
13	Age	C-2	0	0
14	Date of Occurrence	P-4	0	0
15	Date of Offense 1	P-4	0	0
16	Date of Offense 2	P-4	2237	8948
17	Time of Offense 1	P-3	0	0
18	Time of Offense 2	P-3	1385	4155
19	Crime Classification Code	C-5	0	0
20	Status Code	C-1	0	0
21	Cross Reference File Number	P-4	718	2872
22	Officer's Badge Number	C-4	1887	7548
23	Section ID Number	C-1	1888	1888
24	Operator's Initials	C-3	2210	6630
25	Property Attached	C-3	1290	3870
26	Class Property 1	C-1	1361	1361
27	Class Property 2	C-1	2371	2371
28	Class Property 3	C-1	2897	2897
29	Class Property 4	C-1	2954	2954

TABLE 4.5.1-13. OFFENSE STATISTICAL FILE UTILIZATION (CON'T)

I Field Number	II Description	III Field Length	IV Times Blank	V Total Blank Bytes
30	Class Property 5	C-1	2985	2985
31	Class Property 6	C-1	2989	2989
32	Class Property 7	C-1	2993	2993
33	Class Property 8	C-1	2993	2993
34	Class Property 9	C-1	2997	2997
35	Class Property 10	C-1	2998	2998
36	Blanks	C-16	3000	48000
			Total Blank Bytes	114, 595

114, 595/465, 000 x 100 = 24.64% of the reserved disc storage is not utilized

TABLE 4.5.1-14. ASR FILE UTILIZATION

Total Number of Records Surveyed	1, 000
Record Length	x 175
Total Number of Bytes of Storage	175, 000

I Field Number	II Description	III Field Length	IV Times Blank	V Total Blank Bytes
1	File Key	C-7	0	0
2	Service Number	C-8	0	0
3	Street Name	C-14	0	0
4	Street Direction	C-1	720	720
5	Block Number	C-14	0	0
6	Beat Number	C-2	0	0
7	Reporting Area Number	P-3	0	0
8	Arrest Code	C-4	0	0
9	Date of Occurrence	P-4	0	0
10	Time of Occurrence	P-3	0	0
11	Division	C-2	1	2
12	Officer's Badge Number	C-4	3	12
13	Operator's Initials	C-3	1	3
14	Contributing Circumstances	C-2	5	10
15	Weather	C-1	1	1
16	Road Surface	C-1	1	1
17	Road Character	C-1	1	1
18	Light	C-1	1	1
19	Type of Accident	C-2	1	2
20	Manner of Accident	C-1	135	135
21	Roadway Accident	C-1	44	44
22	Class	C-1	1	1
23	Traffic Control	C-1	1	1
24	Traffic Control Footage	C-3	323	969
25	Traffic Control Direction	C-1	323	323
26	Type of Injury	C-1	1	1
27	Direction Analysis	C-2	1	2
28	Pedestrian Action	C-2	979	1958

TABLE 4.5.1-14. ASR FILE UTILIZATION (CON'T)

I Field Number	II Description	III Field Length	IV Times Blank	V Total Blank Bytes
29	Direction of Travel	C-1	40	40
30	Year of Vehicle	C-2	42	84
31	Type of Vehicle	C-2	1	2
32	Seat Belts	C-1	923	923
33	Name	C-16	1	16
34	Street Name	C-14	42	588
35	Street Direction	C-1	930	930
36	Block Number	C-14	9	126
37	Age	C-2	62	124
38	Race	C-1	46	46
39	Sex	C-1	46	46
40	Date of Birth	P-4	61	244
41	Residence	C-1	1	1
42	Occupation	C-1	1	1
43	Under Influence	C-1	982	982
44	Cross Reference File Number	P-4	71	284
45	Which Driver Under Influence	C-1	1000	1000
46	Direction of Turn	C-1	877	877
47	Blanks	17	988	16,796
	Total			27,297

27,297/175,000 x 100 = 15.59% of the reserved disc storage is not utilized

4.5.2 INTEGRATED DATA BASE SYSTEM

The similar nature of the Dallas Police Department file structures and their index sets suggest their integration into one logical structure is possible. An automated system should preserve the vast majority of index sets and correlative relationships dealt with in the preceding sections. In the present discussion law enforcement activity is emphasized. The following index set attributes appear commonly in the present file system:

(1) Name of a person
(2) Name of an establishment
(3) Location by street address, beat and reporting area
(4) Sequence number

Additional index set attributes which are used by some but not all departments include:

(1) Telephone number
(2) UCR code
(3) Property description
(4) Date

Two of these attributes, UCR code and property description, give rise to complex structures. These two attributes will receive special attention. An integrated system should allow the use, in some fashion, of any or all of the existing manual index sets.

The investigation of an integrated structure will commence with a study of the tree structures related to the individual retrieval keywords.

A hierarchical tree beginning with vehicle information will be investigated first. A basic or entity segment for this tree could contain either vehicle license number or vehicle identification number or

both. In this example, let both numbers appear in the entity segment. To further describe this vehicle, a dependent segment which will describe certain vehicle attributes and values for these attributes is defined. The segment will contain make, model, year, and color. Further descendant segments may describe persons associated with the vehicle, establishments associated with the vehicle and Offense/Incident Reports and Accident Reports concerning the vehicle. Another level in the hierarchy would consist of segments containing the addresses of the persons and establishments contained in preceding segments. A segment narrating the disposition of the Offense/Incident and Accident Reports could follow below these reports. See Figure 4.5.2-1 for a diagram of this tree structure.

A similar hierarchical tree beginning with location information such as street address can be constructed. This segment could have logical descendants describing a name, telephone numbers, persons' names, offenses and incidents which occurred at the location. A descendant segment of the offense data could again be descriptive narrative of the incidents. This hierarchical tree is shown in Figure 4.5.2-2.

A third tree can be constructed for the attribute, name of establishment. The basic segment in this case would contain the establishment's name. Its first descendant might be a segment or segments containing the addresses of the establishment.

For reasons which will become apparent, the location information will be placed on the second logical level. The following attributes can also be put on this level:

(1) Names of persons associated with the establishment

(2) A narrative describing the business activities

(3) Vehicle associated by the establishment

(4) Offenses which have relation to the establishment

The third level in this hierarchy would consist of narrative descriptions

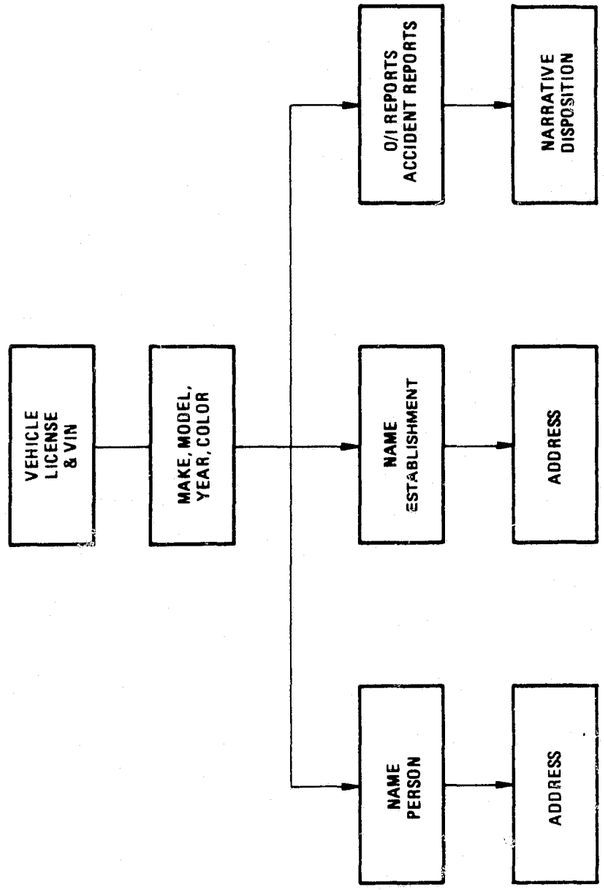


FIGURE 4.5.2–1. VEHICLE LICENSE ROOT SEGMENT LOGICAL RELATIONSHIP

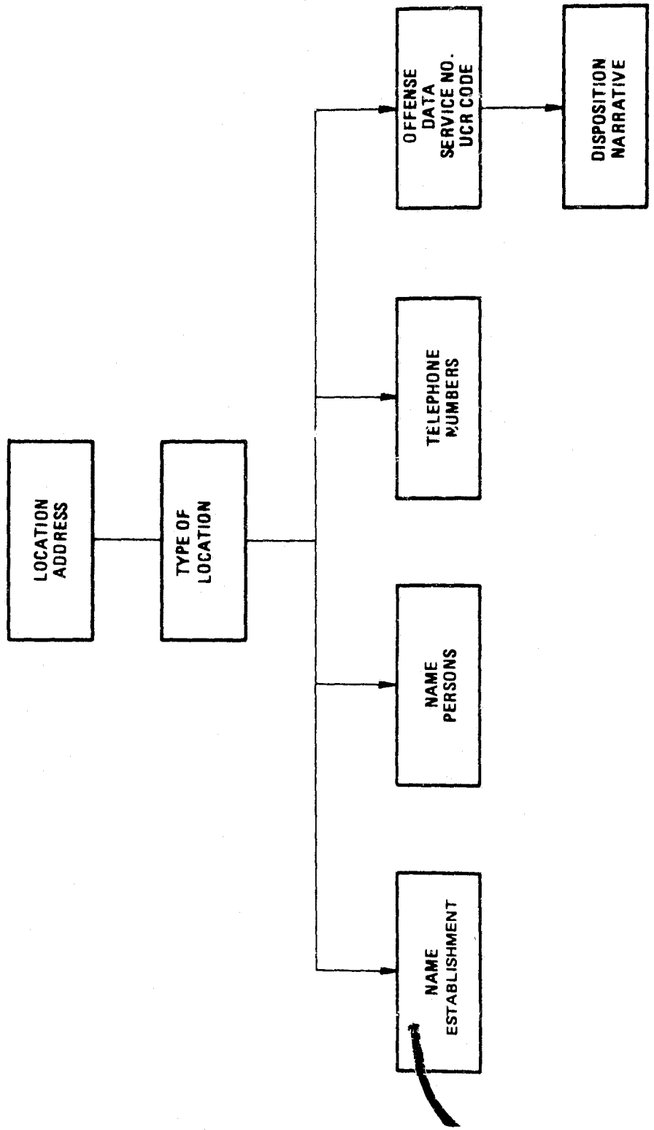


FIGURE 4.5.2-2. LOCATION ROOT SEGMENT LOGICAL RELATIONSHIP

of the offenses and telephone numbers of the establishment's addresses. Figure 4.5.2-3 is a diagram of this tree structure.

The name person root segment will also contain values for race, sex and date of birth. The second level in this tree may contain data about the subject's addresses, vehicles, physical description of the named person, criminal history related to M. O., offenses the person was involved with or arrested for, and data not related to criminal actions by the named person. A third level in this hierarchy might contain further narrative information about offenses the person was questioned about, UCR codes and descriptions of the person's preference in weapons, procedures and trademarks, descriptions of the person's vehicles, residence address, establishment address, and offense addresses. The logical hierarchical diagram, Figure 4.5.2-4 shows four possible levels for this structure.

Modus Operandi has the capability of being a very powerful, many-faceted tool. The Dallas Police Department has a start in this area with the Uniform Crime Reporting Code. As implemented by the Dallas Police Department, UCR is a five-digit code. At this time an incident is considered to fit into one of forty-four basic categories. The remaining three digits are used to further describe the incident. The UCR code can be expanded to provide file directory by category and subject for the master files. The hierarchical logical structure can be represented as a five-level directed tree with up to twelve choices at every level. For example, only five choices currently exist at the first level. However, the existing code uses ten choices at the second level and in one case twelve choices at the third level. The current UCR code allows the specification of one class of occurrences out of a possible set of fifty-five thousand classes.

The preceding discussion suggested the use of M. O.

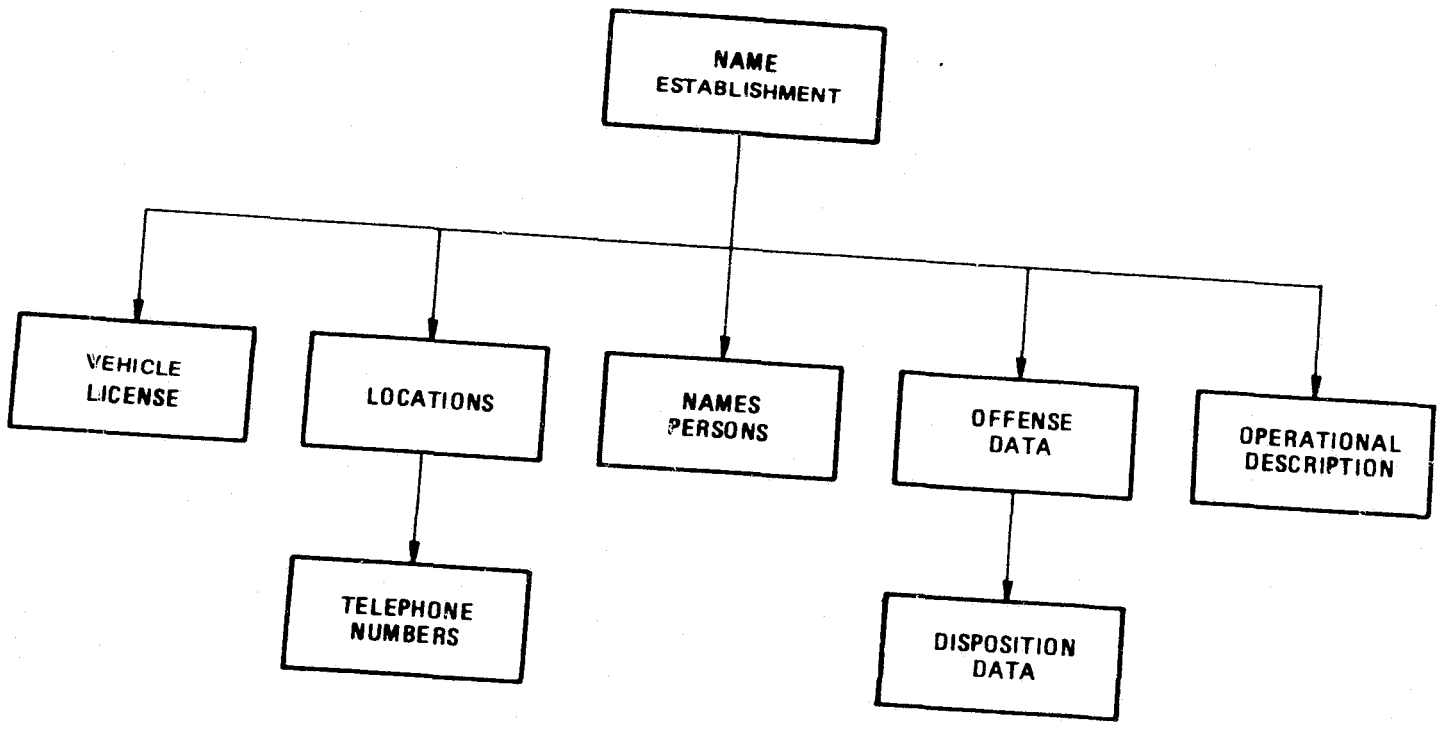


FIGURE 4.5.2–3. NAME ESTABLISHMENT ROOT SEGMENT LOGICAL RELATIONSHIP

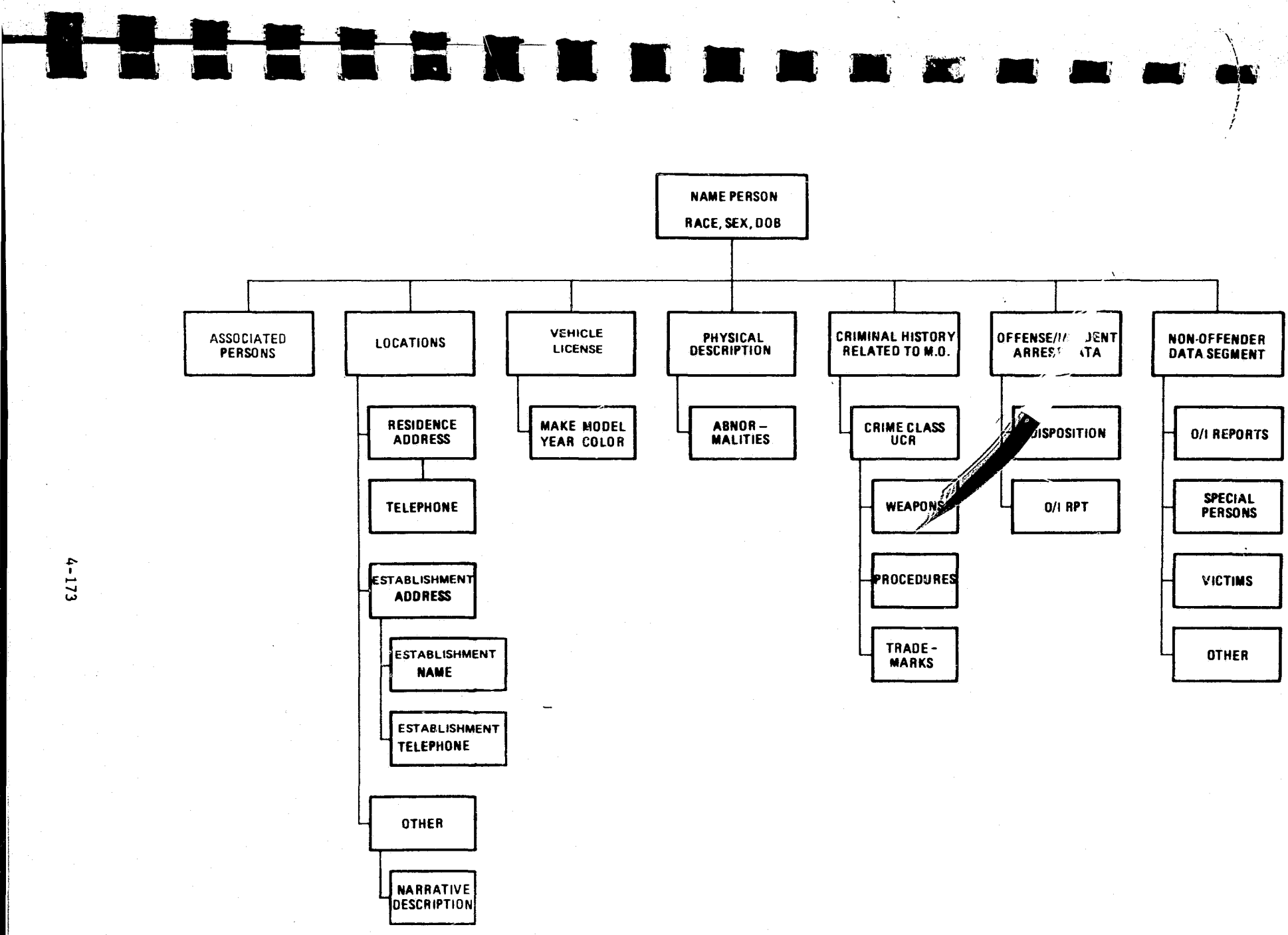


FIGURE 4.5.2–4. NAME PERSON ROOT SEGMENT LOGICAL RELATIONSHIP

implemented by UCR code as a subject directory to the information. If a system such as this were to exist there would be additional benefits to system users. These benefits include:

(1) Identifying possible suspects when the perpetrator of a crime is unknown

(2) Linking related crimes to a suspect

(3) Establishment of possible links between multiple crime occurrences and a group of perpetrators

(4) Evaluating the existence of crime trends to allow effective use of man power

Studies [28] of currently operational M. O. systems indicate that features one and two are heavily stressed. Another facet of these systems is that they use a combination of Modus Operandi trademarks and physical description to identify suspects. Figure 4.5.2-5 shows a portion of a possible logical decision tree and the record segments to be found by these decisions. Using a search process based on this tree, a user could define the desired class of occurrences and/or suspects as exactly or as loosely as desired. The number of records retrieved would decrease as the relevancy of the description of a person or an occurrence improves.

Offense/Incident Reports and Accident Reports share the same service number sequence and contain similar information. UCR codes exist within the Dallas Police Department for most, if not all, traffic accidents and offenses. These facts will allow the construction of a hierarchical structure as follows: the primary record segment might contain service number, date, time, elements dispatched and UCR code of the reported occurrence. A service number based on year, month, day and occurrence number per day would ease many tasks associated with referencing and locating particular reports. Date of an

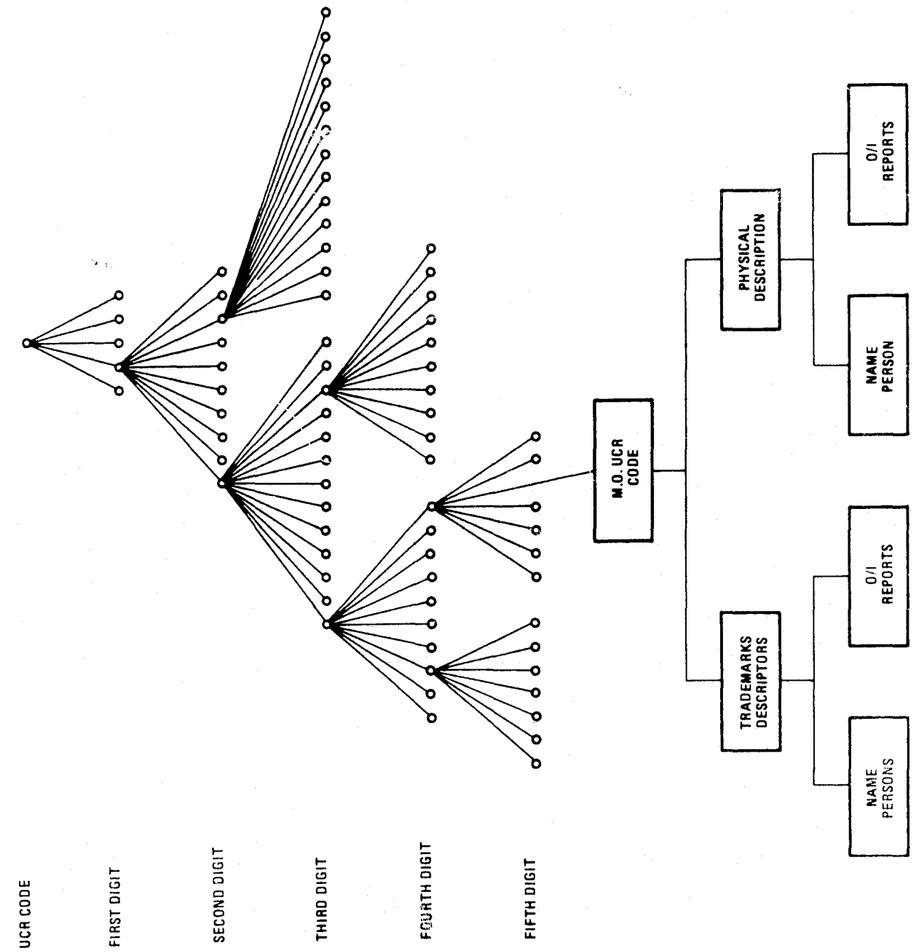


FIGURE 4.5.2–5. MODUS OPERANDI LOGICAL RELATIONSHIP

incident is now used as a method of locating documents when service number is not known. At the lower levels of the hierarchy could be:

(1) Management statistical information such as that captured on the Call File

(2) a. Location of the incident, street address
    b. Description of the location

(3) a. Property information, class of property
    b. Disposition of the property

(4) a. Names of persons associated with the report
    b. Addresses of these persons
    c. Telephone numbers of these persons
    d. Pertinent narrative

(5) a. Names of establishments associated with the report
    b. Addresses of these establishments
    c. Pertinent narrative

(6) a. Vehicle license number
    b. Year, make, model, color of vehicle
    c. Description of vehicle

(7) a. Modus Operandi trademarks
    b. Narrative description of occurrence

Figure 4.5.2-6 shows the possible tree structure associated with these data elements. Note should be taken of the segments allowed for narrative descriptions. These with UCR codes allow the differentiation of offenses and accidents within the same structure.

In the six tree structures discussed previously some of the data segments appear in more than one tree. If each of the tree structures defines the data entities which make up a data set, then the data segments which appear in more than one tree are the data elements which exist in the intersection of the two data sets. It will be found in each case that

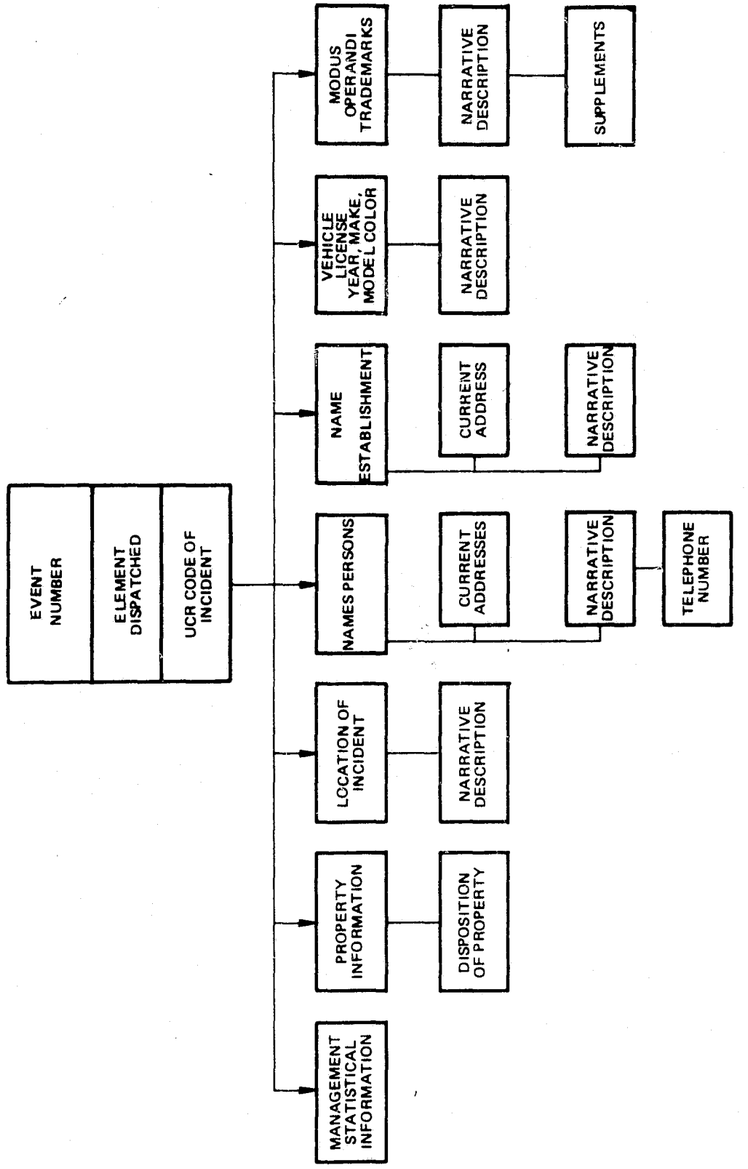


FIGURE 4.5.2-6. OFFENSE/INCIDENT, ACCIDENT LOGICAL STRUCTURE

the data elements which exist in the intersection of two or more sets are also the root or base segment of one of the tree structures. The tree structures are therefore a view of our data space (the totality of the data involved) from a particular vantage point. Figure 4.5.2-7 is a network structure indicating the relationship between the index set elements and the information set. Notice that some additional data may be contained in the index segments. This is not an unusual condition as it allows greater selectivity to be exercised. The logical structure shown here is very similar to that which now exists in the file structure of the Intelligence Division. The Operation LEADER Phase I Report discussed the problems involved in maintaining the Intelligence file system and suggested that an automated method of handling the files be devised. Now that a logical structure for a Law Enforcement Data Base has been developed, a system for maintaining this type of construct will be covered. The Business Administration Data Base is relatively simple and will be handled later. Before actually discussing the proposed integrated data base, design objectives will be covered.

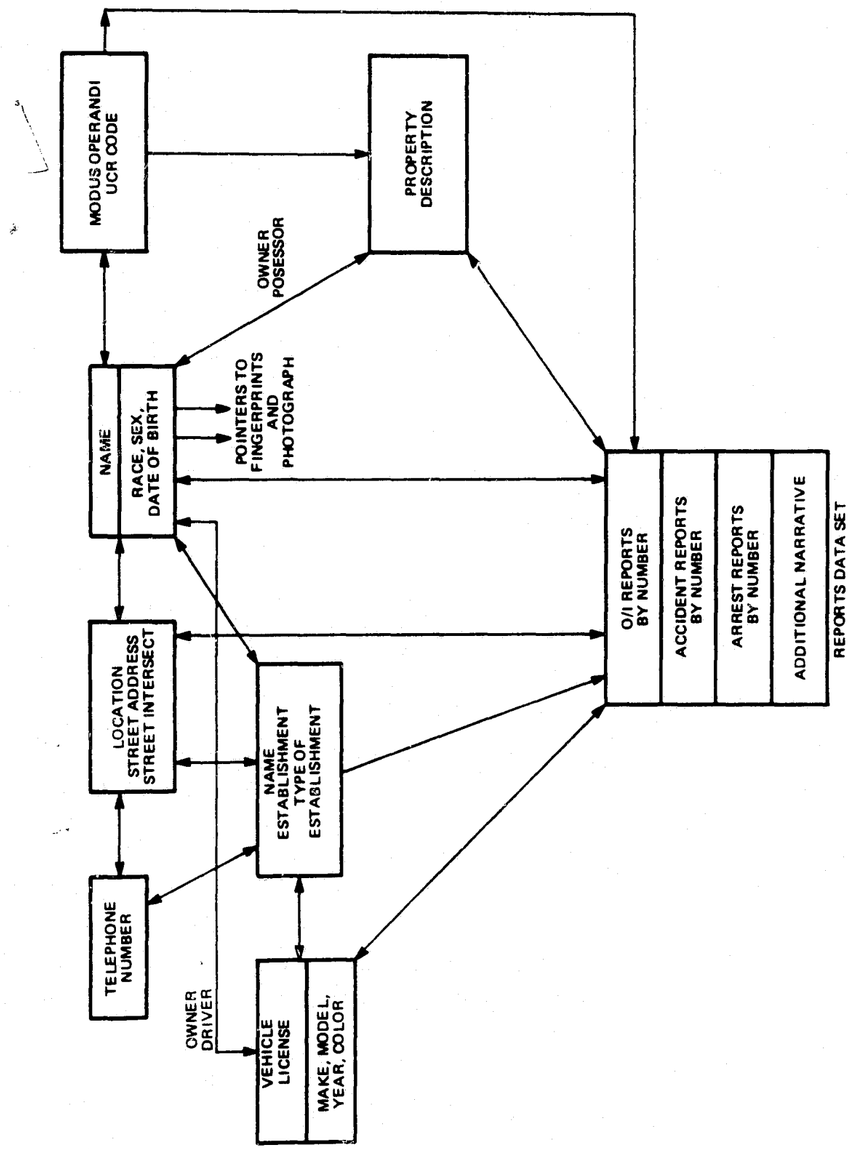


FIGURE 4.5.2-7. UNIFIED FILE SYSTEM LOGIC STRUCTURE

4.5.2.1 DESIGN OBJECTIVES

In this section, those design objectives considered to be most important are formulated.

Information

The amount of information that is maintained in the data base system is related to what is presently considered to be relevant by users in the Dallas Police Department. This information can be associated with additional data that resides in the off-line file system (see Sections 4.5.2.2.1 and 4.5.3.1 for record structure).

The amount of information that is available in the data base system is also dependent upon the input and output facilities and time constraints dictated by the user.

Response Time Characteristics

There appears to be three separate categories of response times that are associated with the user population. These categories are as follows:

(1) Rapid response user: The rapid response user requires only the information maintained in primary record segments. A tolerable limit on this type of response time might be ten seconds. Users requiring this low response time include telephone clerks in the Communications Section. Long response times for these clerks can cause delays in dispatching patrol elements to the scene. Section 9.0 contains response time data in the form of frequency distributions.

(2) Intermediate response user: The intermediate response user is categorized by more complex queries and the willingness to wait longer for more information. It

seems that this user can tolerate up to fifteen minute response times.

(3) The statistical user: The statistical user is the user who wishes management type reports for the purpose of crime trend analysis, statistical evaluation of the system, and so on. This type of user is considered to have relatively low priority and subsequently response times of greater than fifteen minutes can be tolerated. This type of service could be conducted in batch mode.

Access Control

The access of the data that constitute the on-line and off-line information can be controlled by assigning special access codes to specific user sets.

Update Characteristics

The data base system must be structured in such a manner that updates in the form of additions, modifications and deletions can be easily accomplished and that the directories are consistently modified. Deletions are considered secondary in this information system as compared to the retrievals, additions and modifications.

Reliability

The reliability of the internal data base management system is based on the standard algorithms derived to maintain the areas, allocate storage space, maintain directories and allocate resources in a suitable fashion. In the event of a system failure, checkpoint/restart capability ought to be available for data base recovery (see Section 4.5.2.2.3).

Query and Response Profile

The user should be able to present his query in a manner that is easily understood and manipulated. If possible, the data given to

the user should be a single record or small set of records. The results of a retrieval may have to be reduced by the use of the description information input by the user. The data supplied to the user ought to be in an easily communicable format, both on CRT terminal screens and in printed reports. Standardization of report format is considered important.

Resource Independence

The resources to be utilized to maintain the data base system and the directories to access the data are assumed to be of the magnetic disk/drum variety. The utilization of this type of resource is dependent upon the internal data base structure to some extent. As far as possible, the data base structure ought to be device independent.

Custom Data Base System

The reason for considering a custom design is because of the unique information requirements of the Dallas Police Department. In many instances, response time may be an important factor in controlling crime. The design of the data base system is discussed in more detail in Section 4.5.2.

Other Objectives

The data base system should be constructed in such a way that it can be used for statistical research and modeling purposes. This might imply retrieving data using higher level languages such as PL/1, COBOL, etc.

4.5.2.2 LAW ENFORCEMENT INTEGRATED DATA BASE

Introduction

A well designed integrated data base for the Dallas Police Department should allow considerably more data sharing than is currently available. To provide this data sharing capability, the present data base must have a degree of integration. A means of constructing such an integrated data base is now presented.

Events

Information enters the Dallas Police Department information system usually because of an event. A single event may result in the arrest of a person or many persons, the impoundment of property, or the collection of clues, leads, etc. A connection between the assorted people, property, and information is the event.

An event is defined as interaction between police personnel and the public which results in the creation of a record which can be used to:

(1) solve criminal cases

(2) provide documentation of police activity

(3) provide statistical information relating to the efficiency of the department

The three categories above are not mutually exclusive, since all information generated by the Dallas Police Department could be considered to be in categories 2 and 3. However, not all information generated by the Dallas Police Department belongs to category 1. For example, the time required for a patrol element to answer a call is of no concern to the investigator later assigned to the case. This response time would be fitting in category 3, and it might be in category 2. Mark-out records would be considered to be in category 2 but not in category 3.

The following types of event generate category 1 information:

(1) Calls for service which are not N-coded

(2) Arrests

(3) Accidents involving criminal charges

(4) Supplements to offense/incident reports

(5) Field interrogation reports

N-coded service calls and accidents which do not involve criminal charges are not category 1 information.

For the sake of simplicity, category 1 information is considered investigative information and categories 2 and 3 will be considered statistical information.

Areas In The Law Enforcement Integrated Data Base

There are four basic data sets in the proposed Law Enforcement Integrated Data Base. These are termed the Event Area, the Name Area, the Property Area, and the Special Area. In the following paragraphs, these areas are discussed.

The Events Area

The Event Area has a two fold purpose: One is to provide a method of obtaining statistical data concerning the occurrences of events and the second is to provide a linking of all associated data concerning an event.

The Name Area

The Name Area is designed to contain data related to names of people and establishments which are linked to events.

The Property Area

The Property Area is designed to contain data related to all physical property which is under the control of

but does not belong to the City of Dallas. Data for non-event related property is also maintained in this area.

The Special Area

The Special Area contains data that relates to interviews, clues, etc. This type of data cannot be accomodated in the other areas. It may be possible to link this type of data to data in other areas.

Section 4.5.2.2.1 of this report contains detailed information concerning each area. Figure 4.5.2-8 shows how these areas interface.

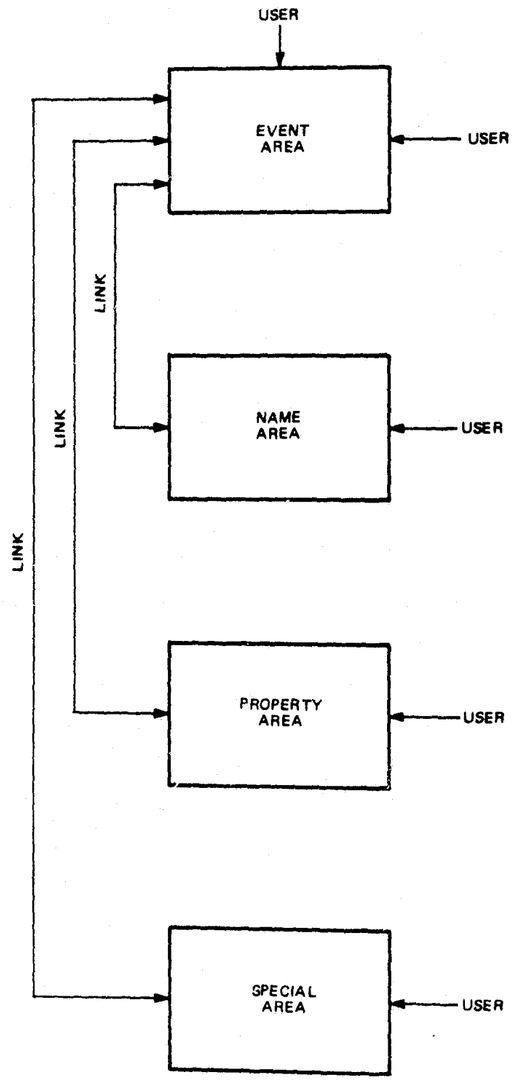


FIGURE 4.5.2–8. OVERVIEW OF THE LAW ENFORCEMENT INTEGRATED DATA BASE

4.5.2.2.1 AREA DEFINITIONS

Event Area

In this section, a more complete definition of the construction of the Event Area is undertaken. The event concept, as reviewed earlier, constitutes a method of linking together other areas in the Law Enforcement Data Base. Here the specific attributes associated with the event record are presented.

Record Structure

The event record is designed to be a statistical and investigative tool. The following field names are associated with the event record:

- Event number
- Type of record code
- Location of event
- First time and date
- Second time and date
- Officer assigned to event
- UCR code 1
- Object or place of attack
- Class property
- UCR code 2 and date
- Status of event
- Investigator assigned
- Address to Name Area(1)
- Address to Name Area(2)
- Flag to point to table of name/event associations
- Address to Property Area
- Address to Special Area

The following statements describe each field in an Event Area record:

- The event number is a number issued at the time the event record is created in the system, i.e., a call for service status or, in the case of the arrest of a person, the time of arrest.

- The location of the event is the street address, beat, and reporting area in which the event occurred.

- The time and date the event occurred are actually two times and two dates. An example of using both times and dates is as follows: an event occurred after the first time and date and before the second time and date recorded. This could be the case for a week-end incident.

- The officer assigned to the event is either the officer answering the call for service or the officer discovering the incident.

- UCR code 1 is the UCR code assigned to the event initially.

- A code number is used to describe the attacked object or the place of attack.

- A code number is used to describe the class of property.

- The second UCR code, UCR code 2, is the UCR code given the event by the investigator.

- The status of the event is the latest disposition of the event.

- The investigator assigned to the event is used to determine those police personnel involved in the event.

- The address to the Name Area is used to point to an individual and/or establishment associated with the event.

- The second address to the Name Area is used to point to another individual and/or establishment associated with the event.

- If more than two people are associated with an event, the flag indicates the Event to Name Table has entries concerning the event.

- The address to the Property Area is used to point to the property associated with the event. This address is used to locate the first item on the property invoice list in the Property Area.

- The address to the Special Area points to additional information concerning the event.

See Figure 4.5.2-9 for the proposed layout of the event record.

Keywords

An Event Area keyword attribute is considered to have the near-unique property if it allows a unique or near-unique identification of an event. The following list of attributes constitutes the event record:

. Event number : AE1

. Type of record : AE2

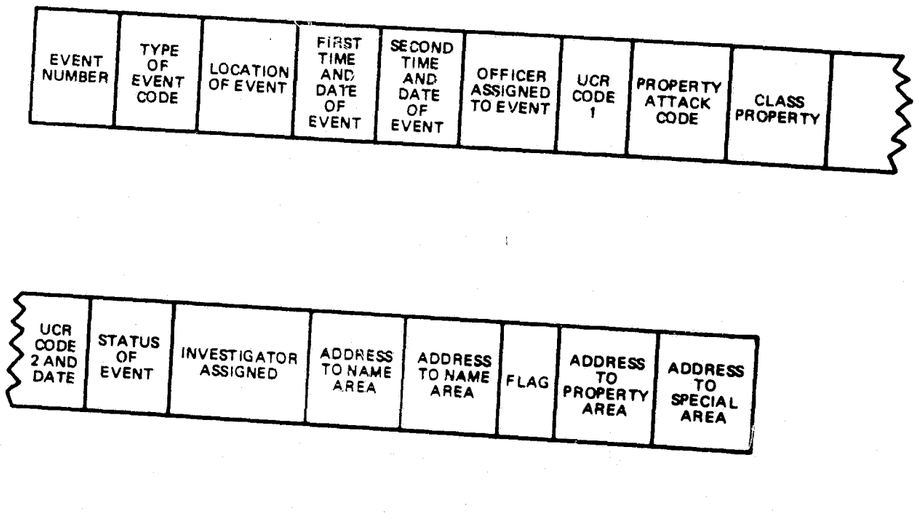


FIGURE 4.5.2–9. PROPOSED LAYOUT OF THE EVENT RECORD

- Location of event : AE3
- First time and date : AE4
- Second time and date : AE5
- Officer assigned to the event : AE6
- UCR code 1 : AE7
- Object or place of attack : AE8
- Class of property : AE9
- UCR code 2 and date : AE10
- Status of event : AE11
- Investigator assigned : AE12

From this list of attributes, it can be seen that attributes such as AE6, officer assigned to the event, do not necessarily lead to the recovery of small amounts of data. Conversely, when attributes with near-unique properties are utilized, such as AE1, the result of a search is a relatively small amount of data. The attributes which possess this property in an Event Area record are as follows:

- Event number : AE1
- Location of event (beat, reporting area) : AE3
- UCR code 1 : AE7
- UCR code 2 : AE10

Let UAE = {AE1, AE3, AE7, AE10} be the set of all near-unique attributes for the Event Area. A search involving attributes in UAE can be conducted on the data.

Name Area

In this section, a more complete description of the construction of the Name Area is presented. The Name Area contains data related to names of persons and establishments, such as businesses and organizations, which are associated with events. The attributes

associated with the name record will be discussed.

Record Structure

The name record is designed to associate the names of people and establishments to events. The field names of a name record pertaining to persons are as follows:

- Name
- Type of name
- Name category
- Physical description
  - Sex
  - Date of birth
  - Race
  - Height
  - Weight
  - Color of hair
  - Color of eyes
- Fingerprint classification
- Occupation
- Social Security number
- Last known address, beat, reporting area
- Dallas Police Department number
- Address to event record
- Flag to name to event table
- Address to book-in system

The following statements discuss each field in the name record:

- The name field contains the name of a person.
- The type of name field is the descriptor to distinguish if the name applies to a person or type of establishment.
- The name category field indicates the role a person has in an event. For example, a person can be an arrestee, complainant, victim, etc.
- The physical description field consists of a minimal physical description of a person.
- The fingerprint classification field is the person's Henry classification.
- The occupation field contains an occupation code.
- The Social Security number field contains a Social Security Number, if known.
- The address field can contain a street address, beat and reporting area.
- The Dallas Police Department number is the number of the Criminal ID Jacket containing all information about the person in the name field, if available.
- The address to the event record is used to obtain the event or events associated with the person.
- This field contains a flag to indicate if a person has been involved in more than one event, i.e., there is an entry in the name to event table.
- The pointer to the book-in system allows the user to

collect all available arrest information.

The field names of an establishment type of name record are as follows:

- Name
- Type of name
- Type of business
- Category
- Street address, beat, reporting area
- Telephone number
- Premises description
  - Building construction code
  - Lighting code
  - Alarm system code
  - Off-street distance
- Address to event record
- Flag to name to event table

The following statements describe the fields in the establishment type of name record:

- The name field contains an establishment's name.
- The type of name code indicates the type of establishment, e.g., school, business, etc.
- The type of business field contains a type code, e.g., liquor store, drug store, etc. can be described.
- The category field is used to specify the type of event with which the establishment is associated.
- The location of the establishment, i.e., street address, beat and reporting area, is recorded in the address field.
- The telephone number field contains an establishment's telephone number, without an extension number.
- The premises description field can be used to describe the construction of the establishment, the lighting of the immediate area, an alarm system, and the distance to the nearest street.
- The address to the associated event is used to link the establishment with an event.
- A flag indicates whether multiple events are associated with an establishment.

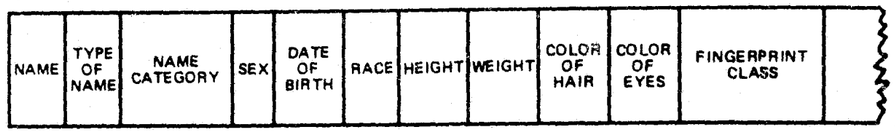
See Figure 4.5.2-10 for the proposed layout of the person and establishment records.

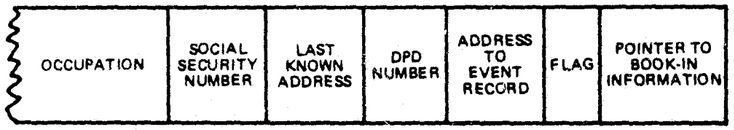
Keywords

Attributes for person records are considered in the following list:

. Name	: APN1
. Type of name	: APN2
. Name category	: APN3
. Sex	: APN4
. Date of birth	: APN5
. Race	: APN6
. Height	: APN7
. Weight	: APN8
. Color of hair	: APN9
. Color of eyes	: APN10

PERSON RECORD





ESTABLISHMENT RECORD

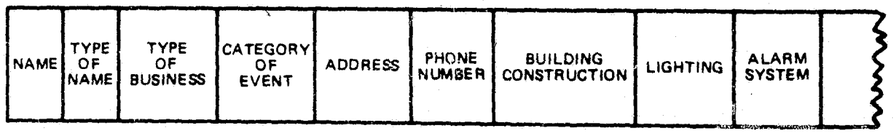


FIGURE 4.5.2–10. PROPOSED LAYOUTS OF THE PERSON AND ESTABLISHMENT RECORDS

- Fingerprint classification : APN11
- Occupation : APN12
- Social Security number : APN13
- Last known address, beat, reporting area : APN14
- Dallas Police Department number : APN15

The following attributes are considered to have the property of near-uniqueness for person records in the Name Area:

- Name : APN1
- Last known address : APN14
- Social Security number : APN13
- Fingerprint classification : APN11
- Dallas Police Department number : APN15

Thus, UAPN = {APN1, APN11, APN13, APN14, APN15} denotes the set of all near-unique attributes for person records in the Name Area.

The Name Area attributes that exist in the Name Area records for establishments are:

- Name : AEN1
- Type of name : AEN2
- Type of business : AEN3
- Category : AEN4
- Address : AEN5
- Telephone number : AEN6
- Building construction : AEN7
- Lighting : AEN8
- Alarm system : AEN9
- Off-street distance : AEN10

The attributes that possess the near-unique property for

establishment records in the Name Area are as follows:

- Name : AEN1
- Location : AEN5
- Type of establishment : AEN3

Thus, UAEN = {A1, A3, A5} denotes the set of all near-unique attributes for establishment records in the Name Area.

Property Area

A more detailed definition of the construction of the Property Area is presented in this section. This section discusses the attributes associated with property records.

Record Structure

The property record is designed to associate the property stored by the Property Division with events and to maintain an inventory. The field names of the property record are as follows:

- Category of property
- Type of property
- Value
- Invoice number
- Property tag number
- Location of property
- Disposition of property
- Computer Identification System number
- Thread record address
- Address to event

The following atatements define each field in a Property Area record:

- The category of property code is used to identify property status, i.e., evidence, etc.

- The type of property code describes the nature of the property.
- The value field is used for an estimate of the value of the item of property.
- The invoice number field contains a number associated with a group of property items.
- The property tag number field contains a unique number assigned to each individual item of property.
- The location of the property field records the physical location of an item of property.
- The disposition of the property field is used to specify property disposition, i.e., on hold, etc.
- The Computer Identification System number is recorded, if it exists.
- The thread record address field relates the address to another item on the same invoice.
- Address to event record allows for linking a property item to an event.

See Figure 4.5.2-11 for the proposed layout of the property record.

Keywords

The attributes associated with a property record are presented in the following list:

- Category of property : AP1
- Type of property : AP2

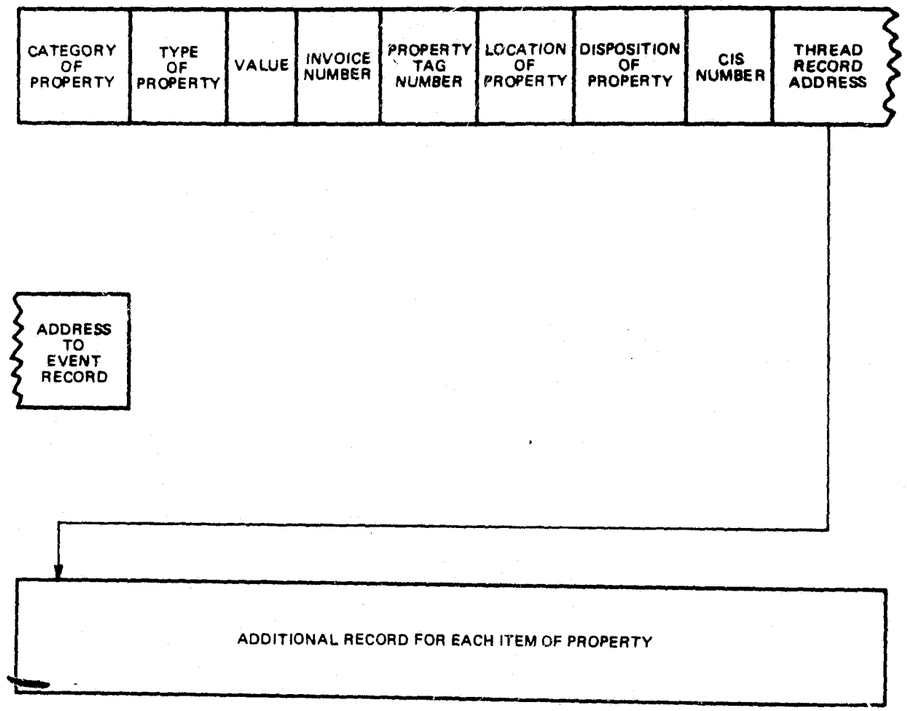


FIGURE 4.5.2–11. PROPOSED LAYOUT OF THE PROPERTY RECORD

- Value : AP3
- Invoice number : AP4
- Property tag number : AP5
- Location of property : AP6
- Disposition of property : AP7
- Computer Identification System number : AP8

The following attributes possess the property of near-uniqueness:

- Type of property : AP2
- Invoice number : AP4

Thus, UAP = {AP2, AP4} denotes the set of all near-unique attributes for property records.

Special Area

The Special Area is designed to retain data which is related to events but which does logically belong in the Name Area or Property Area.

Record Structure

The data in a Special Area can be placed into the following groups:

- Name
- Property
- Motor Vehicle

The following statements define record fields for each of the three groups:

- Name data in Special Area
  - Type record field contains a type record code. A code value one implies that the record has Name Area format.

- The next set of fields corresponds to the attributes of a Name Area record.

- Two secondary record pointers are included in this primary Name Area record to permit addition of some text information regarding latent fingerprints, etc.

For a description of each field in the Name Area record refer to the Name Area record structure in Section 4.5.2.2.1. See Figure 4.5.2-12 for the proposed layout for name type records in the Special Area.

- Property data in the Special Area
  - Type record field contains a type record code. A code value two implies that the record has Property Area format.
  - The next set of fields corresponds to the attributes of a Property Area record.
  - Secondary record pointers are included in this primary Property Area record to permit addition of some text information related to latent fingerprints, etc.

For a description of each field in the Property Area record refer to the Property Area record structure in Section 4.5.2.2.1. See Figure 4.5.2-13 for the proposed layout for property type records in the Special Area.

- Motor Vehicle data in the Special Area
  - Type record field contains a type record code. A code value three implies the record has a motor vehicle record format.

TYPE RECORD CODE	NAME AREA RECORD (SEE SECTION 4.5.2.2.1)	COUNTER*	ADDRESS TO SPECIAL RECORD	ADDRESS TO EVENT	THREAD RECORD POINTER	THREAD RECORD POINTER

LATENT FINGERPRINT INDICATOR	FREE FORM TEXT RELATED TO NAME

*THIS FIELD WILL BE DISCUSSED LATER

FIGURE 4.5.2–12. PROPOSED LAYOUT FOR NAME RECORD IN THE SPECIAL AREA

TYPE RECORD CODE	PROPERTY AREA RECORD (SEE SECTION 4.5.2.2.1)	COUNTER*	ADDRESS TO SPECIAL RECORD	ADDRESS TO EVENT	THREAD RECORD POINTER	THREAD RECORD POINTER

LATENT FINGERPRINT INDICATOR	FREE FORM TEXT RELATED TO PROPERTY

*THIS FIELD WILL BE DISCUSSED LATER

FIGURE 4.5.2–13. PROPOSED LAYOUT FOR PROPERTY RECORD IN THE SPECIAL AREA

- The motor vehicle field names are as follows:
  - Make of car
  - Model of car
  - Year of car
  - License number of car
  - Color of top/color of bottom
  - Characteristics of car (dents, convertible, etc.)
  - Counter
  - Pointer to Special Area record
  - Address to event
  - The secondary record pointers permit some text information related to the Special Area motor vehicle record and latent fingerprints to be added.

See Figure 4.5.2-14 for the proposed layout for motor vehicle type records in the Special Area.

The Special Area records may or may not be associated with an event. See Figure 4.5.2-15 for the organization of the Special Area records.

The counter field in each type of Special Area record is used to limit the length of the chain to three primary records. Notice that a ring structure exists. This makes for easier updating.

Keywords

The attributes for Special Area records are presented below:

- Type 1 - Special Area records dealing with Name information. These near-unique attributes are considered in the keyword discussion for the Name Area.

- Type 2 - Special Area records dealing with Property information. These near-unique attributes are considered

TYPE RECORD CODE	MAKE OF CAR	MODEL OF CAR	YEAR OF CAR	LICENSE NUMBER OF CAR	COLOR OF TOP	COLOR OF BOTTOM	CHARACTERISTICS OF CAR	COUNTER*	ADDRESS TO SPECIAL RECORD

ADDRESS TO EVENT	THREAD RECORD POINTER	THREAD RECORD POINTER

LATENT FINGERPRINT INDICATOR	FREE FORM TEXT RELATED TO PROPERTY

*THIS FIELD WILL BE DISCUSSED LATER

FIGURE 4.5.2–14. PROPOSED LAYOUT FOR MOTOR VEHICLE RECORD IN THE SPECIAL AREA

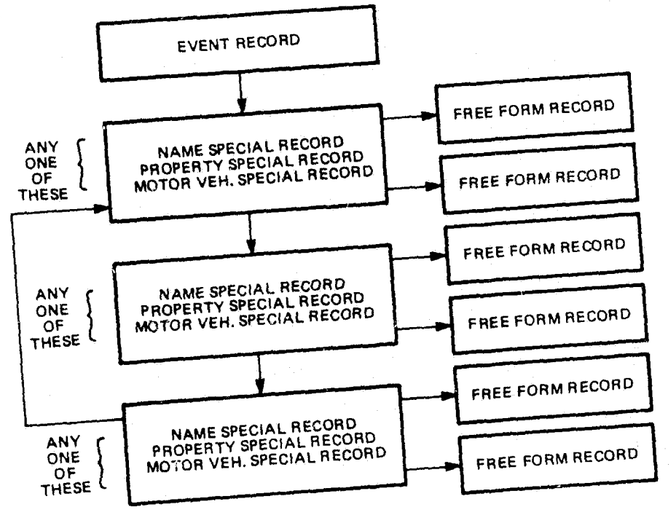


FIGURE 4.5.2–15. ORGANIZATION OF THE SPECIAL AREA RECORDS

in the keyword discussion for the Property Area.

- Type 3 - Special Area attributes pertaining to Motor Vehicle type records are as follows:
  - Type record code : AS1
  - Make of car : AS2
  - Model of car : AS3
  - Year of car : AS4
  - License number : AS5
  - Color of top/color of bottom : AS6
  - Characteristics of car : AS7

The following attributes possess the property of near-uniqueness:

- Type record code : AS1
- License number : AS5

Thus, UAS = {AS1, AS5} denotes the set of all near-unique attributes for Motor Vehicle records in the Special Area.

4.5.2.2.2 AREA ASSOCIATIONS

The associations that exist between logical records within an area of a data base and between logical areas of a data base must have an equivalent physical implementation. This is one phase in the design of a data base where attention should be paid to the fact that a many dimensioned data space must be mapped into the one-dimensional space of physical storage.

Two methods of creating physical implementation of logical associations are available. These implementations will make use of data contained in the physical records. The techniques are:

1. The use of address data which guarantees the existence of another record and tells where to find it.
2. The use of logical data which implies the existence of another record and tells how to find it.

Consider the following example of logical data:
Let A be a data set of records containing the keywords values X, Z, R, Q and L. If the record containing the keyword value Z is logically related to the record containing keyword value Q. Those actions must be taken if we know Z and wish to find the record containing Q. First, the keyword value Z is processed by the search method, which logically maps keyword value to physical locations. Upon retrieval of the record containing Z we will obtain Value Q which must be operated on by the search method before Q can be found.

One can say that the term physical data implies a dependence upon record location but is independent of search method. Logical structures imply that we will be independent of location but dependent on search method. In both cases one devolves to processing lists based upon

keyword values in the record. To some extent, the choice of implementation technique or combinations of the two techniques will be determined by the distribution of records throughout the data space and the relationships which may exist between records. Record distribution may be classed as:

1. sequential - on a keyword
2. random - by a mapping function
3. arbitrary - at system convenience

Physical data is less dependent upon record distribution than is logical data. A physical pointer will be understood to be the actual address of a record. In the case of the relationships which exist between information maintained by the Dallas Police Department a pointer arrangement seems to merit close study.

Name Area/Event Area Associations

Let E indicate a record in the Event Area of the Law Enforcement Data Base and let P indicate a record in the Name Area. Connections between names and events, events with other events and names with names are desired.

The following assumption will be made: at least one name will be associated with each event. In the case of both names and events there may be multiple associations of a name with many events or many names with any given event as shown below.

1. $E_1 \rightarrow (P_1, P_2, P_3, P_4, \ldots, P_n)$
2. $P_1 \rightarrow (E_1, E_2, E_3, E_4, \ldots, E_n)$
3. $P_1 \rightarrow (P_6, P_7, P_8, \ldots, P_n)$
4. $E_1 \rightarrow (E_3, E_5, E_{15}, \ldots, E_n)$

To implement these associations one could place the addresses of the associated record(s) into the primary record. This condition leads to variable length records which become very difficult

to handle. Another technique would be to keep the addresses of the associated records in fixed length tables stored as secondary records. This is an easier situation to handle but tends to waste space when there is a one-to-one ratio of people to events.

A compromise solution which would simplify the problem is to maintain pointers on two levels. A pointer for a primary record association could be placed within the primary record segment. If space for additional pointers is necessary, i.e., when more than one name is associated with an event, a pointer to a table of additional addresses could be added. This type of technique could be used to minimize the waste of storage space.

The address tables can be thought of as a mapping from the set of events into the set of names. The mapping is "into" rather than "onto" because it is neither isomorphic nor is it homomorphic. The mapping is not a self-inverse mapping, i.e., if an event number is entered into the table one finds all persons associated with an event. However, if one wishes to find all events associated with a name a sequential search of the whole event set must be made. An inverse mapping from the set of names into the set of events must be constructed. In this case, the mapping is not isomorphic nor homomorphic.

To implement the event to name mapping the following scheme could be used: In the primary event record allow space for address pointers to two name records and one flag bit. If an event has only two names associated with it, store pointers to these two name records in the event record and set the flag to the off condition. If an event has more than two names associated with it, follow this procedure: Store the pointers to the first two name records in the event record and set the flag to the on condition and store the pointers to the additional name records in the Event to Name Table (ETNT).

The ETNT will be a table maintained in sequential order on event number. The entries in the table will consist of a flag denoting that the next byte string will be an event number. An event number will be followed by one address pointer. The table can be considered as an N by two array. If a new entry must be made in the table some entries below the new entry may be pushed down the number of rows required to obtain space for the new entry. See Figure 4.5.2-16 for a graphical representation of the ETNT Table.

The Name to Event mapping can be implemented in a similar manner. Space for a flag and one address pointer should be assigned within the Name Area record. If the flag is not set, the name is associated with at most one event. If the flag is set, a reference to the Names to Events Table (NTET) will be required. The NTET will be organized in a manner simular to the ETNT Table. The order of the Table will be sequential on starting address of Name Area record. The NTET will be organized as an N by two array also: Again, a flag will be set to indicate that the next byte string in a name address. One byte will be attached to each event number entry; this byte will be used to describe the role which the name had in the event, i.e., victim, arrestee, or witness.

The Name and Event Areas in the Law Enforcement Data Base are linked through these two tables. Associations of names with other names and events with other events can also be supported. The linkage of two names comes from participation in the same event. Two events are linked by having the same name associated with each event.

A query requesting the names associated with a particular name N_i would be processed as follows:

1. Enter name N_i requesting all events associated with it.
2. Receive a listing of all events $E_1, E_2, \ldots, E_i$ on record

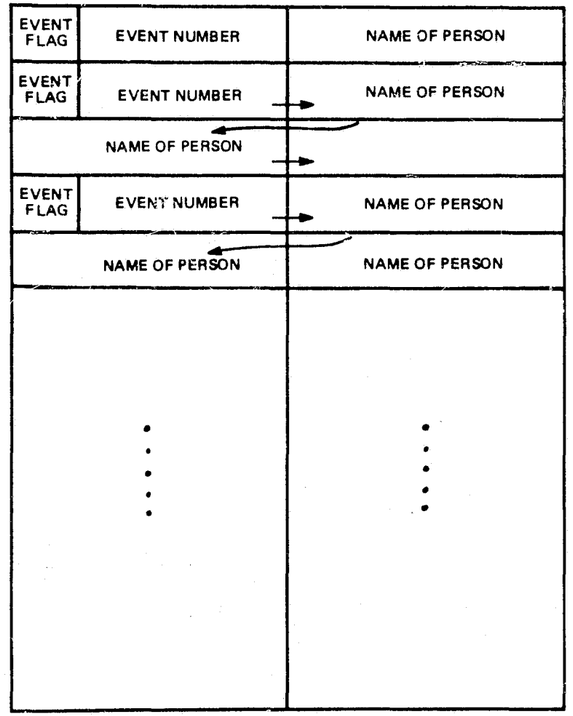


FIGURE 4.5.2–16. ETNT TABLE

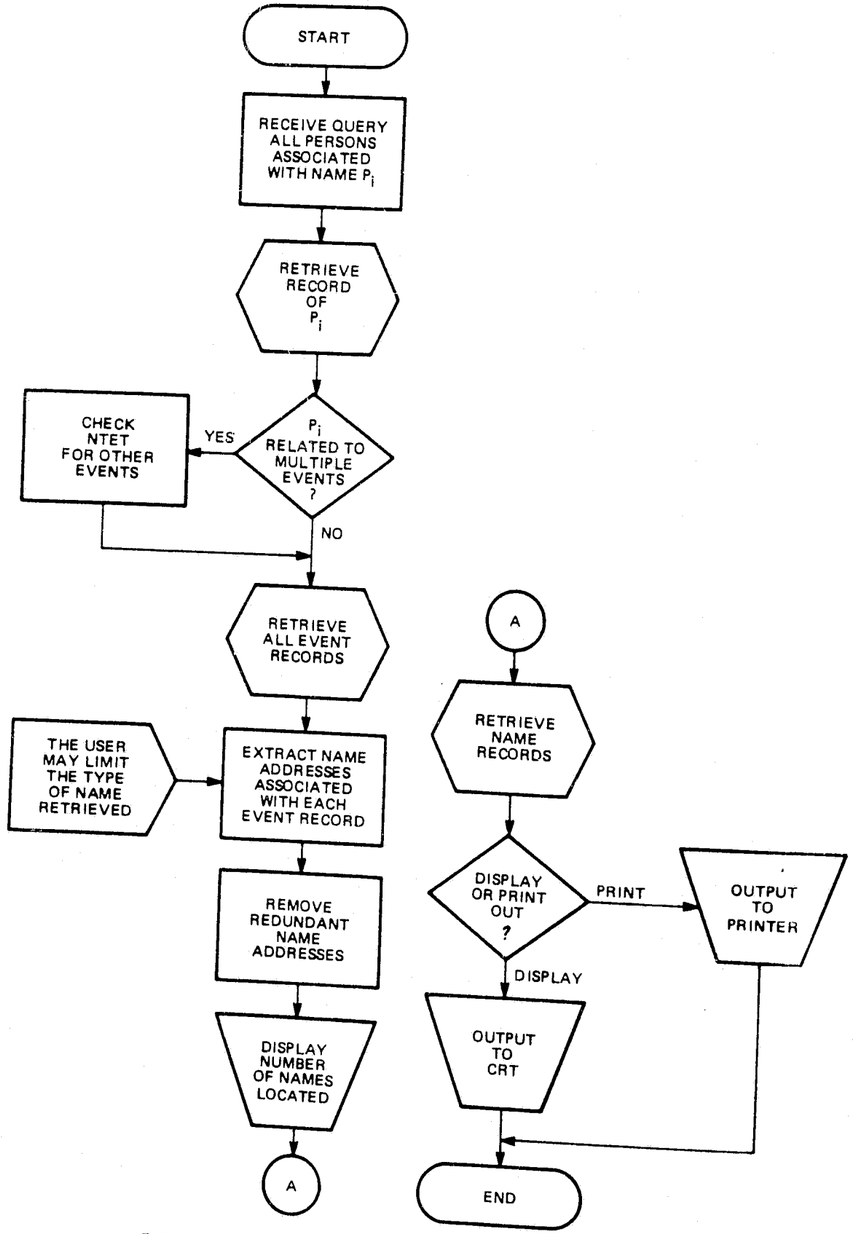


FIGURE 4.5.2–17. NAME TO NAME ASSOCIATION PROCESS

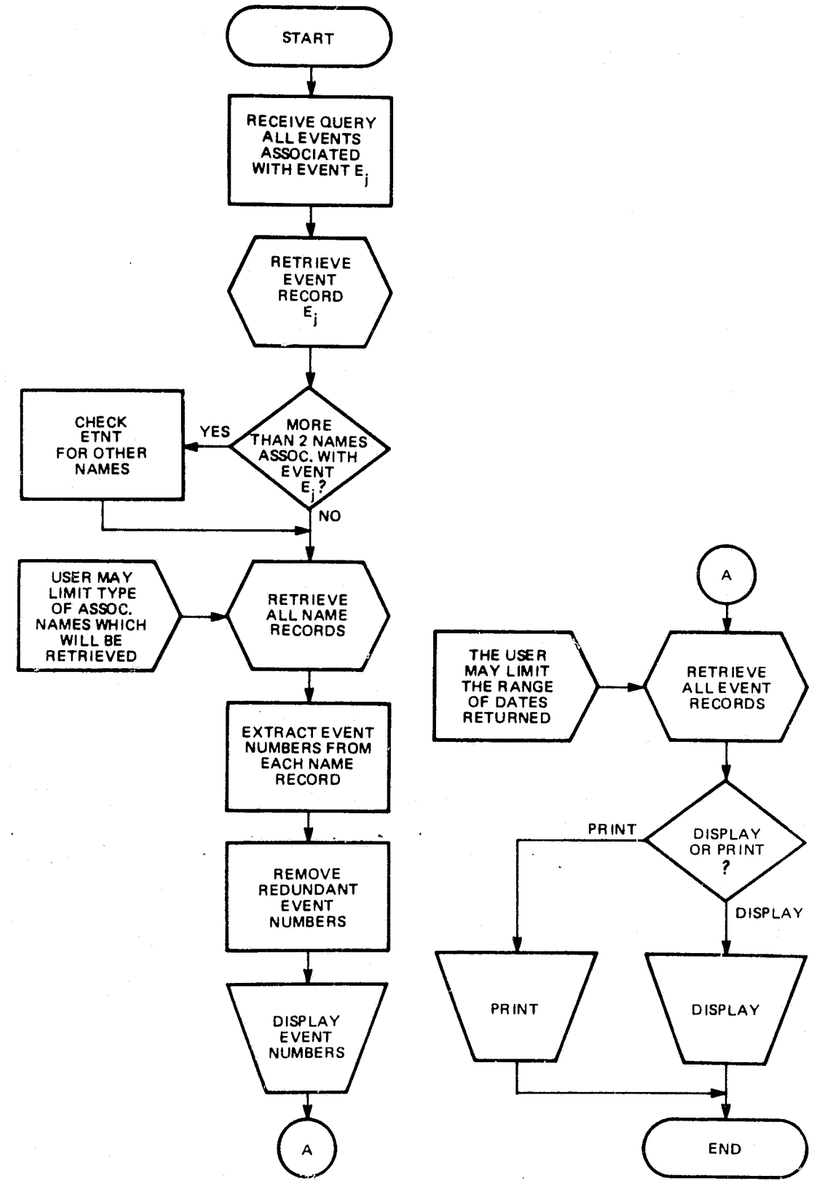


FIGURE 4.5.2–18. EVENT TO EVENT ASSOCIATION PROCESS

with which name N_i was involved.

3. Enter the event numbers received requesting the names involved with each.
4. Receive a listing of name record addresses (A_{11}, A_{12}, ..., A_{1n_1}), ..., (A_{i1}, A_{i2}, ..., A_{in_i}); process the list to remove redundant addresses.
5. Use the resulting list of addresses to retrieve the name records associated with name N_i.

See Figure 4.5.2-17 for a flow diagram of this process.

Queries requesting all events associated with a particular event will be processed in a similar manner. See Figure 4.5.2-18 for a flow diagram of the event to event relation process.

Property Area/Event Area Associations

An assumption will be made about the relation between Property Area and Events Area: any given item of property will be associated with one and only one event. In most cases the event will be the occurrence which caused the property to be stored by the Dallas Police Department. This assumption allows us to link any property record to its event record by placing the event number in the property record. To find the event record associated with any given property record it is necessary only to request the event record be displayed. This is an example of logical association of records.

The event to property relationship is not quite as simple. Any given event may have many property records linked to it. Again however, the assumption made above simplifies the operation. A pointer in the event record can point to a single property record; any additional property records can be chained together so as to include all property associated with the event record. Figure 4.5.2-19 shows the chained structure of event and property records. The property event query process is shown in Figure 4.5.2-20.

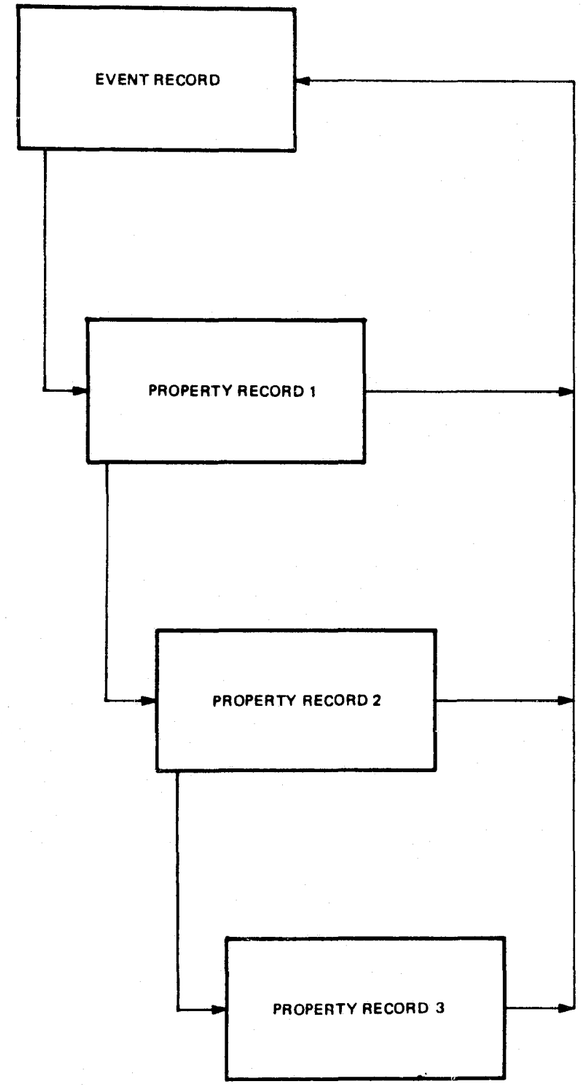


FIGURE 4.5.2–19. EVENT RECORDS/PROPERTY RECORDS LINKAGE

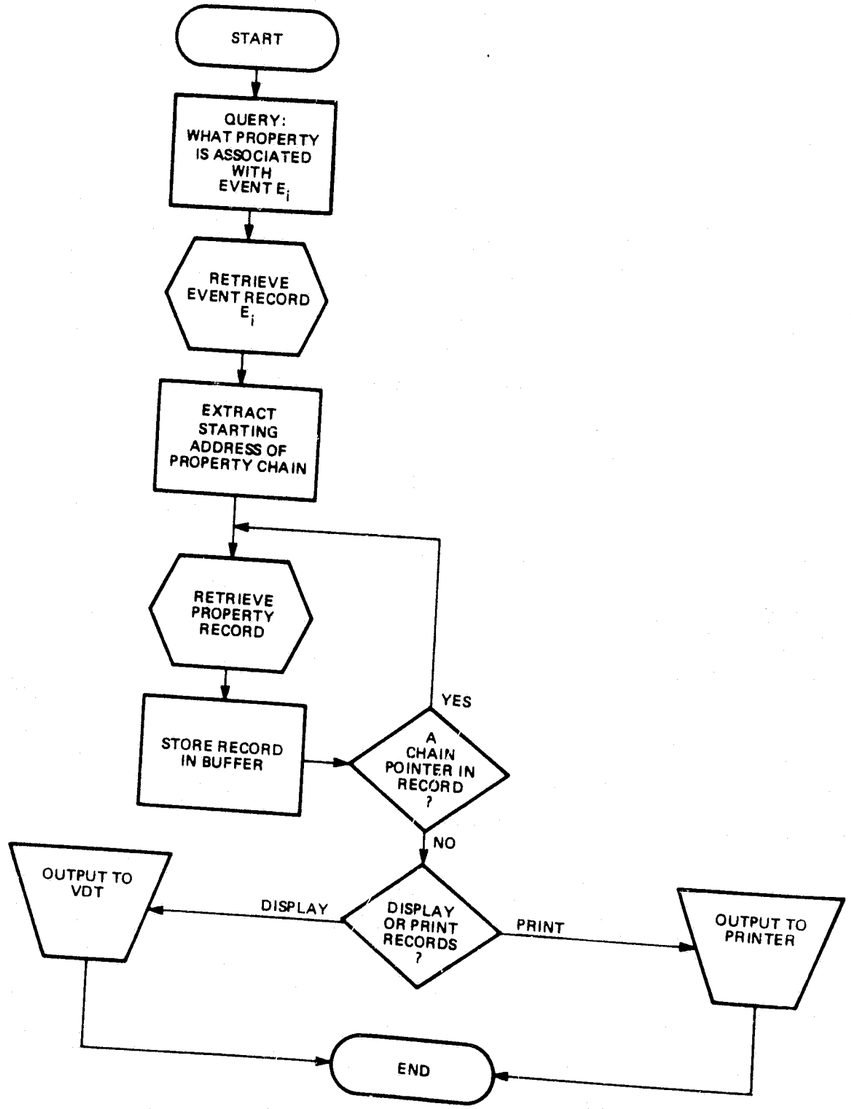


FIGURE 4.5.2–20. EVENT/PROPERTY QUERY

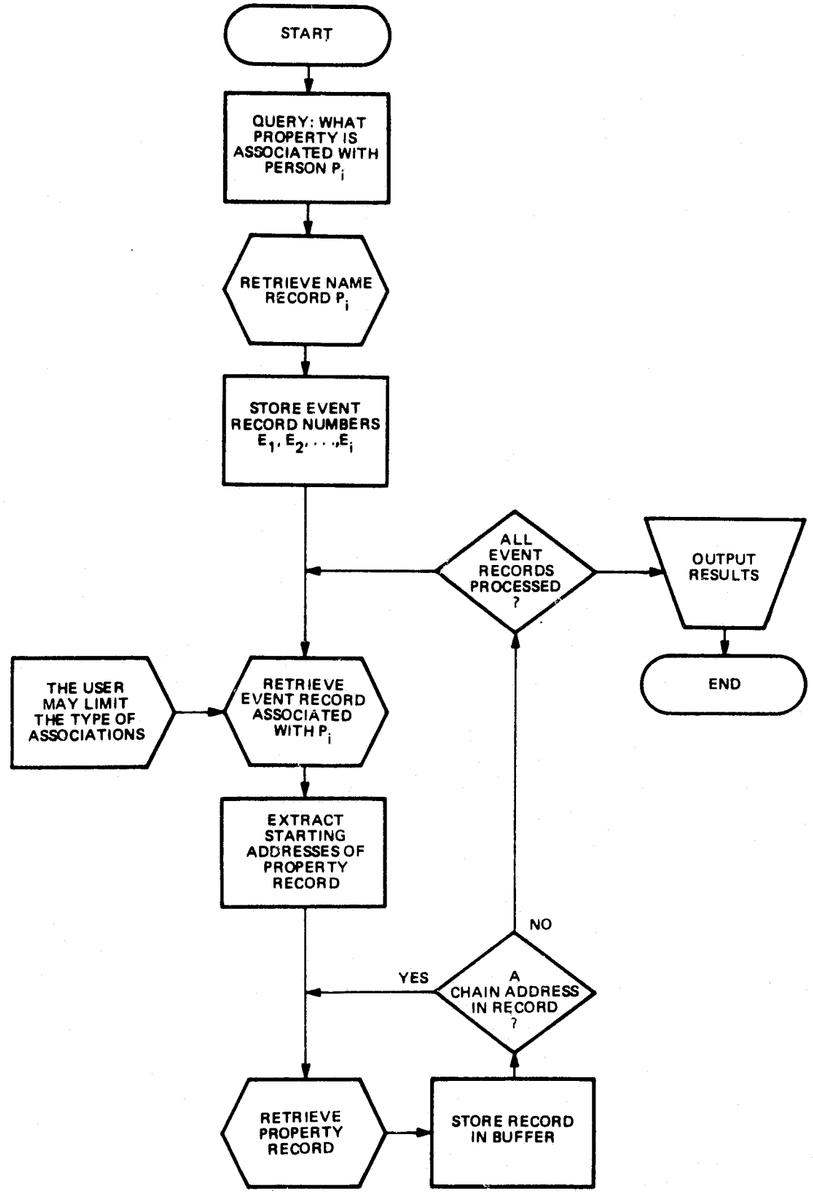


FIGURE 4.5.2–21. NAME/PROPERTY QUERY

As people and events are already closely linked, a connection between people and property is therefore established. A direct linkage between people and property could be maintained if it proves necessary. A flow diagram of query procedures is given in Figure 4.5.2-21.

Associations Within the Special Area

Records which are stored within the Special Area will be discussed by type code. There will be three primary categories of records, i.e., name, property and motor vehicles. The Special Area will also permit the creation of free text secondary records.

The Special Area is the only one within which direct association between two records of the same type will be allowed. The linkage between records will be established by an address pointer contained within each record. In order to limit the complexity of the record structures which can be created by this process, a flag in each record will indicate the record position in the chain being established. Chains which will be maintained as sequential rings should be limited to length three. Whenever an attempt is made to link to a record which already has a level number or creates the fourth member in a chain, an error message will be returned to the user. It will be possible to connect each primary record to two free text secondary records. Figure 4.5.2-22 represents the possible complexity of the structure which can be created by this process.

Linkages will be created at user request only; no automatic linkages are created. In order to create a linkage between any two records the user must indicate the type of record to be pointed to and uniquely identify it. Due to the linked nature of the records in this area, updates and deletions must be processed with extreme care, as it is possible to inadvertently destroy record links.

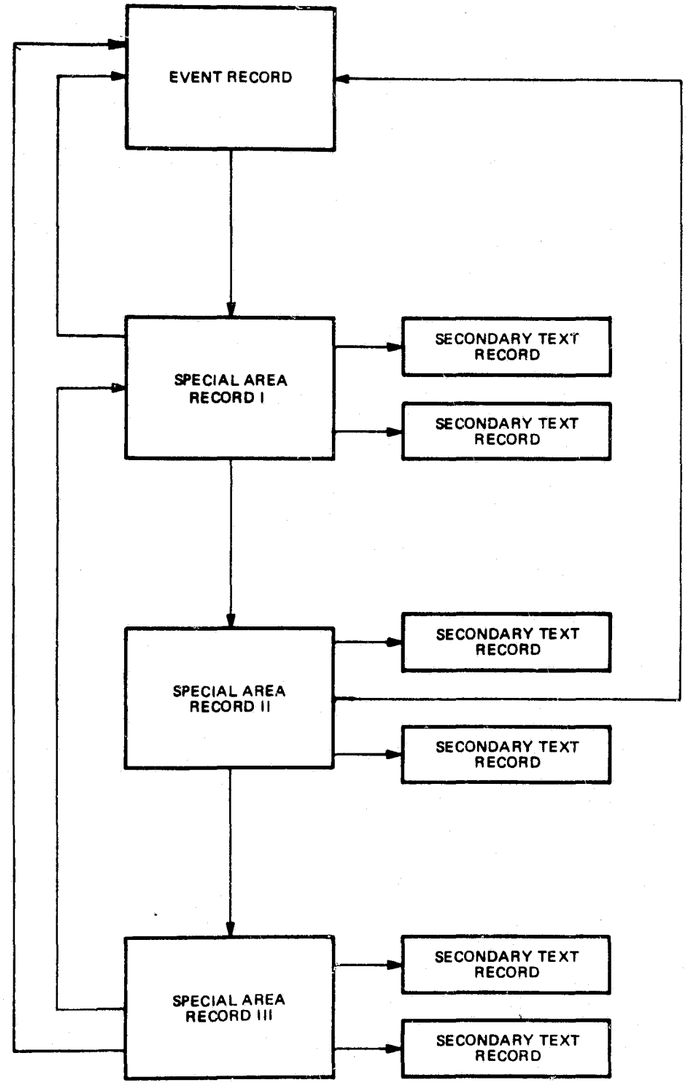


FIGURE 4.5.2–22. ASSOCIATION OF EVENT AREA/SPECIAL AREA

Special Area/Event Area Associations

The primary linkage between the Special Area and the other areas in the data base will be through the Event Area. The linkage between an event record and a special record will be defined to be singular, i.e., an event record may point to one and only one special record. Each primary special record will contain one event number so as to logically link it to an event. If desired, it could be possible to link two event records by going through the Special Area. The technique would be to link two special records with contained different event numbers. As the Event Area is closely linked to both the Name Area and the Property Area, it should not be necessary to directly connect these areas to the Special Area.

Statistical Information

The association techniques suggested in the preceding sections are estimates of what will be needed by the Dallas Police Department. An intimate part of the software maintaining these associations should be routines which capture information about how the associations are used. This information will allow improvements in the operation of the association software to be made. The following is a minimum list of statistics which should be maintained:

1. The total number of events with entries in the Event to Name Table.
2. The total number of names with entries in the Name to Event Table.
3. The frequency distribution of elements in each entry for both tables.
4. The maximum and minimum number of elements in an entry for both tables.

5. The number of queries directed toward each table.
6. The type of association requested.
   a. Name to Name
   b. Event to Event
   c. Name to Event
   d. Event to Name
   e. Event to Property
   f. Property to Name
   g. Name to Property
7. Average number of storage accesses per query.

These remarks also apply to the Business Administration Data Base to some extent.

4.5.2.2.3 DATA BASE SYSTEM

Creation

The creation of the Law Enforcement Integrated Data Base must be initiated by utilizing the information currently being processed by manual and on-line means. The steps necessary to capture, translate and utilize those data are pointed out in the following paragraphs.

- Identification of all files, both manual and on-line, must be made to determine what information should reside in the data base. Analysis of each file must be made in order to determine its relevance.

- When the files containing the relevant information are identified, a format specification for each file must be derived. When this function has been performed a set of files and related format information are available.

- During the process of capturing and analyzing all of the existing files, the data structure for each area of the data base must be developed in order to accomplish the format translation from existing files to the data formats required for the data base. The areas identified in the data base and the related data structures are presented in Section 4.5.2.2.1.

- When the data structure and data base areas have been firmly defined, the next step to be taken up is the definition of the storage structure of the data base. The storage structure must be, as nearly as possible, device

independent and conform to the relative needs of the user in a particular environment.

- The next major step in the creation of the Law Enforcement Data Base is the resource allocation for the data base. The resources that are allocated for this particular system are considered to be of the magnetic drum/disk category because of speed.

- Assuming that the relevant data is in a standard area format and data structure, storage structure and resources have been thoroughly defined, the data is ready to be used for creation of the data base. During the time that the data are being placed in storage, the directories should be constructed. The building of the directories at this time allows the data base to be partly usable. Much emphasis must be placed on an editing function that must be concurrently accomplished to insure that the data transformation from the off-line formatted data to the on-line data structure is correct. If an extensive editing function is not performed, erroneous data will render the on-line system unusable as an investigative or statistical tool.

- After the creation of a representative number of records in each area, a statistical analysis should be conducted. Analysis of the data base should examine the amount of reorganization necessary, updating processes and the validity of data. Complete documentation should be an on-going, integral part of the creation of the Law

Enforcement Integrated Data Base. This documentation is deemed one of the most important steps in the creation of the data base because of its importance in later modifications to the data base and ready understanding by people not associated with the original development. A complete pilot study of the proposed data base design must be completed before any evaluation or utilization can be accomplished. Assuming that the proposed design provides the desired results, any modification of the data base can be accomplished when required.

Event Area Directory

The directory for the Event Area is composed of two parts. The first to be discussed is the event number part of the directory. This part is a sequentially arranged directory based on AE1. This is not to say that every event number is in the directory; event records are considered to be arranged in storage cells. Therefore, the directory contains the first event number in each cell. The cells are contiguous. Figure 4.5.2-23 illustrates the event directory based on the event number.

To illustrate the internal workings of the directory, the following example is studied: Retrieve the attribute/value pair (AE1, K+N). Referring to Figure 4.5.2-24, the query is accepted as being a query based on the AE1 attribute and the directory is referenced. The value K+N of AE1 does not lie in the cell C_n since this cell contains values of AE1 in the range 1 to K-1. The next contiguous cell contains values of AE1 in the range from K to M-1. Assume that K+N is in the range from K to M-1, or cell N+1. Thus, the value of K+N lies in the cell Cn+1. The cell Cn+1 is then placed in core and the record, referenced by (AE1, K+N), is sequentially found and returned as the results of the query. As pointed out in previous sections, the event number is unique.

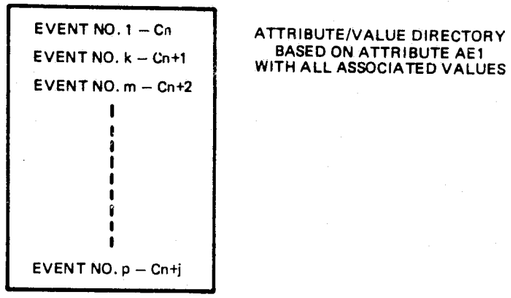


FIGURE 4.5.2–23. EVENT AREA DIRECTORY

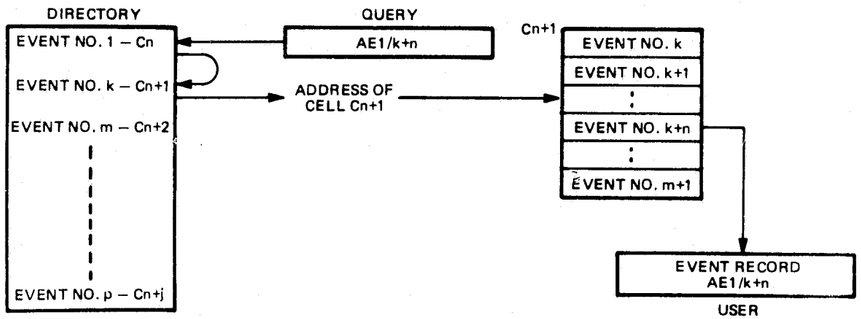


FIGURE 4.5.2–24. EVENT AREA QUERY

The second part of the directory to be discussed is that part containing value ranges for attributes other than AE1. When event records are added or deleted in the Event Area, each cell is examined and the value range for keyword attributes AE3, AE7 and AE10 are placed in this part of the directory. This is done to enable queries that do not contain the AE1 attribute but which are based on combinations of the other three attribute/value pairs to be handled. For example, assume that UCR codes are ranked in classes 0-100 inclusively and that on cell C_n there are thirty event records. The UCR codes associated with these thirty records range from 51 through 85. Thus, the UCR range for cell C_n is 51 through 85 inclusively. This data is maintained for all attributes for all cells in the Event Area.

Figure 4.5.2-25 illustrates this part of the Event Area directory. Figure 4.5.2-26 illustrates a query and the processes that allow for retrieval based on the attributes AE3, AE7 and AE10. The query in Figure 4.5.2-26 is transferred to the directory and the input values of the attributes are compared to the range values of each cell; the result is a set of addresses of cells that might contain the query values. Each candidate cell is placed in core and is examined for event records which contain the values in query expression. The resulting set of event records is returned to the user.

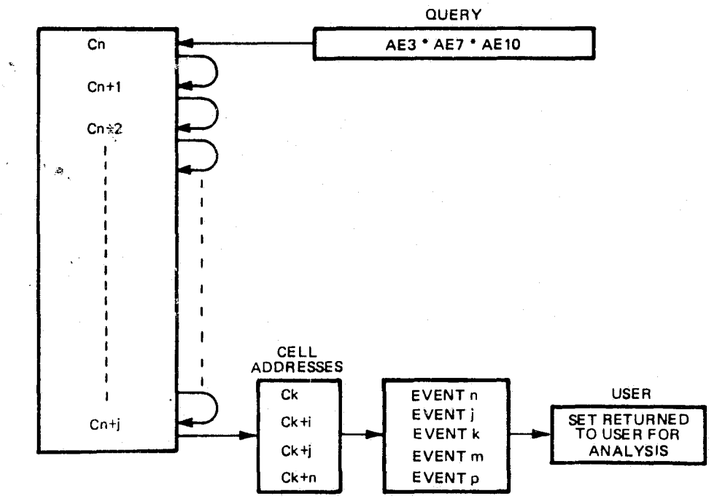
Name Area Directories

There are several directories associated with the Name Area of the Law Enforcement Data Base. These directories are related to the index sets based on UAPN and UAEN. The directories will be constructed based on the following attributes: (APN1, AEN1), (APN14, AEN5), APN13, APN11, APN15, AEN2. Each directory will be explained below with related figures.

The first directory to be considered is based on the

CELL n	AE3	RANGE 0–9
	AE7	RANGE 51–85
	AE10	RANGE 5–76
CELL n+1	AE3	RANGE 14–17
	AE7	RANGE 5–19
	AE10	RANGE 17–29
CELL n+j	AE3	RANGE 0–8
	AE7	RANGE 14–46
	AE10	RANGE 8–85

FIGURE 4.5.2–25. VALUE RANGE SEGMENT OF THE EVENT AREA DIRECTORY



*DENOTES THE CONNECTIVE 'AND' OR 'OR'

FIGURE 4.5.2–26. EVENT/QUERY PROCESS

attribute pair (APN1, AEN1). The reason that the pair is considered instead of the separate attributes is due to the nature of the attributes. The directory associated with this pair is illustrated in Figure 4.5.2-27. As seen in Figure 4.5.2-27 the input values of the pair (APN1, AEN1) maps into an integer which is then mapped into a cell number. This cell number is mapped into a physical device address. The third mapping is designed to make the cell assignment more flexible.

The next directory considered is based on the attribute pair (APN14, AEN5). The attributes relate the location field in the Name Area record. Figure 4.5.2-28 illustrates this location directory which is founded on beat and reporting area. This directory contains value ranges for each cell.

Figure 4.5.2-29 illustrates the directory associated with the type of establishment attribute, AEN2. This is also a value range directory and returns a set of possible cells in which this data could be found.

Figure 4.5.2-30 illustrates the directories associated with attributes APN11, APN13 and APN15 respectively. These are all range value directories and are very similar in nature to each other. As Figure 4.5.2-30 shows, all will return cell locations and not unique addresses. Due to the nature of the information being stored, an inverted list structure for the directory was not considered economical or necessary.

Property Area Directories

There are only two attributes for which directories are maintained. These two attributes are AP2 and AP4. The directories associated with the attributes AP2 and AP4 are illustrated in Figure The AP2 directory is a value range directory. The use of the AP4 will result in a unique cell address whereas a query based on AP2 will only return a set of cells that might contain relevant data.

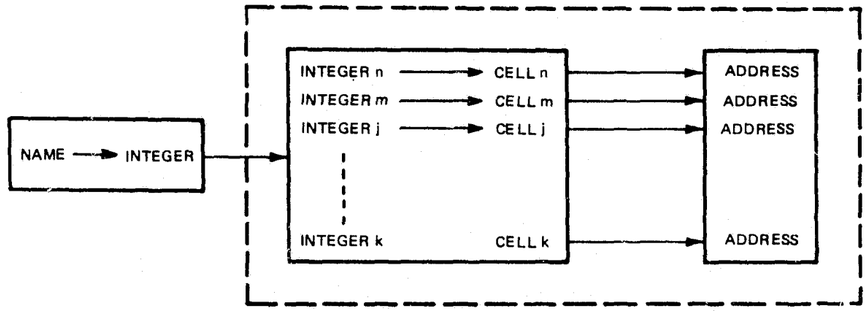


FIGURE 4.5.2–27. DIRECTORY FOR (APN1, AEN1)

CELL A	RANGE LOWER LIMIT RANGE UPPER LIMIT
CELL B	RANGE LOWER LIMIT RANGE UPPER LIMIT
CELL N	RANGE LOWER LIMIT RANGE UPPER LIMIT

FIGURE 4.5.2–28. DIRECTORY FOR (APN14, AEN5)

CELL A	RANGE LOWER LIMIT RANGE UPPER LIMIT
CELL B	RANGE LOWER LIMIT RANGE UPPER LIMIT
CELL C	RANGE LOWER LIMIT RANGE UPPER LIMIT
CELL N	RANGE LOWER LIMIT RANGE UPPER LIMIT

FIGURE 4.5.2–29. DIRECTORY BASED ON AEN2

CELL A	RANGE LOWER LIMIT RANGE UPPER LIMIT
CELL B	RANGE LOWER LIMIT RANGE UPPER LIMIT
CELL N	RANGE LOWER LIMIT RANGE UPPER LIMIT

FIGURE 4.5.2–30. DIRECTORY FOR APN11, APN13 AND APN15

Special Area Directories

There are several attributes that are used in association with the Special Area that have already been discussed for Name and Property Areas. The same directory layouts are applicable for this area since the information is stored in either a name record format as in the Name Area, or in a property record format as in the Property Area, or in a special record format.

The approach used for development of Name Area and Property Area directories can be applied to name and property records in the Special Area. There are two additional directories associated with the Special Area. These two directories are based on the attributes AS1 and AS5. When a query involves the AS1 attribute alone, see Figure 4.5.2-31, the set of all motor vehicle records will be returned to the user.

When AS5 is used in a query, a unique cell address is returned. Figure 4.5.2-32 illustrates a directory for expressions involving AS5.

Retrieval Methods

Retrieval methods for each area of the Law Enforcement Integrated Data Base are discussed in the following paragraphs.

Event Area

The index set for the Event Area is based on the attribute set UAE. The event records are arranged sequentially on a direct access storage device by event number and placed into uniform-sized cells. A cell is defined as an integral number of contiguous tracks within a cylinder. Retrievals from the Event Area are divided into two classes depending on whether AE1 is involved. A retrieval on attribute AE1 is conducted as follows: find the location of the cell in which AE1 resides and then retrieve the record. Figure 4.5.2-33 illustrates the steps taken to retrieve an event record using attribute AE1.

Consider an expression based on a subset of UAE which

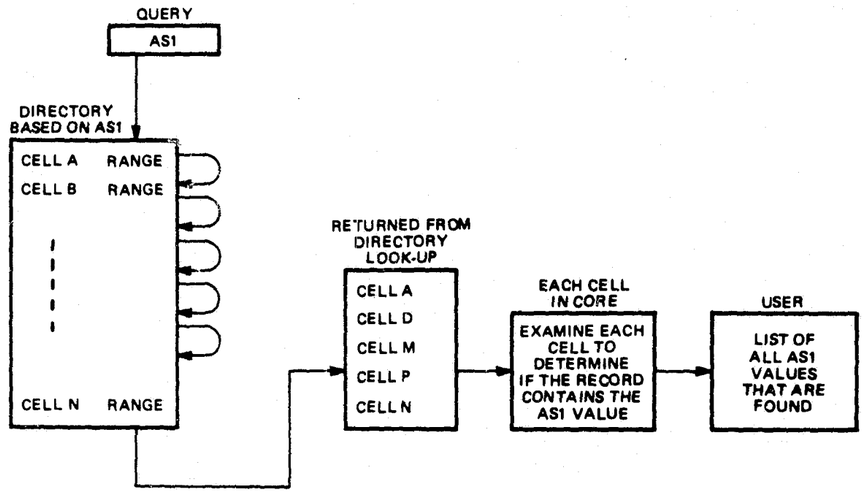


FIGURE 4.5.2–31.

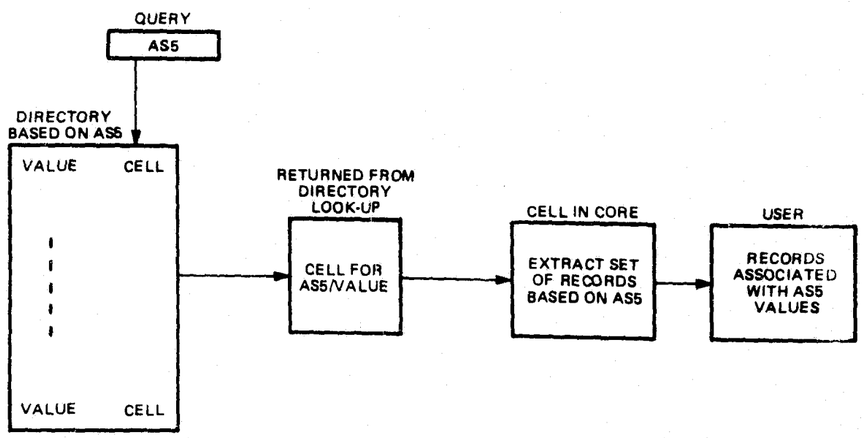


FIGURE 4.5.2–32.

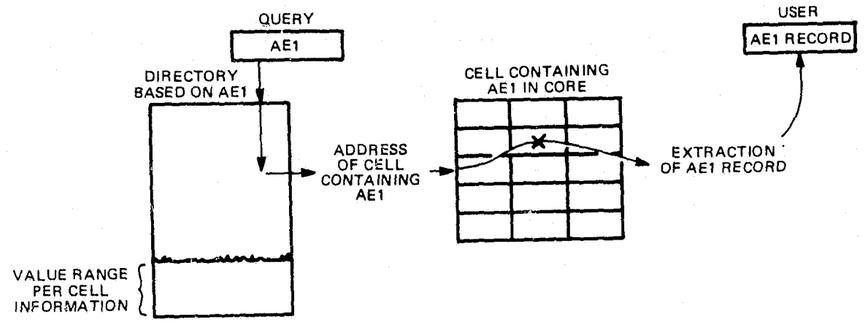
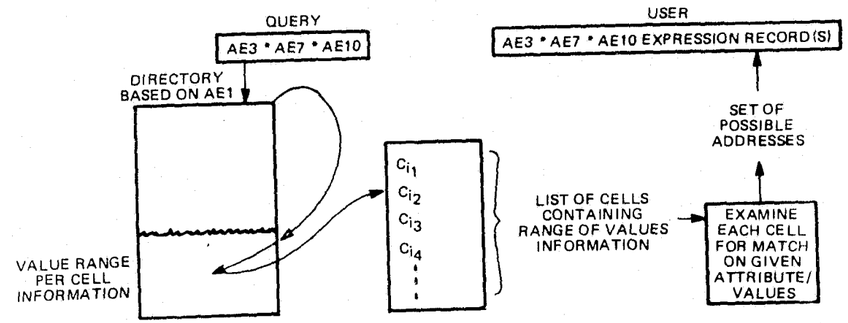


FIGURE 4.5.2–33.



*DENOTES THE CONNECTIVE 'AND' OR 'OR'

FIGURE 4.5.2–34.

does not include AE1. The retrieval scheme that is suggested is explained below. Since the directory associated with the Event Area is constructed primarily for retrievals based on attribute AE1, the directory must also contain value range data for each cell. For this scheme, a cell size of one track is suggested. The smaller the size of the cell, the more probable that the value ranges are small. Figure 4.5.2-34 illustrates the steps taken to retrieve an event record based on any combination of attributes from UAE not including AE1.

Name Area

The index set for the Name Area is based on the two attribute sets, UAPN and UAEN. These attribute sets are related to person data in the Name Area and establishment data in the Name Area respectively. The set UAPN will be tackled first.

Associated with each attribute in the set UAPN is a directory. The attribute/value pairs which are not in the index set but which are supplied by the user are utilized as descriptor information in order to retrieve smaller sets of records. The retrievals from the Name Area are conducted on a directory look-up basis. Given any subset of the index set, a retrieval is made and records are returned to the user. If the user does not supply any element of the index set in his query expression, a retrieval can be made but a large number of possibilities will occur under these circumstances. Figure 4.5.2-35 illustrates a retrieval based on a subset of the index set. Figure 4.5.2-36 illustrates a retrieval based on a subset of the index set and an element not in the index set but in the set of attribute/value pair associated with the Name Area record.

In Figure 4.5.2-35 it is seen that the directories associated with APN11 and APN15 are not utilized. This is because of the way in which the Name Area of the data base is organized. Figure 4.5.2-37 illustrates the internal structure of a typical cell. The ordering of the records in

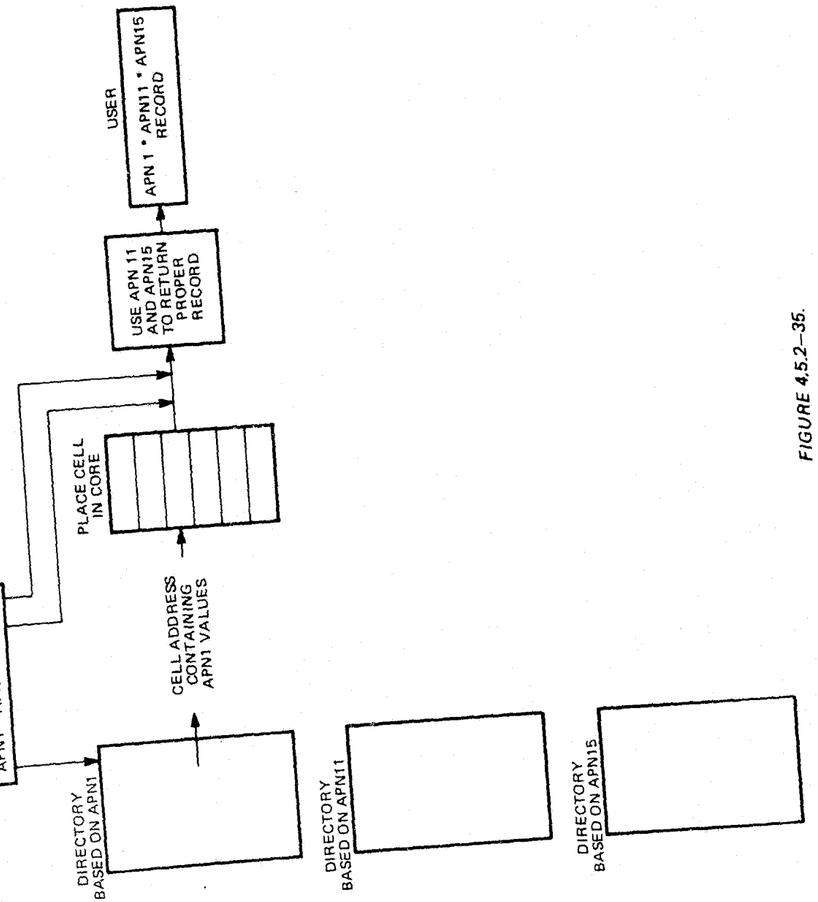


FIGURE 4.5.2-35.

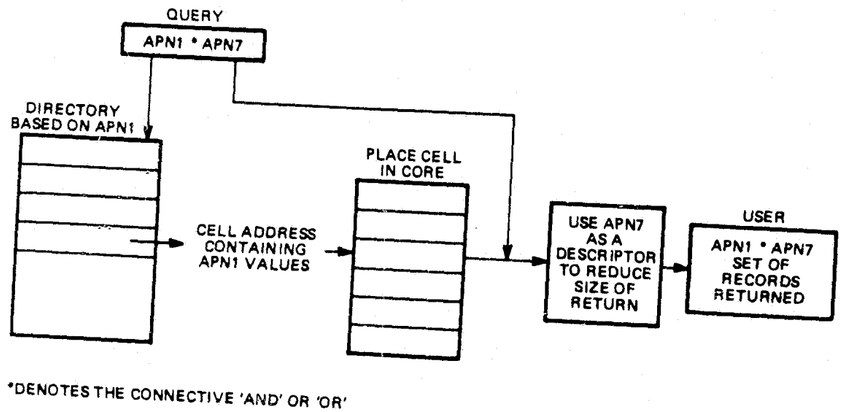


FIGURE 4.5.2–36.

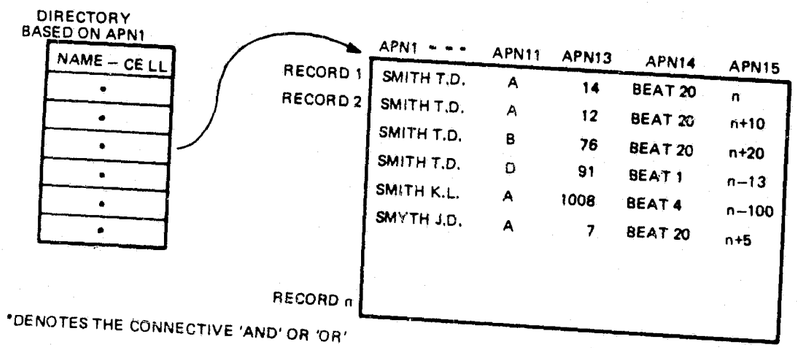


FIGURE 4.5.2–37.

a cell is based on the attribute ranking APN11, APN15, APN13 and APN14.

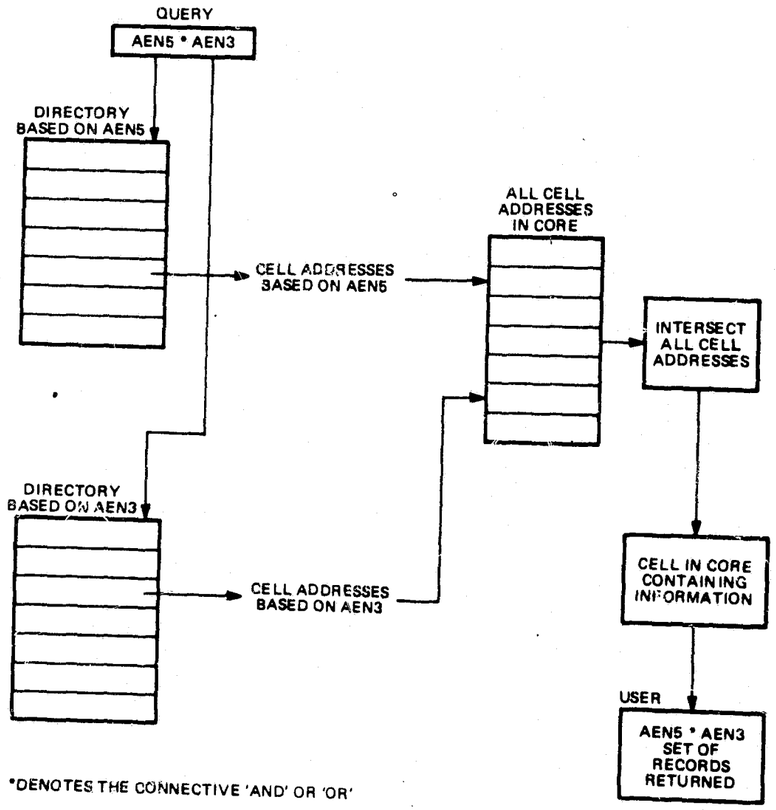
In Figure 4.5.2-36 the use of the descriptor APN7 is shown to illustrate its importance when reducing the size of the set of records returned. Consider a query based on APN1 and APN7. Assume that a retrieval on APN1 results in N possibilities. The use of the descriptor APN7 may reduce the set of N possibilities by some factor k.

As mentioned in the opening paragraph, the type of name record in the Name Area is an important descriptor. It is assumed in the above discussion that the type of name was understood to be the name of a person. To expand this concept the index set UAEN describes the Name Area records associated with establishments. The Name Area records are physically in the same area but the data structure of the record set associated with UAEN is somewhat different. Figure 4.5.2-38 illustrates a retrieval of an establishment type name based on a subset of the index set UAEN. In this figure one sees that the user could obtain a unique record.

Property Area

The index set for the Property Area is based on the attribute set UAP. The set UAP has only two elements, AP2 and AP4. A retrieval based on AP2 will be considered first. This type of property attribute can have many values associated with it. A retrieval of this type is illustrated in Figure 4.5.2-39. Because of the nature of the information input by the user, it is more than likely that many records will be returned. The query uses a value range directory to obtain a list of cells which may contain the information. Each cell must be checked to see if the information exists there, and if it does, the record or records are left. The retrieved set of property records are presented to the user.

When attribute AP4 is used in a query, see Figure 4.5.2-40, the search is more selective although based on essentially the same



*DENOTES THE CONNECTIVE 'AND' OR 'OR'

FIGURE 4.5.2–38.

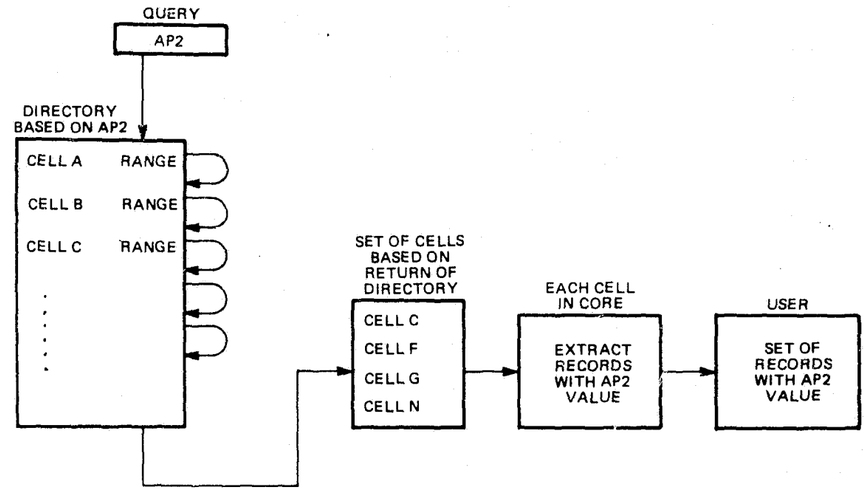


FIGURE 4.5.2–39.

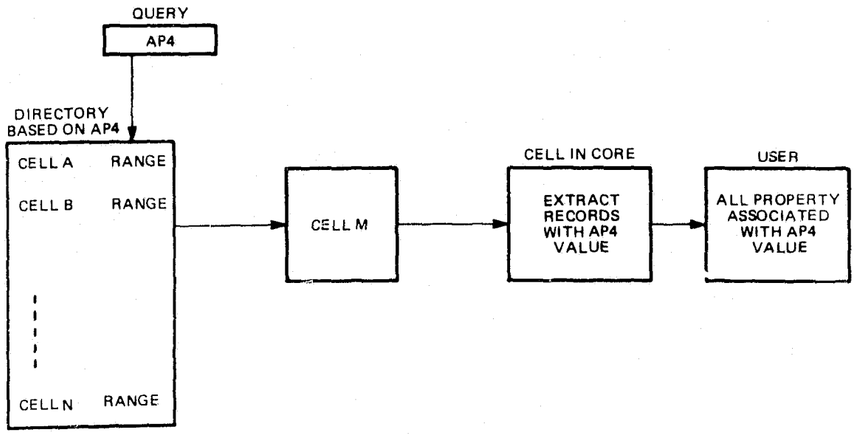


FIGURE 4.5.2–40.

method. See Figure 4.5.2-40 for an illustration of this type of search. The value of the attribute AP4 is compared to directory contents and, since the values associated with AP4 are unique and sequentially arranged, a unique cell location is recovered. The records returned to the user relate to all property associated with the value of AP4.

Special Area

The index set for the Special Area is composed of the name index set, the property index set and a special index set. The "type of record code" in the record distinguishes the particular type of record within the Special Area. When a retrieval is based on the name attributes or the property attributes, retrieval is the same as in those particular areas. Figure 4.5.2-31 illustrates the retrieval of a set of records based on the AS1 attribute. First, all cells containing the AS1 attribute/value are returned as a result of the directory look-up. Then each cell which contains the AS1 attribute is examined and all records of that type are presented to the user.

Figure 4.5.2-32 illustrates the retrieval methods for queries involving attribute AS5. When the directory for AS5 is used, the location of the cell containing the value of the attribute AS5 is returned. The cell is examined in core and the appropriate set of records is extracted. These records are returned to the user. More than one set of records will be returned if the value of the attribute AS5 is found in more than one cell in the Special Area.

Update Processing

An updating process is defined as addition, modification or deletion of a record.

There are two classes of update processes which can take place. Those processes which change non-index set values in a record will be referred to as class 1 processes. Processes which add or delete

records from a data base area or change values of index sets will be referred to as class 2 processes.

Before either class of update process is discussed, the requirement for periodic checkpoints and an audit trail of updates must be made clear. A checkpoint is the process of transcribing the entire data base onto a tape or tapes. A checkpoint is made so as to provide a permanent record of the state of the data base. In the event of a catastrophic system failure, a checkpoint provides a known set of conditions so that an orderly recovery may be made. Checkpoints should be made at intervals dependent upon the volume of updates to the data base. A data base log of all modifications to the data base must be maintained. In the event that input/output errors cause the destruction of the data base, the differences between the checkpoint and the data base at the time of failure are resolved by the data base log. The sequence of events which must occur for recovery is as follows:

(1) Restore the data base from the latest checkpoint
(2) Use the data base log to update the checkpoint
(3) Carefully attempt to re-execute the current jobs

The class 1 modification of a record will be discussed first, as it is a simpler operation. When a user requests that a modification begin, a determination of access authority must first be made. If the user has authority to access a data set and to modify it, a retrieval attempt will be made. If the retrieval produces more than one record the user will be requested to verify the identity of the record to be modified before any modifications are made. Once the user has verified that the proper record has been retrieved, the designated attribute values will be changed. Before the modified record is returned to storage, it is entered and verified in the update log. When all other actions are successfully completed, the updated record is rewritten into the data base. See Figure 4.5.2-41 for a diagram of a class 1 update process.

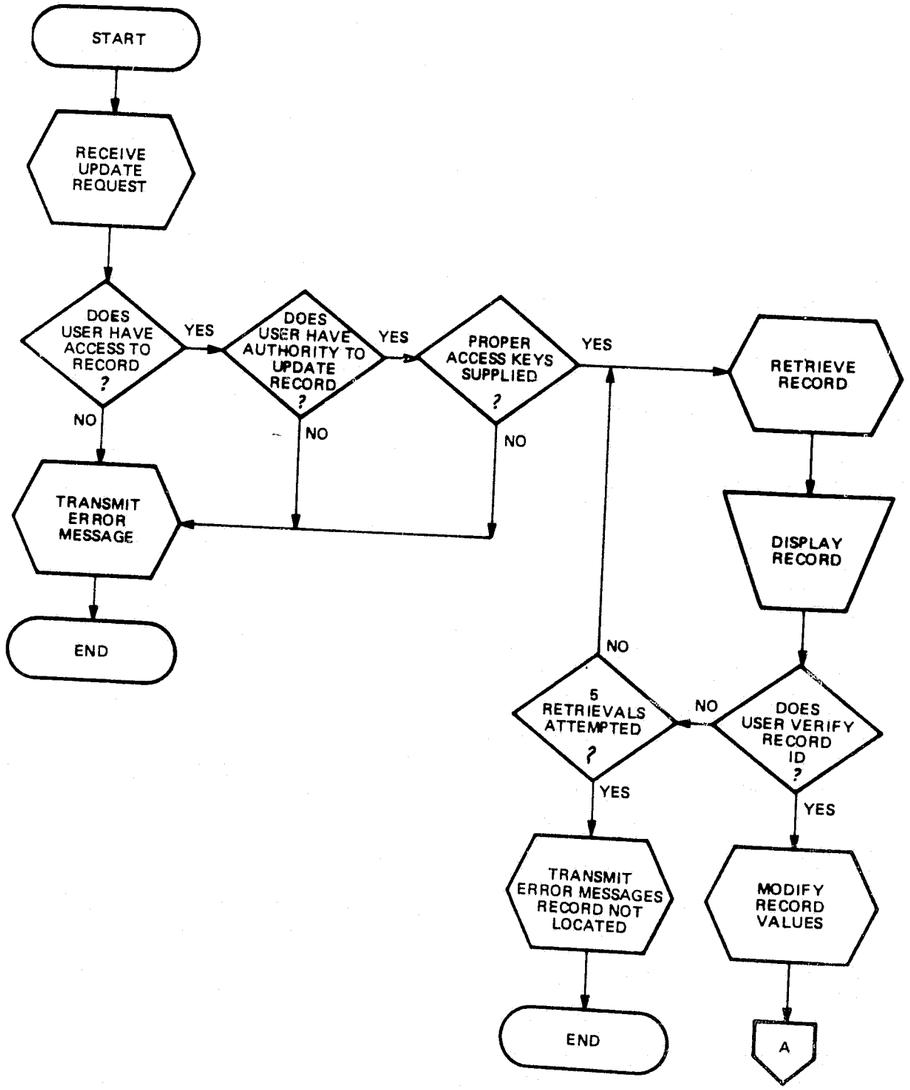


FIGURE 4.5.2-41. CLASS1 UPDATE

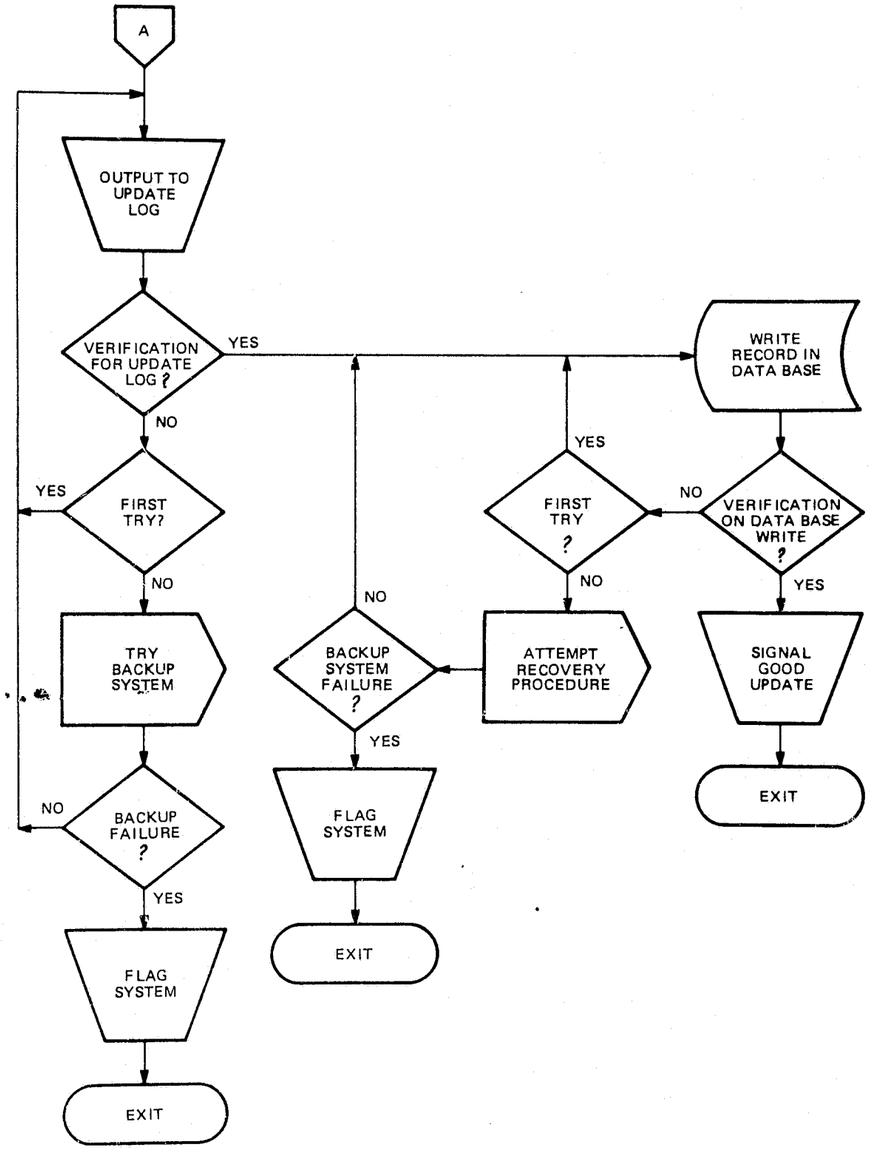


FIGURE 4.5.2-41. CLASS 1 UPDATE (CON'T).

A class 2 update process may involve changes to area directories and association tables. The relative complexity of the class 2 process will depend on the data base area being updated and the specific class 2 update being attempted. Class 2 updates, ranked in order of increasing complexity, are:

(1) Record additions which are independent of other areas

(2) Record deletions which are independent of other areas

(3) Record additions which affect other areas

(4) Record deletions which affect other areas

As there are four areas in the data base and four class 2 processes, many update operations can arise. Fortunately, the operations are nested to a great extent.

Class 2, Type 1 Operations

In order to begin any class 2 process, the user must establish his authorization for access to the given data base area and his authority to perform class 2 updates in this area. Permission to perform class 2 updates should be strictly limited. The user must explicitly define the record segment to be operated upon. Once the user has gained access to the proper data base area, the record to be added to the data base must be carefully examined. Only if valid attribute values have been provided will further action be attempted. If proper keywords are present, a retrieval cycle is initiated by the update process. This procedure can establish the location of the cell in which to place the record and verify that the record does not already exist in the data base. If the retrieval cycle returns a record, the user will be requested to provide additional information so as to uniquely identify the record to be added. When sufficient additional information has been provided by the user, the proper relative location within a cell for the new record can be ascertained.

The new record and its proper address is now known. At this time, the free space inventory is updated and then the new record is entered in the update log and written into the data base. See Figure 4.5.2-42 for a block diagram of this process. Using the attribute/value pair of the new record, the area directory will be updated if necessary. When the update routine is operating on a directory, all other users will be "locked out" of that particular part of the directory. It will be necessary to insure that the lockout time will be as short as possible. See Section 4.5.2.2.3 for a discussion of area directories. Figure 4.5.2-42 is a flow diagram depicting this kind of class 2 update process. It should be observed that this update process applies only to the Special Area of the data base.

Class 2, Type 2 Operations

Record deletions that are independent of other areas can be carried out by methods described in the previous discussion. When a user has established his authority to perform the process requested and his access to the data base area is assured, the operation will begin. The user will be required to identify the record he wishes to delete. Based upon the user-supplied keywords a retrieval cycle will be initiated. When a record is retrieved it will be the user's responsibility to verify that it is the proper record. If the user decides that the proper record has been found, the update system will use the address of the record and its attribute value to update the area directory is necessary. When the area directory has been updated, the deleted record will be placed in a file so that it can be stored in a manual system if required. At this time the update routine will indicate to the data base space manager that the record's previous address is now open and may be placed in the unused space inventory. See Figure 4.5.2-43 for a block diagram of the class 2, type 2 update process.

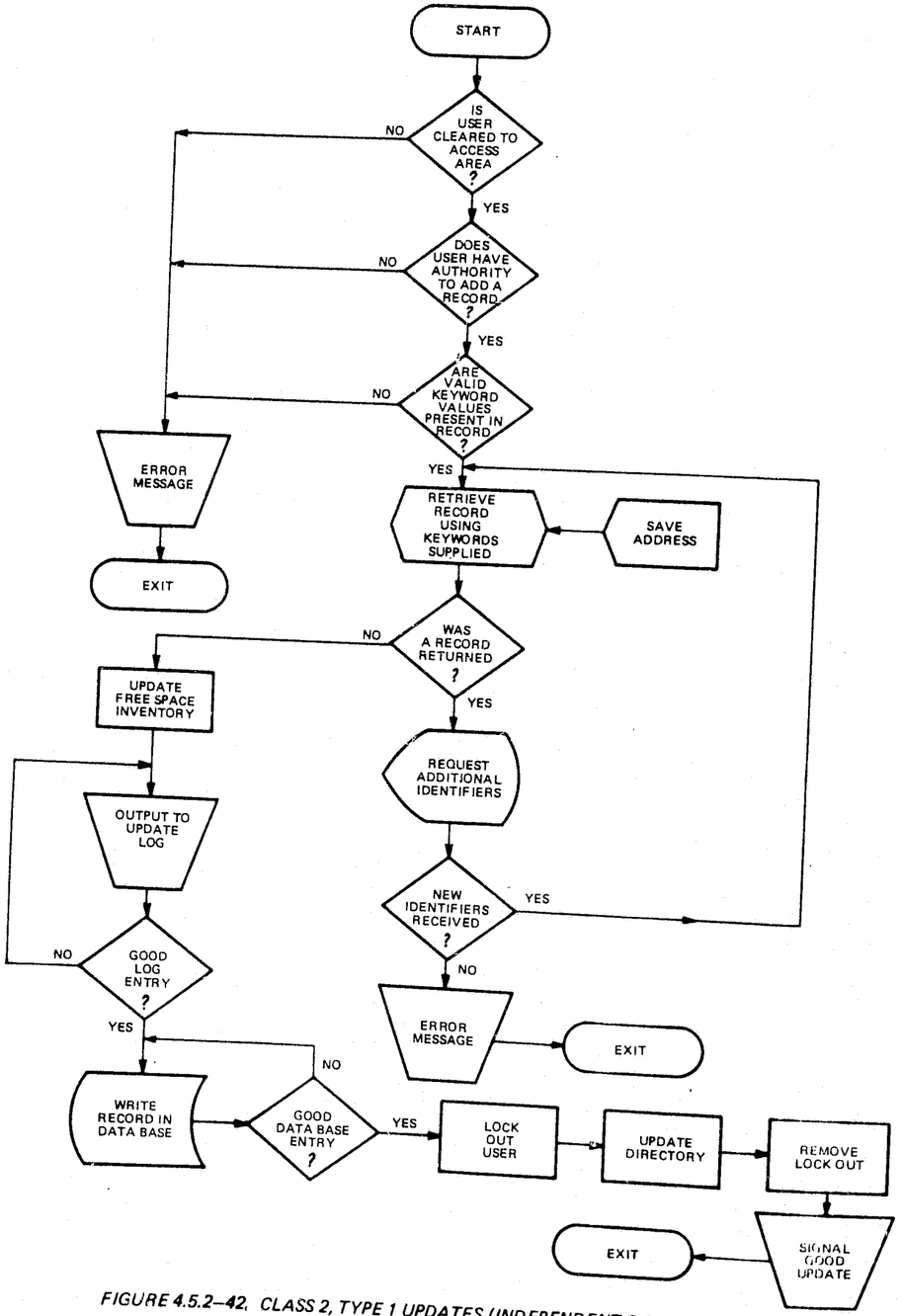


FIGURE 4.5.2–42. CLASS 2, TYPE 1 UPDATES (INDEPENDENT RECORD ADDITIONS)

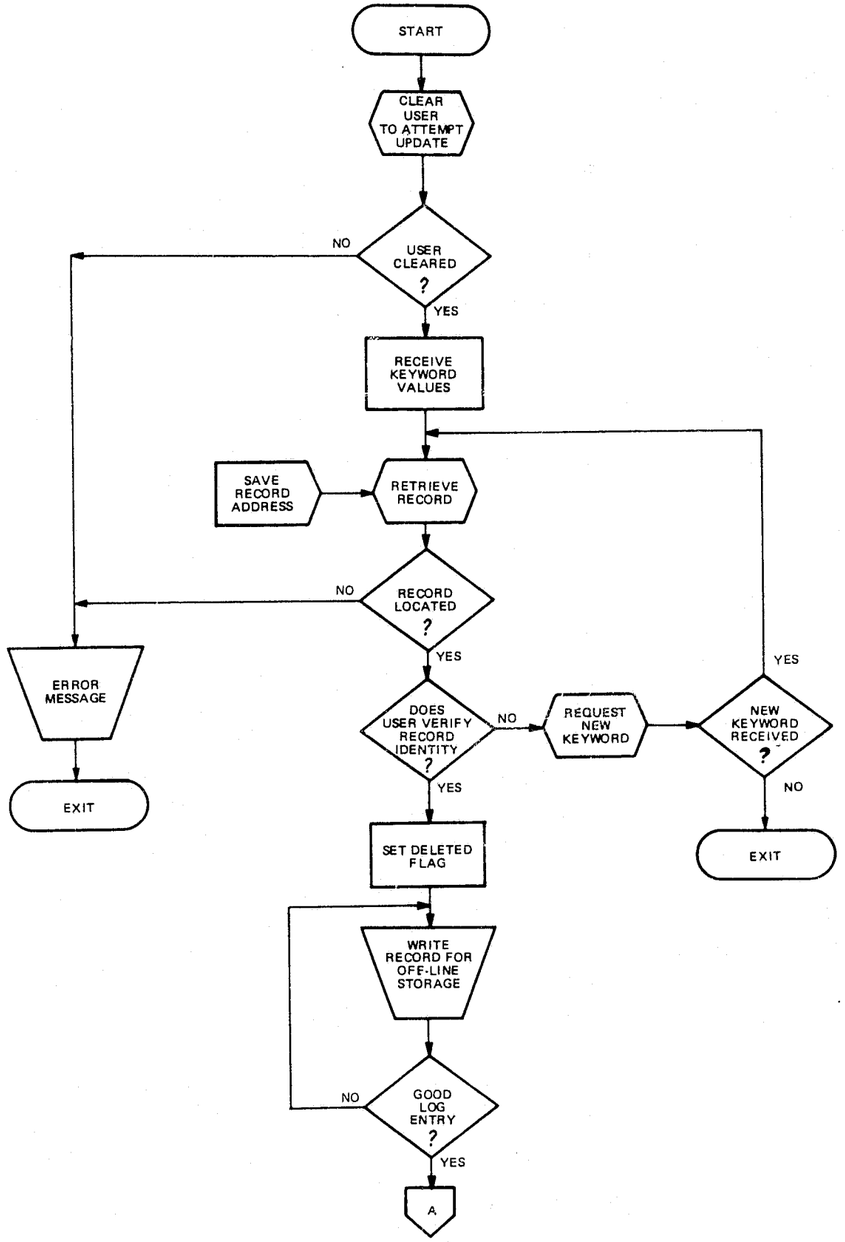


FIGURE 4.5.2–43. CLASS 2, TYPE 2 UPDATES (INDEPENDENT RECORD DELETIONS) (SHEET 1 OF 2)

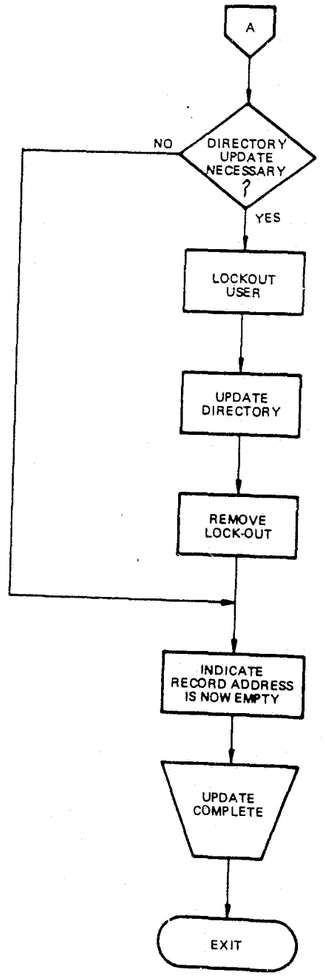


FIGURE 4.5.2–43. CLASS 2, TYPE 2 UPDATES (INDEPENDENT RECORD DELETIONS) (SHEET 2 OF 2)

Class 2, Type 3 Operations

As in other cases, the user's authority must be checked before any action is taken. Assuming that the user has been properly identified, the record he wishes to add and the associations he wishes to establish are received and checked. A retrieval cycle is initiated to discover the proper address for the new record and to insure that it does not already exist in the data base. If the retrieval cycle discovers a record, additional information will be required from the user so as to establish the uniqueness of the new record. If the only characteristic which makes a new record R_n unique is its association with another record R_i, R_i must reside in the data base prior to the entry of R_n into the data base. Only after the new record is sufficiently identified will further action take place. A location in which to store the new record will be determined. This space will be reserved for the new record addition. Necessary updates to the area directories and additions to association tables will now be defined. Once all changes that will be required to the data base system have been determined, all required pointer information will be added to the new record R_n and to the record R_i with which it is to be associated. The two records and the pointer information will be written onto the update log before any changes to the data base or area directories is attempted. Only after the log entries are successfully completed will changes to the data base begin. The changes will be processed in the following sequence:

(1) The new record R_n will be written into its proper storage location

(2) The system space inventory will be updated to reflect the use of an additional storage location

(3) The system directories will be updated to permit the new record to be accessed

(4) If necessary, the association tables for R_i will be modified so as to reflect the association between R_i and R_n

(5) If necessary, R_i will be re-written in its proper storage location

(6) The update program will signal the completion of the update process

See Figure 4.5.2-44.

Class 2, Type 4 Operations

Record deletions which affect other areas are the most complex of the updating processes. Carelessness during this process could result in the loss of valuable information by destroying the associations between records.

After the usual authority clearance procedures have been satisfied, the identity of the record to be deleted must be established and verified by the user. The data contained in the Name, Property and Special Areas are associated by event records contained in the Event Area. Any deletion of name, property or special records must occur as the result of the deletion of an event record. Therefore, this process must be initiated through the input of an event record number.

The deletion process has two levels of complexity depending upon the number of records associated with a given event record. If a single name record, single property record and single special record are associated with the event record the deletion process is straightforward. Only the associated name record need be checked to ascertain if it is associated with another event record. See Figure 4.5.2-45 for an illustration of this condition. If the name record is associated with no other event the deletion process may continue as follows:

(1) Retrieve the Name Area record associated with the event number and place it in a buffer

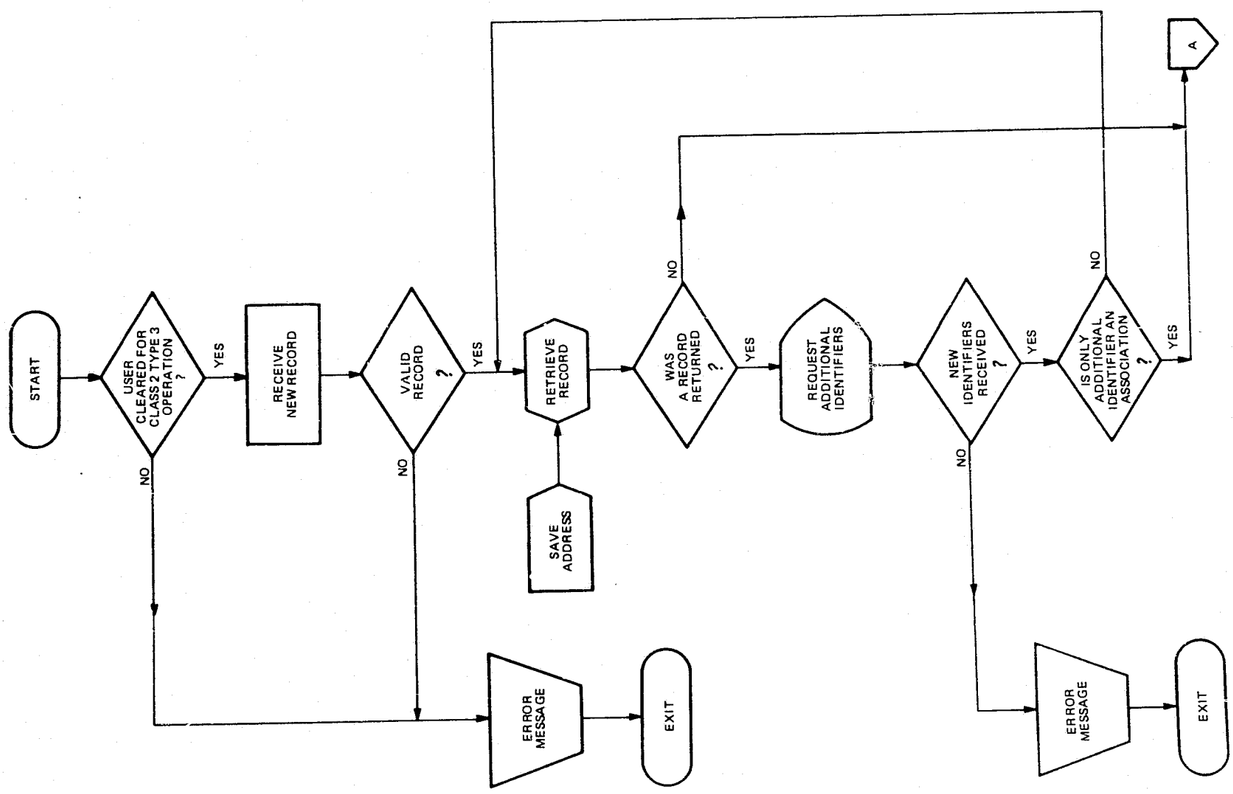


FIGURE 4.5.2-44. CLASS 2, TYPE 3 UPDATES (RECORD ADDITIONS AFFECT OTHER AREAS) (SHEET 1 OF 2)

FIGURE 4.5.2–44. CLASS 2, TYPE 3 UPDATES (RECORD ADDITIONS AFFECT OTHER AREAS) (SHEET 2 OF 2)

FIGURE 4.5.2–45.

(2) Retrieve the Property Area records associated with the event number and place them in a buffer

(3) Retrieve the Special Area records associated with the event number and place them in a buffer

(4) Write all information contained in items (1), (2) and (3) above plus the event record information in a formatted manner to a file for off-line updating

(5) Check processes in item (4)

(5.5) Lock out user

(6) Update directories in each area

(6.5) Delete information in each area

(7) Inform system manager of available space as a result of deletions

(8) Turn user lockout off

(9) Continue processing

The process is more complicated if the given event record is associated with more than one name record. It now is possible that the given event record is the only link between two names. A similar condition can exist if a single name is associated with more than one event. Refer to Figure 4.5.2-45. The solution to this problem should be to set a flag in the event record and in the name record indicating that the deletion of these records is desired. When delete flags have been set in all associated name and event records the actual deletion of the records may be accomplished.

Due to the number of retrievals and amount of output required by the class 2, type 4 update operation it should be able to accept deletion requests at all times. However, the processes involved should be executed on a low priority basis so as to prevent overload of the system during high activity periods. Figure 4.5.2-46 is a flow diagram of the class 2, type 4 update process.

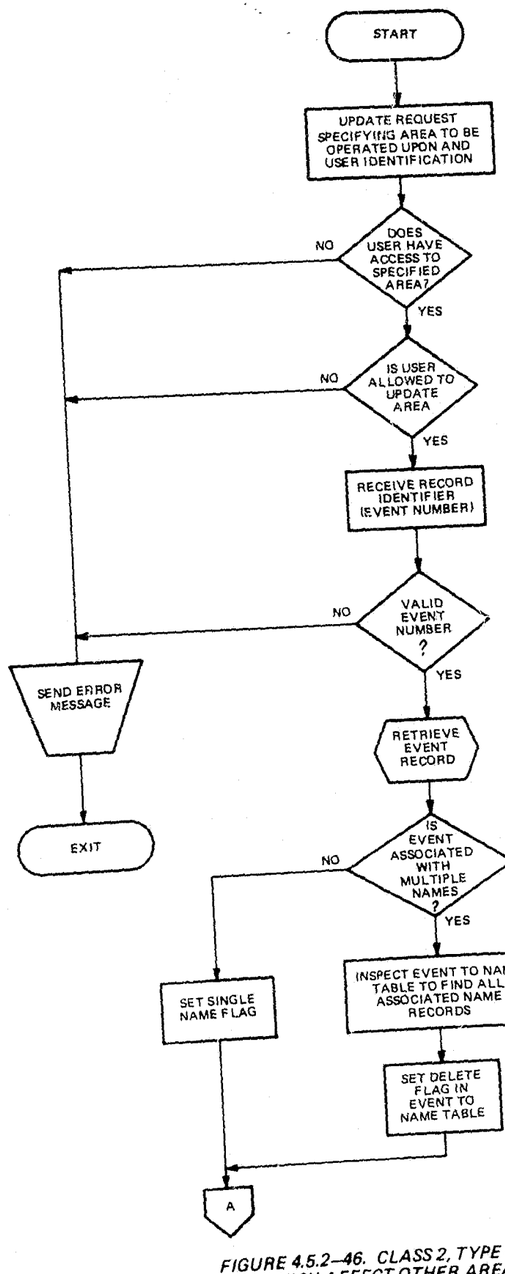


FIGURE 4.5.2-46. CLASS 2, TYPE 4 (RECORD DELETIONS WHICH AFFECT OTHER AREAS) (SHEET 1 OF 5)

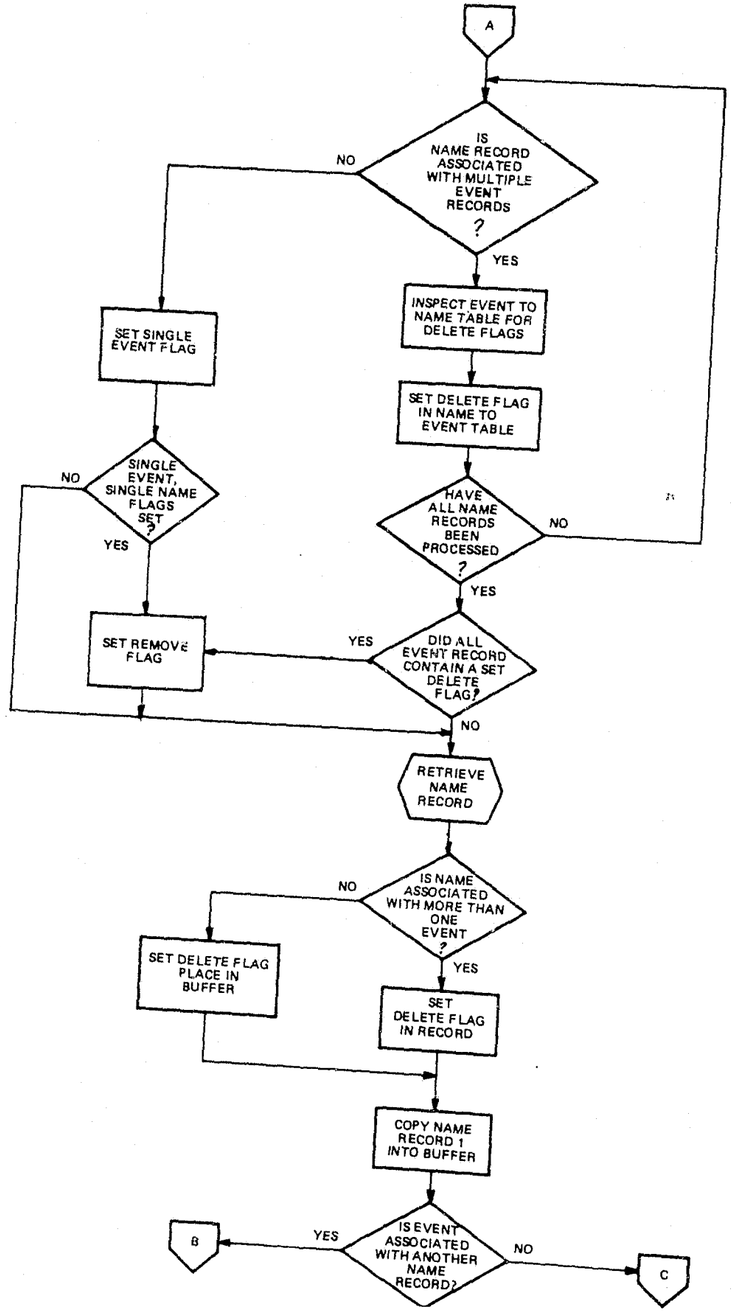


FIGURE 4.5.2–46. CLASS 2, TYPE 4 (RECORD DELETIONS WHICH AFFECT OTHER AREAS) (SHEET 2 OF 5)

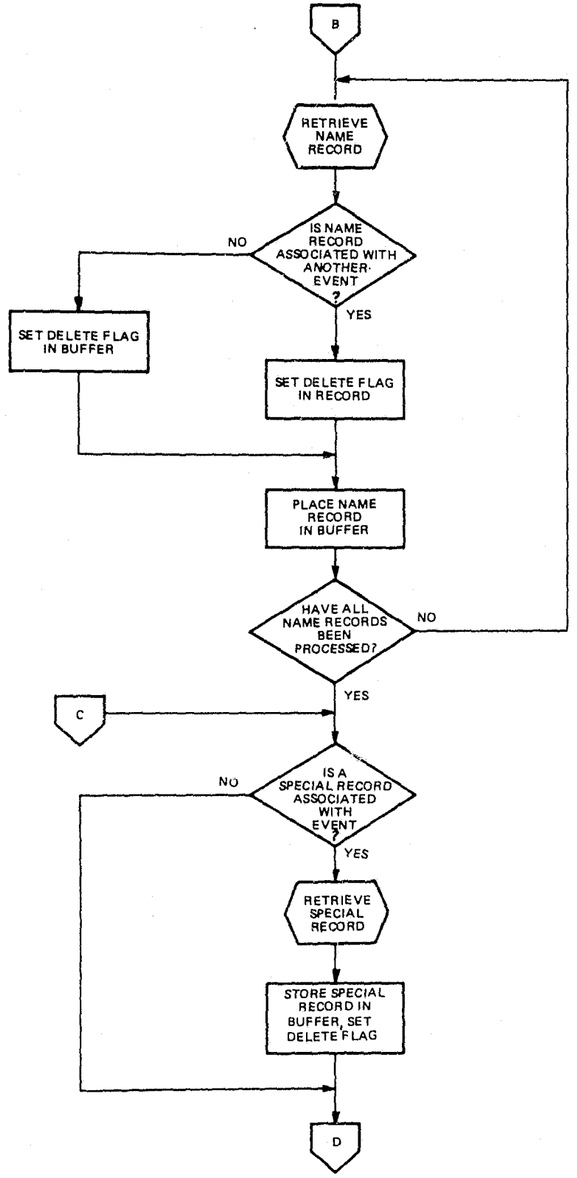


FIGURE 4.5.2–46. CLASS 2, TYPE 4 (RECORD DELETIONS WHICH AFFECT OTHER AREAS) (SHEET 3 OF 5)

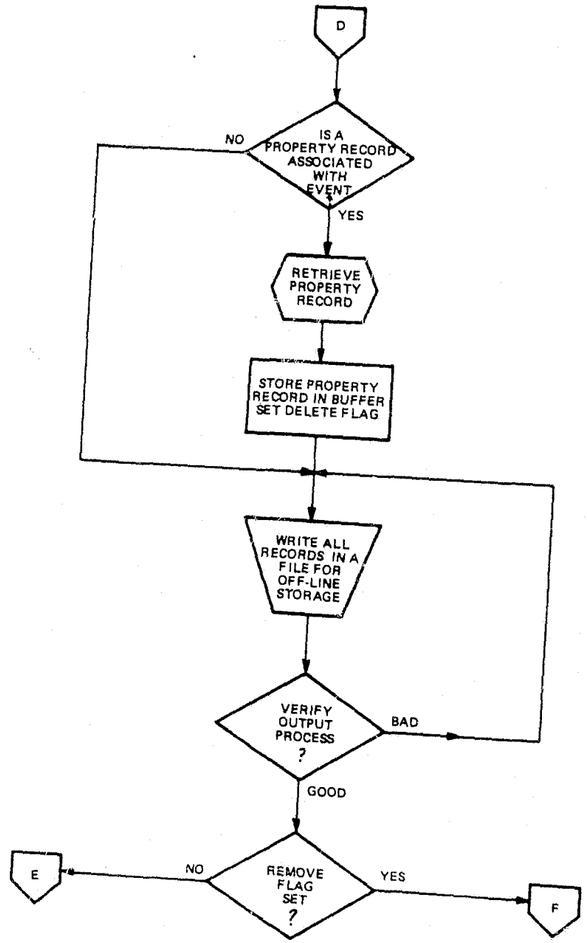


FIGURE 4.5.2–46. CLASS 2, TYPE 4 (RECORD DELETIONS WHICH AFFECT OTHER AREAS) (SHEET 4 OF 5)

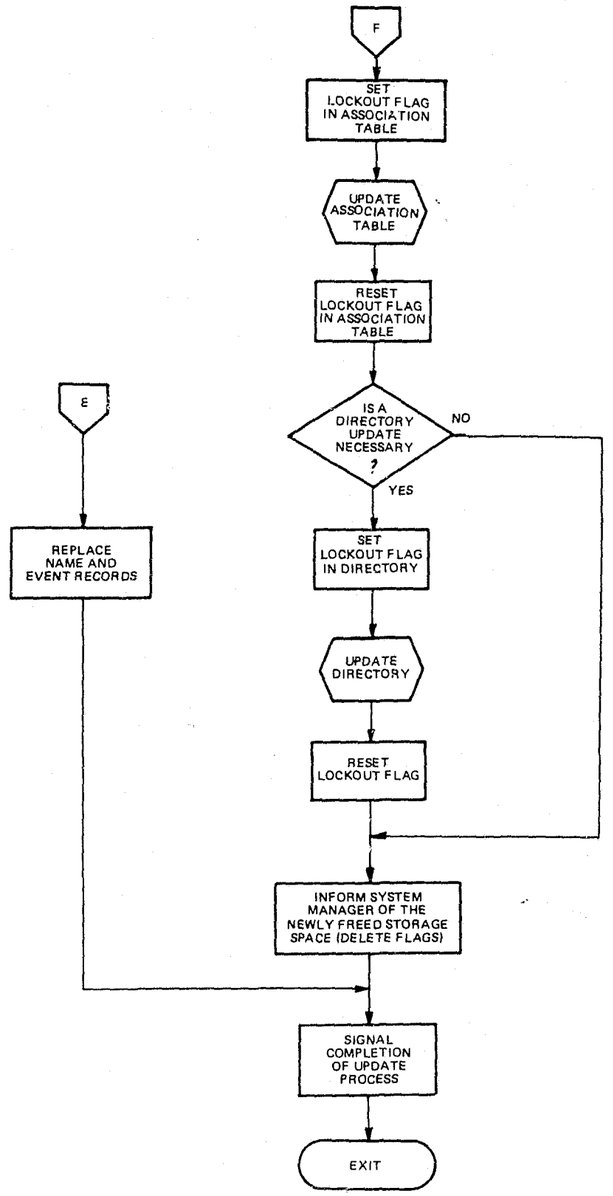


FIGURE 4.5.2–46. CLASS 2, TYPE 4 (RECORD DELETIONS WHICH AFFECT OTHER AREAS) (SHEET 5 OF 5)

Reorganization of the Data Base

It can be expected that as the information needs of the Dallas Police Department change the content of the Law Enforcement Integrated Data Base will likewise change. These changes combined with the normal updating function will eventually cause storage inefficiencies and result in inadequate retrieval times. When either of these conditions reaches an intolerable level, portions of the data base will need to be reorganized. The reorganization function can be considered as a subfunction of the creation process. The data base administrator will make the decisions which cause the reorganization to take place. The necessary decisions will include determination of any changes in record structures, any changes in allowed record associations and any changes in storage structure.

In order to assist the data base administrator, the DBMS should keep statistics on its internal operations. As a minimum, the following statistics should always be available:

(1) The total number of records in any of the four areas
(2) The total unused space in any of the four areas
(3) The number of records stored in each cell in an area
(4) The total number of queries using an area in a given time
(5) The average response time per query
(6) The average number of head movements required per query
(7) The average number of head movements required of each device per given time period
(8) Frequency distribution for response time for each user
(9) The total queries from each user in a given time period

When the data base administrator has decided that reorganization is necessary, the following events should take place:

(1) The area of the data base to be reorganized should be copied and placed on another storage device
(2) Using the data base creation programs, the copied data should be reformatted and reorganized for re-entry
(3) The reorganized data should be used to create new area directories
(4) Using the newly created directories, the data should be rewritten in the data base

4.5.3 BUSINESS ADMINISTRATIVE DATA BASE

The purpose of the Business Administrative Data Base is to organize the records pertinent to the administration of the Dallas Police Department assets, both human and material.

The Business Administrative Data Base can be used to exercise control over the acquisition and administration of internal resources. Resources refer to the various types of assets within the department such as: (a) personnel and their representative skills, (b) availability of finances, and (c) property that is purchased by, or assigned for the use of, the department.

The Business Administrative Data Base should be divided into the Name, Property and Organizational Areas. The Name Area should contain information pertaining to names of both sworn and civilian personnel. The Property Area should contain information concerning the material resources of the department and the disposition thereof. The Organizational Area not only relates the Name Area to the Property Area but can be used as a statistical tool by organizational units.

There are two functions associated with each of the three areas described above. They are the inventory control function and the fiscal control function. The inventory control function is first discussed for all areas of the Business Administrative Data Base and then the fiscal control function is dealt with.

The inventory control function for the Name Area data is related to records of sworn and civilian personnel, i.e., skills, ethnic background, educational level and data such as home address, date of birth, race, sex, marital status, etc.

Property records should contain data related to transactions such as purchase, issue, and removal of property from inventory.

Report type data such as usage factors can be maintained also.

Name Area data is similar to the Organizational Area type data. This area contains data related to each organizational unit in the Dallas Police Department.

The fiscal control functions for the Name, Property and Organizational Areas are now discussed. Payroll data for all sworn and civilian employees is maintained along with all records of money issued to organizational units for other purposes. The purchase and sale of properties of the Dallas Police Department can also be recorded.

The necessary fiscal records will be created in order to account for all department funds.

A look at existing on-line files related to business administration shows that only the police personnel file is currently on-line. This file is not utilized to provide any management information by which decisions could effectively be made.

The police payroll is presently processed by the Fiscal Affairs Division of the Dallas Police Department in conjunction with the City Auditor and City Data Services. The Fiscal Affairs Division manually records hours and calculates gross pay for the pay period. Calculation of deductions and net pay is conducted by City Data Services on a batch basis. The pay voucher is authorized by the City Auditor.

An overview of the Business Administrative Data Base is shown in Figure 4.5.3-1. It is emphasized that the basic structure and concepts employed for the Business Administrative Data Base are the same as the structure and concepts of the Law Enforcement Integrated Data Base.

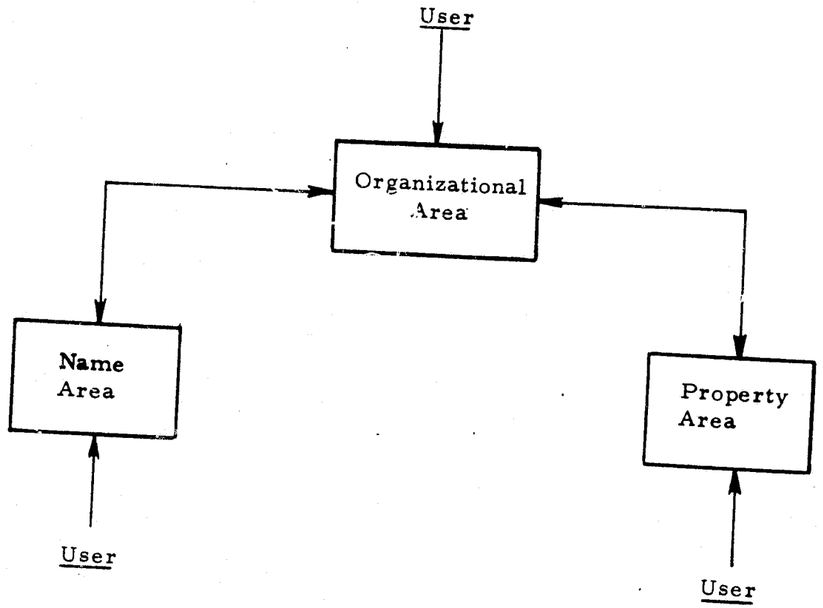


FIGURE 4.5.3–1. OVERVIEW OF THE BUSINESS ADMINISTRATIVE DATA BASE

4.5.3.1 AREA DEFINITIONS

The area definitions show the relationship between the different areas and the relationships within areas.

Name Area

The Name Area contains information on both sworn and civilian personnel within the Dallas Police Department.

Record Structure

The proposed record layout is designed to contain data related to a particular person so that information surveys concerning the personnel of the Dallas Police Department can be conducted. The Name Area record should contain information of the following nature:

Primary Record Segment

- Name of person and type of name (sworn, civilian) — AP1
- Physical Characteristics
  - Sex — AP2
  - Date of birth — AP3
  - Race — AP4
  - Height — AP5
  - Weight — AP6
  - Color of hair — AP7
  - Color of eyes — AP8
- Employee ID number and badge number — AP9
- Fingerprint classification — AP10
- Street address — AP11
- Telephone number — AP12
- Service record information — AP13

- Social Security number — AP14
- Payroll information
  - Hire date — AP15
  - Current salary — AP16
  - Deductions — AP17
  - Pension fund — AP18
  - Marital status — AP19
  - Number of children — AP20
- Address to Organizational Area Record
- Address to Secondary Record Segment

Secondary Record Segment

- Attendance information
  - Sick days
  - Vacation
- Military service
- Educational training
- Language skills
- Job performance
- Hobbies
- Text information

Keywords

When all of the information concerning an individual has been thoroughly analyzed, certain attributes will be recognized as being near-unique identifiers (see Section 4.5.2.2.1 of this report for definition). These attributes can be used to define directories to enable entry into the Name Area. The index set for the Name Area of the Business Administrative Data Base is based on the following attributes:

- Name — API
- Employee ID and badge number — AP9

- Social Security number — AP14
- Fingerprint classification — AP10

Property Area

The Property Area contains information related to all property assigned to the Dallas Police Department.

Record Structure

The Property Area contain physical property inventory data as well as data for property on order or property ordered but not received. The following list of fields is considered as the basis of the Property Area record:

- Type of property (person or organizational property) — APR1
- If person property; inventory of Quartermaster issue
  If organizational, address to Organizational/Property Table
- Address to Organizational Area Record

Keywords

The attributes with the near-unique property can only be defined after an analysis of the exact record structure of the Property Area record. These attributes will be used to determine the directories allowing the user access to the Property Area of the Business Administrative Data Base:

- Type of property — APR1
- Weapon ID number — APR2
- Inventory number of non-person property — APR3

Organizational Area

The Organizational Area is designed to contain information related to a specific organizational unit of the Dallas Police Department.

Record Structure

The record structure allows the association of people to property, people to organization, and property to organization. The Organizational Area record is also a record of all people, property and fiscal data of a particular organizational unit. The proposed record structure for the Organizational Area should contain the following data:

- Name of organization unit (code) AO1
- Location of organization (room number, street address) AO2
- Address to Name Area Record
- Address to Property Area Record

Keywords

The attributes of the Organizational Area record should allow the user to survey the area and obtain personnel rosters, property associated with the department and other statistical data for management reporting. The choice of the proper attributes for the Organizational Area record can be selected only after much analysis of the desired management information. The proposed index set for the Organizational Area is as follows:

- Name of Organizational Unit (code) AO1
- Location of Organizational Unit AO2

4.5.3.2 CREATION, UPDATING AND RETRIEVAL

The topics of Area Associations, Creation, Directories, Retrieval Methods and Updating of the Business Administrative Data Base are not covered in any detail in this section because of the conceptual similarity that exists between the Business Administrative Data Base and the Law Enforcement Integrated Data Base. All concepts and schemes that are covered in the Law Enforcement Integrated Data Base apply in general terms to all items that must be considered in order to structure the Business Administrative Data Base.

4.5.4 INTERFACES

There are eight major interfaces that exist in the total proposed system. These interfaces are as follows:

(1) Operations Control Data Base interface with the Business Administrative Data Base

(2) Operations Control Data Base interface with the Law Enforcement Integrated Data Base

(3) Law Enforcement Integrated Data Base interface with the Business Administrative Data Base

(4) Law Enforcement Integrated Data Base interface with the Book-In System

(5) Law Enforcement Integrated Data Base interface with the Off-Line Data Base

(6) Business Administrative Data Base interface with the Off-Line Data Base

(7) Law Enforcement Integrated Data Base interface with the Regional Files

(8) User interface with each major configuration

These interfaces will be discussed in the order of occurrence in the above list. The discussions will be limited to concepts of software design and will not be inclusive of specific items or examples. Section 4.1 of this report contains an illustration of the total proposed system.

The interface between the Operations Control Data Base and the Business Administrative Data Base is a software link that enables the use of some data in the Business Administrative Data Base concerning personnel for the Operations Control Data Base. This link enables the requester to access relevant information concerning personnel assigned to specific tasks or units, their addresses and telephone numbers, etc. This

interface is considered to be a minor link in the above list of interfaces to the other areas.

The Operations Control Data Base interface with the Law Enforcement Integrated Data Base is an important interface.

The present Operations Control Data Base consists of the following on-line files:

- Call File
- Street Locator File/File
- Unit Availability File
- Mark-Out File
- Correct Street Name File
- Ambulance Call File

There are various NCTCIC, NCIC and vehicle registration files which are accessed by the Operations Control Data Base. However, these files are used for inquiries and are not used to store information relating to the operation of the Dallas Police Department.

Of the files in the Operations Control Data Base, the Call File contains the information which is of most concern to Dallas Police Department law enforcement, especially investigative personnel. It also contains information which is not of concern to investigative personnel, but which is valuable to management.

It is essential that the information contained in the Call File which is relevant to investigative personnel be maintained on-line for a long period of time (two-three years). The information which is of no significance for investigative purposes should be pulled out of the Call File record and placed on tape in a form suitable for weekly, monthly, quarterly and yearly management reports.

To accomplish the above mentioned concept, a decision must be made as soon as possible after a Call File record has been created

determining whether a call for service will generate information useful in the investigative process. This decision can only be made by the officer/officers handling the call for service and related to the dispatcher when the officer clears from the call. If the call involves or generates useful information, the Call File record associated with the call for service should be treated or viewed as a different type of record than one which does not involve useful information.

This system should operate as shown in Figure 4.5.4-1.

When a routine call for service is initiated, it is assigned a service number just as it is in the present system. This service number provides the dispatcher with a key by which specific records in the Call File can be readily accessed. However, upon termination of the initial call for service (when the officer clears from the call) the officer wishes to file a written report, an event number must be generated to identify the report. This event number can be generated from an event number-service number log maintained internally by the computer. The event number is an eleven-digit number. The leftmost two digits indicate the year, the next three digits the Julian date, the next two digits the hour of day, and the last four digits a sequence number. When an officer requests an event number, the next available sequence number is pulled from the log, the time call received is pulled from the Call File record, and given the date and year, the event number is generated and returned to the dispatcher. The officer then uses this number to identify the written report. After the event number is generated, the complete event number is placed in the event number-service number log along with the corresponding service number. The event number is preferred as an identifier of an event area record over the service number for the following reasons: (1) it is a time-date based number which provides more information to the user than a service number; (2) due to it being

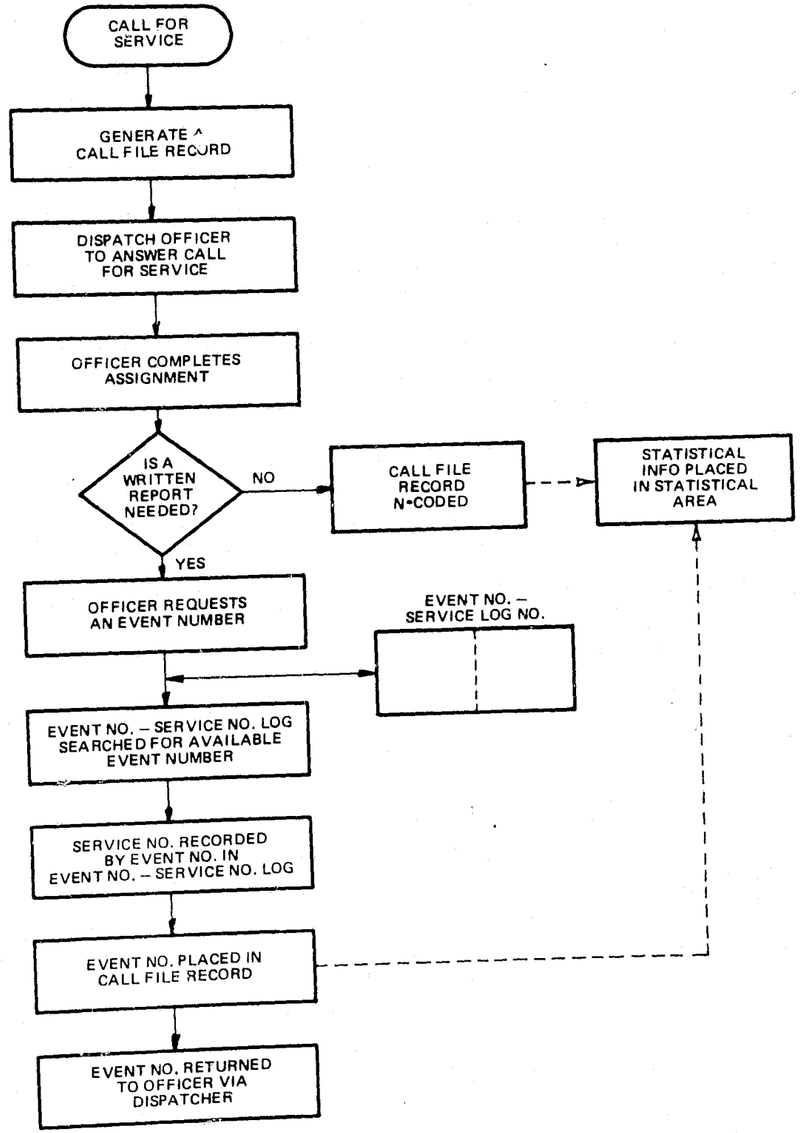


FIGURE 4.5.4–1.

time-date based it lends itself to file structures supporting date-time on-line reviews; (3) it provides a means through which officers can identify reports which were not a result of or initiated by a call for service.

The Law Enforcement Integrated Data Base should be updated at the beginning of each day. (See Figure 4.5.4-2.) When it is updated, the event number-service number log is scanned and an event record created for all event numbers used since the last update. If an event number is mapped into a service number, the information in the Call File record which is suitable for the Law Enforcement Integrated Data Base is copied into the event record. A flag should be set in the Call File record to prevent any updating of the Call File record after an event record has been created corresponding to a Call File record. Updating could occur in the Call File until the event record is created.

A software package must be designed to extract statistical information from the Call File. See Figure 4.5.4-3. This package should be run on a regular time basis (weekly). It could provide needed statistical reports relating to calls for service. The reports could be printed for distribution and placed on magnetic tape so that the information needed for a monthly report would be available in machine form in past weekly tapes.

The Law Enforcement Integrated Data Base interface with the Business Administrative Data Base is an interface that allows the user of the Law Enforcement Integrated Data Base access to some of the information concerning personnel. This is sometimes essential when reviewing information and one needs to know something about the officer involved in the event.

The Law Enforcement Integrated Data Base interface with the Book-In System allows the user to access all of the available information concerning the arrest of an individual or group of individuals.

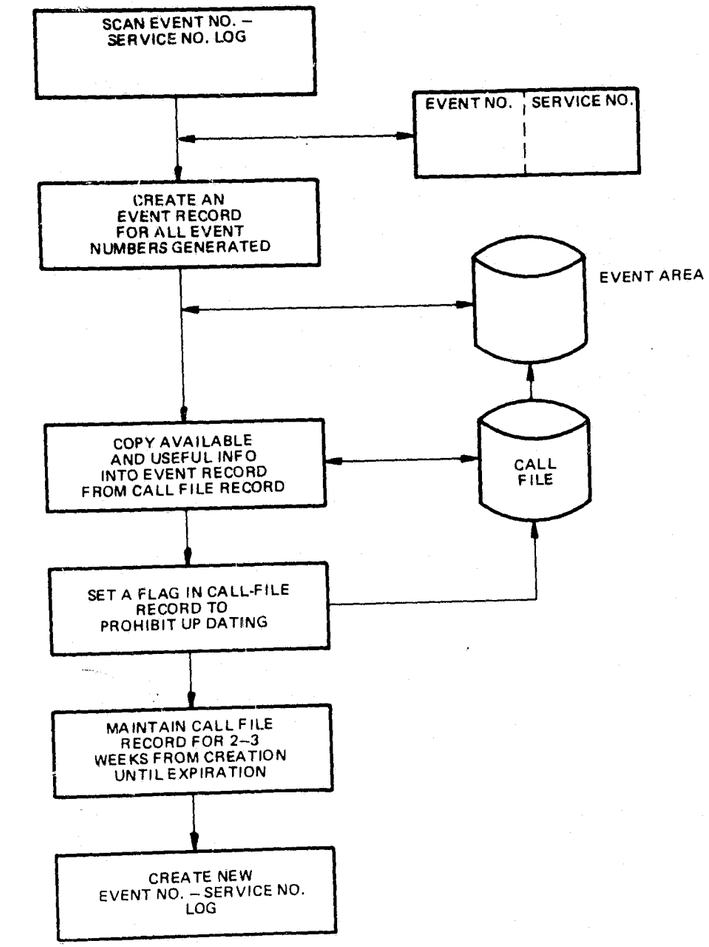


FIGURE 4.5.4–2.

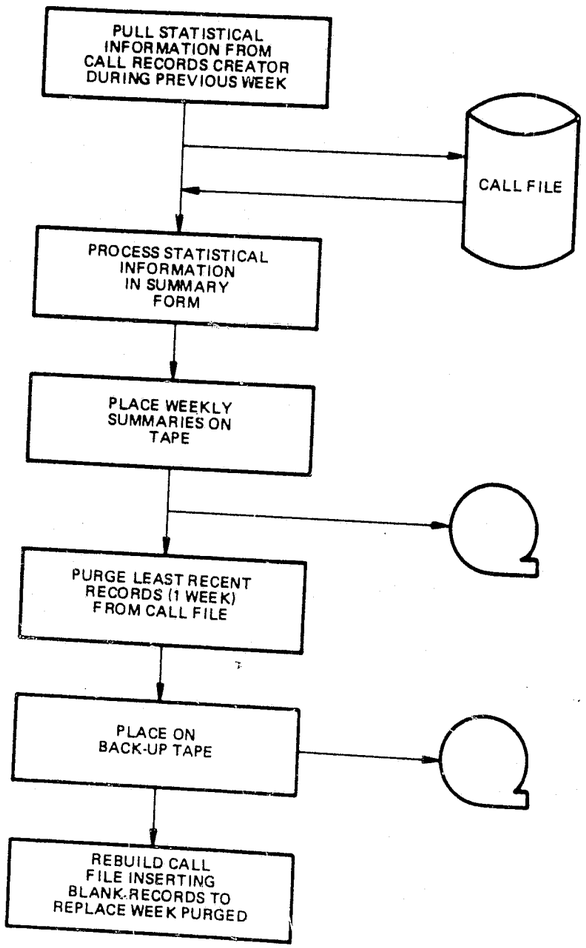


FIGURE 4.5.4-3.

Items (5) and (6) of the interface list will be considered in the following paragraphs which treat a manual filing system interface with on-line systems.

The primary topic to be addressed is : How can a manual filing system be designed to :

(1) Provide the same index sets as the on-line system does, or a subset thereof

(2) Interface with the on-line system in such a fashion as to provide for an easy and speedy conversion from the on-line system to the manual system as data is transferred from the on-line files to the manual files

(3) Provide the above features in a cost effective manner

It is felt by Operation LEADER personnel that the on-line index sets associated with some data be retained. Otherwise, the users' needs cannot be met.

One obvious and simple solution to the problem of indexing manual filing systems is to produce a computer printout of the computer indexing system relating to a set of data before the data files and index files are updated and the information is destroyed in the computer. These printouts are then microfilmed and the microfilm is used as the cross index. If the index set is of size N, then N cross indices must be created: one cross index for each keyword sorted on that keyword. The following is an example:

Keyword Value (name)	Keyword Value (date)	Record Location (address)
Adams	12/2/72	133
Berry	11/3/72	108
Carter	1/4/72	119
Fowler	3/10/72	146
Kimp	8/20/72	172
Ranger	6/1/72	201
Zackry	10/3/72	86

In the preceding example, if one wanted to search for a record given a person's name as the keyword, the sequential search down the name column would be quite fast on a microfilm device. But, if the search was by date, the preceding table would not provide an effective way to locate the record. Therefore, to provide access on both name and date, the preceding table would need to be sorted to appear in the following manner:

Keyword Value (name)	Keyword Value (date)	Record Location (address)
Carter	1/4/72	119
Fowler	3/10/72	146
Ranger	6/1/72	201
Kimp	8/20/72	172
Zackry	10/3/72	86
Adams	11/3/72	108
Berry	12/2/72	133

By searching the second column, the records can be rapidly accessed by date. If a combination of keywords is used, suppose name and date, the search becomes even more difficult. This involves searching both the name index and the date index to find the intersection of the two indices, or, searching either the name or date index and then looking for the correct name or date depending upon which file was searched. As files grow and the keyword expressions become more complex, the task of cross indexing via microfilm increases proportionally.

Updating a microfilm cross indexing system also presents a major problem.

A better solution to the cross indexing system might be to incorporate the use of a mini-computer. The cross indices could be maintained on magnetic tape cartridges. These indices could be very similar to those maintained by the on-line system. These on-line indices could be edited and modified, if necessary, by the larger computer and

output on paper tape which would provide a rapid mode of entry into the mini-computer system. A magnetic tape (reel to reel) could also be produced by the larger computer as back-up. The indices in the mini-computer system would need to be sorted primarily on date. One reel of indices might contain information relating to a month of information. The search on the indices could be sequential given an approximate time frame so that only one or two tapes need be searched.

The interface of the Law Enforcement Integrated Data Base and the Regional Files is essential in cross checking items in the Special Area of Law Enforcement Integrated Data Base and the Regional Files. The same hardware used for the off-line data base can be utilized as a switcher for all requests going to the Regional Files from the Operations Control Data Base and the Law Enforcement Integrated Data Base and requests that must be met by referring to the Off-Line Data Base.

The user interface is always an essential part of the total system. The items necessary for an adequate user interface are discussed in Section 4.3 of this report.

5.0 INFORMATION SYSTEM DEVELOPMENT AND IMPLEMENTATION

This discussion will begin with three assumptions:

(1) A System Development Process exists as a definable entity.

(2) The System Development Process entity can be studied and improved.

(3) In order to develop an information system it is necessary to understand both the system and steps required for its development.

There are a number of phases through which an information system must pass before it begins to produce returns on the investments made during its development. The six phases through which the system should pass are:

(1) Feasibility study (system investigation)

(2) System specification (preliminary design)

(3) System engineering (design and documentation)

(4) Programming and procedure development (construction and preliminary testing)

(5) Implementation (final testing and system conversion)

(6) System operation (production processing)

It is obvious that some of the phases will represent a substantial capital investment. However, the expenditure will be much less than that which would result if a well-defined structure for design, management and control did not exist. See Figure 5.0-1 for a diagram of the System Development Management Organization.

Operation LEADER can be considered to have brought the system development to a point midway between phase 2 and phase 3 above.

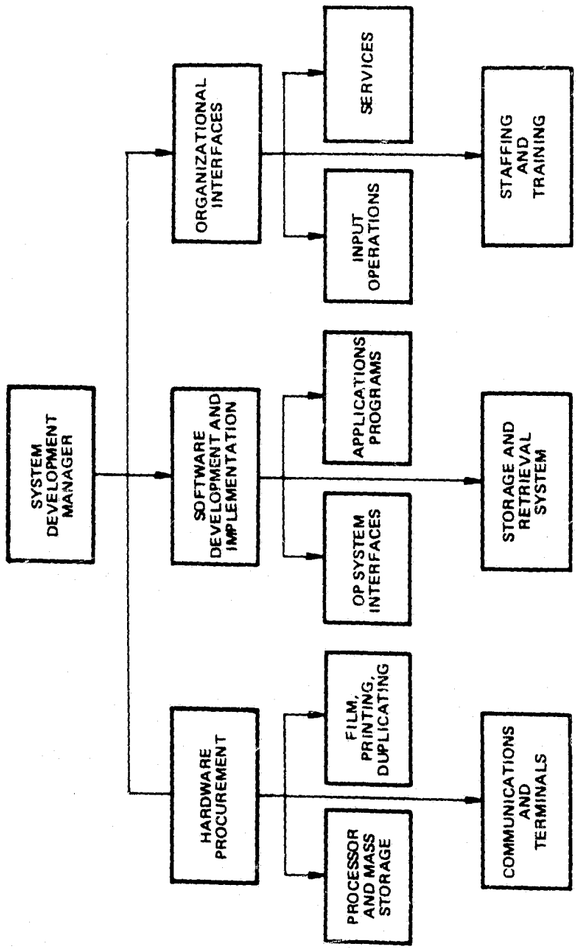


FIGURE 5.0-1. SYSTEM DEVELOPMENT MANAGEMENT ORGANIZATION

As the succeeding phases are initiated a heavier investment in manpower and time will become necessary.

In order to allow the development cycle to continue at a rapid pace the System Specifications presented in the Operation LEADER Phase III Report should be designed for and implemented in a higher level language such as COBOL or PL/1 in combination with some assembly level code. While some sacrifice in system speed and storage space will be required by the use of a higher level languages there are definite advantages to be gained through their use. The advantages are:

(1) A significant degree of hardware independence

(2) Reduced programming time

(3) Reduced testing requirements

(4) Ease of implementation of system modifications

An outline of the steps to be taken, with an approximate time schedule, will be presented as an indication of the lead time required by the remainder of the information system development process.

Software System Development/Implementation

(1) Design and implement a high speed computer-to-computer message processing system between NCIC, NCTCIC and Austin files and Dallas. The message processing system will allow rapid access to State Vehicle Registration Files, Regional and National Stolen Vehicle and Wanted Person Files. Software design/implementation time should be approximately six months.

(2) Design and implement the Law Enforcement Integrated Data Base Management System. Initially the data base should contain only the Events and Persons Areas. At a later date the Special and Property Areas can be added. The total time required to build the system will be on the order of two years.

(3) As portions of the Law Enforcement Integrated Data

Base become operational the conversion of existing systems should begin. This process will overlap the Integrated Data Base Development to some extent. The total time required for this effort can be expected to be about two years. During this period, the Business Administrative Integrated Data Base can also be developed.

(4) When the Integrated Data Base Implementation is essentially complete, work on Management Report Systems can be increased so as to allow near real-time control of the Dallas Police Department operations to begin. As this will be a new area for management, operational personnel and software personnel, it can be expected to be a continuing project.

(5) Once the Integrated Data Base is in an operational condition the training of Dallas Police Department personnel in the use of the new system should begin. It would be desirable for this process to be combined with the later portions of step three so as to ease the transition period between the old and new systems. The training process can be expected to require approximately one and one-half years.

For a discussion of the hardware refer to Section 3.0 and Section 4.2.

5.1 FACILITIES PREPARATION

In the future the Dallas Police Department deserves no less than a secure site to house the best and most modern computing equipment available. This in turn will help provide data processing services to all users within the department and the various regional users. To accomplish fast, cost-effective, uninterrupted service, the computing facility must be designed and constructed with all the safety and fail-safe requirements comparable to those that exist for important military command and control centers. The ever present dangers of fire, sabotoge, bomb threats, theft and malicious mischief to valuable computerized information and records can no longer be ignored. Decisive management action must be taken and soon. There seems to be no single set of procedures to be followed in setting up a secure computer complex; however, there are some basic guidelines the police should adhere to in creating a safe and secure data processing installation.

To provide maximum protection for the computer facility and support a completely integrated security system the following factors should be taken into consideration:

- Location - The computer center should be located in an inside area of the building with few or no windows and not on an outside wall. Solid wall construction should be emphasized in all perimeter construction, with doors made of riot-proof material. Glass should be at a minimum and if used at all should be bullet and shatter proof. It is suggested that the basement of a building never be used due to the likelihood of water damage.

- Security - A tight access-control system into the computer area is most important. Access should be limited to one or two controlled points and only authorized personnel should be allowed through these control points. A badge or ID card system is usually effective and/or closed circuit television surveillance. Visitors, if allowed at all, should be escorted at all times and a complete background or security check run on all new personnel hired in the data processing area. Included also in this type check should be the janitors and clean-up people that work in and around the computer center.

- Fire protection - Perimeter protection and adequate access control systems usually provide the first line of defense, but protection of the vital data within the computer area must be safeguarded from destruction either by fire or other means. To provide the earliest possible fire warning, an approved ionized smoke detection system should be used as well as sensitive heat-rise sensors located throughout the area. Fire extinguishers (CO_2) and instructions for their use should also be located throughout the area. The protection of tapes and disks must also be given consideration. All such media should be stored in a special fire resistant anti-magnetic safe built specifically to Underwriter Laboratories standards for E. D. P. classification. Conventional fire resistive safes or vaults are not recommended for the protection of computer media. Fire does not have to make direct contact with any magnetic tape to

destroy the information being stored. Paper can be damaged or destroyed at temperatures over 350° F, but the critical temperature for computer tapes and disk packs is only 150° F. Precaution should also be taken not to store combustible materials near or adjacent to any part of the computer center and air conditioning and electrical cut-off switches should be conspicuously posted in case of over-heating and impending fire.

- Data protection - Proprietory and confidential police data and information must be kept from unauthorized access. Police terminals and future remote job entry points should be provided with a select security code, "key" feature or other technique to see that only authorized personnel are able to enter or review the police files.

- Disaster planning - Procedures relating to emergency and disaster planning should be carefully defined and these plans should set forth what actions are to be taken in the event of a fire, bomb threat, actual bombing, civil disturbances, as well as natural disasters. Disaster plans should at best cover all major contengencies and establish responsibility and directions for police and civilian employee conduct and authority.

- Air conditioning - Adequate back-up power and air conditioning must be provided if the regular building equipment fails. Usually this is accomplished through auxillary generators.

- Alternate storage - Alternate suitable facilities for the off-premise storage of key programs, criminal history files and crime statistics data must be provided. A tight control system requires a periodic audit of such procedures to insure that the proper files are being considered, the duplication procedure for the selected files is secure, and that duplicates are given safe storage in separate storage locations. Thus, in case the computer facility and/or its contents are destroyed data can be re-constructed for future use with little or no disruption of police activities.

- Housekeeping - A clean, orderly work environment must be maintained at all times and all activity which might endanger the center such as soldering, welding, sand blasting, or any type repair where workmen may use magnetic tools should be performed at another location.

The continuing need for critical examination of security measures in effect for computer systems cannot be overemphasized. The complexity of E. D. P. systems, the costs and difficulty in recreating data, and the reliance of police management upon computer-generated information all point to the necessity for the Dallas Police Department to exercise the utmost care in prescribing adequate safeguards for their computer system and network of terminals. Thus, in any facilities planning for the future, various steps and precautions should be taken to limit bad exposure. Although a perfect airtight security system is possibly beyond reach, the Dallas Police Department can implement a very satisfactory one at reasonable cost, and one that other police agencies might well follow.

6.0 MISCELLANEOUS CONCLUSIONS AND RECOMMENDATIONS

For all conclusions and recommendations concerning this report see Section 3.0.

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8.0 DEFINITION OF TERMS

Data Element: A data element is an ordered pair of the form (attribute, value).

Record: A record consists of a finite set of (attribute, value) ordered pairs.

Primary Record Segment: A primary record segment is a record segment that is accessible by addresses returned from the directory decoder.

Secondary Record Segment: A secondary record segment is a record segment that is linked to the primary record segment by address pointers.

Data Set: A data set is a collection of related records.

Keyword: A keyword is an ordered pair from the primary record segment by which the primary record segment can be selected from the data set.

Index Set: The index set is the set of all keywords from the primary record segment.

Directory: A directory is a means of locating the set of records based on a subset of all Boolean expressions of keywords.

Directory Decoder: A directory decoder is an algorithm for mapping keyword values into storage space.

Storage Space: A storage space is a set of physical device locations for

storing records.

Area: An area is a named subdivision of the storage space.

Logical Information Space: A logical information space is a set of data and a rule defining the logical order of the data.

Physical Information Space: A physical information space is a set of data and the rules defining the physical placement of the data in a storage device.

REPORT NO: LEADER III

DALLAS POLICE DEPARTMENT

COMMAND AND CONTROL STUDY
FINAL SYSTEM RECOMMENDATIONS

8 FEBRUARY 1973

REPORT NO: LEADER III

DALLAS POLICE DEPARTMENT

FINAL REPORT

COMMAND AND CONTROL STUDY

Section 3.0
Recommendations

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3.0 RECOMMENDATIONS FOR THE DALLAS POLICE DEPARTMENT INFORMATION SYSTEM

This section of the report contains the recommendations which have been generated as a result of the detailed system analysis accomplished under the Command and Control Study, Operation LEADER, and modified as a result of discussions with various executive personnel of the City of Dallas outside the Dallas Police Department. The purpose of these modifications was to make the recommendations more applicable to the overall operations of the City.

On February 7, 1973, this volume, entitled Section 3.0, was provided in a special and separate section of the Phase III report to satisfy the security requirements imposed by the City of Dallas. As a result of the security requirements, a total of four copies of the original report were prepared. Two reports were provided to Assistant Chief of Police D. F. Steele, and one copy was transmitted to the Assistant to the City Manager who, according to the existing contract between the City of Dallas and E-SYSTEMS, Inc., has responsibility for this program. The remaining copy of this report was maintained in E-SYSTEMS' files with controlled access through the E-SYSTEMS Security Department. Also, a minimal number of personnel from the Operation LEADER working group were privy to the contents of the original document.

The Operation LEADER personnel attempted to arrive at the original recommendations in a truly objective manner. During the past year the project personnel delved into all facets of Dallas Police Department

operations as required by the contract. Many suggestions and comments were made by police personnel on the structure of the present information system. As stated in the Phase I report, these suggestions were important factors in determining the content and scope of the recommendations made thus far in the study. However, all comments and suggestions emanating from police sources were carefully considered and analyzed by the Operation LEADER group prior to establishing a recommendation as the result of one or more comments. As the study progressed through Phase II and Phase III, the overview gained by the consulting group of total police department operations and the interactions which occur in the information system has led to the conclusion that a few major changes are necessary in the method of handling law enforcement information. These recommended changes are presented in paragraphs 3.1 and 3.2. Section 3.3 relates to recommendations affecting general DPD operations, and Section 3.4 relates to hardware recommendations.

3.1 GENERAL RECOMMENDATIONS

3.1.1 DALLAS POLICE DEPARTMENT COMPUTER SERVICES

RECOMMENDATION

IN ORDER TO MEET POLICE REQUIREMENTS FOR INFORMATION SECURITY AND RESPONSE TIME, IT IS RECOMMENDED THAT SPECIFIC PLANNING BE STARTED IMMEDIATELY TO PROVIDE THE DPD WITH A MINICOMPUTER SYSTEM UNDER DPD MANAGEMENT AND OPERATING CONTROL. THIS MINICOMPUTER SYSTEM SHOULD BE RESTRICTED TO STORING, PROCESSING AND DISPLAYING ONLY THAT INFORMATION RELATING TO PRIVACY AND SECURITY OF POLICE OPERATIONS.

RATIONALE:

A large amount of the information stored and utilized by the Dallas Police Department is sensitive in nature. Much of it deals with information regarding citizens engaged in illegal activity. The information may or may not be factual, but it must be documented so that viable data can be eventually extracted. If information is determined to be false after investigation, it is maintained in its original form along with supplementary data to preclude other investigators from conducting the same research. Law Enforcement personnel are accustomed to handling such information, and must be responsible for controlling its use.

In order to effectively utilize the capabilities of computers, the Dallas Police Department must integrate computer system usage closely with its normal operations. In order to accomplish this, the computer system must be easy to use and responsive to the user's needs. One of the especially critical factors is system response time, particularly in the areas directly concerned with emergency response and services to the citizens.

Appendix 8 is a compilation of terminal response times for 21 different groups of users. These user groups are defined in the table preceding

the computer printouts. For example, group 1 consists of the five district dispatchers. The first column shows that between the hours of midnight and 1 A. M., 2023 transactions had a response time between zero and 3 seconds, 256 transactions had a response time between 3 and 6 seconds, and so forth. These transactions are counted for the period 1-2-73 through 1-8-73.

The box labeled 'max' contains the longest response times during the week, e.g., 190 seconds for the time between midnight and 1 A. M. At the bottom of the first column the longest time shown is 200 seconds. Any transactions having a response time longer than 200 seconds are found in the row marked '0'. One area of concern is the data in the row marked 'max'. For group 1, the longest response time is 529 seconds. This occurred between the hours of five and six P. M. Any transaction related to a call for police service which has such a long response time generates a problem for the police as well as for the citizen needing service. Since the Communications Section terminals are assigned the number one priority in the computer system, the only conclusion to be drawn is that both the Dallas Police Department and the Department of Data Services have a problem if calls can be resident in the system for 529 seconds without reaching the dispatcher for processing. A problem also exists between the hours of 8 and 10 A. M. and between the hours of 4 P. M. to midnight. The reasons for the delays were not determined by the Operation LEADER personnel, but it is felt that these problems are due possibly to the batch processing performed for other City departments during these hours.

The data concerning daily response times are to be found in Appendix 9. In this appendix, attention has been drawn to the longest response time for each of the hourly periods as well as for the 21 groups. These response time data are included since they represent a detailed description of how police needs are being served. The opinions of police department personnel, both civilian and sworn, regarding terminal usage were solicited. It was felt that these comments along with other observations justified the documentation of the response time data in Appendices 8 and 9.

Appendix 10 is another compilation of data which illustrates a problem of support to the Dallas Police Department. The data were collected during the period from February 7, 1972, to January 9, 1973, in memorandum form from the Captain in charge of the Communications Section of the Dallas Police Department. Every time at least one of the terminals or at least one of the printers in the Communications Section failed to perform its functions the data was documented. The memorandum dated April 2, 1972, included at the end of Appendix 10 covering the down time data for March 25, 1972, is included as a typical example of the data collected. It can be seen from data collected in this 12 month period that the lack of availability reported is significant when related to the need for providing police service to the citizens of Dallas.

The following paragraph presents some possible problems connected with information security. Certain types of sensitive data such as arrest, witness, evidence and intelligence data can be used for many purposes.

These data could be found useful by defense attorneys and hence the potential money value of such data could encourage its sale. The presence of an "inside agent" could insure procurement of such information. Data associated with crime pattern recognition and police deployments against specific types of crimes could also be very marketable.

There exist technological solutions to the problem of information security. One way to overcome these problems is through the use of a computer dedicated to Dallas Police Department needs.

Computer services are provided to the Dallas Police Department by the City of Dallas Department of Data Services. On-Line Services are provided through the use of a shared Data Services Computer. Although it was beyond the scope of this study to assess the services provided by Data Services to the City as a whole, it is clear that this method for utilizing computers complicates the provision of adequate security of information and system responsiveness.

Thus, it is imperative that the City continuously examine these problems and provide for their solution.

Pages 7 through 19 intentionally left blank.

3.1.2 DALLAS POLICE DEPARTMENT PAYROLL FUNCTION

IT IS RECOMMENDED THAT THE PRESENT POLICE PAYROLL FORMS BE OBSOLETED AND REPLACED BY A WEEKLY PAYROLL DATA CARD WHICH CONTAINS THE OFFICER'S SIGNATURE AND THAT OF HIS SUPERVISOR AS VERIFICATION THAT THE HOURS AND TYPE OF HOURS CLAIMED ON THE CARD WERE ACTUALLY WORKED. THIS PAYROLL CARD SHOULD BE PREPUNCHED SHOWING PERTINENT IDENTIFICATION AND LOCATION DATA ON THE OFFICER SO THAT IT CAN BE SORTED AND SENT TO HIS WORKING LOCATION VIA DEPARTMENT MAIL. IT IS RECOMMENDED THAT PAYROLL DATA BE STORED ON-LINE AND THAT THE PAYROLL VOUCHER DATA BE PREPARED BY COMPUTER, SIGNED BY THE DIRECTOR OF FISCAL AFFAIRS, AND FORWARDED TO THE CITY AUDITOR FOR PAYROLL PREPARATION.

Rationale:

The Operation LEADER monthly progress report for June, 1972, contained a recommendation on the handling of the police payroll problem. The recommendations in that document were made because relatively obsolete procedures are being used by the City of Dallas for the preparation of payroll documents. These procedures are expensive, prone to error, inefficient when large amounts of overtime are worked and do not allow for easy analysis of payroll data to determine where resources are being expended and whether the effects are commensurate with the costs. In accordance with the recommendation of Section 3.1.3, some type of cost accounting system using the methods and techniques of contemporary business practice will be a necessity. Appendix 4 contains a letter which expresses the need for improvements in this area.

3.1.3 NEW PROGRAM IMPLEMENTATION COSTS

IT IS RECOMMENDED THAT THE DALLAS POLICE DEPARTMENT DEVELOP METHODS AND TECHNIQUES FOR ACCUMULATING AND RECORDING DETAILED INFORMATION ON THE COSTS ASSOCIATED WITH ALL NEW PROGRAMS INSTITUTED AND UNDER EVALUATION THROUGHOUT THE DEPARTMENT. IT IS RECOMMENDED THAT THE COST EFFECTIVENESS OF THE INNOVATIVE PROGRAMS BE JUDGED IN PARALLEL WITH THEIR EFFECTIVENESS IN REDUCING CRIME.

Rationale:

Large amounts of federal funds are currently being assigned to the Dallas Police Department, and in the near future this level of funding will increase. The Dallas Police Department has the responsibility of applying for these funds and for expending the funds assigned to it. The Department fiscal records are now structured so that the payroll function is served primarily. Manual records are maintained on the costs associated with LEAA programs such as Operation LEADER. Since few police personnel are directly associated with this effort, the task of collecting the data once a month is not a major job. However, when large programs involving many people are instituted, the fiscal data collection and recording task will become impossible unless cost accounting functions can be provided by following the recommendations of Sections 3.1.2 and 3.2.1.

3.1.4 DECENTRALIZATION

IT IS RECOMMENDED THAT NO FURTHER DECENTRALIZATION TAKE PLACE UNTIL THE DALLAS POLICE DEPARTMENT LAW ENFORCEMENT INTEGRATED DATA BASE IS ON-LINE.

Rationale:

During the analysis of the Southeast District Substation operations, several important shortcomings were noted. The shortcomings are due to either a lack of planning on the factors affecting the deployment of personnel or due to a lack of funds to prepare the station properly for the decentralized operation. In collecting the statistics for the analysis, one feature of Southeast operations which makes the deployment expensive and wasteful of time was observed: Because there is a small file system at the Southeast Substation, the investigators must travel from the Southeast Substation to the Report and ID Sections for information, and then either go to the Central jail to interview the prisoner or go back to Southeast to interview the prisoner if he has not yet been transferred to Central. This problem exists because of a lack of realization that the investigators must be supported by a readily available file system in order to perform their investigative functions.

The problems at the Southeast Substation can be handled by focusing special attention on this operation, as is now done. However, if more than one District is decentralized without providing the investigators with the ability to rapidly access investigative information from this District or from other Districts, then the investigative functions will be severly limited to a degree which more than offsets the advantages ultimately to be obtained from decentralization.

3.1.5 OPERATIONS RESEARCH PERSONNEL

IT IS RECOMMENDED THAT THE DALLAS POLICE DEPARTMENT OBTAIN THE SERVICES OF A SMALL GROUP OF OPERATIONS RESEARCH PERSONNEL TO BE USED IN PROVIDING SOLUTIONS TO CERTAIN TYPES OF OPERATIONAL PROBLEMS IN THE DALLAS POLICE DEPARTMENT.

Rationale:

The Dallas Police Department has embarked on extensive programs, the purpose of which are to test new theories and ideas for performing police service functions. The personnel involved in the program development do not appear to have sufficient technical training in preparation of test plans, in the use of contemporary data collection techniques, in evaluation schemes for assessing program results and in using computers for data analysis. An 'Operations Analysis' group in the Dallas Police Department appears to be primarily specializing in Crimes Analysis. The type of personnel required in the Dallas Police Department to provide support in new program planning and in evaluating certain types of police problems in field operations are basically technical personnel who are qualified to make recommendations as a result of their analyses. By using these personnel both for development of test plans and for evaluation of current problems, two needs of the department can be satisfied simulataenously.

3.2 RECOMMENDATIONS RELATED TO SOFTWARE

3.2.1 LAW ENFORCEMENT INTEGRATED DATA BASE

IT IS RECOMMENDED THAT THE DALLAS POLICE DEPARTMENT PROCEED WITH THE DEVELOPMENT OF AN INTEGRATED DATA BASE AS DESCRIBED IN SECTION 4.5.2 OF THIS REPORT, AND THAT THE IMPLEMENTATION OF THE DATA BASE BE IN ACCORDANCE WITH THE SCHEDULE SHOWN IN SECTION 5.0. IT IS FURTHER RECOMMENDED THAT THE DEVELOPMENT WORK ON THE DATA BASE BE DONE UNDER THE DIRECTION OF THE DALLAS POLICE DEPARTMENT AND THAT COMPETENT COMMERCIAL SOFTWARE SUPPLIERS BE USED IN THE DEVELOPMENT OF THE DATA BASE.

Rationale:

The explanation of the need for the integrated data base is found in Section 4.5 of this report. In fact, the majority of this report is devoted to the design work needed for the data base if it is to fit the specific needs of the Dallas Police Department. The reasons for recommending outside software support for development of an integrated data base are as follows:

(1) An outside group is required which has the capability of providing software personnel in accordance with the effort.

(2) An outside group can be assigned a schedule to implement the integrated data base. If the schedule slips, the outside concern should be able to supply additional talent to resolve the problems. Also, in working against a contract, the City would not be able to bleed off personnel for solution of emergency problems.

(3) For performance of the type of work required in the development of the integrated data base, an infusion of new specialized talent experienced in state-of-the-art data base design is required.

3.2.2 LEGAL POLICY FOR COMPUTER DATA

IT IS RECOMMENDED THAT THE DALLAS POLICE DEPARTMENT OBTAIN LEGISLATION WHICH SPECIFIES THAT INFORMATION WHICH IS ENTERED INTO A COMPUTER SYSTEM AND WHICH IS IDENTIFIED (SIGNED) BY THE OFFICER'S ACCESS CODE (SEE PARAGRAPH 3.2.3) HAS THE SAME EFFECT UNDER THE LAW AS IF A TYPEWRITTEN COPY OF THE INFORMATION WERE SIGNED BY THE OFFICER. FURTHER, IF A NOTARY PUBLIC OR JUDGE ENTERS HIS 'ACCESS CODE' ON THE DOCUMENT AFTER THE OFFICER'S 'SIGNATURE' APPEARS ON THE TERMINAL OF THE NOTARY PUBLIC, OR JUDGE, IT IS RECOMMENDED THAT THE EFFECT UNDER THE LAW BE THE SAME AS IF THE NOTARY HAD AFFIXED HIS SIGNATURE TO THE DOCUMENT.

Rationale:

Documents such as search warrants and authorizations to destroy materials such as drugs require the signature of a judge. All the information pertaining to the case or destruction certificate is contained in the present typewritten copy which is taken by the officer to the judge for signature. The judge may question some aspect of the written material which is brought before him, but after the questions are answered he will either affix his signature or refuse to affix his signature to the document. If a video data terminal or printer is used to present the information to the official whose signature is requested, he can affirm or deny the request through use of his access code. The printer can provide him with a hard copy of that which he has approved and the officer can tear his document off the printer with the official's 'signature' to use as a search warrant or an authorization to destroy material. The officer will have the ability to make out reports in the field by entering the information in a video data terminal, affixing his

access code signature, and the document will have the same effect as if he had prepared it in longhand and signed it with his name. If computer systems are to become integral parts of law enforcement operational systems, then legal procedures should be changed so that manual methods can be simplified and full advantage can be taken of the computer's speed of handling information and the ability of contemporary communications systems to transmit data between systems.

3.2.3 ACCESS CODE

ACCESS TO THE DATA BASE IN THE POLICE COMPUTER SHOULD BE ALLOWED BY SPECIAL ACCESS CODE ONLY.

Rationale:

This is essentially the same recommendation as appeared in Section 4.2 of the Phase II report.

3.2.4 USE OF CODES

IT IS RECOMMENDED THAT MAN/MACHINE INTERFACE FORMATS USED BY THE DALLAS POLICE DEPARTMENT COMPUTER SYSTEM BE DEVOID OF ALL CODES EXCEPT THE MOST SIMPLE, AND THESE SHOULD BE VERY FEW IN NUMBER. WHEN DATA IS ACCESSED OR PRESENTED ON A VIDEO DATA TERMINAL OR ON A PRINTER THE INFORMATION PRESENTED SHOULD BE DEVOID OF ALL CODES.

Rationale:

It is a characteristic of computer oriented personnel to devise and use codes which compress commonly used statements or descriptors into a minimum of space. Where much repetition of the same statements occurs, codes have a distinct advantage in saving space and time. However, in a system which must be highly user oriented and which will satisfy the needs of hundreds of personnel, the use of codes is completely unsatisfactory. For example, few officers, if any, have committed the Uniform Crime Reporting system to memory. If the full details of an incident are needed by an officer, he will refer to a manual which lists the descriptor associated with the UCR code number. Also, by minimizing the use of codes, the training process for the large number of system users will be shorter and simpler. Confidence in use of the system will result in much wider use.

3.2.5 MAINTAIN RECORD OF ACCESSES TO INTEGRATED DATA BASE

IT IS RECOMMENDED THAT THE DALLAS POLICE DEPARTMENT MAINTAIN A RECORD ON ALL ACCESSES TO THE INTEGRATED DATA BASE BOTH BY DALLAS POLICE DEPARTMENT PERSONNEL AND BY POLICE PERSONNEL FROM OTHER CITIES IN THE REGION.

Rationale:

The need for collecting information on the users of the system is twofold. First, it is required by paragraph 10 of Appendix 3, and secondly it is necessary to maintain records on usage of the system so that proper charges can be allocated to the regional users.

3.3 RECOMMENDATIONS RELATED TO DALLAS POLICE DEPARTMENT OPERATIONS CONTROL

3.3.1 REGIONAL USE OF INFORMATION SYSTEM

IT IS RECOMMENDED THAT THE DALLAS POLICE DEPARTMENT SERVICES BE EXTENDED TO PROVIDE SPECIALIZED SUPPORT TO THE POLICE DEPARTMENTS IN THE NORTH CENTRAL TEXAS REGION. THIS SUPPORT SHOULD CONSIST OF PROVIDING DATA ON LAW ENFORCEMENT MATTERS FOR ALL CITIES IN THE REGION, PROVIDING TELEPHONE CLERK SERVICE ON THE 911 SYSTEM WHEN THE 911 SYSTEM IS ADOPTED, AND PROVIDING SPECIAL COMPUTER REPORTS TO THE CITIES AT THEIR REQUEST. IT IS FURTHER RECOMMENDED THAT THE DALLAS POLICE DEPARTMENT CHARGE THE CITIES A PRO RATA AMOUNT FOR THE SERVICES PROVIDED, AND THAT THE DALLAS POLICE DEPARTMENT BE THE SOLE AUTHORITY IN DEFINING AUTHORIZATION TO USE THE INFORMATION IN ACCORDANCE WITH THE GUIDELINES OF PROJECT SEARCH, AND THAT THE DALLAS POLICE DEPARTMENT BE THE SOLE AUTHORITY IN DEFINING THE FORMATS, COMPUTER ACCESS METHODS, AND TECHNICAL DETAILS ASSOCIATED WITH THE REGIONAL USE.

Rationale:

At the present time the City Data Services computer provides a large measure of support to surrounding cities. Figure 3.3.1-1 shows the level of police support provided by the system during the month of November, 1972. This figure shows that about 8% of the computer (City Data Services) accesses through terminals were for the purpose of supplying the needs of surrounding cities. It is not known

whether charges are made for these services but it is a legitimate chargeable item. A regional police information system has very definite advantages for the citizens and police departments of the region. The system which provides data for law enforcement agencies in the region has been developed by the Dallas Police Department through requests for programs to the City Data Services Department. The conduct of criminal activities throughout the region is not affected by the boundary lines between the cities. The use of the Dallas Police Department programs by all cities in the region will give the regional law enforcement agencies the ability to access a system for the latest information on current criminal activities in the region and will allow requests for personnel information to be made.

If the recommendation of Section 3.4.4 (use of switcher for Criminal Case History access) is adopted, then all present regional law enforcement users will have access to national files on Criminal Case Histories through a system for which the hardware is already in operation. By payment of line costs, terminal costs, and user costs (pro rated), the regional system can be expanded to include all police departments of cities in the 17 county NCTCOG region without excessive investment in labor or equipment. Thus, a small city of population 1000 can have access to the entire law enforcement files in the nation through a relatively minor investment in line costs, equipment leasing and a small charge for service from the computer system. Figure 3.4.4-1 shows the layout of the proposed regional system. Appendix 5 contains the details of the plan which has been developed by the Dallas Police Department Police Data Processing Section regarding the implementation of such a system.

USE OF CITY COMPUTER SYSTEM FOR POLICE TRANSACTIONS IN DECEMBER 1972

		Transactions*	% of Total
Total Dallas Police Department		1,185,415	74.09
Total Regional			
Dallas County Sheriff (5th Floor)	3,112		
Grand Prairie Police Department	7,392		
Highland Park Police Department	3,277		
Mesquite Police Department	8,541		
University Park Police Department	1,705		
Tarrant County Sheriff	4,089		
Ft. Worth Police Department	24,222		
McKinney Police Department	6,852		
Arlington Police Department	9,044		
Denton Police Department	2,757		
National Auto Theft Bureau	5,023		
Dallas County Sheriff (7th Floor)	15,219		
Duncanville Police Department	2,567		
Garland Police Department	10,134		
Richardson Police Department	3,419		
Irving Police Department	13,026		
Farmers Branch Police Department	3,540		
Department of Public Safety	5,635		
		129,854	8.12
City Transactions		284,619	17.79
Total Computer System Transactions Figure		1,599,888	100.00

*Definition: A transaction is defined as a function performed via Video Data Terminal by the computer system such as an inquiry, an input, or an update of a record.

FIGURE 3.3.1-1

3.3.2 COMPUTER MONITORING OF VEHICLE CHECKOUT

IT IS RECOMMENDED THAT A VIDEO DATA TERMINAL BE INSTALLED AT THE DALLAS POLICE DEPARTMENT CENTRAL AUTOMOBILE STORAGE FACILITY AND THAT IT BE USED FOR CHECKING OUT AND CHECKING IN POLICE VEHICLES USED FOR POLICE BUSINESS.

Rationale:

A procedure now exists whereby officers check out police cars through use of a Car Check Ticket. These tickets contain name and number of officer, odometer reading out and in, car number, and various other types of information. The work involved in checking the mileage for proper use of the vehicles located in the garage is an extensive task. The vehicles represent an appreciable portion of the total value of police resources which are utilized in law enforcement activities. This particular data should be placed in a computer so that a weekly analysis can be made of proper use of the vehicles, and statistics can be gathered on trends of usage. Forms could be sent to keypunch for entry of the data into a computer for the purposes of analysis, but this would not cover the occasions, if any, when the Car Check Ticket is lost or misplaced. By entering data via a Video Data Terminal, other benefits can be achieved. The computer can keep the records, calculate time and miles used, charge against section number, can print out defects noted in the car during use so automotive service personnel can be made aware of the problem. By extending this checkout procedure to all police vehicles in the five police districts, the total transportation resources of the department can be monitored by the Inspection Division through routine analysis of computer prepared reports.

3.3.3 EXPANDED USE OF HELICOPTER FORCES

IT IS RECOMMENDED THAT TRAINING PROCEDURES AND OPERATIONS BE INITIATED SO THAT SUPERVISORY PERSONNEL IN PATROL, TACTICAL, DRUG ABUSE AND INTELLIGENCE BECOME AWARE OF THE BENEFITS TO BE ACHIEVED IN THEIR INDIVIDUAL OPERATIONS BY USING AND RELYING ON HELICOPTERS TO PROVIDE INFORMATION PERTINENT TO THEIR ON-GOING OPERATIONS.

Rationale:

Aerial observation of incidents as they take place provides an amount of information the scope of which is difficult to realize without actually participating in helicopter flight operations. The locations and movements of citizens, vehicles, and police personnel at the scene of an incident provide information which should be further utilized by Dallas Police Department supervisory personnel in a command and control mode. Also, the stand-off surveillance of personnel, cars and homes or buildings, without knowledge of the personnel being tracked, is an operating method which needs to be further exploited by the Dallas Police Department. The recommendation for supervisory participation through training programs is made so that these supervisory personnel can develop an understanding of the helicopter capabilities in relation to the operations which they supervise. By putting supervisory personnel rather than patrolmen through such a training program, the information on helicopter use is passed directly to the personnel who need it.

3.3.4 TRAINING PROGRAMS

IT IS RECOMMENDED THAT THE DALLAS POLICE DEPARTMENT INCLUDE THE REQUIREMENT FOR TRAINING PERSONNEL IN EXISTING OR FUTURE INFORMATION SYSTEMS.

Rationale:

The existing Dallas Police Department Information System allows access through the use of Video Data Terminals to incident information resident in the present file system. Familiarity with use of the terminals is required on the part of the officer before he can extract the information. The present system provides personnel from the Police Data Processing Section upon request or whenever a new terminal is installed to present lectures and demonstrations to key personnel throughout the Dallas Police Department. This amount of training does not appear to satisfy the needs of the users. The recipients of the training need support over a longer period of time than is presently provided in use of the system for different purposes. The Special Report on the analysis of the Southeast Substation contained a recommendation that a dedicated operator be always available for all requestors and for all possible uses of the terminal. This implies the availability of a terminal operator for three watches seven days per week. It is believed that if terminal operations were combined with training, i.e., where the terminal operator allowed the officer needing the information to operate the terminal under his direction, then in several months a sufficient number of personnel would be familiar with the terminal and be able to provide support to their fellow officers. At this point in time the training personnel could be made available to other divisions to continue their training function. Training in terminal operations should also be made a part of the courses at the Police Academy.

3.3.5 USE OF MICROFILM FOR EXISTING NARRATIVE FILES

IT IS RECOMMENDED THAT THE PRESENT MICROFILM PROCEDURES USED IN THE REPORT SECTION AND THE ID SECTION BE CONTINUED WITHOUT CHANGE UNTIL THE INTEGRATED DATA BASE (SECTION 3.2.1) IS AVAILABLE AND ABLE TO ACCEPT RECORD LOCATION DATA FROM A CARD INDEX. IT IS RECOMMENDED THAT THE PRESENT METHOD OF COLLECTING, STORING AND HANDLING OF DATA IN THE INTELLIGENCE DIVISION AND THE DRUG ABUSE DIVISION BE CONTINUED UNTIL THE INTEGRATED DATA BASE IS READY TO ACCEPT INFORMATION AND HANDLE IT IN A SECURE MANNER IN ACCORDANCE WITH THE RECOMMENDATIONS OF SECTION 3.2.5.

Rationale:

The purging of old and unneeded files from the ID Section has resulted in reducing the current ID filing system to a manageable level. For a manual system the operating procedures are efficient and effective in serving those who make use of the system. The Report Section operating procedures and file status are likewise in a sound condition. The use of the N-code has reduced paperwork to the point where existing procedures and existing filing space are adequate for the next year, and improved methods for handling information in the Report Section can await the arrival of the Integrated Data Base.

The recommendation of the Phase II report, in Section 4.9, should be applied to the work done in developing the integrated data base, but the inputs for this subsystem should be collected in a card file. As O/I reports and the available supplements are microfilmed, they will be entered into the microfilm roll by numerical sequence. If, after the microfilm is produced, another supplement on an O/I Report arrives which has been microfilmed, then the supplement should be microfilmed

and its location by frame number and roll number should be entered into an index card file. Until the Integrated Data Base is ready, the card file can be utilized to locate these supplements. When the integrated data base is available, the index card file will be the source of input data for the computer programming. This is further described in Section 4.5.4.

3.4 RECOMMENDATIONS RELATED TO HARDWARE

3.4.1 COLLECTION OF ENVIRONMENTAL TEST DATA

IT IS RECOMMENDED THAT THE DALLAS POLICE DEPARTMENT COLLECT DATA ON THE TEMPERATURE RANGE IN THE TRUNK OF TWO POLICE CARS AND DATA ON THE HIGH AND LOW VOLTAGES AVAILABLE FROM THE VEHICLE POWER SYSTEM DURING NORMAL OPERATIONAL USE DURING THE DAYLIGHT SUMMER HOURS.

Rationale:

If in-car hardware is to be used by the Dallas Police Department, it is important to be able to specify the operating conditions at which the equipment must function. Two of the most important parameters for vehicular equipment are high temperature and voltage functions consisting of high voltage surges, low voltage conditions and fast transients caused by switching equipment in the vehicle. The Department should instrument two vehicles so that data may be collected over the summer months of 1973. These data can then be used to specify to manufacturers the environmental operating ranges over which the equipment must operate. For example, it is known that when using existing equipment, the power system is so marginal that in some vehicles the siren will not operate during a relatively long run, such as from the downtown blood bank to Methodist Hospital. The police vehicle must resort to flashing lights and horn in order to make its way through traffic. For test of new equipments, it is important to provide reasonable power sources so that equipment prices will remain reasonable. This requires data on the existing environmental conditions so that proper corrections can be made to the vehicular power source.

3.4.2 IN-CAR TERMINAL

THE DALLAS POLICE DEPARTMENT SHOULD LEASE APPROXIMATELY 10 DIGITAL DATA TERMINALS FOR IN-CAR USE IN ONE OF THE FIVE DISTRICTS. THESE TERMINALS SHOULD HAVE BEEN FIELD TESTED UNDER ACTUAL OPERATIONAL CONDITIONS. THE TERMINALS SHOULD HAVE A FULL KEYBOARD AND CHARACTER FIELD. THE TERMINALS SUGGESTED FOR DALLAS POLICE DEPARTMENT USE ARE KUSTOM MCT-10 OR EQUIVILENT. THE IN-CAR TERMINAL EQUIPMENT SHOULD BE USED ON A SEPARATE TEST CHANNEL IN PARALLEL WITH THE PRESENT AUDIO SYSTEM, WHICH SHOULD REMAIN ON ITS PRESENT CHANNEL.
THE DALLAS POLICE DEPARTMENT SHOULD SELECT ITS OWN SYSTEMS INTEGRATION CONTRACTOR TO PERFORM THE FOLLOWING TASKS UNDER CONTRACT.

- lease a suitable mini-computer to serve as interface between present 360/50 hardware, the present software for the dispatch system, and the existing communications lines
- prepare the detailed system test specifications, acceptance test of the terminals as well as the operational use testing
- training of police personnel in use of the terminal
- preparation of software to collect and prepare, in reduced form, statistics on effects of terminal usage
- provide maintenance personnel to keep system on-line as malfunctions occur and document shortcomings of system being tested

- prepare documentation on results of program so that other police agencies can make use of the information collected

Rationale:

The results of the Phase II report indicate the need for bypassing the dispatcher in sending calls to field elements if a three minute response time criterion is to be satisfied. A feasible method for doing this is to use in-car digital data terminals or to use printers. In order to make regional and NCIC checks on people and vehicles and bypass the dispatcher and the channel 7 operator, it is necessary to have a keyboard so the alphanumeric data can be entered into the computer from the police vehicle. For thorough test of the all-digital concept (no voice to or from the dispatcher unless in case of emergency or special over-ride), the in-car terminal with keyboard must be used rather than just a printer with function keys.

In order to avoid the problem of interference between digital data and voice, the digital test should be conducted on a dedicated channel. The use of a non-dedicated channel was one of the main reasons that the Sylvania Digicom System experienced such great difficulty during its testing in the Oakland, California Police Department.

The various lines of reasoning which led to the recommendation of a full capability terminal are presented in Figure 3.4.2-1. The results of an independent evaluation made by Operation LEADER personnel is presented in Appendix 11.

L COST/ MINAL	COMMENTS
.00 LUDES IIO)	A PRINTER TERMINAL PROVIDES A HARD, RECORD COPY OUTPUT AND IS PROBABLY THE LEAST EXPENSIVE TERMINAL.
.00	MOST SMALL MOBILE PRINTERS DO NOT USE AN INKED RIBBON AND THEREFORE REQUIRE SPECIAL PAPER.
.00	CONSIDERATION MUST BE GIVEN TO PROBLEMS OF PAPER SUPPLY, STORAGE AND DISPOSAL.
.00	ADEQUATE LIGHTING MUST BE PROVIDED FOR NIGHT OPERATION. SMALL, MOBILE PRINTERS HAVE PROVED DIFFICULT TO BUILD AND IN THE PAST HAVE BEEN ONE OF THE LEAST RELIABLE UNITS IN A COMMUNICATION SYSTEM. A NEW GENERATION OF SMALL PRINTERS IS PRESENTLY BECOMING AVAILABLE IN WHICH THE RELIABILITY PROBLEMS MAY HAVE BEEN SOLVED.
.00	
.00	THE DISPLAY DOES NOT PROVIDE RECORD COPY AND IS MORE EXPENSIVE THAN A PRINTER. A DISPLAY, PROPERLY BUILT, SHOULD BE MUCH MORE RELIABLE THAN A PRINTER.
.00 00.00) 0.00)	MOST DISPLAY DEVICES ARE SELF ILLUMINATING AND OBVIOUSLY DO NOT REQUIRE A CONTINUOUS SUPPLY OF PAPER. WHEN COMBINED WITH A KEYBOARD ENTRY DEVICE A DISPLAY PROVIDES A MEANS OF MONITORING THE COMPOSITION OF MESSAGES. FOR EFFICIENT EDITING (CORRECTING COMPOSITION ERRORS) OF COMPOSED MESSAGES A DISPLAY DEVICE IS ESSENTIAL.

CONTINUED

4 OF 4

	OPERATING MODE	INPUT DEVICE	OUTPUT DEVICE	OPERATIONAL CHARACTERISTICS	ADDITIONAL CIRCUITRY	OPERATING SPEED	EST. COST PER TERM.	ADD. EQUIP. REQUIRED	TOTAL COST/ TERMINAL	COMMENTS
1.	RECEIVE	NONE	PRINTER	PROVIDES FOR COMPUTER DISPATCHING. ALL INQUIRIES, STATUS REPORTS BY VOICE. WILL NOT REDUCE VOICE TRAFFIC SIGNIFICANTLY AND THEREFORE PROBABLY REQUIRES A SEPARATE RADIO CHANNEL FOR DATA	DEMOD. (INCLUDED IN PRINTER)	LIMITED BY PRINTER (APPROX. 75 BPS) SOME HIGHER SPEED PRINTERS WILL OPERATE UP TO 300 BPS. DATA RATE CAN BE INCREASED TO CHANNEL CAPACITY BY USE OF BUFFER STORAGE OF INCOMING MSGS. AND SUBSEQUENT LOW SPEED PRINTOUT.	800.00	(MOBILE TRANSCEIVER 1500.00)	2300.00 (INCLUDES RADIO)	A PRINTER TERMINAL PROVIDES A HARD, RECORD COPY OUTPUT AND IS PROBABLY THE LEAST EXPENSIVE TERMINAL. MOST SMALL MOBILE PRINTERS DO NOT USE AN INKED RIBBON AND THEREFORE REQUIRE SPECIAL PAPER. CONSIDERATION MUST BE GIVEN TO PROBLEMS OF PAPER SUPPLY, STORAGE AND DISPOSAL. ADEQUATE LIGHTING MUST BE PROVIDED FOR NIGHT OPERATION. SMALL, MOBILE PRINTERS HAVE PROVED DIFFICULT TO BUILD AND IN THE PAST HAVE BEEN ONE OF THE LEAST RELIABLE UNITS IN A COMMUNICATION SYSTEM. A NEW GENERATION OF SMALL PRINTERS IS PRESENTLY BECOMING AVAILABLE IN WHICH THE RELIABILITY PROBLEMS MAY HAVE BEEN SOLVED.
2.					DEMOD. SELECTIVE CALL,		1100.00		2600.00	
3.					DEMOD. SELECTIVE CALL, BUFFER		1300.00		2800.00	
4.			HIGH SPEED PRINTER		DEMOD. SELECTIVE CALL.		1500.00		3000.00	
5.	RECEIVE/ TRANSMIT	4-10 KEY "CANNED" MSG ENTRY DEVICE	PRINTER	PROVIDES FOR COMPUTER DISPATCHING, DATA TRANSMISSION OF RESPONSES AND STATUS REPORTS, INQUIRIES MUST BE MADE BY VOICE. DEDICATED DATA CHANNEL PROBABLY REQUIRED.	DEMOD. MOD. SELECTIVE CALL		1600.00		3100.00	
6.					DEMOD. MOD SELECTIVE CALL BUFFER		1800.00		3300.00	
7.			DISPLAY		DEMOD. MOD., SELECTIVE CALL BUFFER	THE DATA RATE IS NOT LIMITED BY THE OUTPUT DEVICE	2000.00		3500.00	THE DISPLAY DOES NOT PROVIDE RECORD COPY AND IS MORE EXPENSIVE THAN A PRINTER. A DISPLAY, PROPERLY BUILT, SHOULD BE MUCH MORE RELIABLE THAN A PRINTER. MOST DISPLAY DEVICES ARE SELF ILLUMINATING AND OBVIOUSLY DO NOT REQUIRE A CONTINUOUS SUPPLY OF PAPER. WHEN COMBINED WITH A KEYBOARD ENTRY DEVICE A DISPLAY PROVIDES A MEANS OF MONITORING THE COMPOSITION OF MESSAGES. FOR EFFICIENT EDITING (CORRECTING COMPOSITION ERRORS) OF COMPOSED MESSAGES A DISPLAY DEVICE IS ESSENTIAL.
8.	RECEIVE/ TRANSMIT	FULL ALPHA/ NUMERIC KEYBOARD + STATUS KEYS	DISPLAY	PROVIDES FOR COMPUTER DISPATCHING, DATA TRANSMISSION OF RESPONSES, STATUS REPORTS, INQUIRIES AND FIELD REPORTS. IF VOICE TRAFFIC CAN BE REDUCED TO A MINIMUM, A DEDICATED DATA CHANNEL SHOULD NOT BE NECESSARY.			3200.00	(POSSIBLY A MOBILE TRANSCEIVER)	3200.00 (+1500.00) (4700.00)	

FIGURE 3.4.2-1. PARAMETERS ASSOCIATED WITH IN-CAR DIGITAL EQUIPMENT.

3.4.3 VEHICLE LOCATION SYSTEM

IT IS RECOMMENDED THAT THE DALLAS POLICE DEPARTMENT MONITOR THE DEVELOPMENTS IN THE FIELD OF VEHICLE LOCATION SYSTEMS AND KEEP ABREAST OF RESULTS ON THE TESTS BEING CONDUCTED BY THE DEPARTMENT OF TRANSPORTATION. THE GENERAL REQUIREMENTS FOR A VEHICLE LOCATION SYSTEM AS NEEDED BY THE DALLAS POLICE DEPARTMENT TO ENHANCE RESPONSE TIMES ON CALLS FOR SERVICE ARE:

THE LOCATION ACCURACY OF THE SYSTEM OVER A ONE HOUR PERIOD OR OVER A 30 MILE DISTANCE TRAVELLED BY THE VEHICLE, WHICHEVER OCCURS FIRST, SHOULD BE 1000 FEET CEP (CIRCULAR ERROR PROBABILITY). ON THE AVERAGE, THE UPDATE TIMES, IF REQUIRED, SHOULD BE NOT LESS THAN ONE HOUR.

Rationale:

The United States Department of Transportation is conducting a series of tests whose purpose is to evaluate the various types of vehicle location systems. While location determination techniques are well known and defined in current military systems, the availability of a reasonably priced system to police usage is not known. For enhancement of the dispatch function (reduction of response time) a low level of system accuracy is required. Also, rather than specify an absolute set of performance criteria on location accuracy, the use of a statistical criteria is deemed more useful, such as the circular error probability quoted. Many other benefits will be derived from use of a location system, but the primary benefit of the system will be to assist in the dispatching function of selecting the nearest element to the scene of an incident. It should be noted that a vehicle location system can operate independently of an in-car terminal; however, the advantages of each system greatly complement the other.

3.4.4 REGIONAL LAW ENFORCEMENT MESSAGE SWITCHER

IT IS RECOMMENDED THAT THE DALLAS POLICE DEPARTMENT ACCEPT THE OFFER OF DALLAS COUNTY AND INSTALL AND USE THE DUPLICATE SWITCHER FOR ACCESS TO NCIC AND CCH INFORMATION. THIS RECOMMENDATION IS CONTINGENT UPON ADOPTION OF THE RECOMMENDATION OF SECTION 3.1.1.

Rationale:

The 'switcher' referred to here is a minicomputer which is used to manage the flow of messages from various terminals to the National Crime Information Center and the the Texas State Switcher. The switcher also routes the requested information to the requestor's location after receipt of the data. Figure 3.4.4-1 shows the scheme of how the regional law enforcement switcher can be interfaced with the various information systems as viewed by the personnel of the Dallas Police Department Police Data Processing Section. The description of the operation of this network is contained in Appendix 5. Through interconnection of the Regional Law Fnforcement Switcher and the Regional Criminal Justice Switcher, the two systems can operate either independently or one can serve in the place of the other if a malfunction occurs in either switcher.

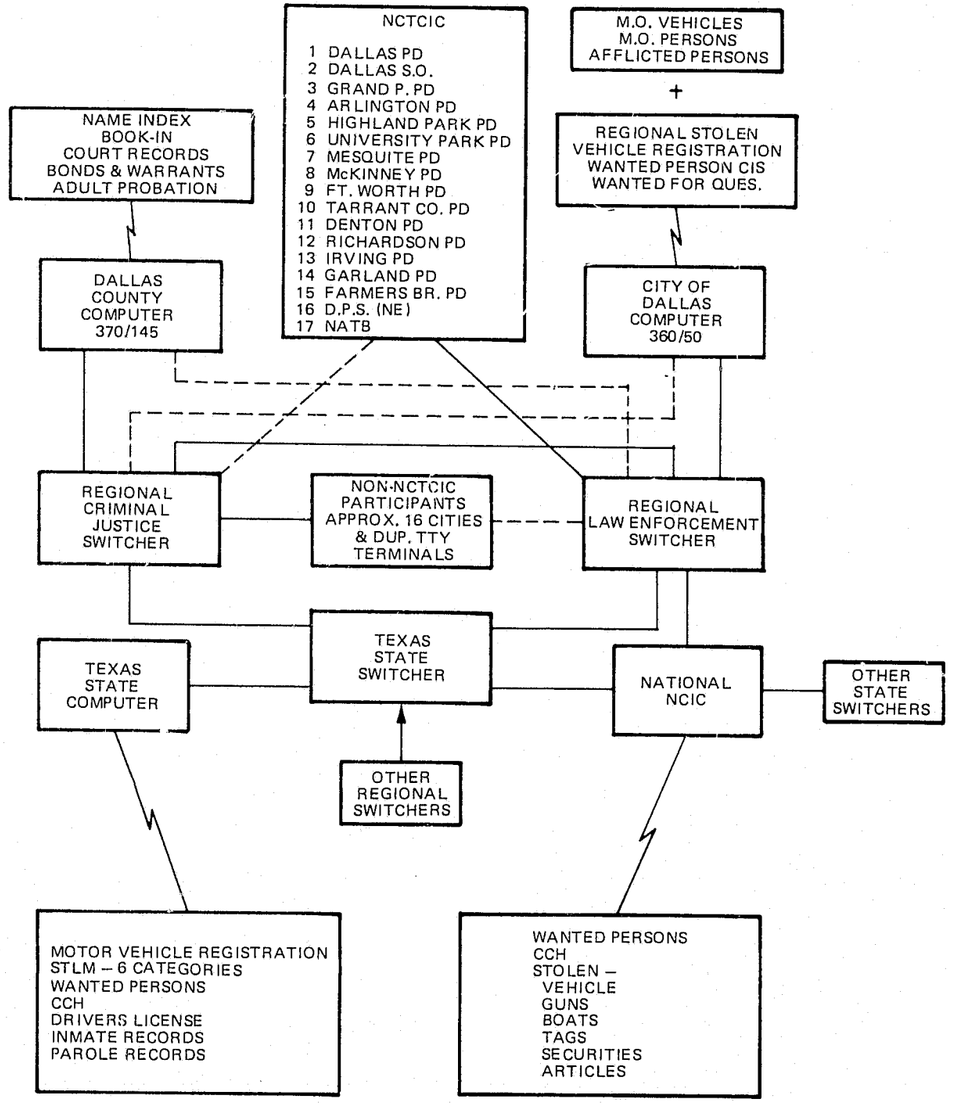

FIGURE 3.4.4-1. LAW ENFORCEMENT ACTIVE DATA INTERCHANGE NETWORK OF GOVERNMENTS (LEADING).

ADDENDUM

ADDENDUM

The information contained in this addendum to the recommendations was collected after the final report was submitted to the Dallas Police Department. The purpose for which this information was collected was to show the Dallas Police Department that by following the recommendation contained in paragraph 3.1.1 there would be an appreciable cost reduction in the lease of computer equipment having exactly the same configuration and capability as now exists under the Department of Data Services. The reduction in lease cost would be due to leasing the equipment from one of the many computer leasing companies rather than from the manufacturer. In compiling the information, catalog prices were used and unofficial quotes were obtained from two leasing companies based on the list of equipment now in place.

Table 1 SUMMARY OF COST ESTIMATES

Case 1	IBM Lease on Monthly Basis. Standard Catalog Price	
	Monthly Rate	89915
	Extra Shift @10%	8992
	Total Cost/Month	98, 907
Case 2	Lease for 2 year period from Computer Investment Group	
	(a) All equipment needed is available; rate is 49% of IBM rate.	
	Monthly Rate (89915 x . 49)	44058
	Maintenance @6765/Month	6765
	Total Cost/Month	50, 823
	(b) No equipment is available, all must be obtained; rate is 54% of IBM price	
	Monthly Rate (89915 x . 54)	48554
	Maintenance @6765	6765
	Total Cost/Month	55, 319
Difference between Case 1 and Case 2b.		98907 55319
Savings to the City.		43, 588/month or 523, 056/year.
Difference between Case 1 and Case 2a.		98907 50823
Savings to the City.		48, 084/month or 577, 008/year.

Table 2 BREAKDOWN OF COST ESTIMATES

Quantity	Machine	Model/ Feature	Description	IBM Rental 30 Days	IBM Rental W/2 year FTP
1	2050	I	Processing Unit - 512K	20730	20730
		6980	Selector Channel	730	730
		6981	Selector Channel	730	730
		6982	Selector Channel	730	730
		7920	1052 Adapter	235	235
1	1052	7	Printer - Keyboard	63 23218	63 23218
1	2050	HG	Processing Unit - 384K	17840	17840
		6980	Selector Channel	730	730
		6981	Selector Channel	730	730
		7920	1052 Adapter	235	235
1	1052	7	Printer - Keyboard	63 19598	63 19598

Table 2 BREAKDOWN OF COST ESTIMATES (CON'T)

Quantity	Machine	Model/ Feature	Description	IBM Rental 30 Days	IBM Rental W/ 2 year FTP
1	2020	D2	Processing Unit	1275	1275
		8099	2560 Attachment	75	75
		4442	1403 Attachment	225	225
		8090	2501 Attachment	20	20
				1595	1595

Table 2 BREAKDOWN OF COST ESTIMATES (CON'T)

Quantity	Machine	Model/ Feature	Description	IBM Rental 30 Days	IBM Rental W/ 2 year FTP
2	1403	N1	1100 LPM Printer @875 - 735	1750	1470
1	1403	2	600 LPM Printer	750	630
10	3420	3	Magnetic Tape @355 - 298	3550	2980
		3550	Dual Density @110 - 92	1100	920
				4650	3900
2	3803	1	Tape Control @675 - 567	1350	1134
		1972	2 Control Switchers @200 - 168	400	336
		3551	Dual Density @75 - 63	150	126
				1900	1596

Table 2 BREAKDOWN OF COST ESTIMATES (CON'T)

Quantity	Machine	Model/ Feature	Description	IBM Rental 30 Days	IBM Rental W/ 2 year FTP
1	2501	A2	1000 CPM Card Reader	255	255
		1531	Card Image	30	30
				285	285
1	2501	B2	1000 CPM Card Reader	320	320
		1531	Card Image	30	30
				350	350
1	2540	1	Card Reader/ Puncher	710	710
1	2560	A1	MFCM	615	615
		1576	Card Printer - Second 2 lines	135	135
		1575	Card Printer - First 2 lines	135	135
				885	885

Table 2 BREAKDOWN OF COST ESTIMATES (CON'T)

Quantity	Machine	Model/ Feature	Description	IBM Rental 30 Days	IBM Rental W/ 2 year FTP
5	2314	1	DASF @5250 - 4410	26250	22050
		8170	2 Channel Switchers @140 - 118	700	590
				26950	22640
3	2701	1	Data Adapter Unit @200	600	600
			Features	919	919
				1519	1519
1	2702	1	Transmission Control & Features	2500	2500
1	2848	3	Display Control	545	545
1	2914	1	Switching Unit	350	350
4	3272	2	Control Unit @205	820	820
28		3250	Device Adapter @55	1540	1540
				2360	2360

Table 2 BREAKDOWN OF COST ESTIMATES (CON'T)

Quantity	Machine	Model/ Feature	Description	IBM Rental 30 Days	IBM Rental W/ 2 year FTP
			Grand Total	89915	83801
			Extra Shift (1 Shift 10%	8992	8380
				98907	92181

END