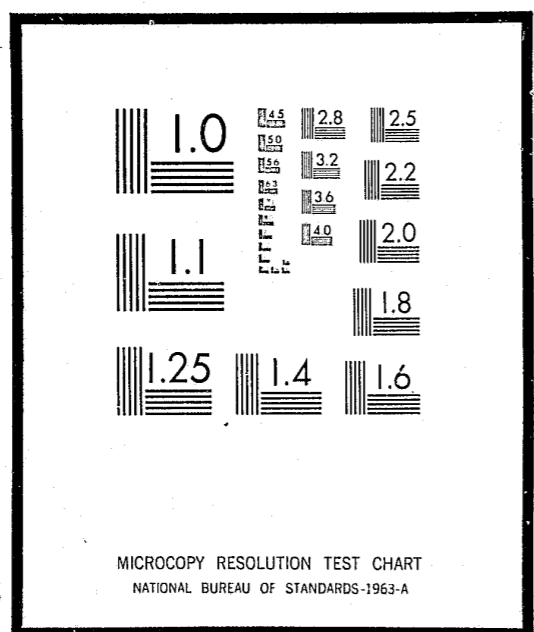


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## LAW ENFORCEMENT ASSISTANCE ADMINISTRATION (LEAA)

### POLICE TECHNICAL ASSISTANCE REPORT

SUBJECT: A Study of Police Communications Systems and Equipment for the Overland Park, Kansas Police Department.

REPORT NUMBER: 76-120-073

FOR: Overland Park, Kansas Police Department

Population: 82,000

Police Strength:

Sworn:	94
Civilian:	25
Total:	119

Square Mile Area: 48

CONTRACTOR: Public Administration Service  
1776 Massachusetts Avenue, N.W.  
Washington, D.C. 20036

CONSULTANT: Mr. James R. Evans

CONTRACT NUMBER: J-LEAA-002-76

DATE: August, 1976

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ACQUISITIONS

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## SECTION I. INTRODUCTION

The police department in Overland Park is one of thirteen (13) agencies located in Johnson County, Kansas, and adjacent to the Metro-area of Kansas City, Missouri. The County has a population of approximately 250,000 persons. The City of Overland Park has a population of 82,000 and has a land area of forty-eight (48) square miles. It is the largest of the thirteen (13) entities, it has fifty-two (52) radio equipped vehicles, ninety-four (94) sworn police officers, twenty-five (25) civilians, and maintains a twenty-four (24) hour dispatch and patrol service.

The department's present communications control center is manned by nine (9) civilian personnel. Two persons are required on one radio shift. A chief dispatcher is in charge of the center. A uniform lieutenant in charge of police services supervises the entire communications section.

### Nature of the Study

Generally, the Overland Park Police Department requested technical assistance in improving its present communications facilities and systems. The department sought assistance in three specific areas of concern:

- A review of existing basic radio systems
- A determination of the feasibility of adding computer aided dispatch (C.A.D.) to reduce police response time
- An assessment of how recommended changes in communications systems would interface with adjoining jurisdictions and the proposed telecommunications/ C.A.D. plans presently being developed in the State of Kansas.

The department felt that its communications systems needed improvement for numerous reasons; the major ones being: increased crime and population in the city; poor signal areas in the north and south sections of the city causing failure of patrol officer communications (mobile and portable) with the dispatch office (located approximately in the center of the populated area); and the need for greater computer storage and faster retrieval processes.

### Study Methods

On-site evaluation and data collection was conducted between July 12, 1976, and July 15, 1976. During the course of the study the consultant performed the following technical activities:

- (1) Assessed the present communications control center activities;
- (2) Examined and identified system overloads, system interference (from other stations), and system failures (poor signal areas);
- (3) Reviewed operating techniques;
- (4) Assessed the adequacy of present base station facilities (including planned improvements), and mobile and portable radio equipment;
- (5) Examined expansion possibilities with existing equipment;
- (6) Determined the best frequency plan.

In addition, on-site visits were made to the control center, the base station transmitting location, the emergency power location, and the "poor reception" areas of the north and south sectors of the city, (tests were conducted from these areas for verification of radio signal loss).

Concerning the feasibility of C. A. D. for the Overland Park Police, it was necessary to review the present ALERT system in Kansas City, Missouri Police Department along with the C. R. T. terminals (traffic load) located in the Overland Park dispatch center. The use of the 911 common telephone number in the Metro area was discussed, and a regional meeting on 911 was attended by the consultant at the invitation of the Chief of Police.

The last technical requirement was to review the existing communications interface with adjoining agencies. Presently, the base station (control center) and mobile units interface very well with adjoining jurisdictions through a common radio channel and computer switching. A new and updated system design would require some modifications to insure fast and dependable inter-agency contacts.

Considerable prior planning has been undertaken to improve communications on both a local and a statewide basis. A local existing plan for Overland Park Police was designed by police communications personnel with the assistance

of private technical experts. This basic plan changed the radio system from very high frequency (V. H. F.) to ultra high frequency (U. H. F.) using four pairs of U. H. F. channels. A north and south base repeater station would cover the poor signal areas, the radio signals from the repeater towers would be relayed back to the communications center via a 960 MHZ microwave system. All mobile and portable radios would be four channel using the U. H. F. frequency. Modifications of the proposed system will be discussed in Section II.

Some statewide data system concepts were planned by Systems Consultants, Inc. of Washington, D. C. Mr. Bieber of this company was contacted, but at the present time there are no viable plans that cover Overland Park for computerization of records.

A statewide telecommunications plan is presently being developed for the State of Kansas under LEAA (APCO) Project 13A. The contractor is the Booz, Allen, Hamilton Corp. Mr. McMarrow of the Company was contacted and plans for eastern Kansas were discussed prior to the technical assistance task. Further consultation and results of contacts with Mr. McMarrow will be discussed in Section IV.

Persons interviewed during the assignment:

Mr. Jeffrey Peterson  
Regional Office, LEAA  
Kansas City, Kansas

Myron Scafe  
Chief of Police  
Overland Park, Kansas

John Patton, Captain  
Commander of Operations  
Police Department  
Overland Park, Kansas

Lt. Gus Ramirez  
Commander of Services  
Police Department  
Overland Park, Kansas

John Nicholson  
Chief Dispatcher  
Police Department  
Overland Park, Kansas

Ron Parks  
Planner Analyst  
Police Department  
Overland Park, Kansas

Pat Brasington  
Computer Systems (ALERT)  
Kansas City Police Department  
Kansas City, Missouri

Floyd Duell  
Frequency Coordinator  
State of Kansas  
Topeka, Kansas

Vance Collins  
Communications Specialist  
Kansas S. P. A.  
Topeka, Kansas

William Bieber (telephone interview)  
Systems Consultants  
Washington, D. C.

Charles McMarrow (telephone interview)  
Booz, Allen and Hamilton  
Bethesda, Maryland

## SECTION II. UNDERSTANDING THE PROBLEM

The objectives of the technical assistance assignment were to review the department's basic radio system and prior plans, to react to the question of the feasibility of C.A.D., and to review future interface problems with adjacent jurisdictions.

### The Department's Radio System

The basic two-way radio system consists of two separate areas, both inter-related to each other. These are the dispatch (communications center) and radio field operations (mobile and portable systems).

### Dispatch Operation

The department's dispatch center consoles (2) were designed and built locally a number of years ago. Although they have functioned satisfactorily for the police department during its growth cycle, they are now obsolete and not capable of the required expansion. It would be difficult, for example, to add controls for future channels. The two consoles are equipped with electronic devices using I.B.M. cards to instantly supply patrol car status for the console operators. Each radio operator/dispatcher also answers the telephone. A citizen's call for assistance is placed on the IBM card along with his address and the time and date of the call. A police car is then assigned to the call, and the time, date and car number are stamped on the card. The IBM card is inserted into an electronic card slot device that lights a lamp on the large city map indicating the car has received the assignment. The map and car status equipment were purchased a number of years ago. The department has installed cathode-ray-terminals (C.R.T.) at each dispatch position that are connected to the ALERT computer system at the Kansas City Police Department. This provides the officers on patrol with a rapid means of checking for crime information stored in the computer. The ALERT system automatically interfaces with other local criminal justice computers and with the NCIC (FBI) computer in Washington, D.C. The control center has complete tape recording equipment for all telephone and radio circuits. Alarms for banks and other major businesses are terminated in the dispatch center with a sophisticated electronic readout device. The center has a Citizens Band (C.B.) radio for contact with citizens on Channel 9. The Overland Park Police Department is in direct telephone contact (hot lines) with the Johnson County Sheriff's Department, the Prosecutor's office, and the Lenexa and Prairieview Police Departments. The center's operators answer calls direct from citizens between 5 P.M. and 8 A.M.

The City Hall operator answers all calls from 8 A.M. to 5 P.M. transferring those requiring police action to the dispatch center. The common telephone number 911 has not been implemented in the Kansas City area as yet.

The department has a 175 K.W. generator for emergency power backup in case of power failure. The police dispatch center is designed to be used as a civil defense area since it is underground, has no outside windows, and maximum security. Security arrangements include an underground location, locked doors with limited distribution of access keys, and the regular use of sixteen (16) T.V. cameras for surveillance of all critical outside and inside areas. The camera areas (some scanned) are viewed on four (4) T.V. monitors in the dispatch area. The monitors are designed for automatic switching and may be locked to any one camera if desired. Zoom camera lenses are used for critical viewing. Officer access to the building during the night hours is achieved through controls located in the dispatch center.

The base stations connected to the dispatch center are located one block away at the City Hall. The stations have an emergency power backup consisting of a 15 K.W. generator. The main base station transmits on 158.850 MHZ and receives cars and portables on 158.970 MHZ. These are V.H.F. frequencies and additional channels are not available for expansion in the Kansas City Area. The center can transmit and receive on the Sheriff's frequency of 39.46 MHZ. A third radio station on 158.775 MHZ is used, with the permission of the County, for interface or inter-communications with other adjacent jurisdictions. The antenna tower at City Hall is 135 feet high and secured by an eight foot fence.

#### Radio Field Operations

Radio field operations are maintained by officers using the mobile radios and hand carried portable units. All radios are multi-channel and provide inter-communications with the Sheriff's department and other local entities. Three major problems are related to these field operations:

- a. The present V.H.F. radio equipment does not have tone squelch (an electronic device that quiets the radio receiver until the center or one of the local units of the system calls). Therefore, other stations using the same frequency may cause interference.
- b. Expansion of the existing V.H.F. system is not possible due to the lack of adequate V.H.F. channels in the area. The frequency coordinator for the State verified this fact.



- c. System expansion in field operations is necessary because of poor signal areas in the north and south sections of the city. This effect was verified by the consultant while riding on patrol with a shift commander. Tests were performed with mobile and portable equipment. Signals on the mobile radio were weak and communications by the portables were non-existent. This lack of communications provided background support for analysis of one major system problem.

The basic radio system has periods of traffic overload. These are normally during the evening hours and have increased since the use of the ALERT C.R.T. terminals.

#### C.A.D. Feasibility

The concept of computer-assisted-dispatching is the second task the consultant was requested to investigate. The Overland Park Police Department presently has computer assistance through the use of the C.R.T. terminals and printers connected to the Kansas City Police Department's ALERT system. Overland Park, however, is limited as to the amount of storage of local crime-oriented data, and consideration has been given to a city-owned mini-computer with storage capability. There are four C.R.T. terminals connected to the ALERT system in use in the police department, and no expansion of this system is anticipated at this time. A number of agencies share a party line from the Overland Park area to the Kansas City computer and any backlog or waiting time at the terminals is logged at the computer center. All agencies in northeast Johnson County have C.R.T. terminals with switching capability allowing interdepartmental communications. The feasibility of C.A.D. depends upon many factors. These will be discussed in Section III.

#### Improved Interagency Communications

The existing interagency communications at Overland Park Police dispatch center are adequate, but, would become inadequate with a change in the basic radio system. As each agency in the area changes its radio system there is a new requirement for cooperative interface with adjacent departments. Overland Park presently has three means of contact with adjacent agencies in addition to the public telephone; these are, the C.R.T. terminal switching (in all agencies), the countywide radio frequency, and the hot lines (leased dedicated circuits) to three adjacent departments. Each of these methods require a time element for contact. The ideal system would

be a voice radio contact on a dedicated point to point frequency.

The internal influences on the three problems are primarily budget restrictions. The cost of a new basic radio system and a C.A.D. may exceed several hundred thousand dollars. The C.A.D. system may be justified, if shared by several agencies. (An example of a joint C.A.D. system can be found in Oak Park, Illinois).

The basic radio system has external influences such as the necessity of obtaining new U.H.F. radio frequencies. These must be cleared for use by the State coordinators in Kansas and Missouri, then approved by the F.C.C. in Washington.

## SECTION III. ANALYSIS OF THE PROBLEM

The problems outlined in Section II will be analyzed in the following sequence:

- a. Basic radio system update and improved communications interface with adjacent jurisdictions and the proposed State telecommunications plans.
- b. The feasibility of C. A. D.

Radio System Update and Improved Communications Interface

The basic updating of the department's radio system would require changing base station, mobile, and portable equipment from the V. H. F. to U. H. F. police band. New equipment must be purchased since it is not economically feasible to convert existing equipment from V. H. F. to U. H. F. because of the wide frequency separation. Two mobile repeater base stations would need to be purchased and installed in the north and south areas of the city to provide dependable communications in the poor signal areas. (See Figure 1: Poor Signal Areas.)

The present V. H. F. radio system is plagued with voice interference by other users on the same frequency. This problem could be corrected by the addition of tone squelch on all transmitting and receiving units. However, a conversion of this type would be costly, and not a sound investment due to other needed system improvements.

The existing police radio system uses two V. H. F. radio channels, one for base operation to vehicles and portables, and one for talk-back from the vehicles to the dispatch center. Expansion is impossible due to the lack of available V. H. F. channels in the Kansas City Area.

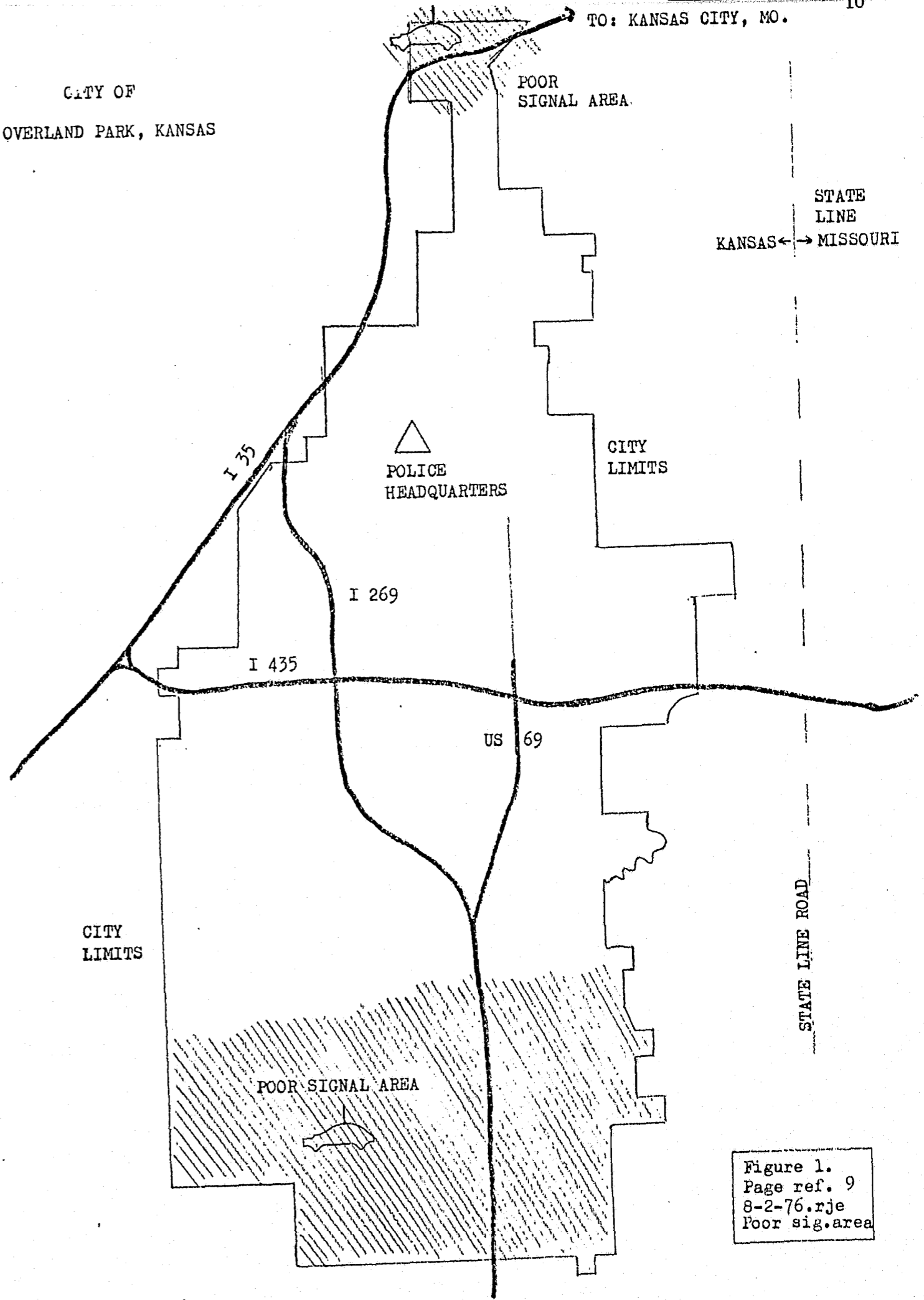
The only long range solution for improvement and system expansion in the next several years is a complete change to the U. H. F. band. The interference problem would be eliminated by the use of tone squelch on the new equipment. Repeater stations in the north and south areas would be possible with the U. H. F. frequencies. (See Figure 2: Proposed Repeater Locations.) The mobile repeater type of operation would provide extended range for all mobile and portable units. Original plans indicated a need for new radio towers in the north and south areas. These do not appear to be necessary at this time because there are tall buildings in both areas that would allow antenna installations providing there is no interference between

CITY OF  
OVERLAND PARK, KANSAS

TO: KANSAS CITY, MO.

POOR  
SIGNAL AREA

STATE  
LINE  
KANSAS ← → MISSOURI



CITY  
LIMITS

POLICE  
HEADQUARTERS

CITY  
LIMITS

I 35

I 269

I 435

US 69

POOR SIGNAL AREA

STATE LINE ROAD

Figure 1.  
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Poor sig.area

CITY OF  
OVERLAND PARK, KANSAS

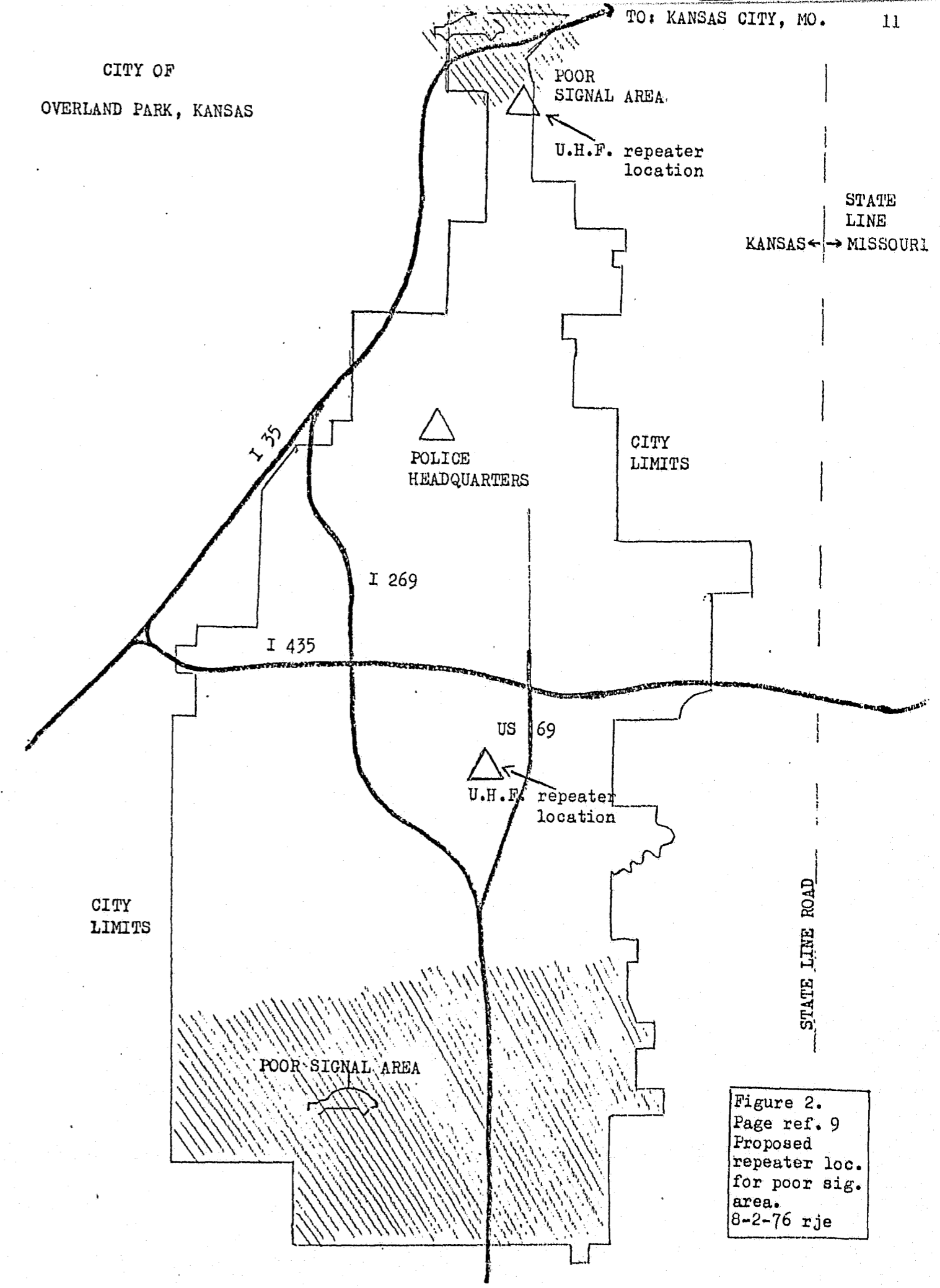


Figure 2.  
 Page ref. 9  
 Proposed  
 repeater loc.  
 for poor sig.  
 area.  
 8-2-76 rje

existing systems at these locations. The roof area on existing buildings can usually be rented for a nominal fee per month, whereas, a radio tower, land, and building are costly items.

The mobile radio repeaters in the north and south sections of the city can be connected to the control center at police headquarters by one of several methods. These are microwave, leased telephone line or radio control. The microwave control (960 MHZ) is not recommended at this time due to the high original cost. The advantage of microwave is its dependability, and its capability of carrying a number of channels of communications over a single system. The leased telephone line is a method of base station control normally used in many departments. The advantage is a low initial cost and easy installation. The disadvantage is the ongoing monthly payments. The radio control method lies between the microwave and the leased line methods. It has some advantages of each of the other methods. (See Figure 3, Radio Control Concept; and Figure 4, Leased Line Control Concept.)

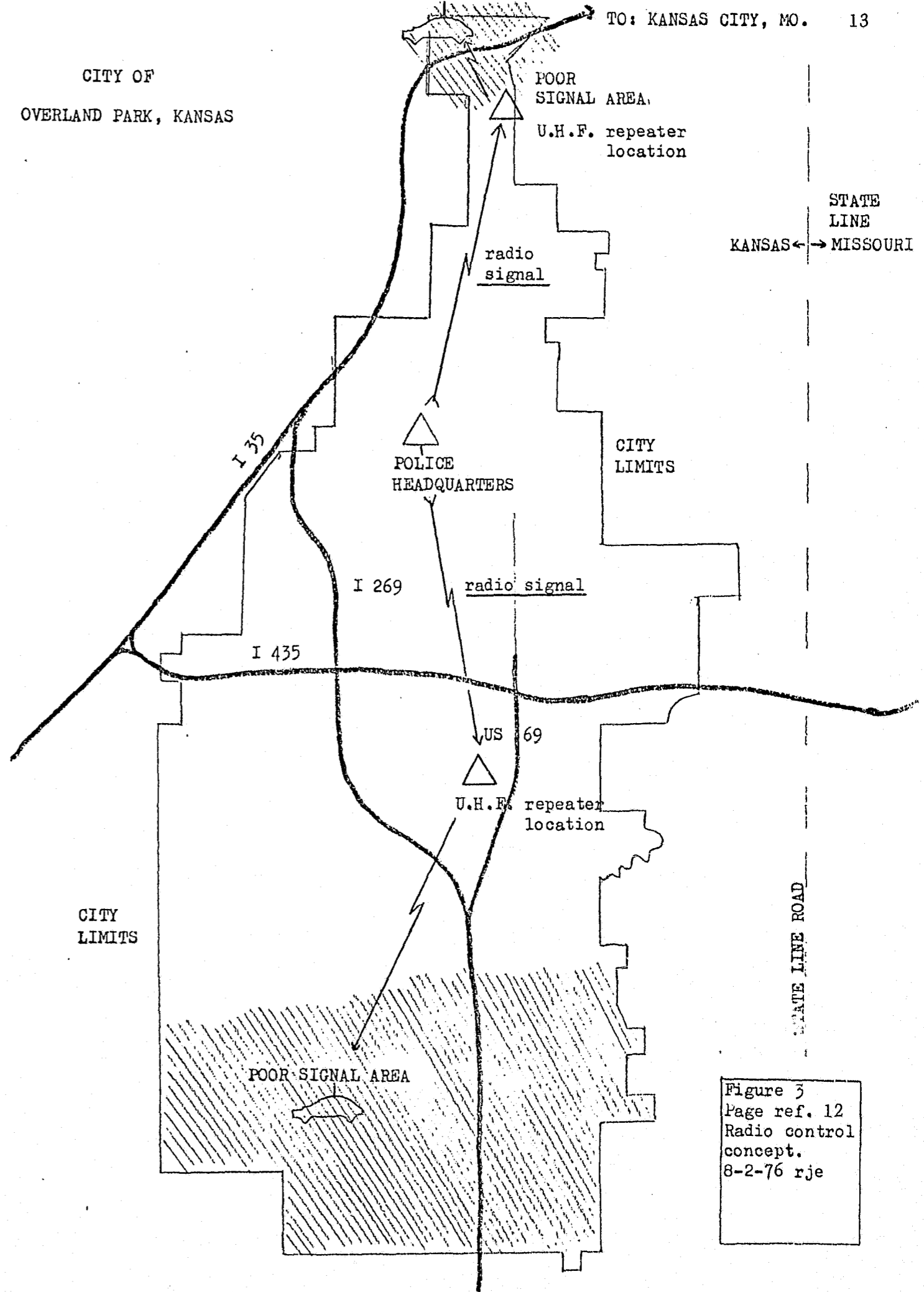
A new base station would be required at the police headquarters to be used as a backup in case of failure of the north or south repeater. A 150 foot radio tower would need to be installed for the antennas.

Discussions held with the State frequency coordinator indicates that two U.H.F. pairs of radio channels can be considered for the Overland Park Plan. These would be for the patrol and data use. An additional pair of U.H.F. channels would be available for mutual aid in all of Kansas. These channels would provide interface with other agencies using the U.H.F. band. Another interagency frequency that has been assigned on a nationwide basis is 155.475 MHZ. The use of this frequency in vehicles using U.H.F. (450-470 MHZ) requires a second radio in the vehicle. Some departments only install the second unit in their command vehicles. The F.C.C. rules and regulations provide a low power frequency for intelligence operations. Any frequency between 40 and 952 MHZ may be used at 2 watts or less, providing harmful interference is not created to other users. (See part 89.309(c) (2) of F.C.C. rules. See Figure 5; Existing and Proposed Radio Channels.)

A benefit to the Kansas City area, would be the release of the two V.H.F. radio frequencies. These could be reassigned.

The basic radio improvement would also include new control consoles in the dispatch center along with accessories such as, status boards and a city map. Existing items that would not be changed would be the new tape recording equipment, closed circuit T.V., alarm systems, C.R.T. terminals and printers, weather teletype, door openers, and other operating accessories.

CITY OF  
OVERLAND PARK, KANSAS



STATE  
LINE  
KANSAS ← → MISSOURI

Figure 3  
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Radio control  
concept.  
8-2-76 rje

CITY OF  
OVERLAND PARK, KANSAS

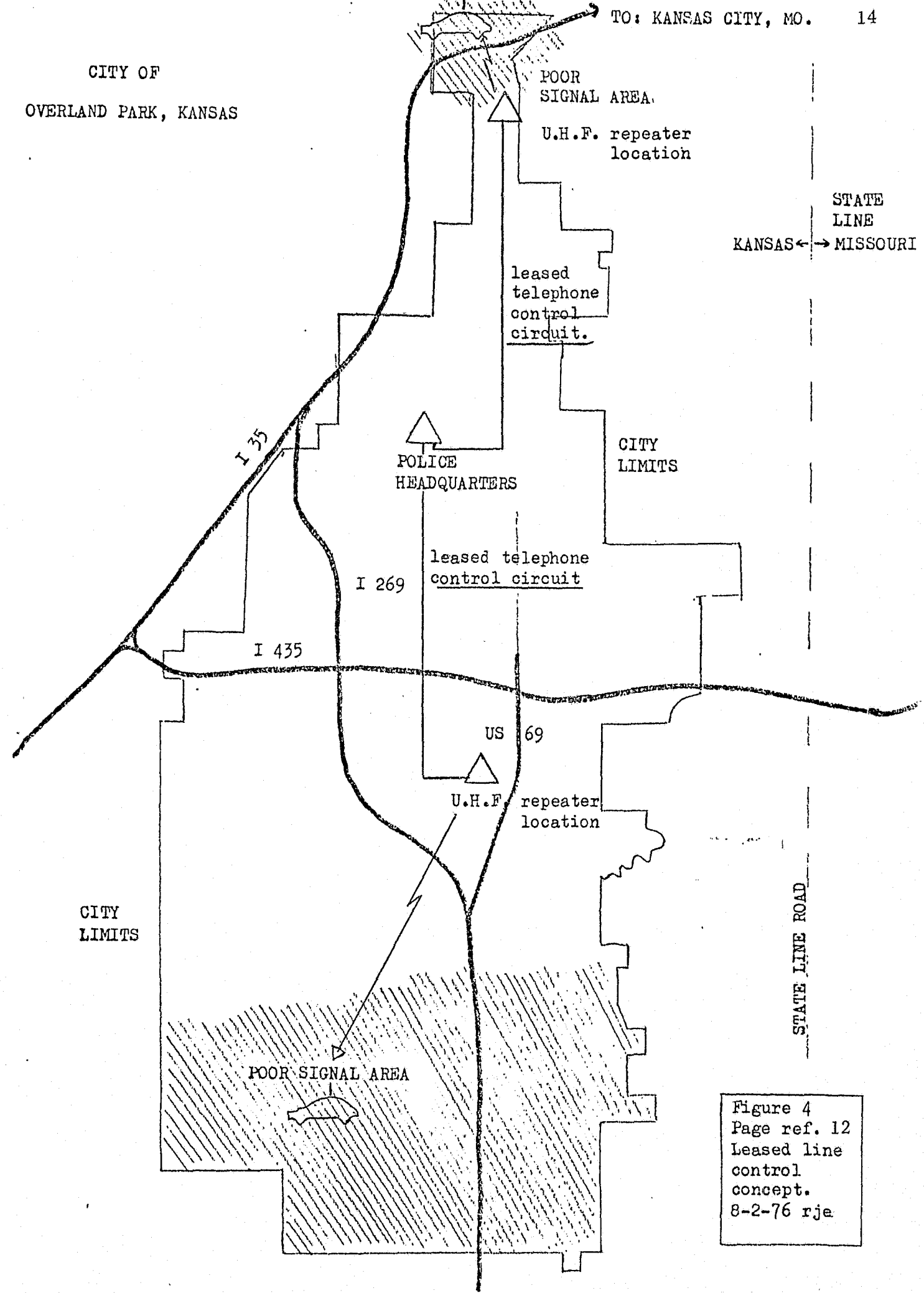


Figure 4  
 Page ref. 12  
 Leased line  
 control  
 concept.  
 8-2-76 rje



EXISTING POLICE RADIO FREQUENCIES  
OVERLAND PARK, KANSAS.

Base 158.850 MHz., Mobile 158.970 MHz. City net.

Base and mobile 158.775 MHz. Countywide (use by permission of County)

Base 39.46 MHz. Sheriff Johnson County network.

PROPOSED UHF ASSIGNMENTS.

Channel 1, Base 460.375 MHz., Mobile 465.375 MHz.

Channel 2, Base 460.500 MHz., Mobile 465.500 MHz.

Channel 3, Base 460.250 MHz., Mobile 465.250 MHz. Mutual aid.

Channel 4, Mobile (Portable 2 watts) 465. --- (Unlicensed).

Figure 5.  
Page ref. 12  
Existing and  
Proposed  
Frequencies.  
8-2-76 rje.

A review of the operating conditions at the control center indicates the need of additional personnel for the evening shift. Frequently, the radio traffic from field officers is so heavy that there becomes a backlog that cannot be handled by two operators. Some relief can possibly be obtained by having each officer keep his radio traffic to a minimum by reducing the length of his transmissions. The present work schedule of the operator/dispatcher is very well organized on each shift.

A committee representing entities in the Kansas City Area is working on plans for implementing the 911 common telephone number. Progress is being made in this area. Several major problems have surfaced, such as overlapping telephone jurisdictions in Kansas and Missouri, different rates and state regulations of tariffs in the two states and the high cost of converting telephone exchanges.

#### Feasibility of C. A. D.

The feasibility of computer-aided-dispatch may be analyzed in several ways. All police departments are realizing the need for storage and fast retrieval of many criminal files. In addition to the criminal files there are many non-criminal operations that can be computerized for storage and still be available for immediate use by the agency. Justification for mini-computer installation should be based upon immediate maximum use by all divisions of the police department. The assistance to the dispatch center should be an important part of the justification since field officers need to have available, on an immediate basis, all local criminal information.

A method of C.A.D. that is becoming popular is the shared use of a mini-computer by several police departments with similar crime problems. An example of this coordinated use is found in Oak Park, Illinois. The Oak Park C.A.D. system serves three cities with varying populations from 14,000 to 63,000. It provides C.R.T. input and output, instant car status, pre-formatted data entry, backlog of unassigned incidents, federal and state file access, plus many other advantages for more effective police service. Some departments use a telephone operator or a complaint clerk who is responsible for data entry. Other agencies use a dispatcher/complaint clerk in a single operation. The single operation usually lessens the response time since the person receiving the call also dispatches the vehicle.

## SECTION IV. FINDINGS AND CONCLUSIONS

The findings and conclusions reached in the three problem areas (basic radio improvement, feasibility of C.A.D. and improved interface with adjacent jurisdictions) have been reviewed with Mr. McMarrow of the Booz, Allen and Hamilton firm. The firm is preparing state-wide plans on communications. There are no major conflicts with Mr. McMarrow's plan.

The findings and conclusions are as follows:

- a. Finding: The control center and associated items require updating.

Conclusion: The equipment is difficult to modify or update and this is necessary for system expansion.

- b. Finding: The present radio base station requires modification and updating. It operates on V.H.F. channels.

Conclusion: The base station should be changed to U.H.F. and used in a backup or emergency configuration in case of repeater failure. A 150 foot radio tower should be placed at the police headquarters.

- c. Findings: There are poor reception areas in the north and south sections of the city.

Conclusion: Base station repeaters should be installed on the U.H.F. band near the poor reception areas. The repeater stations would extend portable and mobile operations. Tone squelch in the new equipment would nullify the interference problems.

- d. Finding: Mobile and portable radio units need expansion and modification.

Conclusion: All mobile and portable units should be changed to U.H.F. and contain a squelch accessory. Both units should be multi-frequency in transmit and receive. The mobile units should have a scanning capability. The power of the mobile units should be very nominal since the mobile repeaters will greatly extend the range. The portable units used for intelligence should be 2 watts. The standard police unit may be 5 watts or more.

- e. Finding: The mobile repeater stations should have a dependable control system from the dispatch center.

Conclusion: "Radio control," appears to be the most dependable alternative. It does not require a monthly rental fee except for maintenance. The next best method is leased telephone lines. The microwave control appears too costly for this size of system.

- f. Findings: The C.A.D. system is a possibility in this area especially since it can connect directly to the ALERT system in Kansas City for all state and federal file information.

Conclusion: C.A.D. should be considered in future planning after the basic radio design is accomplished. The C.A.D. concept, in order to be justified, should be considered either as a part of a larger city or police storage/data system, or as a shared system between several of the large communities, each sharing a part of the original cost and the monthly maintenance.

- g. Findings: Interagency communications will require updating with system design changes.

Conclusion: The V.H.F. base station should be maintained for some period of time until all agencies have a capability on the U.H.F. mutual aid channel. Monitors should be installed in the command cars for interagency communications. Each command officer should have a V.H.F. portable on the countywide frequency (VHF) for mutual aid operations. The present base station on the Sheriff's frequency of 39.46 MHZ should be maintained at the communications center for contact with county cars. The present base station on 158.775 MHZ (V.H.F.) should be maintained at the center for contact with county and city systems and vehicles using this channel.

- h. Finding: V.H.F. frequencies are not available for expansion. U.H.F. frequencies (2 pair) are available.

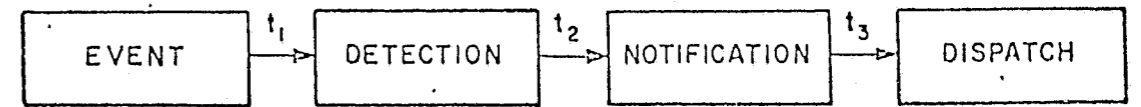
Conclusion: The City of Overland Park should immediately apply for the two U.H.F. frequencies that are designated by the State coordinator for their use. They should also apply for the mutual aid channel.

- i. Finding: The 911 common telephone number is not in use in the area.

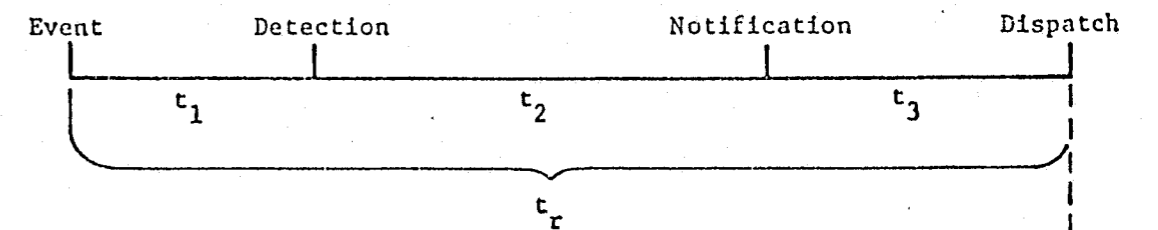
Conclusion: All efforts should be expended to implement the 911 number, since tests have shown that a citizen will save a minimum of twenty-nine (29) seconds when dialing a seven (7) digit number. (See Figure 6, Response Time Chart.)

- j. Finding: There is radio call backlog on evening shift at the communications control center.

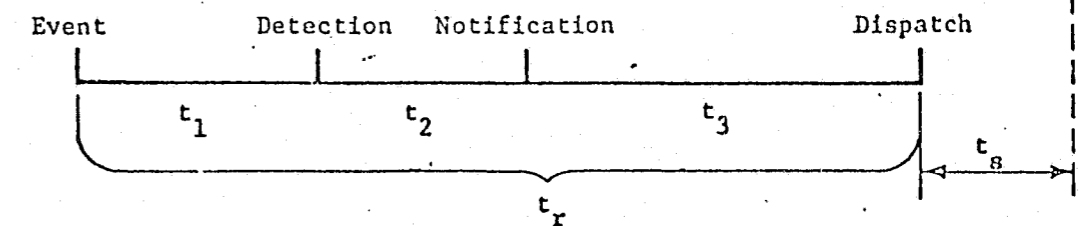
Conclusion: Consideration should be given to future addition of personnel in the dispatch center. As an interim solution, the field officers could be advised to keep their transmissions as short as possible. Since all radio traffic is recorded on tape, examples of long transmissions could be played at officer training sessions.



RESPONSE CYCLE DEFINITION



RESPONSE CYCLE TIMING WITHOUT 911



TIMING WITH CENTRAL DISPATCH AND 911

Note: From report of Franklin Institute Research Laboratories on Single Emergency Telephone Number, March 1970.

THE EMERGENCY RESPONSE CYCLE

Figure 6.  
Page ref. 19  
Response time  
improvement  $t_2$

## SECTION V. RECOMMENDATIONS

General Recommendation

The police department should immediately pursue the updating of its radio system to U.H.F. Planning should be continued for 911 and some type of C.A.D. system.

Specific Recommendations

1. The police department should apply immediately for new U.H.F. channels.
2. The department should replace existing communications equipment with new room consoles and accessories. New equipment should have future expansion capabilities for U.H.F. control and C.A.D. operation.
3. After frequency approval, the new base station/repeaters/control stations, mobile and portable plans should be executed.
4. C.A.D. and 911 plans should be executed as rapidly as possible. The planning and implementation of these may take several years.
5. Additional operating personnel should be hired as system expands. For instance, 911 will create many more citizens calls to the department for not only police, but also, for fire and emergency medical services.
6. A new radio tower should be purchased and placed at the police department building. The old tower at city hall could be used for emergencies and other city radio operations.
7. The department's intelligence units should use the 2 watt or less U.H.F. frequencies for their work. A F.C.C. license is not required and monitoring by the public becomes difficult. Communications to the center should be over the regular police channel.

Action Plan

An action plan and costs have already been prepared by the Overland Police Department. It will require modification to fit the conclusions and recommendations contained herein.