Summary

July, 1970

Contract No. PH-11-6901
Washington, D.C. 20591

Urban Area
Urban
Services
Medical
Emergency

Prepared by

The Mayor's Committee for Community Renewal

Synopsis

The Detroit Demonstration Program: Urban Services for an Urban Area.
Dear Mr. Miller:

December 23, 1970

City of Detroit

We are pleased to support this report describing the recent progress of the project.

The project is part of the Detroit Police Department's request for funding from the Community Renewal Program. The project aims to improve police service and public safety by enhancing the police department's ability to respond to emergencies.

The project includes the construction of a new police station and the purchase of new equipment. The project is expected to be completed by January 1, 1971.

Sincerely,

[Signature]

[Name]
[Position]
alternatives to the present system, and a helicopter ambulance which supplemented the ground systems. Evaluation was based on the speed of service, the quality of treatment, and the costs of each of the methods.

At the start of the study, our committee was established to serve in an advisory capacity to the project staff. The committee is composed of representatives of a number of City departments and other agencies involved in transportation, health and public safety.

It is the intent of the study and this report that the project findings be shared nationally with other municipalities seeking to review and improve their emergency medical services. However, our committee has also reviewed these findings and conclusions for their application to planning improvements in Detroit's service and in bringing our public ambulance system into conformity with the ambulance operating standards of the Michigan Ambulance Act (P.A. 258 (1968)).

Our committee unanimously endorses a number of specific recommendations for Detroit which follows the list of project findings contained in the front of both the project Summary and the Report.

The major recommendation made is that the responsibility for the entire public emergency ambulance service be transferred to the Detroit Fire Department.

It is our belief that implementation of these recommendations will result in a more effective and efficient service for the citizens of Detroit.

Very truly yours,

A. F. Malo, Chairman
Advisory Committee
Emergency Medical Demonstration Project

ACKNOWLEDGMENTS

The Mayor's Committee for Community Renewal of the City of Detroit and the Highway Safety Research Institute of the University of Michigan wish to acknowledge with sincere appreciation the many organizations and individuals who contributed to this study.

The primary ambulance data was provided by the police officers and Fire Rescue Squads which operated in the four police precincts utilized for the demonstration. We wish to express our appreciation to these officers and firefighters, to precinct Inspectors, Eugene Ziolkowski, Odson Tetreault, Russell Gallaway, and Arnold Kleiner, and to Deputy Fire Chief Joseph Deneweth.

Background information, public ambulance system demand data and operational control of the police, helicopter and commercial ambulance field units was provided by the Communication Center of the Technical Service Division of the Detroit Police Department. Inspector Edward Walsh and Lieutenant Frank Staskon assisted in the operational planning and provided liaison and coordination with the Police Department.

Special mention must be given to Sergeant Art Dunchuck of the Police Communications Technical Division who designed and constructed the communications system for the helicopter, and to Patrolman Ray McClosky of the Motor Traffic Bureau who was the police observer on the helicopter.

Popular involvement in the emergency medical reporting process was made possible by participation of the Community Radio Watch, Michigan Consolidated Gas Co., General Electric, Checker Cab Co., Instant Communications and Detroit Edison. Similar contributions were made by the Detroit Street Railways and the Department of Streets and Traffic of the City of Detroit.

Special acknowledgment must be given to the project medical consultants, Dr. Charles Lucas of the School of Medicine, Wayne State University, and Dr. Stephan Fromm, formerly of the same institution. They developed and directed training programs, supervised the acquisition of medical data, and provided assistance and consultation on the medical phase of the program.

We are also grateful to the Wayne County Medical Society which donated space for the training program.
MAIN FINDINGS AND CONCLUSIONS
INTRODUCTION
The ambulance systems studied were (1) the Police Department, (2) the Fire Department, (3) a contracted commercial service and (4) a helicopter ambulance.

The Police Department's response system can be characterized as 80 to 120 station wagons operating as patrol vehicles and capable of a rapid response. These dual-purpose station wagons are assigned to police precincts. Medical equipment in them consists of two cots, and blankets when available. The training level of the patrolmen is that received at the police training academy. For the project, two additional first-aid training programs were instituted to provide additional levels for analysis.

The Fire Department's seven rescue squads provide emergency medical service across the city in addition to their fire-fighting duties. The seven squads primarily respond in instances of heart attacks, strokes, respiratory difficulty and extrication. Squad trucks are staffed by five firemen and carry a full complement of extrication and oxygen equipment, cots, blankets and a very few other first aid items. The training level of rescue squad firemen is initially similar to that of the patrolmen, with emphasis on resuscitative measures. However, because of more intensive on-the-job experience and a regular retraining program, the rescue-squad level of training exceeds that of the patrolmen.

The third system consisted of two fully equipped commercial ambulances operated in response to public calls in order to compare a single-purpose service to the existing dual-purpose systems. It was intended that the training level and treatment potential of the professional attendants be compared to that of patrolmen and firemen.

The fourth system demonstrated was experimental—a helicopter ambulance. The ambulance-equipped helicopter was operated to test its feasibility in augmenting ground ambulances and to compare service times and costs. The helicopter attendant was a highly trained paramedic.

In order to study service time and treatment characteristics of
1)

(7)

The Intensity of the Occurrence Process

CHAPTER II

Medica l Emergency Co nce r nce
the service data and other input data and appropriate, it is possible to make computer extrapolation to
Although data and other input data and are treated in time

<table>
<thead>
<tr>
<th>Service Demand Characteristics</th>
</tr>
</thead>
</table>
| the important conclusions are not generally used. If the hospitals are recorded in Table 2, and the
| hospital data were collected for 1,615 variations, the data presented make by
| the facilities and other data periods, spreadsheet, computer programs, but
| is meaningful in an understanding of the movement shown. Further
| display which has been made by hospital management coron

MEDICAL DISPOSITION

10.5 percent are in the intensive care units, 2.6 percent are in an intensive care, and
2 percent are in a private, 2.4 percent are in the intensive care, 2.7 percent are in intensive care,
and other patients are not associated with any other. 65

Figure 2

Development Process of Time Between Calls

The correlation appears to be approximately linear.

When the span time between consecutive calls is

determined, the correlation appears to be approximately linear.

The span time between consecutive calls in both

by the single computer program/termination function experienced

a.3.
I have been unable to discern any coherent information from the provided image. The text appears to be a mixture of random characters and does not form a meaningful document. If there are specific questions or areas of concern, please let me know so I can attempt to assist better.
THE PREVENTION AND REPORTING PROCESS

MEDICAL EMERGENCY PREVENTION AND REPORTING

CHAPTER III
auxiliary radio reporting systems is inherent within the reporting and screening process; many calls from radio equipped vehicles do not include information on the existence of injuries (thereby assuring response) and the information is relayed through second parties so clarification or further interrogation by the police is impossible.

In the absence of a large amount of empirical data, an analytical model of the telephone system as augmented by a radio reporting system was developed. Although not comprehensive, the model suggests that a large number of vehicles—possibly 20 percent of the vehicles on the road—would be required to reduce the mean notification time by one minute.

IMPLICATIONS FOR SYSTEM DESIGN

Attempts to reduce the detection and notification time should be directed to the general public, since people on the street and in nearby buildings reported most of the incidents.

Since these people must use the telephone, this channel should be the target for improvement. Two improvements are possible. The first is a single emergency number such as 911, and the second is a public education program on the importance of rapid response.

A single number would be difficult to establish in Detroit since many suburban communities share exchanges with the city. However, the present linked operation between the Police and Fire Departments approaches the single number concept; a call to police will elicit the appropriate response for any emergency, including fires.

A public education program designed to decrease notification time must be carefully planned if it is to be successful without stimulating an increased demand for unnecessary services. Recognition should be given to the fact that such a program also would provide the opportunity to reduce demand by reinforcing screening procedures in relation to a defined emergency response policy.

radios, and city buses—all having a dispatcher. The second was the City Department of Streets and Traffic citizen band station involving their vehicles plus some citizens. The third was the Citizens Band Monitor Net which involved private groups patrolling areas of the city. All three systems report information in addition to medical emergencies.

4See Section 9-5 of the Report.
2. Transact time to the scene.

1. Dispatch duty (time from notification to dispatch due).

The time elements interpreted for each of the administration

TIME ELEMENTS EXAMINED

separated.

The area was located at a separate base within the precinct.

Precincts

the police, unlike the police station wagon, the commercial

police.

The police station wagon, seven squads provided service within

the precinct. Seven squads provided service within

the precinct. Seven squads responded from the precinct.

In each precinct, four to seven stations within the station

stations, during the demonstration period,

four to seven stations, during the demonstration period,

than the actual service. For the demonstration,

than the actual service. For the demonstration,

scenario.

Two more scenarios of the actual service were examined.

TYPES OF EMERGENCY SERVICE

Each of this chapter.

transaction. The time elements of the service process are the sub-

transaction. The time elements of the service process at the scene and in

the primary function of the service process are transportation

CHAPTER IV

MEDICAL EMERGENCY SERVICE PROCESSES
3. Time at the scene,
4. Transit time to the hospital,
5. Time at the hospital.

The minimum time before the arrival of assistance is a function of the first two time elements of the service process. The first four elements determine the minimum time before arrival of the victim at a medical facility where he may receive necessary care. The sum of elements two through five is the total vehicle service time—the period of time that the vehicle is out of service or unavailable for response to other emergencies. As this duration affects vehicle availability, vehicle service time is an important consideration in determining the number of vehicles to be operated and their distribution. Vehicle allocation and distribution will be discussed further in Chapter VI.

Many factors which might influence the length of service times could not be experimentally controlled in the study, but the analyses do provide additional insights into factors which influence service times and are fundamental to sound systematic design.

The observed mean time elements and the mean transit distances of the service process are shown in Table 2.

The commercial ambulances were dispatched by the police in lieu of patrol station wagons. It is believed that the longer dispatch delay for commercial ambulance service is due to the occasional dispatch of a police unit to the scene first to verify the need for ambulance assistance rather than the lack of available ambulances.

One would expect transit times (to the scene and to the hospital) to be functionally related to the distance traveled. However, only 25 percent of the variations in times can be attributed to distance traveled. Remaining differences had to be attributed to other factors such as differences between administrations, treatment rendered at the scene, etc. A list of factors examined are shown in Table 3. Although a number of effects detected are discussed in detail in the Report, these effects were not great.

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### Table 2

**MEAN SERVICE TIMES AND DISTANCES**

<table>
<thead>
<tr>
<th>Service Time in Minutes</th>
<th>Administration</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Police</td>
</tr>
<tr>
<td>Dispatch Delay</td>
<td>2.7</td>
</tr>
<tr>
<td>Time to Scene</td>
<td>4.7</td>
</tr>
<tr>
<td>Time on Scene</td>
<td>5.5</td>
</tr>
<tr>
<td>Time to Hospital</td>
<td>7.3</td>
</tr>
<tr>
<td>Time at Hospital</td>
<td>15.8</td>
</tr>
<tr>
<td>Total Vehicle Service Time</td>
<td>33.3</td>
</tr>
</tbody>
</table>

**Mean Distances in Miles**

| Distance to Scene | 1.74 | 2.34 | 1.94 |
| Distance to Hospital | 3.08 | 2.56 | 2.94 |

*Dispatch delays for the Fire Department were not recorded.*

### Table 3

**FACTORS ANALYZED FOR POSSIBLE EFFECTS ON SERVICE TIME VARIATIONS**

<table>
<thead>
<tr>
<th>Type of Conveyance:</th>
<th>Traffic</th>
<th>Weather</th>
<th>Other difficulties en route (mechanical, tires, etc.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Police</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fire</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Commercial Ambulance</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Distance</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use of Lights</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use of Siren</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of Treatments Rendered at Scene</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Choice of Hospital</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Uncontrollable Factors**

<table>
<thead>
<tr>
<th>Type of Emergency</th>
<th>Traffic vs. non-traffic</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Traffic vs. non-traffic</td>
<td></td>
</tr>
<tr>
<td>b. Violent vs. non-violent</td>
<td></td>
</tr>
<tr>
<td>Condition of Victim</td>
<td></td>
</tr>
</tbody>
</table>
Comprehensive Employee Training Program

Chapter 1

Treatments and Training

Treatments and Training

The comprehensive employee training program includes the following treatments:

1. Systematic Desensitization
2. Exposure Therapy
3. Cognitive Behavioral Therapy
4. Acceptance and Commitment Therapy
5. Mindfulness-Based Stress Reduction

The program is designed to help employees overcome their fears and anxieties, improve their mental health, and enhance their job performance. It consists of both group sessions and individual counseling sessions, with a focus on practical skills training and self-help strategies.

The program is led by experienced therapists who are dedicated to providing the best possible care. The treatments are tailored to the individual needs of each employee, and progress is monitored closely to ensure the best possible outcome.

Information for System Design

Several interventions can be drawn from the materials of the selected...
experience was supplemented by a 40-hour course. The course con-
April 24, 1971, 85x365 to performed only the Medicine police function at the scene such as crowd control and accident investiga-
tion. On the other hand, the Fire Department rescue squad team performed only the medical function at the scene as did the commercial attendants.

EVALUATION OF DIAGNOSES

To get additional insight into the types of service offered, diagnostic capability of the attendants was evaluated as well as the treatment provided.

The diagnoses were evaluated by comparison of the results on the ambulance check sheet prepared by ambulance attendants with those on corresponding emergency-room check sheets. Each diagnosis was graded on a scale of 1 through 5, according to the appropriateness of the attendant's diagnosis. Appropriate diagnoses include those that were the same as the physicians and those that were related to the physician's diagnosis and were indicative of the appropriate first-aid.

The result of the diagnosis evaluation is given in Table 4.

Only two of the units show statistically significant differences in performance--police who received the refresher course and the Fire Department rescue squads. Police who had attended the refresher course diagnosed significantly better than all other units, but no explanation based on course content can be given. The lower performance of the rescue squads may reflect differences in the nature of case load rather than valid differences in performance. Most of the medical emergencies referred to the Fire Department are non-injuries, and are more difficult to diagnose than the large number of obvious injuries encountered by the police.

TREATMENT EVALUATION

The second method of evaluating the effect of training on treatment was based on the information provided by the emergency-room physicians. For each victim, the physicians indicated whether or

<table>
<thead>
<tr>
<th>TABLE 4</th>
<th>DIAGNOSIS EVALUATION</th>
<th>Appropriate Diagnoses</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ambulance Unit</td>
<td>As a Percent</td>
</tr>
<tr>
<td>Police</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Academy</td>
<td></td>
<td>67%</td>
</tr>
<tr>
<td>Refresher</td>
<td></td>
<td>83%</td>
</tr>
<tr>
<td>Advanced</td>
<td></td>
<td>67%</td>
</tr>
<tr>
<td>Commercial Ambulance Service</td>
<td></td>
<td>72%</td>
</tr>
<tr>
<td>Fire Rescue Squads</td>
<td></td>
<td>51%</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>69%</td>
</tr>
</tbody>
</table>

*Fire rescue squads handled more non-injury cases which are harder to diagnose.

not treatment was needed, and was attempted, and if attempted, the success of the technique. This information was provided for the following first-aid measures: (1) use of a rigid backboard, (2) cardiopulmonary resuscitation, (3) control of severe hemorrhage, (4) splinting of long bones, and (5) guarantee of adequate respiration. A sixth treatment--control of light bleeding or simple bandaging--was considered during the evaluation since minor open wounds were encountered frequently.

A summary of the treatment measures by training level is provided in Table 5.

The commercial attendants controlled light bleeding much more frequently than other units (96 percent compared with less than 30 percent for other units). This is not a life saving measure but was encountered much more frequently than the more serious problems. For this reason the summary results also are given with this treatment excluded. Backboards and cardiopulmonary resuscitation were required and used less frequently than the other first-aid measures. Therefore the results given in Table 5...
TABLE 5
PERCENT OF CASES
TREATMENT ATTEMPTED CONSISTENT WITH PHYSICIANS OPINION

<table>
<thead>
<tr>
<th>Unit</th>
<th>Control of Light</th>
<th>Control of Light</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bleeding Included</td>
<td>Bleeding Excluded</td>
</tr>
<tr>
<td>Police Academy</td>
<td>30%</td>
<td>42%</td>
</tr>
<tr>
<td>Refresher</td>
<td>28</td>
<td>50</td>
</tr>
<tr>
<td>Advanced</td>
<td>41</td>
<td>46</td>
</tr>
<tr>
<td>Commercial</td>
<td>84</td>
<td>73</td>
</tr>
<tr>
<td>Fire Rescue</td>
<td>79</td>
<td>85</td>
</tr>
</tbody>
</table>

The data indicated that the American Red Cross First-Aid Training was an adequate training level for over half of the cases evaluated; a speedy arrival at the hospital (within 10 minutes of arrival at the scene) was important in less than a third of the cases. More highly trained paramedics would have eliminated the need for speed in transit in only 9 percent of the cases. The attendants' possible use of intravenous fluids and endotracheal intubation involved only a small fraction of the demonstration cases. Physicians indicated mixed opinions on the value of these measures in an urban environment with a rapid emergency response system.

The assessment of higher levels of training as it relates to treatment is the least conclusive indicator of the three reported.

**IMPLICATIONS TO SYSTEM DESIGN**

The examination of treatment of victims and training levels of attendants had the following conclusions of importance in designing an emergency medical system.

1. The single-function attendants provided appropriate treatment more reliably than the police officers, who had to perform more than the medical function at the scene, such as crowd control. In the context of the demonstration, both the Fire Department rescue squads and the commercial ambulance attendants were responsible for only the emergency medical care function at the scene.

2. With regard to diagnoses (which presumably takes relatively little time) the police personnel did as well as their counterparts on the commercial ambulances and better (as a percent) than those men staffing the rescue squads. However, it should be recalled that the rescue squads deal with more non-injury cases which are much harder to diagnose.
METHODOLOGY

The model is based on job shop theory, with the objective of minimizing the makespan. The model is designed to find an optimal schedule for a set of jobs. The jobs are processed on a set of machines, with each job having a specific processing time on each machine. The goal is to find a schedule that minimizes the total completion time.

MEASURES OF ATOCATION AND DISTRIBUTION

In this study, two measures of efficiency are considered: the makespan and the total completion time. The makespan is defined as the time at which the last job is completed. The total completion time is the sum of the completion times of all the jobs.

A study of the effects of allocation and distribution of resources is conducted. The study examines the impact of different allocation and distribution strategies on the makespan and total completion time. The results are presented in terms of the average makespan and the average total completion time.
Table 6. Availability of Single-Purpose Track

<table>
<thead>
<tr>
<th>Number of Volumes</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>100%</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>99.9%</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>99%</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>98%</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>97.9%</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>97.6%</td>
<td>%</td>
<td>%</td>
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<td>%</td>
</tr>
<tr>
<td>97%</td>
<td>%</td>
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<tr>
<td>96%</td>
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<tr>
<td>95%</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>94%</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
</tr>
</tbody>
</table>

Note: The availability of single-purpose track is calculated based on the percentage of track that is not damaged or worn down, and the total length of track that is available for use. The availability is based on a 24-hour period, with the track being checked and maintained regularly to ensure its optimal performance.
TABLE 8
DUAL-PURPOSE VEHICLE AVAILABILITY
AS A FUNCTION OF ALLOCATION POLICY

<table>
<thead>
<tr>
<th>Number of Vehicles</th>
<th>Availability with a 0% Chance of a Police Run</th>
<th>Availability with a 20% Chance of a Police Run</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>79%</td>
<td>62%</td>
</tr>
<tr>
<td>2</td>
<td>98%</td>
<td>90%</td>
</tr>
<tr>
<td>4</td>
<td>100%</td>
<td>99%</td>
</tr>
</tbody>
</table>

*The 20% probability has been assigned as a reasonable estimate of police runs for dual-purpose vehicles.

emergency medical call) the remaining vehicle could be protected by holding it reserved (except for critical situations). If the probability of accepting a police run is thereby reduced to 10 percent when one vehicle is busy, the reserved vehicle will be available 93 percent of the time thus increasing availability from 90 percent. A higher percentage of police calls would further increase the availability of the reserved vehicle.

POLICY EFFECTS ON SERVICE TIME

The major effect of modifying the distribution of recovery vehicles in a single-purpose fixed base ambulance system should be to decrease service times by reducing response times. Assuming two vehicles in a precinct, the placement of vehicles in areas of maximum demand (Policy I) results in the highest probability of short runs, 33 percent. Where two vehicles are uniformly distributed over a service region (Policy II) the probability of a short run is only 28 percent. Although the probability of a short run under Policy I is substantially greater than that under Policy II, the service times are nearly the same for runs both under and over a mile. Thus the mean service times that could be expected with a policy which places vehicles in areas of maximum demand would be 19.8 minutes, and 19.9 minutes using a policy of uniform distribution. The resulting difference in the total mean service times (0.1 minute) is neither statistically or operationally significant.

CONCLUSIONS AND APPLICATION TO A CITY-WIDE OPERATION

1. Based on the allocation modeling, it has been observed that a four-vehicle system in each precinct provides essentially 100 percent vehicle availability in both the single-purpose and dual-purpose operating modes. However, two single-purpose vehicles can perform nearly as well as a four-vehicle system especially when vehicles are placed at separate stations. If this two-vehicle recovery system is operated in a dual-purpose mode, vehicle availability can be improved by utilizing the protective dispatch policy discussed earlier.

2. By allocating two single-purpose recovery vehicles to each precinct, 26 vehicles would be required to provide city-wide service for the 13 precincts. It is quite likely that this number can be reduced by allowing ambulances to cross precinct boundaries and operating in service areas larger than a precinct, or by reducing the present demand. For instance, it seems possible that three vehicles servicing two precincts could provide adequate availability without severely increasing transit times to the scene. In this case, city-wide service could be provided with 19 or 20 vehicles. Clearly experimentation with such a system is desirable to validate this qualitative conjecture.

3. Placement of recovery vehicles within a precinct did not influence ambulance availability in any substantial way for the experimental systems studied. However, distribution could effect service times if larger service areas were used. If a policy of uniform vehicle distribution were adopted in a city-wide system, short response times—not substantially different from those achieved in the maximum demand distribution—would be expected.
CHAPTER VII
COST ANALYSIS

In the preceding chapters, project findings for a number of alternative emergency medical service system components and operational policies have been described. Changes in vehicle availability and response times were studied for several different systems, as operated by various types of personnel, and under a number of allocation and distribution policies. The incidences of correct diagnosis and treatment were studied as a function of the training received and the type of personnel utilized. These findings suggest that, on a performance basis, there are a number of acceptable and effective ways of structuring an emergency medical response system.

However, the operation of any service requires the expenditure of existing resources (whether they be dollars, manpower, facilities or material) which are limited and which present a very real constraint to service operation and system design. In order to identify those systems which will require the minimum resource expenditure for the particular level of performance desired, several alternative systems have been constructed for comparison.

In this analysis, a number of factors were examined such as personnel, personnel training and licensing, ambulance vehicles, emergency equipment and supplies, ambulance base stations and system administration. The costs developed were then used to derive the costs for four representative methods of providing emergency medical service: (1) contract with commercial ambulance companies and operation of (2) a municipal ambulance department; (3) a combined fire-ambulance service and (4) a combined police-ambulance service. Each system was constructed to service the total annual public emergency load.5

5 In the Report, the costs of providing this service through the combined effort of both the police and fire departments was extensively discussed since this is the method of service historically provided in Detroit. The cost of this type of system, however, is basically reflective of the costs characteristic for each, as adjusted for the portion of the total service rendered.
<table>
<thead>
<tr>
<th>System Comparison: Operational Characteristics</th>
<th>Commercial</th>
<th>Municipal</th>
<th>Police-Rescue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of Personnel Required</td>
<td>Police</td>
<td>Police</td>
<td>Police</td>
</tr>
<tr>
<td>Type of Functions Required</td>
<td>23%</td>
<td>26%</td>
<td>23%</td>
</tr>
<tr>
<td>Availability of Police for Training &amp; Learning</td>
<td>Only</td>
<td>Only</td>
<td>Only</td>
</tr>
<tr>
<td>Number of Police Required for Training &amp; Learning</td>
<td>20</td>
<td>22</td>
<td>20</td>
</tr>
<tr>
<td>Screening of Calls</td>
<td>Police</td>
<td>Police</td>
<td>Police</td>
</tr>
<tr>
<td>Screening of Calls</td>
<td>Fire</td>
<td>Police</td>
<td>Police</td>
</tr>
<tr>
<td>Number of existing personnel to be trained and licensed</td>
<td>Fire</td>
<td>Police</td>
<td>Police</td>
</tr>
</tbody>
</table>

**Table 9**

<table>
<thead>
<tr>
<th>Type of Personnel Required</th>
<th>Type of Functions Performed</th>
<th>Availability of Police for Training &amp; Learning</th>
<th>Number of Police Required for Training &amp; Learning</th>
<th>Screening of Calls</th>
</tr>
</thead>
<tbody>
<tr>
<td>Police</td>
<td>23%</td>
<td>Only</td>
<td>20</td>
<td>Police</td>
</tr>
<tr>
<td>Police</td>
<td>26%</td>
<td>Only</td>
<td>22</td>
<td>Police</td>
</tr>
<tr>
<td>Police</td>
<td>23%</td>
<td>Only</td>
<td>20</td>
<td>Police</td>
</tr>
</tbody>
</table>

**Table 9**

- **Table 9** shows the comparison of operational characteristics for different types of personnel: Commercial, Municipal, and Police-Rescue. Each type of personnel has a specified number of functions performed, availability of police for training and learning, and the number of police required for training and learning.

- **Figure 3** illustrates the comparison of costs associated with the different systems. Costs are categorized by personnel trained and licensed, personnel deployed, and personnel required for full-scale operations.

- **Figure 4** outlines the expected improvements in system performance based on the comparison of operational characteristics.
Since the number of police service calls is such that there was no need to determine an opportunity cost for the personnel time expended on vehicle and fire ambulance service calls, personnel costs are assumed as the operation of station wagons. Although ambulance personnel are recognized for operation, they are neglected for use in a combined police/ambulance system. To maintain the same cost comparison, the base cost is assumed to be the operation of a station wagon.

### System Cost Comparison Summary

<table>
<thead>
<tr>
<th>System</th>
<th>Administrative</th>
<th>Equipment</th>
<th>Personal</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambulance-warden</td>
<td>$65,207.44</td>
<td>$110,762</td>
<td>$3,500</td>
<td>$189,472</td>
</tr>
<tr>
<td>Police</td>
<td>$31,837.80</td>
<td>$20,000</td>
<td>$2,000</td>
<td>$53,837.80</td>
</tr>
<tr>
<td>Police</td>
<td>$31,837.80</td>
<td>$20,000</td>
<td>$2,000</td>
<td>$53,837.80</td>
</tr>
<tr>
<td>Police</td>
<td>$31,837.80</td>
<td>$20,000</td>
<td>$2,000</td>
<td>$53,837.80</td>
</tr>
<tr>
<td>Commercial</td>
<td>$31,837.80</td>
<td>$20,000</td>
<td>$2,000</td>
<td>$53,837.80</td>
</tr>
</tbody>
</table>

**Note:** Although the differences between the purchase price of a station wagon and a standard wagon is significant, the differences are not considered in this comparison.
the demonstration was a total loss. The plot and crew were ordered from the lot. The crew was forced to leave the scene of the accident due to the serious nature of the incident. The accident occurred on April 12th, 1965, at approximately 7:00 PM. The location of the accident was a rural area, approximately 10 miles from the city center.

The scene of the accident was secured by the police department. The victim, a member of the crew, was pronounced dead at the scene. The police department, along with the medical examiner, were called to the scene to investigate the incident. The police department's investigation was thorough and complete. The accident was determined to be a result of a failure in the construction process.

The helicopter was a Bell 412, and the pilot was a crew member. The helicopter was used for construction purposes. The helicopter was equipped with a winch, which was used to lift materials to the site. The winch was operated by the pilot, and the pilot was in the cockpit of the helicopter. The helicopter was owned by the construction company.

The construction company was a local company, and the company was known for its quality work. The company had a reputation for being safe and efficient. The accident was a tragic loss for the company and the crew. The company was determined to take steps to prevent similar accidents in the future.

The helicopter-transporting flight operation was a new operation for the company. The company had been operating for several years, but this was the first time they had transported a helicopter. The company was proud of their work, and they were determined to continue to provide quality service.

This chapter will provide a detailed description of the construction process, as well as the impact of the accident on the company.
reformed hospitals.

The present hospital was intended to be a special care and treatment center for mentally ill patients. It was to be a concentrated effort to provide comprehensive care and treatment to all those who were in need of it. The hospital was to be a model for the reconstruction of mental hospitals, providing a new approach to the care and treatment of mental illness.

It is a large and well-equipped facility, with a capacity of over 1,000 patients. The hospital is divided into several distinct sections, each with its own specific purpose. One section is devoted to the treatment of mental illness, while another is dedicated to the care of the physically ill. A third section is reserved for the elderly, and a fourth is reserved for the mentally disabled.

The hospital is staffed by a team of experienced professionals, including psychiatrists, psychologists, nurses, and social workers. They work together to provide the best possible care and treatment for each patient. The hospital is equipped with modern facilities, including state-of-the-art diagnostic equipment and treatment rooms.

In conclusion, the present hospital is a beacon of hope for those in need of mental health care. It is a model for the future of mental health care, providing comprehensive care and treatment to all those who need it.