4

COMMONWEALTH OF PENNSYLVANIA

FINAL REPORT

HELICOPTER AMBULANCE STUDY

MAY 1969

RAYMOND P. SHAFER, *Governor*

ROBERT G. BARTLETT, *Secretary of Highways and Highway Safety Coordinator*

FINAL REPORT

HELICOPTER AMBULANCE STUDY

joint project sponsored by

PENNSYLVANIA DEPARTMENT OF HIGHWAYS

AND

U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY SAFETY BUREAU
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participating state agencies

PENNSYLVANIA STATE POLICE
PENNSYLVANIA DEPARTMENT OF HEALTH
PENNSYLVANIA AERONAUTICS COMMISSION

contractor

Copter's Incorporated
Bryn Mawr, Pennsylvania

final report prepared by

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STATEMENT OF DISCLAIMER

The contents of this report including the conclusions represent the views of the authors, contractor, and participating state agencies and should not be considered as having official United States Department of Transportation approval, either expressed or implied.

TABLE OF CONTENTS

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Notes:

1 All staff positions except flight crew were part-time functions.

2 Troopers other than those listed above served in flight crew occasionly, while project was at Troop K Headquarters.

3 Troop K Headquarters located on Belmont Avenue, Philadelphia. May be referred to in this report as the "Belmont Barracks".

ADVISORY COMMITTEE

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ACKNOWLEDGEMENT

The members of the project staff wish to express their appreciation to the many persons and agencies who assisted in this study.

They are grateful to the participating hospitals, the physicians, and many ambulance companies for keeping special records, gratuitously, which were essential to the project. The staff particularly appreciates the cooperation extended by the Good Fellowship Ambulance Club of West Chester, by enthusiastically participating in many tests conducted for the benefit of this project.

The study also appreciates the cooperation of the State Police in providing troopers, base facilities, and communications.

Finally, the project director is grateful to many persons within the Department of Highways who helped with the preparation of the final report and for the many helpful comments and suggestions offered by reviewers of the report prior to its publication.

LIST OF FIGURES

LIST OF FIGURES (cont'd.)

LIST OF TABLES

FINAL REPORT PREPARATION

Many individuals were responsible for collecting data and maintaining records during this study. The state police troopers aboard the helicopter prepared daily logs for each flight or patrol, as well as special reports for each airlift completed. In addition, the Exton substation personnel maintained "incident" logs involving the helicopter operations.

The contractor maintained logs of flight operations. Physicians at participating hospitals prepared medical reports of all injured persons airlifted to hospitals. These reports were reviewed by physicians in the Department of Health.

Special study tasks covering accident history, existing ambulance services, accident simulations and time-delay studies were conducted by the Department of Highways. An Assistant Attorney General investigated the legal aspects of helicopter ambulance operations. The Pennsylvania Aeronautics Commission provided guidance and standards for helicopter landing sites.

At the conclusion of the study the contractor submitted a draft of his portion of the final report. The participating state agencies also prepared final reports covering their particular area of interest. Additional medical opinion was sought not only from those physicians who participated in the study but also from others who were known to have a particular interest in emergency medical services.

It became the project director's task to prepare the final report covering all areas of the study based upon reports received and supplemental information which was gathered. He served in a dual capacity as editor of some sections of the report and author of others.

The final report was reviewed by each agency connected with the study prior to its publication.

SUMMARY

This study was a joint project co-sponsored by the Pennsylvania Department of Highways and the National Highway Safety Bureau under the provisions of the 1966 Highway Safety Act.

The principal objective was to determine how effective a helicopter ambulance could be in increasing the chances of survival of traffic accident victims. It was hypothesized that travel time could be reduced particularly in an urban environment where traffic congestion and other factors could delay conventional ambulance response to traffic accidents. It was also the purpose of this study to analyze the reactions of those transported, the operational problems of landing at accident sites and hospitals, weather restrictions, communications, helicopter characteristics, possible area coverage, costs and other than medical uses of the helicopter.

The highly urbanized southeastern corner of Pennsylvania (excluding City of Philadelphia) was selected as a study site. This included Chester, Delaware, Montgomery and southern Bucks Counties. It consists of nearly 900 square miles, 1 million persons, and 34,000 miles of public highways. The area is presently serviced by 29 general hospitals and 93 ambulance clubs, most of which are manned by volunteer attendants.

Three other state agencies - State Police, Department of Health and Aeronautics Commission - participated in this study. Initially, five area hospitals were requested to participate (three more were added later) in order to provide medical guidance and evaluation.

A Bell helicopter Model J-2A was leased for 14 hours daily (7 a.m. - 9 p.m.) for one year. This model, which is normally 4-place and powered by a piston engine, with cruising speed of 91 mph, was modified to accommodate a medical attendant and one litter placed laterally across the cabin. It was equipped with a state police radio in addition to Aircraft VHF.

The crew included the pilot and a state trooper who served a dual function as police-medical attendant. Both were given special ambulance attendant training.

Orientation meetings were held with local police, ambulance clubs, and participating hospitals to outline the objectives of the study and enlist their support.

The general operational procedure was as follows: The need for helicopter ambulance service was determined by the officer at the accident scene. The state police barracks then dispatched the helicopter which, upon reaching the accident scene would land on the roadway or adjacent to it with the assistance of the ground police. The hospital was notified by the state police barracks of the helicopter's ETA with an accident casualty.

From November 16, 1967 to March 1, 1968, the crew operated from the Philadelphia Troop K Headquarters. Fourteen requests for helicopter service were received which resulted in completing three airlifts. In each instance the landing, administration of first aid, and loading and transporting of the victim to the hospital was carried out smoothly and without incident. Response times were remarkably short. In one instance the total time from call to delivery of victim to hospital was 9 minutes.

The helicopter patrolled heavily-traveled traffic corridors during morning and evening peak traffic hours. It detected disabled vehicles and dispatched assistance, and reported minor accidents and traffic congestion to ground units.

Although 58% of the patrols recorded a useful service of some type being performed, the lack of requests for ambulance service caused concern. Investigation revealed that competition between ambulance clubs was high, that working arrangements between clubs, local police and hospitals had been in existance for many years and that a general reluctance to call the helicopter prevailed unless the "spectacular" accident occurred. In the majority of cases the local police simply elected not to request the helicopter.

On March 1, 1968, the helicopter was moved to the state police Exton substation located in a more rural environment in the western section of the 4-county study area. The helicopter was identified as a police vehicle as well as an ambulance and was utilized more frequently in regular police routine. The area of operations was generally limited to Chester County although the crew responded when requested to any part of the 4-county area, during the remainder of the study.

During the study year 622 flights were completed. The following table summarizes the major activities during the 12 month period.

Traffic Service	Flights
disabled vehicles	83
accident response	144
air lifts completed	49
Police Service	
criminal	55
civil search (missing persons, etc.)	24
miscellaneous	30
Other	
demonstrations, accident simulations, surveys	77
Patrols recording no incidences	244

Functioning as an ambulance, the helicopter completed 49 airlifts of victims to hospitals. The overall response from time of call to delivery of victim to the hospital averaged 19.5 minutes. The average trip time from base to accident scene was 7.5 minutes and from accident scene to hospital, 5.8 minutes.

The types of injuries sustained by persons airlifted included lacerations, fractures, chest and internal injuries. The time factor in transporting the victims to the hospital was not critical in the majority of incidents. Six of the 49 injured persons had suffered injuries that were later classed as "lite threatening". Two of these six victims died after arrival at the hospital.

While physicians are reluctant to state conclusively that a life was (or was not) saved, a medical review indicated that two lives were "probably" saved because of rapid transport to the hospital. In one case the helicopter delivered the victim in 3

minutes whereas police estimated a conventional ambulance trip would have been 20-25 minutes at that time of day (4 p.m.) In the second case the medical report indicated that in addition to "probably" saving the victim's life due to rapid transport, his period of hospitalization was reduced. The overall response time was 14 minutes (initial call to delivery to hospital) while the trip time from accident scene to the hospital was 5 minutes. Trip time via local ambulance was not estimated although it arrived at the accident scene after the victim had reached the hospital.

Aircraft

Helicopter landings were made on busy highways, parking lots and sod fields, under a variety of conditions. All helicopter operations were accident-free which was a result of the capability and judgement of the pilots. While the 47 J 2A was satisfactory for this pilot study and performed well within its design limits, it had serious shortcomings and was not considered satisfactory for use in a regular ambulance service. Limited power and performance prevented operations in many locations; high temperatures in the summer restricted lifting capability and low temperatures in the winter required long and frequent warmup periods. Strong headwinds slowed response time. The internal litter and seating arrangement made it difficult to load a litter victim and attend him during flight. Only minimum first aid and medical equipment could be carried because of space and weight limitations.

For a two-week period a Fairchild Hiller turbine model FH 1100 with a cruising speed of 142 mph was loaned the study for test and evaluation. In addition to superior performance characteristics, this model was equipped with twin basket type litters arranged fore and aft in the cabin. The trooper-medic was in a better position to service the victim's needs during flight. In addition double doors permitted easy loading and unloading the litters.

Hospital Landing Facilities

Only one of the hospitals had facilities previously planned for helicopter operations. Conditions at the other hospitals varied extensively. At one location the landing point was on a parking lot 75' from the emergency room entrance while at another location it was 875'. At Chester County Hospital where 23 victims were admitted, the helicopter used a section of the parking lot 375' from the emergency room entrance. The Good Fellowship Ambulance Club assisted in unloading the injured persons, transporting them to the hospital using either a wheeled litter or an ambulance depending upon the severity of the injury or the weather conditions.

It is believed that landing points should be within 100' of emergency room entrances to avoid time losses and excessive handling of the victim. Minimum standards established by the Pennsylvania Aeronautics Commission require 8' horizontal clearance for each 1' vertical height, with a properly marked landing area, 200' x 200'.

Communications

The helicopter crew had direct radio contact with the state police net and all messages to hospitals concerning arrival of injured persons were relayed by phone through the state police station. In addition the helicopter was equipped with a PA system for direct ground contact at any point. While the system could have been im-

proved, the major communications problem was the lack of notification of the helicopter crew of an accident. In the majority of instances it was a personal decision not to request the helicopter ambulance rather than a communications hardware deficiency.

Two-thirds of the requests for service were sent by local or state police; one-third came from private citizens. Radio was used for 39% of the requests, while the phone was used for 54%.

There was concern throughout the study that the helicopter was not being used sufficiently for emergency medical purposes. To increase the helicopter usage, Chester County radio net was monitored which enabled the helicopter to respond to accidents on the basis of intercepted information rather than await a specific request for service. This is the practice of many local ambulance clubs and while it could benefit the injured persons it more often results in jurisdictional disputes and a needless waste of manpower and equipment. It was believed a regional dispatch agency and defined local service areas are necessary to provide efficient service yet avoid duplication of service. Basic to this is an adequate communications system which should receive a high priority in planning an emergency medical service program within a region.

Police and Other Uses

In addition to daily routine patrols and accident service, the helicopter was used 186 times for police surveillance and other functions. During the periods radio contact was maintained with the police net so the helicopter could be diverted when called to service accident emergencies.

As a police vehicle, the helicopter fit easily into the operational pattern of a state police installation without any major changes in station procedures. It provided the trooper with an advantageous position of being able to observe long sections of highway, vehicles, objects and persons normally obscured from the vision of ground patrols. It was used successfully in incidents requiring support and coordination of ground units and contributed directly to criminal apprehensions, location of missing persons, assistance to disabled motorists and relief of traffic congestion.

During the year the helicopter also participated in 53 demonstrations at schools, hospitals and ambulance club meetings; 15 simulated accident rescue operations and 9 engineering surveys.

Legal Aspects

The Attorney General's office expressed the opinion that no relevant legal distinction existed, for purposes of tort liability, between helicopter and conventional ambulance operations. Provisions of the Good Samaritan Act applies to the helicopter crew in rendering service as it does to a conventional ambulance crew. This Act does not, however, grant exemption to drivers (or pilots) for acts of negligence resulting from operation of the vehicle (or helicopter).

In the question of public vs private ownership of helicopter ambulance services, the state cannot be held liable for acts of negligence of its employees unless it grants consent for suit. Local political subdivisions are immune from tort liability only if they are carrying out governmental rather than proprietary functions. It is believed that a helicopter ambulance function would be proprietary, hence the local government would not be immune. In the case of private ownership and operation, both the employees as well as the owners may be liable in tort.

In all cases, however, regardless of the class of the operating agency, the actual personnel involved in this rendition of its services would not be immune from tort liability. Their rights and obligations would be governed by the Good Samaritan Act as it applies to them.

Existing Emergency Medical Services

Of the 93 ambulance companies in the study area, 55, as listed in the official directory, were sent questionnaires requesting information regarding their personnel, training, equipment, operations, etc. Thirty questionnaires which were completed and returned, indicated a wide variety in organization, equipment and operations. Two-thirds of the clubs have one ambulance while the remainder have two or more vehicles. All are radio equipped. The typical club makes 46 trips per month of which two-thirds were classed as emergencies. Each vehicle cost averaged $10,000 and is driven 6,800 miles per year at an annual operating cost of $1,700. Many operate in areas which overlap with other clubs. Some geographical sections are served by as many as 3 ambulance clubs.

Thirteen clubs kept special logs to record trip and response times for use in this project.

For a two-week period, the helicopter operated from the West Goshen Township office as a unit in the Good Fellowship Ambulance Club for test and evaluation. Club ambulance attendants were part of the flight crew which during this period completed seven airlifts of injured persons. These club members were impressed by the speed and accessibility of the helicopter but regarded the space limitations, litter arrangement and limited medical equipment as quite inferior to their own ambulance vehicles.

Trip Time: Ambulance vs Helicopter

It was difficult to make direct comparisons of response and trip times between conventional ambulances and the helicopter under normal day-to-day operating conditions because conditions were seldom identical. Three methods which were used to estimate the trip time differences revealed that the time saving by helicopter varied widely. The helicopter was able to reduce trip time required by conventional ambulances by as little as 30% on short trips during periods of light traffic but by 85% on longer trips during periods of heavy traffic. In most instances the reduction in travel time was 50%

Accident History

Accident data for the 4-county area was extracted from the state-wide record file for the 12 month period October 1, 1967 to September 30, 1968 which approximates the study year. Accidents occurring during this period were as follows:

	Accidents	Persons
Fatal	306	339
Injury	14,450	22,551
Property Damage	30,505	--
Total	45,261	22,890

One-third of the 45,261 accidents were injury-producing. It was estimated that one-quarter of these required ambulance services. Since 1.5 persons are injured per injury accident, approximately 5,600 persons used ambulance service during the study year.

Monthly injury accident frequency varied only slightly from month to month indicating that emergency medical services were required at a consistent rate. In contrast, there was wide variation in injury accident occurrence by day of week with 1,644 occurring on Tuesday and 2,520 on Saturday. Fifty percent (50%) of all injury accidents occurred Friday through Sunday indicating that the heaviest demand for ambulance service occurred over the weekend period. The daily rate on Saturday exceeds the daily average for the week by 38%. On an hourly basis there is extreme variation in frequency ranging from a low of 108 to a high of 1,354, with an average of 600 injury accidents per hour. The highest hour was 4-5 p.m., at which time the frequency of occurrence was 225% above the average hourly rate. Only 1.2% of the injury accidents occurred between 3 a.m., and 7 a.m., which indicates minimum needs for emergency medical services during this period. It was also noted that 75% of the injury accidents occurred during the 14 hour period the helicopter was available during this study.

This accident data illustrates the need for careful analysis of accident occurrence by an hour, day and monthly basis in order to have sufficient personnel and equipment available at the right time to provide an adequate level of emergency medical service within any specified geographical area.

Accident frequency analyzed by local government revealed that a relatively small number of local governments have a large number of injury or fatal accidents occurring within their jurisdictional limits. For example, only 4 local governments in Chester County had 100 or more injury or fatal accidents during the study year. This emphasizes the need for neighboring local governments to combine their ambulance activities and develop an effective emergency medical service on a regional rather than a local basis.

Cost Analysis

The total cost of this pilot study was $161,250 for both the medical and police functions. A separate cost breakdown by function was not maintained. In 49 airlifts of injured persons, 2 lives were "probably" saved as a result of rapid transfer to the hospital. The question of whether or not society can afford such service requires placing a dollar value on a human life and bodily injury, neglecting entirely human suffering and distress that might also be reduced by improved service.

The National Safety Council has established $37,000 as the cost per death, $2,200 per injury and $360 for property damage. Death costs are based upon wage loss, insurance costs, medical expenses and property damage. Based upon the National Safety Council scale, the costs of accidents in the study area during the study year were computed to be $73 million.

Basic helicopter ambulance costs for this study were $17.00 per stand-by hour plus $35.00 per flight hour. A typical 14 hour day with 3 hours of flight time cost $343.00. Flight time per airlift averaged 19.5 minutes plus approximately 10 minutes to return to base or a rounded value totaling 30 minutes.

Two approaches are considered in this analysis (1) cost-effectiveness for a helicopter ambulance service and, (2) cost of service to the user.

(1) At an assumed usage rate of 10 airlifts per 24 hour day (five hours flight time) the cost per airlift would be $59.00; per month cost would total $17,700 for 300 airlifts. A life saved is worth $34,800 ($37,000-$2,200) according to National Safety Council formula. Therefore, a helicopter ambulance service would be cost-effective if

it saved at least one life in 600 airlifts. This level appears to be easily achievable since two lives were apparently saved in 49 airlifts during this study.

(2) Even at a usage rate of 10 airlifts per day the cost per trip is $59.00, which is two to three times conventional ambulance charges. The question of whether or not individuals or insurance companies would be willing to pay this cost remains unanswered.

Since society is the ultimate beneficiary of lives saved, then perhaps society should provide the helicopter service on a standby basis through an acceptable method of financing, with the user paying only the direct cost. If this were done the cost per trip would be reduced from $59.00 to $17.00.

Can a helicopter ambulance maintain an average usage of 10 airlifts per day in a practical day-to-day service? The 900 square mile study area produced 5,600 injured persons who required ambulance service; this is an average of 15 persons per day. All of these could not be serviced by one helicopter because of distance, drakness, rate of occurrence, obstructions, and weather. Therefore, it is apparent that highway accidents in this area did not produce sufficient injuries to attain an average usage rate of 10 airlifts per day. Other medical emergencies would also need to be serviced to reach this level.

Finally, the question of time lapse between injury and proper medical treatment is of vital importance in establishing a level of emergency medical service for the accident victim. Most physicians queried in connection with this study believe it is essential to transport expert personnel and equipment to the accident scene as quickly as possible and even though his condition is successfully stabilized the critically injured person should be transported to definitive medical care in the hospital as quickly as possible. The consensus of medical opinion believes that the effective use of helicopter transport in medical emergencies depends upon the development of emergency medical operations center on a regional rather then a local community basis. The helicopter should carry a highly-trained paramedic who could render proper medical aid and determine the victim's needs for transportation and hospital care. The helicopter ambulance could be used for hospital to hospital transfer when not servicing emergencies.

This study concluded the helicopter can improve the level of medical service, by reducing travel time even in an area where existing ambulance service is considered to be above average. Citizenry readily accepted this mode of transportation. However, it should function as part of a regional emergency medical center in cooperation with other emergency services within the region. Because it is a costly mode of transportation, it must be used frequently to maintain the cost per trip at acceptable levels.

CONCLUSIONS

1. Helicopter ambulance transportation can reduce travel time below that required by a conventional ambulance during normal day-to-day conditions. While individual trip times varied extensively, the helicopter trip times were 30% less than ambulance trip times during periods of low traffic volumes and 85% less during periods of heavy traffic volumes. On the average, the reduction was estimated at 50%.

These travel time differences were achieved in an area where services by conventional ambulance were considered superior and where the helicopter trip lengths were about double those of conventional ambulances.

In 49 airlifts completed by the helicopter the trip from base to accident site averaged 7.5 minutes, from accident site to the hospital, 5.8 minutes, with total response time, from initial alert to delivery of the victim to the hospital of 19.5 minutes.

2. The majority of persons airlifted were not seriously injured. However, of the six victims who did suffer life threatening injuries, conservative medical opinion stated that the lives of two victims were "probably" saved as a result of rapid transportation to the hospital. In one case the helicopter trip time from the accident to the hospital was three (3) minutes while conventional ambulance trip time was estimated at 20 to 25 minutes. In the second case the helicopter trip time was five (5) minutes. No estimate was made for the conventional ambulance however, it did not arrive at the accident scene until after the victim was in the hospital.

3. There were no cases reported where permanent disability was avoided because of low response time although the period of hospitalization was reduced for one victim. In no instances did medical reports show that injuries had been aggravated by helicopter transport.

4. Nearly all accident victims readily accepted helicopter transportation as a mode of travel. Two persons, neither of whom were seriously injured, refused helicopter transport and were taken to the hospital in conventional ambulances. Similarly, many physicians and hospital personnel who had contact with the helicopter operations were initially surprised at the low response times and continued to be enthusiastic about the service throughout the study.

5. Adverse weather conditions (usually fog, snow or high winds), prevented flights 15% of the time. Surprisingly, more flights were limited during spring and summer than the fall and winter. Airlifts were successfully completed from travel lanes of limited access highways, 2-lane highways, fields, parking lots and highway shoulders. Some landings were completed at night although after-dark usage was limited unless the pilot was familiar with the terrain. Because of these limitations, it was evident that an effective emergency care system could not exclude ground transportation.

6. While the communications system used by the helicopter could have been improved, the lack of requests for helicopter ambulance service throughout the study was a result of personal decisions not to call the helicopter rather than a communications hardware deficiency. In addition, many ambulance companies make a practice of monitoring

emergency radio frequencies and respond to accidents without having received a specific request for their services. These two conditions resulted in far fewer airlifts by the helicopter crew than initially expected and compelled the crew to respond to some accidents on the basis of monitored reports. In those instances where helicopter service was requested, the communications network operated satisfactorily.

While it was believed that direct contact between the helicopter and hospital would be beneficial in an operating helicopter ambulance service, it was concluded that the prime requisite would be establishment of a regional emergency medical operations center in which definition of service areas and functions were clarified so both the helicopter and conventional ambulance capabilities could be used efficiently. Such a center could reduce duplication of services and operate effectively with a minimum of phone and radio equipment.

7. In spite of the wide variety of services rendered by ambulance companies within the study area and the identifiable weaknesses of some, it was concluded by the project staff that the majority of ambulance companies were satisfactorily meeting the demands and expectations, made by their individual communities for emergency medical transportation.

8. Helicopter ambulances should be equipped with oxygen, resuscitation equipment, suction apparatus and a physicians kit in addition to inflatable splints and a first aid kit. Even though trip times are short from the accident scene to the hospital, certain treatment and resuscitation methods must be continuous until the victim reaches the emergency room.

9. The Bell 47J2A model was satisfactory for purposes of this pilot study. However, its performance characteristics and space limitations are considered less than satisfactory as a vehicle in a regularly established ambulance service. It was concluded that the turbine-powered class helicopter service would reasonably meet the minimum needs of an ambulance service because of its litter configuration, speed and lift characteristics.

It is not believed economically practical for a helicopter to meet the minimum standards for interior space dimensions used for a conventional ambulance. Minimum standards should be developed which would be applicable to helicopter ambulances.

10. The hospital landing site should be located within 100 feet of the emergency room entrance so the injured can be easily transported by wheeled litter from the helicopter to the emergency room. Multiple transfers should be avoided since they are time-consuming and distressing to the victim.

11. To maintain a reasonable cost per trip, the helicopter ambulance would need to average ten (10) airlifts per day. Even at this usage rate the cost per trip would be $59.00 which is about three times conventional ambulance charges.

12. It was estimated the study area produced an average of 15 persons per day, injured in traffic accidents, who required the services of an ambulance. One helicopter could not have adequately serviced all these accidents because of sequence of occurrence, weather, darkness, etc. Therefore, in order to maintain a daily average of ten (10) airlifts, the helicopter ambulance would need to service other medical emergencies.

13. Based upon National Safety Council's estimates, prevention of one traffic fatility represents a monetary saving to society of $34,800. Therefore at a usage rate of 10 airlifts per day, a helicopter ambulance service would be cost-effective if it saved one or more lives in 600 airlifts. This level of service appears to be achievable in practice since in this study two lives were apparently saved in 49 airlifts.

14. The Good Samaritan Act contains legal implications that apply equally to a helicopter ambulance as it does to the conventional ambulance and its personnel. There are, in fact, no legal distinctions, for purposes of tort liability, between the use of a conventional vehicle or a helicopter as an ambulance. The rights and obligations of personnel involved are governed by the Act which considers negligence, intentional acts and omissions designed to do harm to persons receiving emergency care.

The State Police evaluated the helicopter from the enforcement viewpoint and the following conclusions apply to it as a police vehicle:

1. Initial planning is of utmost and paramount importance. Any and all affected agencies must be considered in this phase of the program. All steps or phases of the program should be outlined in their entirety. Planning should continue during the course of the project in order to make any adjustments that might become necessary.

2. Adequate communications is an absolute necessity for proper utilization of the aircraft and personnel. Permanent installation of a police radio transceiver must be made aboard the aircraft. This installation permits an excellent distance range for transmissions and receptions. Some type of public address system is essential to communicate with people on the ground who are isolated or removed from radio contact.

3. Singular control by a department or agency of its responsibilities is necessary for proper direction and utilization of personnel and equipment.

4. Aircraft operations can easily be integrated into a station's operations without any disrupting influence. If anything, the integration provides a close working interrelationship between aircraft members and regular field personnel.

5. Personnel, who are selected to participate in the program, must be accepted on a voluntary and expressed interest basis.

6. Regular police field personnel accept the craft as another tool or supplemental aid in the performance of their sworn duties. Reliance and mutual cooperation accentuates a complimentary element which promotes a greater number of successful accomplishments.

7. Under emergency conditions, the aircraft has the capability to assist in activities outside the perimeter of the base station's area of operation.

8. From the police viewpoint, restricting the activities of the helicopter to responding to accidents, or simply patrolling for accidents, is unproductive, costly, and unrealistic. As a patrol vehicle, it excelled because of its multi-purpose use. In utilization of the flight time allowed, it was obvious that accident response was only one of the many diversified uses.

9. Evaluation tests must be performed under controlled conditions for measuring the craft's effectiveness in the area of highway traffic safety. Similar tests must be performed to illustrate a cost analysis.

10. Public attitude is favorable to the use of a police helicopter, especially under emergency conditions.

11. The aircraft must be identified as a police vehicle in order to communicate this fact to the public and generate an awareness of police presence. Publicity through the news media will assist in accomplishing this purpose. Craft identification, coupled with the selection of an area which has light helicopter traffic, makes the patrol vehicle more obvious.

INTRODUCTION

The Highway Safety Act of 1966, Public Law 89-564 is the fundamental force which has generally moved the Federal Government toward the application of modern-day technology to the field of highway safety. While many Federal agencies as well as State Organizations have been pursuing solutions to complicated highway problems, the Highway Safety Act of 1966 has collectively brought attention to the seriousness of the national problem.

The National Highway Safety Bureau which was created by this Act developed sixteen safety standards covering all phases of activities affecting highway travel. These standards set the goals and establish the levels of performance that each state and local government must attempt to reach over the next several years. One of these standards, Standard 311, Emergency Medical Services states that:

"Each State, in cooperation with its local political subdivisions, shall have a program to ensure that persons involved in highway accidents receive prompt emergency medical care under the range of emergency conditions encountered."

In early 1967, prior to the development of this standard, the Commonwealth of Pennsylvania became actively involved in discussions and plans which included the use of helicopters for emergency evacuation of highway victims.

Copters, Inc., a Philadelphia based helicopter transport firm, pursued the matter by making a presentation entitled "A Pilot Program for Highway Casualty Assistance" to Secretary of Highways, the Honorable Robert G. Bartlett. From that date, April 24, 1967, state interest moved the concept along to the point of submission June 22, 1967, to the National Highway Safety Bureau for a Highway Safety project grant. The program was accepted by the Federal Government and, with supplemental changes, Project EM 68-1-002 was approved by the Federal Government September 22, 1967; Copters, Inc. received a signed contract November 10, 1967; and the project started November 17, 1967 and ended November 16, 1968.

OBJECTIVE & SCOPE

The feasibility of using helicopters as "air ambulances" has been proved in Korea and Vietnam. Whether the need is on a battlefield or on a highway, the civilian and military objectives are similar. In both cases the helicopter must provide a fast, effective means of transporting medical aid to the victims; it must also transport the victim to a center for major medical attention. However, the economics of a civilian system vs. a military system can be quite different because of mission or purpose.

The principle objective of this study was to determine how effective a helicopter ambulance could be in increasing the chances of survival of traffic accident victims. Some specific questions for which answers were sought are:

(1) What is the time reduction possible in getting proper medical aid to the accident victim either at the accident scene or hospital as compared to normal ambulance transportation?
(2) Is this time reduction significant in preventing death or permanent disability to a severely injured person?
(3) How many deaths or permanent injuries can be prevented using helicopter ambulance over a given area and/or time span?
(4) What are reactions of the injured persons being transported by helicopter?
(5) Are certain types of injuries likely to be aggravated by helicopter transport?
(6) What is the cost of maintaining helicopter ambulance service as compared to regular ambulance service?
(7) Can a helicopter reduce the number of ground ambulances required to properly service a given area; what is the proper balance between maintaining both helicopter and ground ambulances?
(8) How large an area can one helicopter adequately service?
(9) What are the minimum desirable characteristics for the helicopter, with respect to size, range, speed and equipment?
(10) To what extent do adverse weather conditions, physical obstructions or other factors prevent the helicopter from performing its function as an ambulance?
(11) Are speciliazed types of medical equipment necessary or desirable to optimize the helicopter mode of transport?
(12) What communications are necessary between helicopter, local or state police, ambulance clubs, hospitals, and others?
(13) Should the helicopter patrol certain areas, or at certain times, or remain at the base awaiting calls?
(14) Can helicopter be assigned other functions, such as police patrol or criminal work without adversely affecting its primary mission of an ambulance for traffic accidents or other emergencies?
(15) Does rapid removal of accident victims permit earlier resumption of normal traffic flow?

It was difficult to define an objective in terms of specific goals to be achieved such as saving "x" number of lives or providing x% better service than existing ambulance service, although the desirability of doing this was recognized for evaluation and measurement of the degree of success in attaining these goals.

The systems approach which depends upon identification of specific goals has been effective for developing solutions to difficult problems. This technique usually consists of identification of problem and system requirements, development of system components or sub-systems and finally testing alternatives independently and in combination to determine the effects on the total system.

This methodology is particularly applicable to studies involving many interrelated variables, such as those encountered in development of emergency care systems.

The general premise assumed that the physical (and emotional) conditions of an injured person worsens with passage of time until proper medical attention is provided. The rapidity of deterioration is dependent upon the type and seriousness of the injury, the normal physical well-being of the victim prior to injury and his environment during the period between injury and hospital care.

Although many interrelated factors are involved in improving a victim's chances of survival, this study was principally concerned with evaluating the effect helicopter transportation might have on those variables connected with response time.

Common events connected with any injury producing accident might be classified as follows:

1. accident occurrence
2. detection of accident
3. notification of authorities
4. dispatching of ambulance
5. ambulance arrival at scene
6. diagnosis of injury
7. treatment at scene
8. departure for hospital
9. treatment enroute to hospital
10. arrival at hospital
11. arrival in emergency room
12. diagnosis of injuries
13. treatment

Other variables include quality of emergency service by ambulance and emergency room personnel, availability of physicians, jurisdictional boundaries, local habits and customs, which must be identified and measured in a total systems approach.

Thus this study which was concerned principally with events 4 through 10, in evaluating one mode of transportation in relation to another mode could easily expand into a series of comprehensive studies carrying far beyond the original scope of this project without necessarily finding an answer to the basic question "Can a helicopter ambulance provide the means to reduce deaths and the effects of injuries in a civil environment as it does in a military environment?"

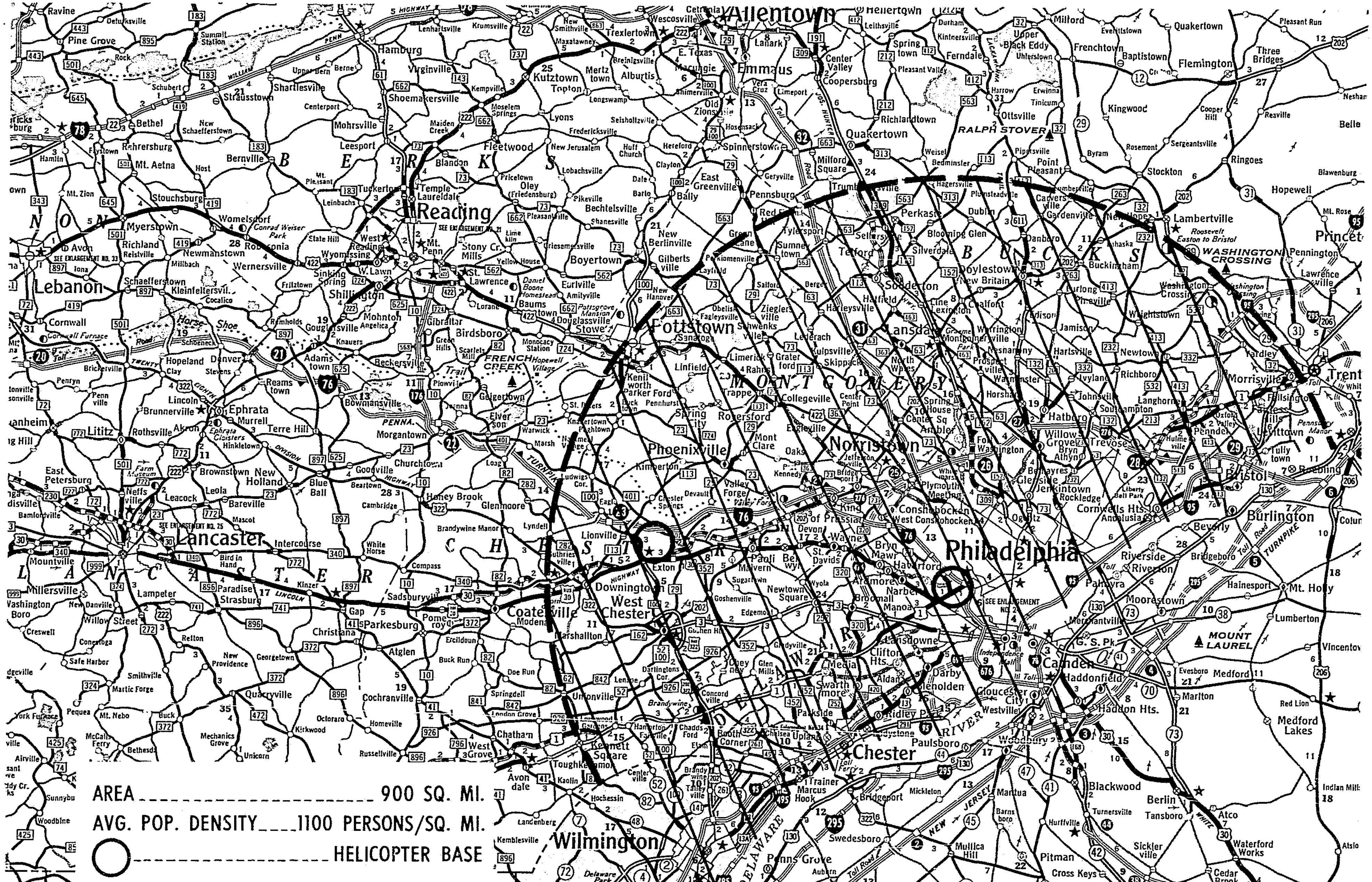
It was believed that answers could be found to most of the questions previously stated by practical testing. The method of approach, therefore, was to place a helicopter ambulance in service and develop in general terms, only those studies required to find answers to those questions without the sophistication of rigorous systems analysis. These tasks include:

(1) Measurement of helicopter capabilities in a civil environment through airlift of victims from both actual and simulated traffic accidents.

(2) Medical evaluation of victims transported by helicopters.
(3) Development of criteria of communications needs to permit optimum use of helicopter.
(4) Survey and analysis of existing ambulance service within study area.
(5) Analysis of accidents occurring during study year within study area.
(6) Evaluation of other uses of the helicopter (especially police).
(7) Review of the legal status and responsibility of helicopter ambulance operating agency.
(8) Cost-effectiveness evaluation.

FIGURE 1

SOUTHEASTERN PENNSYLVANIA HELICOPTER AMBULANCE STUDY AREA



STUDY APPROACH

It was hypothesized that a helicopter ambulance would be useful in reducing travel time under either of two common circumstances: (1) in heavily populated areas where traffic density or unusual road network could delay normal ground ambulance operations, and (2) in remote rural areas where distance rather than traffic volumes prevented the ambulance from first reaching the victim and then the hospital quickly.

Geographical Location

Since this study was to be conducted in an urban environment, the southeastern corner of Pennsylvania (excluding City of Philadelphia) was selected as the study area. This consists of 900 square miles encompassing the suburban Philadelphia region in Delaware, Chester, Montgomery and Lower Bucks Counties. This area which has a population of just over one million persons has an average density of 1,100 persons per square mile. It includes 34,000 miles of highways and is presently serviced by 29 general hospitals and 93 ambulance companies, the majority of which are composed of volunteer attendants.

It was not known at the beginning of the study the magnitude of the emergency medical problem for the area. During 1966, 39,300 accidents occurred within the area of which approximately 1/3 resulted in personal injuries. It was found later by sampling accident data for one month, approximately 25% of the injury producing accidents require the services of an ambulance.

A nine-month study of accidents on 150 miles of high-volume routes (both limited access and surface arteries) in this area showed accidents occurred at rates varying between 232 and 1,283 accidents per 100 million vehicle miles. Expressed in terms of density, the rate varied between 20 and 89 accidents per highway mile. It was evident from this sampling that the accident frequency in this area was sufficient to test the helicopter ambulance, although the efficiency and quality of ambulance service was not known.

◀ Figure 1 illustrates the location, highway network and the limits of the study area.

Participating Agencies

Because the project involved highway safety, law enforcement, emergency medical service, and aviation, the support and cooperation of the state departments responsible in these areas was sought and received. The study thus became a joint project consisting of:

Pennsylvania Department of Highways
Pennsylvania State Police
Pennsylvania Department of Health
Pennsylvania Aeronautics Commission

The general responsibilities of each state agency were as follows:

Department of Highways: Provide overall supervision to project, assist project coordinator as required, prepare progress reports for National Highway Safety Bureau,

LOCATIONS OF PARTICIPATING HOSPITALS

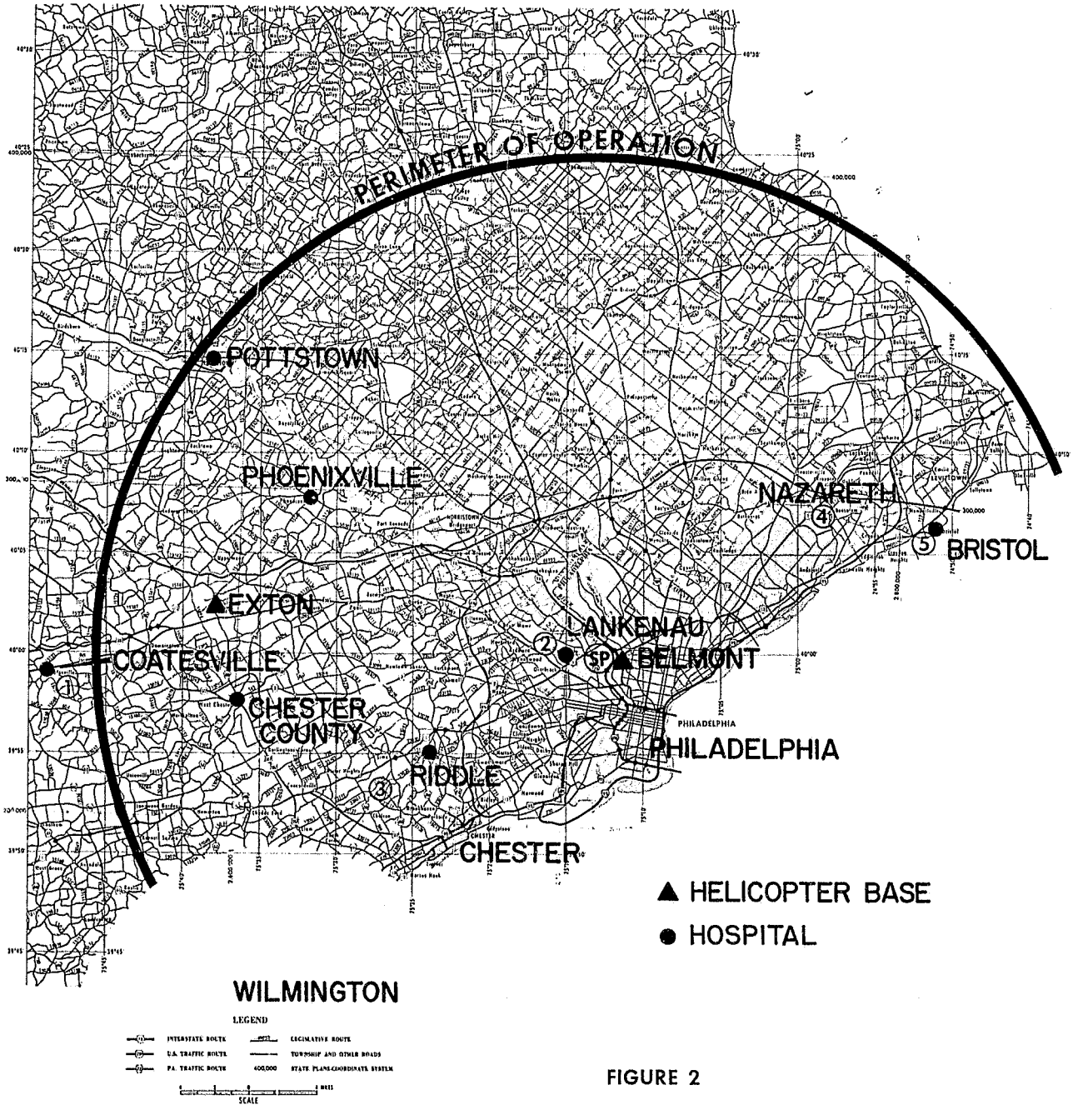


FIGURE 2

compile accident data during study year, study existing ambulance services, review legal aspects associated with helicopter ambulance operations.

State Police: Provide base facilities for helicopter and crew, troopers to serve as medics, and communications net; maintain daily records of flights, special reports of each medical evacuation; evaluate alternate uses of helicopter for law enforcement.

Department of Health: Arrange for and conduct advance training in first aid for troopers and pilots; work with participating hospitals and physicians to evaluate medical reports and analyze effects of helicopter transport on accident victims.

Aeronautics Commission: Provide technical support in selecting and approving landing sites at hospitals; provide professional assistance in selecting and evaluating aircraft, performance and review of flight operations.

A Coordinating and Advisory Committee was created consisting of representatives of these organizations for the purpose of reviewing the progress of the study periodically and providing guidance. The Committee, whose function was advisory in nature, met monthly in the early stages of the study to hear a report by the project coordinator, discuss the results achieved and recommend modifications to operating procedures as required to improve effectiveness of study.

In addition to the committee members, representatives from the Franklin Institute, involved in a study for National Highway Safety Bureau in emergency medical services, were invited to attend and participate in the meetings.

It was believed that the project needed the guidance of persons who understand the clinical needs of patients and who could evaluate or develop new equipment or procedures to best utilize the helicopter mode of transport in emergency situations. It was also essential that a physician evaluate the medical effect of "time saving" for the injured in receiving proper medical care, made possible by helicopter transport.

Five hospitals were invited to participate in this program. These were chosen on the basis of interest in the project, adequate emergency room facilities, adequate heliport, and geographical location within the study area. They were:

Coatesville Hospital
Lankenau Hospital
Lower Bucks County Hospital
Nazareth Hospital
Riddle Hospital

A representative of the surgical staff of each hospital was requested to serve on a medical advisory committee and to assume responsibility for collecting the required data on accident victims admitted via helicopter. Dr. Stanley Smith of the Department of Health was appointed chairman of this committee. The initial meeting of the committee was held November 14 to review the project and design an appropriate emergency room data form.

In addition to the five original hospitals associated with the project, three other hospitals were added after March 1, 1968. These were:

Phoenixville Hospital
Pottstown Hospital
Chester County Hospital

◀ Figure 2 shows the locations of these hospitals.

Local police and ambulance companies within the study area were invited to attend a series of briefing sessions which described the objectives of the study, the procedures

to be followed and its relationship to the overall safety effort. Their support and cooperation was solicited.

There are 56 separate police jurisdictions in the four county area and even though interest in the project appeared to be high, it was apparent that coordination among units could not be achieved on a regional basis; procedures and communications varied and there was no common radio net.

A similar situation existed among the 93 ambulance companies. Each operated within an area, roughly defined, which generally overlapped with other ambulance units. There was wide variance in organization, operating procedures, and equipment. A later survey revealed at least 17 different radio frequencies being used by the 93 companies.

There was no one ambulance association representing the majority of companies with which to work. It was apparent that future contact and assistance would have to be obtained on an individual company basis.

Operating Procedures, Personnel and Equipment

A contract to provide helicopter service was entered into with a Philadelphia firm of Copter's, Inc. to furnish a helicopter properly equipped for ambulance service, to be available 14 hours daily, 7:00 a.m. to 9:00 p.m. seven days a week for a period of one year.

A Bell Model J-2A helicopter, which was recommended by the contractor, was modified to accommodate a pilot, a medical attendant and one litter passenger. This is normally a 4-place craft, piston engine with a cruising speed of 91 mph, top speed of 105 mph. It has a payload capacity of 659 pounds and a range of 200 miles. Special doors were required to accommodate the litter. Two litters could be used, however, there would not be sufficient space for the medic.

The helicopter was equipped with the aircraft VHF radio as well as an FM transceiver tuned to the state police frequency. It carried the following medical supplies and equipment:

a. Complete first aid kit with splints
b. Oxygen tank with mask
c. Stretcher
d. Clean linen and blankets

In addition it was equipped with a public address system.

Time schedules, procedures, and data collection forms were developed which required continuous liaison among the participating agencies. The following general procedures were established:

(a) The aircraft and assigned personnel were stationed at the State Police Troop K Headquarters located at the western edge of the City of Philadelphia. Duty hours were 7:00 a.m. to 9:00 p.m. daily

(b) The flight crew consisted of the pilot and a state trooper who served in a dual function - policeman and medical attendant.

(c) The helicopter would patrol the heavy traffic corrdiors during the 7-9 a.m. and 4-6 p.m. periods, on the basis that it would be readily available for emergency calls or could observe needs and dispatch for assistance to accidents, disabled vehicles, traffic bottlenecks, etc.

FIGURE 3

BELL MODEL J-2A 4-PLACE HELICOPTER MODIFIED TO CARRY ONE LITTER PATIENT AND ONE MEDICAL ATTENDANT IN ADDITION TO THE PILOT.

FIGURE 4

INTERIOR ARRANGEMENT SHOWING LITTER AND DROP SEAT FOR ATTENDANT BEHIND THE PILOT.

FIGURE 5

TROOPERS CARRYING "ACCIDENT VICTIM" ON LITTER.

FIGURE 6

"VICTIM" BEING PLACED IN J-2A.

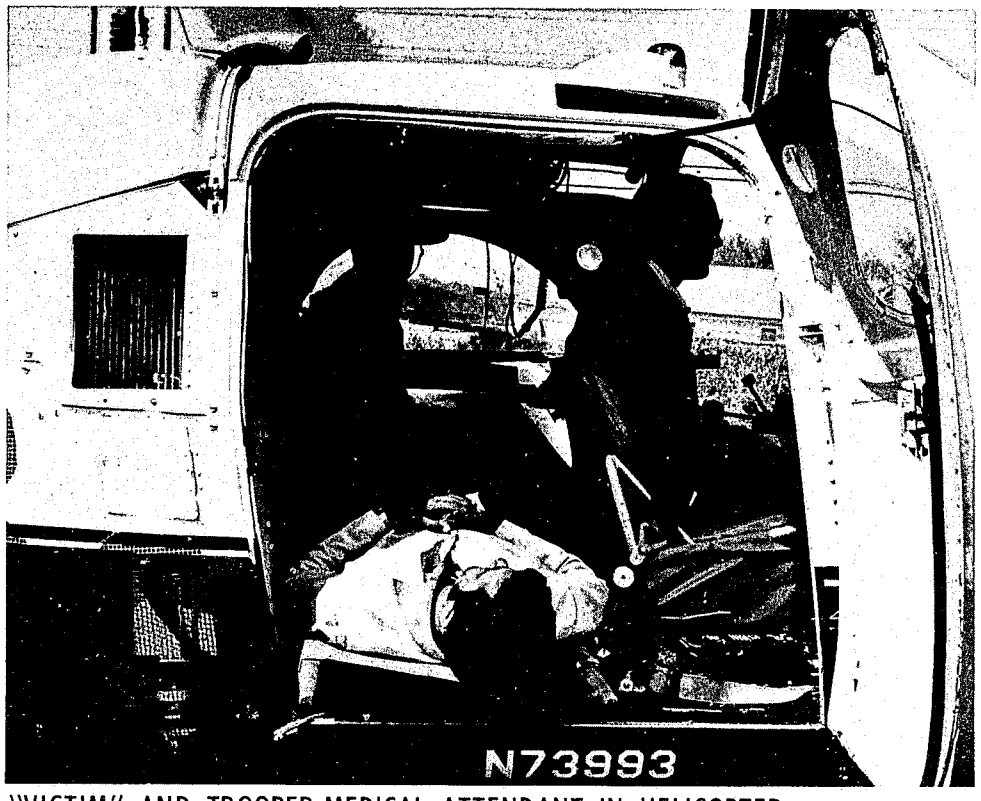


FIGURE 7

"VICTIM" AND TROOPER-MEDICAL ATTENDANT IN HELICOPTER.

FIGURE 8

DOOR SECURED — READY FOR LIFT-OFF.

(d) The trooper aboard would serve as "commander." He would select patrol routes, determine traffic service needs, and maintain radio contact with the base station and mobile police units.

(e) During off-duty hours, the aircraft was stationed at Copter's, Inc. maintenance base at Philadelphia International Airport.

(f) During the flight to Troop K each day, regular checks were made to insure the operational status of aircraft and communications equipment through the service system.

(g) In the event of inclement weather, the aircraft and personnel remained on standby and were prepared to operate from the maintenance base at International Airport.

The following operational procedures were established for the service while on patrol or on standby (See Figures 9 & 10).

1. The need for air-ambulance service was determined by local or state police on the accident scene.
2. The officer requested the service through his headquarters, providing accurate location information.
3. The police unit involved in turn requested the service by radio or telephone through Troop K Headquarters.
4. Troop K dispatched the helicopter.
5. Upon reaching the scene, the crew rendered first aid.
6. The trooper made the basic determination:
   a. He could elect to take the injured to a hospital
   b. He could decide it necessary to bring medical assistance to the scene.
7. In the event of victim removal:
   a. The crew advised the dispatcher at Troop K of nature of injury, hospital destination and ETA.
   b. Troop K alerted the participating hospital.
   c. During the flight, the crew maintained communication with Troop K, which in turn maintained contact with the hospital so that appropriate facilities would be on hand upon arrival.
8. In the event of a need to bring medical assistance:
   a. The crew was to advise Troop K of the situation and request assistance.
   b. Troop K would forward the request to appropriate hospital.
   c. The helicopter would proceed to the hospital, pick up required personnel and return to the scene.
   d. The trooper would remain on the scene and would communicate with the system using a portable radio unit.
9. A detailed log of operations was maintained, including calls received, time of call, location, departure from base, arrival at scene, arrival at hospital, description of accident including degree of injury, traffic conditions, weather conditions, name of officer who requested service, etc.

Copter's, Inc. maintained a staff of three (3) pilots and one manager to operate the facility during prescribed hours.

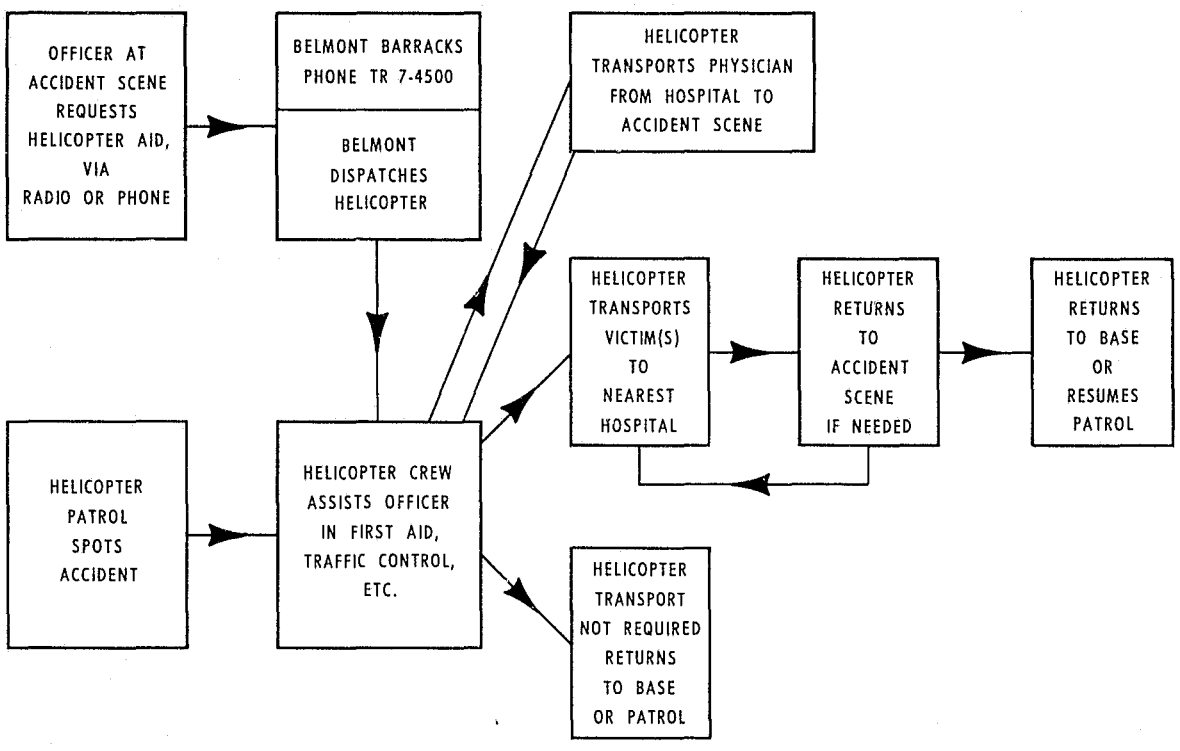
(a) Pilots held current commercial helicopter ratings and current medical certificates. They also met Copter's, Inc. requirements of a minimum 3,000 hours flight time and were given a flight check at least every six (6) months.

(b) First aid Training

1. The Pilots were given advanced red cross training (troopers had previously received this)

FIGURE 9

MODE OF OPERATIONS



2. Both troopers and pilots were given ambulance attendant training course sponsored by the Department of Health and conducted by Lankenau Hospital.

(c) The Copter's, Inc. manager was responsible for maintaining appropriate liaison between the Department of Highways, State Police and participating hospitals.

Copter's, Inc. provided full insurance protection to the Commonwealth and its employees, along with a "Save Harmless" clause with respect to Commonwealth employees. Also provided was mal-practice insurance for all employees.

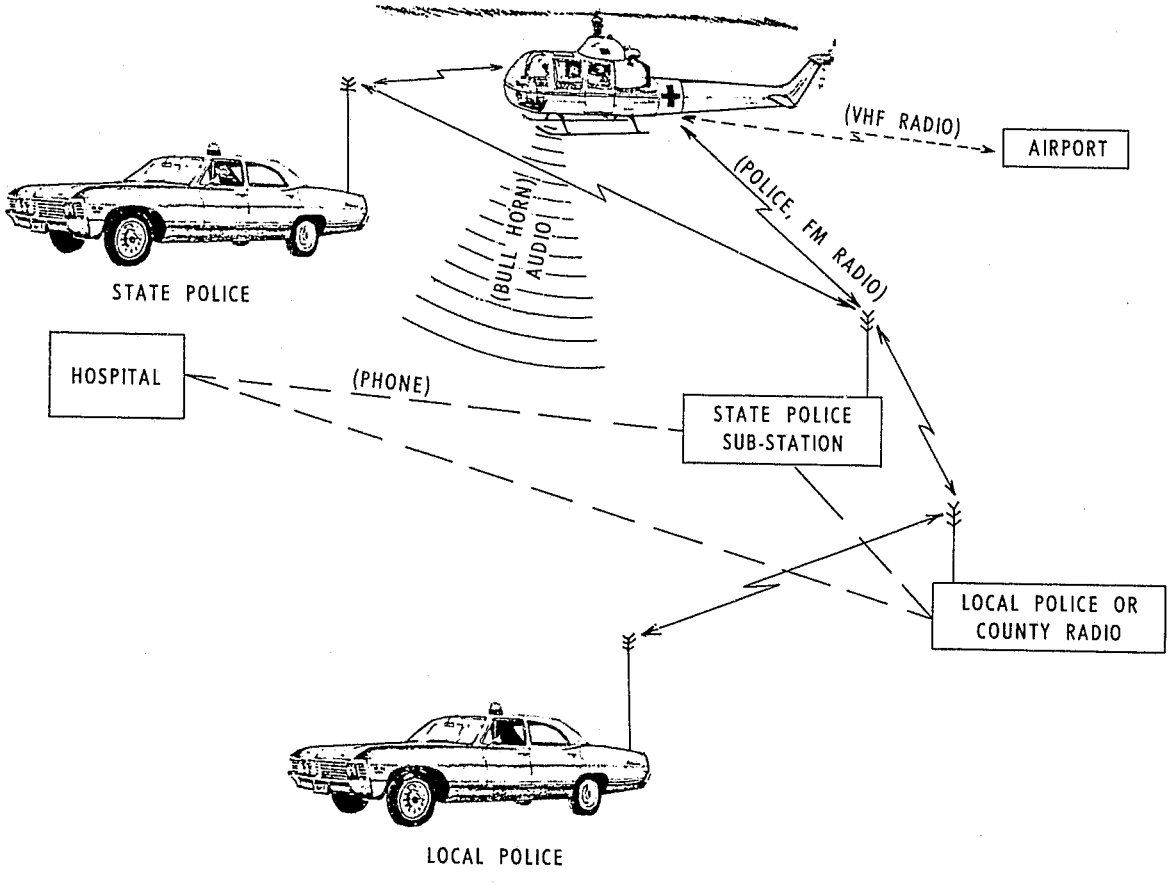
A second 47 J-2 helicopter was required to be available at all times as a backup aircraft. This would allow routine as well as unscheduled maintanance to be performed without disruption to the ambulance operation. In case of a major emergency, the second aircraft was available for use as needed. The original contract was modified later however, to permit the contractor to use the back up helicopter for other purposes within the Philadelphia area provided it would be available within one hour.

Nine troopers from Troop K were selected to serve with the project on a part-time basis. They were briefed on the objectives of the study and assisted in developing the procedures. They were assigned on a rotating two-shift per day basis; 7:00 a.m. to 3:00 p.m., and 3:00 p.m. to 9:00 p.m., which corresponded to the pilot rotation.

With the multitude of local radio systems operated by local police and ambulance companies throughout the study area, it was apparent the only common means of communications available was the state police net.

FIGURE 10

COMMUNICATIONS NETWORK



DISCUSSION

OF

PROJECT FINDINGS

STUDY PHASES I AND II

Phase I (Troop K Headquarters, Belmont Ave., Philadelphia)

The first weeks were spent principally in familiarizing the pilots and troopers with operational procedures, recognition of land marks, physical obstructions and hospital landing sites. Patrols were flown during peak traffic periods, 7:30 to 9:00 in the morning and 4:30 to 6:00 in the afternoon. Flight schedules were not rigid, however, and some off-peak hour patrols were also flown. The major service provided while on patrol consisted of dispatching assistance to disabled vehicles which were spotted, reporting minor accidents, and responding to varied emergencies. In one instance, a rare type of blood was rushed to an outlying hospital. In another, the helicopter served as an observation post, clearing a path and directing Highway Department salt trucks through hunddreds of stalled vehicles on I-76 during a sudden icing condition.

The operation at Troop K Headquarters was somewhat hampered by weather conditions. Severe cold weather had a direct bearing on the performance of the helicopter. There were no protective facilities at Belmont for the helicopter and during the months of December and January, it was not possible to keep the helicopter at the state police station. During these times, the ship was on call by phone to Copter, Inc., operations at Philadelphia International Airport. This, of course, did shed some light on operating restrictions due to weather. In approximately two and a half months, the helicopter was scheduled to fly 204 normal patrol missions. On 19 occassions (9.4%) weather prevented the ship from responding to the schedule. Three requests were received for helicopter ambulance service during the time weather restricted flights. While this number in itself is not large, it does indicate the importance of considering weather as a significant factor in planning helicopter operations for emergency medical services.

In view of the number of accidents that occurred daily, very few requests for helicopter service were received at the Troop K Base. Fourteen requests resulted in three actual air lifts, one of which was a heart attack victim. In each instance the landing, administration of first-aid, loading and transporting of the victim to the hospital was carried out smoothly and without incident. Response times were remarkably short. In one instance the total elapsed time from receipt of call at the police barracks to delivery of victim to hospital was just nine minutes. Trip time from accident scene to hospital was three minutes. Normal trip time by ambulance at this hour to hospital from accident scene would have been 25 minutes.

Although 58% of the flights recorded a useful service of some type being performed, the lack of requests for ambulance service caused concern. Investigations indicated that competition between ambulance clubs located throughout the area was high, that working arrangements between local police, ambulance clubs and hospitals had been in existence for many years and that a general reluctance to call the helicopter prevailed unless the "spectacular" accident occurred. In the majority of instances, the local police simply elected not to request the helicopter for the "normal" injury accidents that occurred so frequently. Thus the study suffered from a lack of necessary data required to evaluate the helicopter as an ambulance and it was a factor over which the project had little or no control.

Phase II (Exton Sub-Station)

A special consultant was employed to review the study procedures and based upon his recommendations, the advisory committee moved the study to the State Police Sub-Station on March 1, 1968 at Exton which is located in the western section of the study area in a more rural environment.

The Exton operation functioned in a similar manner to that at Troop K so far as flight schedules, communications and operational procedures were concerned. The principle differences between the two operations were as follows:

(1) Four troopers (in contrast to 9 at Troop K) were selected from a group of volunteers to fly as trooper-medical attendants. They were given special first-aid training and briefed on the objectives of the study. Only three troopers were used in the crew during the latter part of the study.

(2) The area of operations was generally limited to Chester County although the helicopter would respond, if called, to any part of the original study area.

(3) The helicopter was identified as a State Police vehicle (green and white with letters "STATE POLICE") and was used more extensively in the day-to-day police operations of the sub-station; however, its priority mission continued to be an ambulance to service traffic accidents or other medical emergencies.

(4) A radio monitor for the Chester County radio network was placed in the Exton sub-station which permitted mutual monitoring between the county and state police radio nets. This resulted in more effective communications for the helicopter operations because the base station at Exton could monitor Chester County radio and relay information to the helicopter. This also enabled the helicopter crew to respond to some emergencies upon hearing first reports, even though their services had not been specifically requested.

TABLE 1
SUMMARY OF HELICOPTER OPERATIONS

	PERIOD ENDING					
	12/31	3/31	6/30	9/30	11/16	Total
Number of Days	45	91	91	91	47	365
Hours Flown	143	285	201	206	148	983
Patrols						
Scheduled	90	176	182	182	94	724
Completed	85	151	154	165	67	622
Patrols Noting Disabled Vehicles	13	39	18	9	4	83
Accident Response	3	12	51	62	16	144
Airlifts Completed	0	6	15	19	9	49
Police Surveillance						
Criminal	0	4	16	27	8	55
Civil Search (Missing Persons, etc.)	0	1	7	9	7	24
Miscellaneous (Fires, Traffic Violations, etc.)	3	9	15	9	4	30
Demonstrations	3	3	15	28	4	53
Accident Simulations	1	3	3	8	0	15
Engineering Surveys	1	2	2	4	0	9
Patrols Recording No Incidents	55	41	42	67	39	244

Details of these activities are discussed in other sections of the report.

Table 1 summarizes the various helicopter activities during the 12 month period as recorded in the trooper's daily log. Although the operation at Exton produced improved results because of the changes outlined previously, it was still of concern to all project personnel that more requests for ambulance services were not received. Of the 144 medical emergencies to which the helicopter responded, many responses were a result of intercepting a report of an accident by monitoring the local county frequency.

Disabled vehicles were observed on 83 patrols and response by the helicopter crew found the 55% of the vehicles required some type of aid which was summoned by the trooper aboard the helicopter.

As a police vehicle, it was dispatched to 55 criminal cases, 24 civil searches, usually including missing persons, and 30 miscellaneous police activities, such as servicing fires, civil disturbances, and traffic violations.

It completed 244 (39% of the total) patrols in which no incidents were recorded.

In addition, it participated in 53 demonstrations at hospitals, schools and ambulance club meetings.

It was used 9 times for engineering surveys and 15 times for airlifts at simulated accidents.

ACCIDENT HISTORY DURING STUDY YEAR

Accident data from the four county area were extracted from the statewide record file covering the twelve month period from October 1, 1967 to September 30, 1968. This period approximated the study year which began November 15, 1967. The data desired was the total accident frequency, occurrence by hour, day of week and month of year. The following table indicates the totals by county.

TABLE 2
ACCIDENTS DURING STUDY YEAR

	Number of Accidents				No. of Persons		Average No. of Persons Injured
	Fatal	Injury	P.D.	Total	Killed	Injured	Per Injury Accident
Bucks	92	2,915	5,809	8,816	101	4,741	1.6
Chester	79	2,326	4,556	6,961	86	3,773	1.6
Delaware	62	3,913	8,363	12,338	67	6,002	1.5
Montgomery	73	5,296	11,777	17,146	85	8,035	1.5
Total	306	14,450	30,505	45,261	339	22,551	1.55

Monthly Variation

Although the pattern of all traffic accidents varied widely from month to month between counties (430 in Chester to 1,700 in Montgomery), the injury type accident frequency was relatively constant over the twelve month period as illustrated in Figures 11 through 15. The table below illustrates the injury accident frequency ranges and the variation between counties.

TABLE 3
MONTHLY FREQUENCY OF INJURY ACCIDENTS

	NUMBER OF INJURY ACCIDENTS	
	Monthly Range (low/high)	High Month
Bucks	194/280	August
Chester	165/248	May
Delaware	271/405	May
Montgomery	367/531	December

Fatal accident occurrence varied between 3 and 14 fatals per month over the 12 month interval in each of the four counties. It is evident that emergency medical services are required at a fairly constant rate, month by month, which would result in uniform utilization of personnel and equipment.

ACCIDENT FREQUENCY BY MONTH

(October 1, 1967 - September 30, 1968)

FIGURE 11

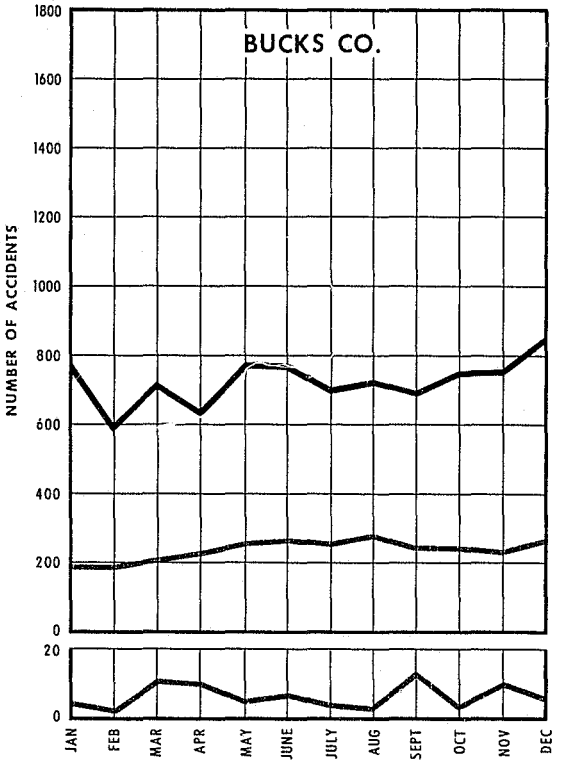
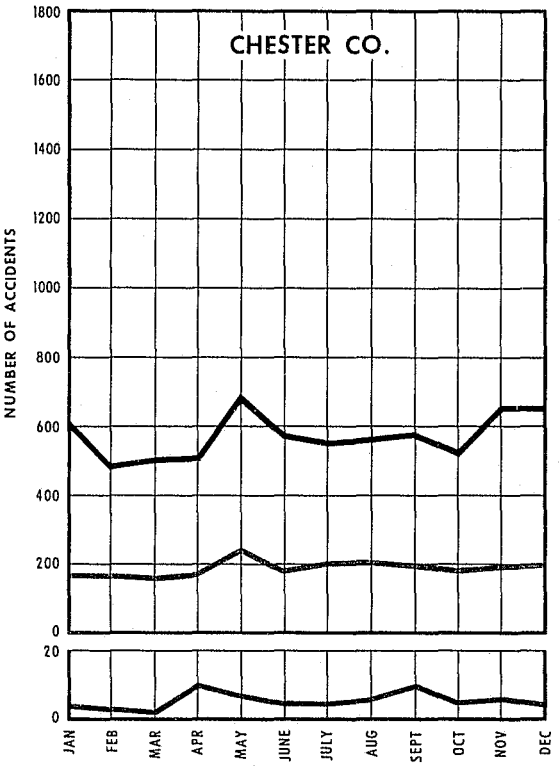


FIGURE 12



INJURY FATAL TOTAL

FIGURE 13

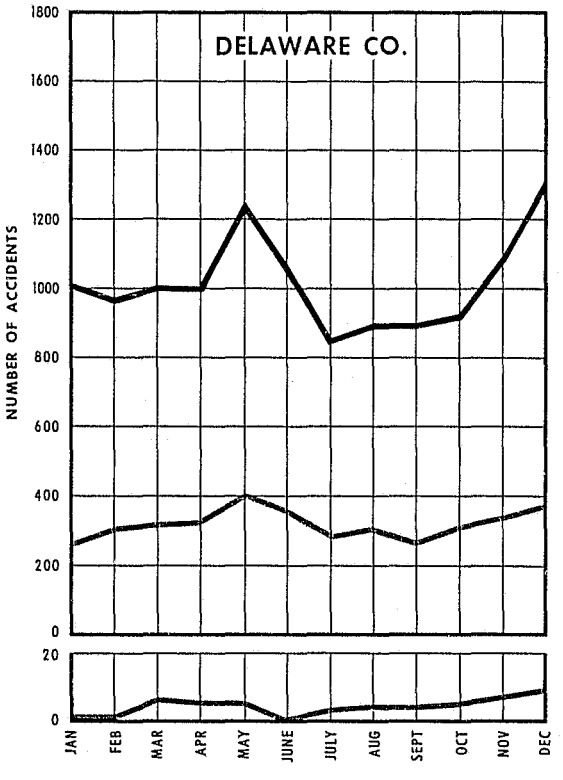


FIGURE 14

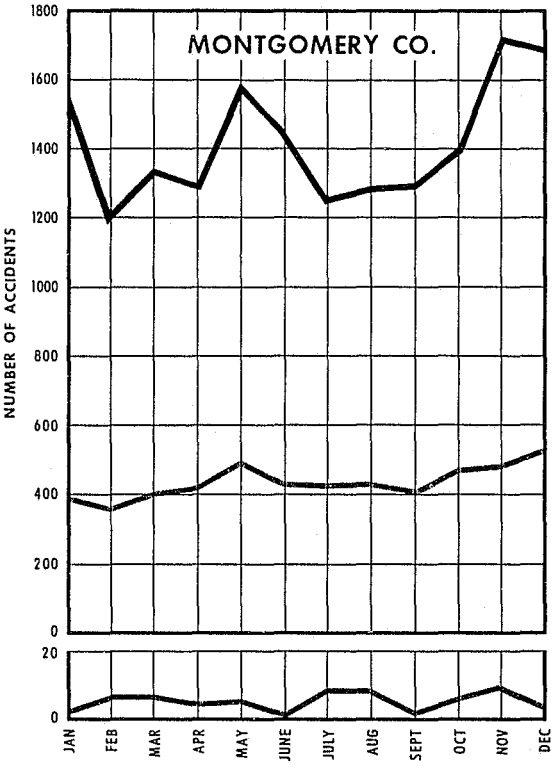
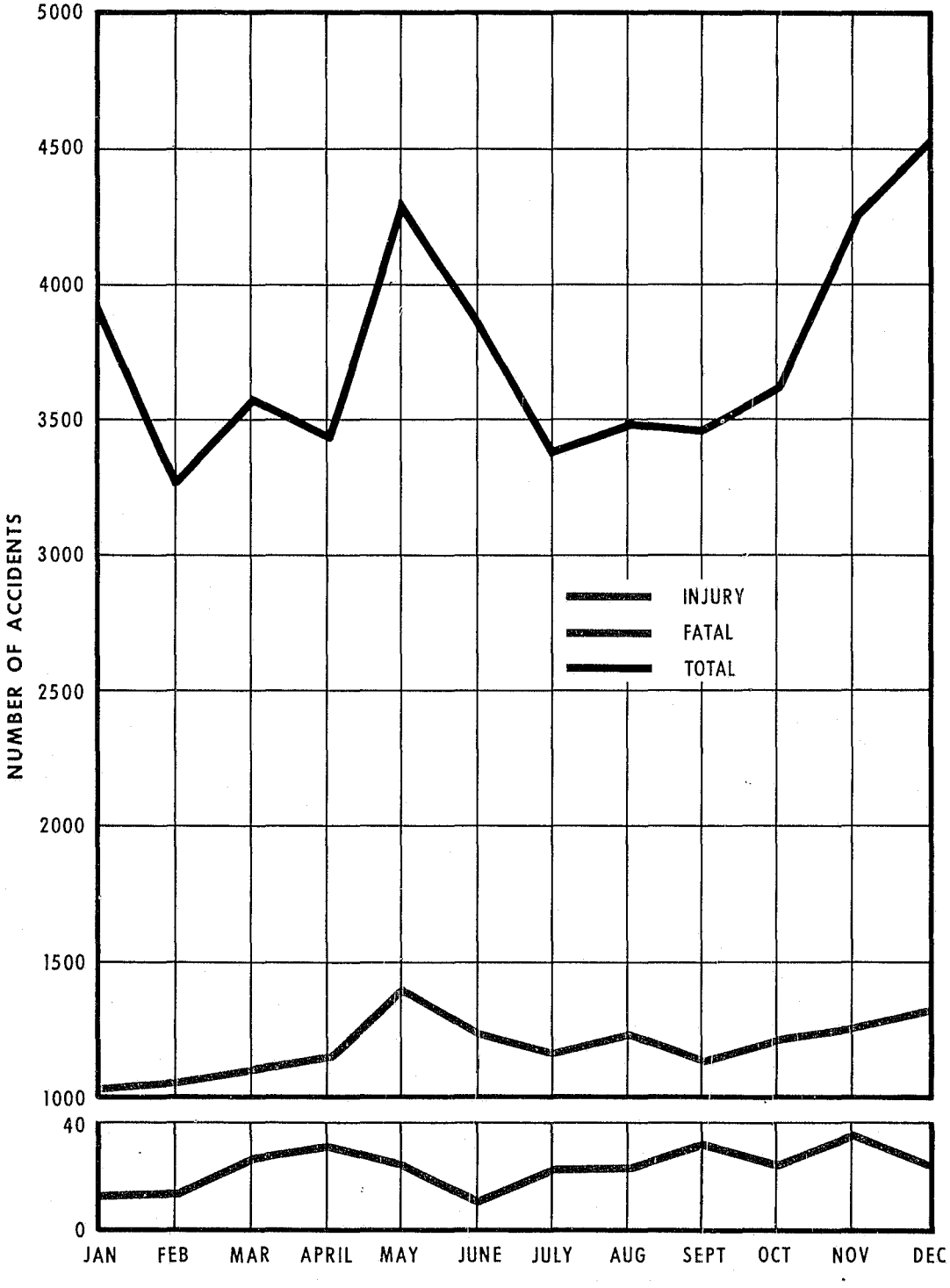


FIGURE 15

ACCIDENT FREQUENCY SUMMARY BY MONTH

(4 County Total)



ACCIDENT FREQUENCY BY DAY OF WEEK

(October 1, 1967 - September 30, 1968)

FIGURE 16

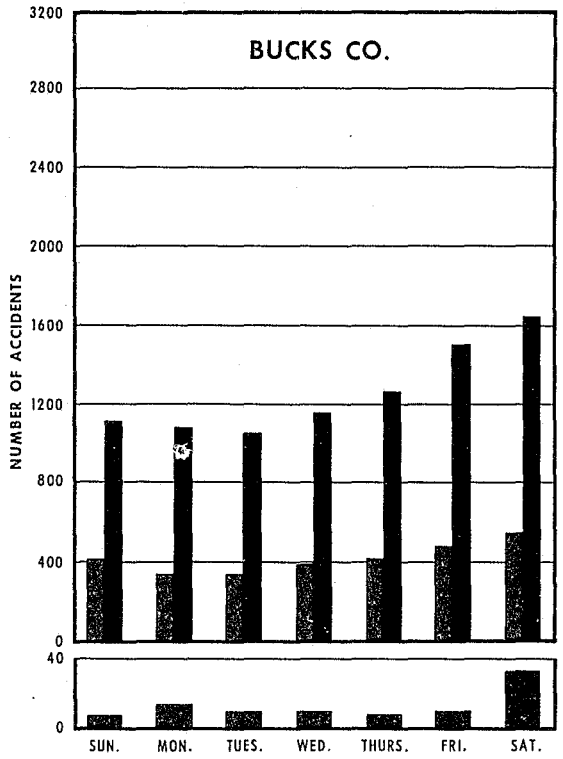
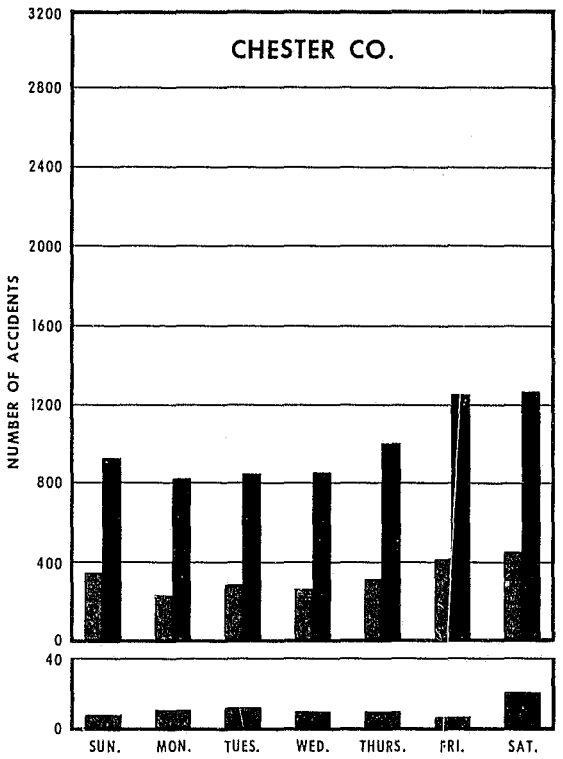


FIGURE 17



INJURY FATAL TOTAL

FIGURE 18

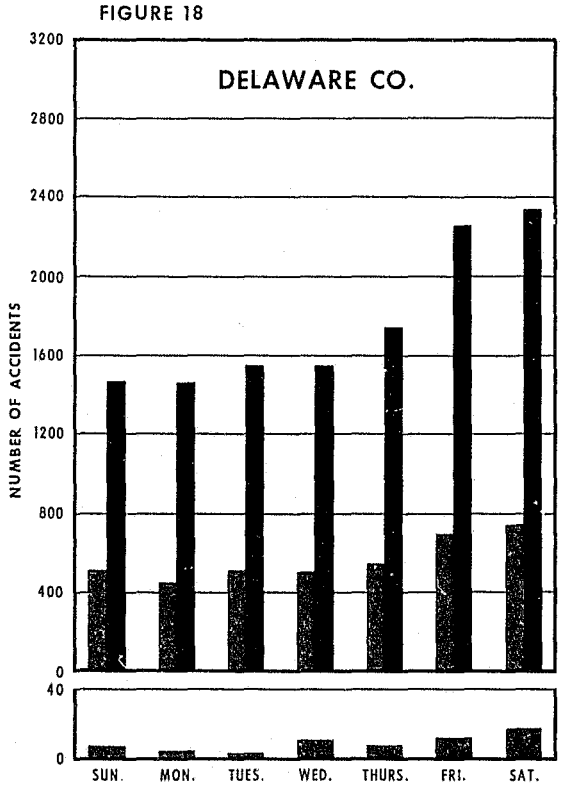


FIGURE 19

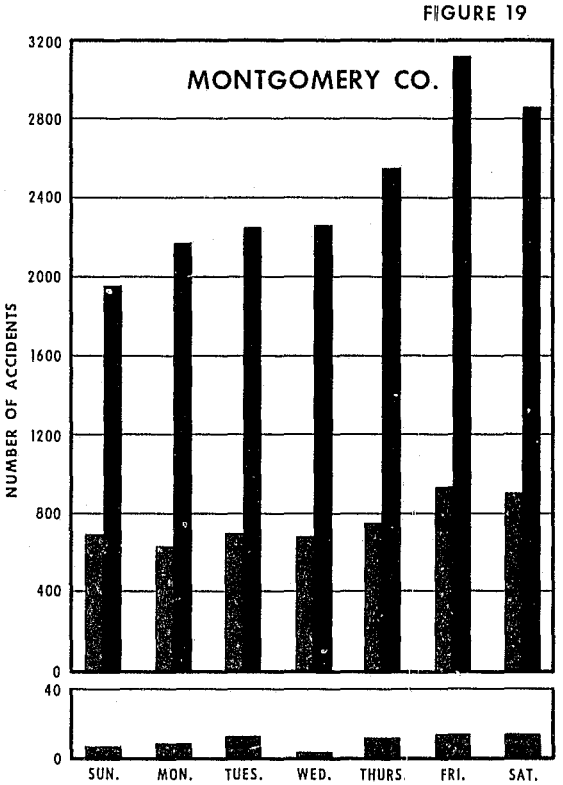
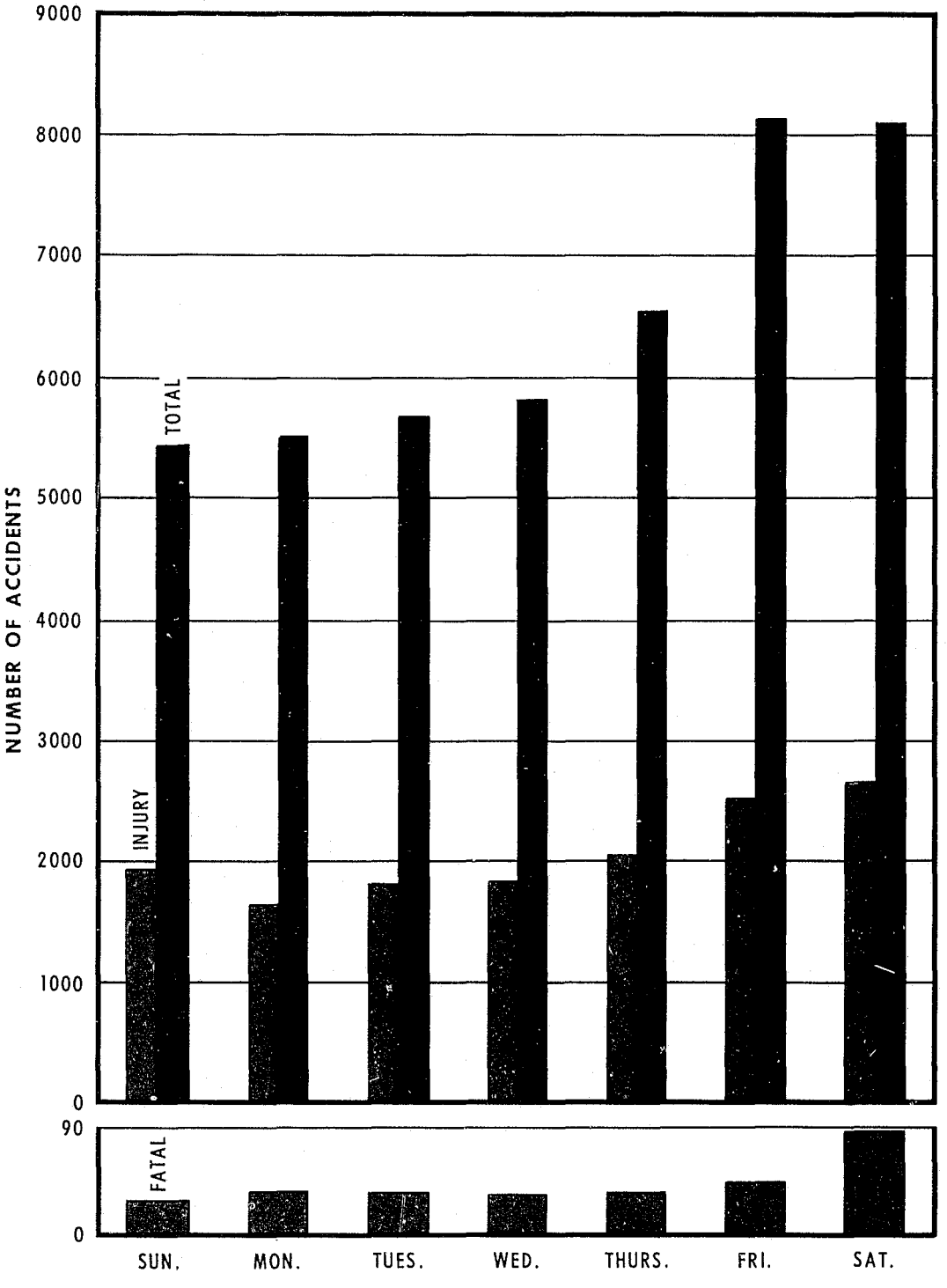


FIGURE 20

ACCIDENT FREQUENCY SUMMARY BY DAY OF WEEK (4 County Total)



Daily Variation

Figures 16 through 20 illustrate the variation in accident occurrence by day of week. Note the very high fluctuation in the injury accident pattern; in the four county area Tuesday was the lowest day with 1,644 accidents while Saturday was the highest with 2,520. Fifty percent (50%) of all injury producing accidents and fifty-two percent (52%) of all fatal accidents occurred within the three day period, Friday through Sunday. More fatal accidents occurred on Saturday than any other day of the week - 85 (28% of total) although the fatal accident occurrence was fairly constant on the other six days, ranging from 31 to 44 per day.

The county by county distribution of the number of injury producing accidents is summarized as follows:

TABLE 4
DAILY FREQUENCY OF INJURY ACCIDENTS

	Daily Range		
	Min./Max.	Average	High Day
Bucks	340/548	414	Saturday
Chester	235/452	332	Saturday
Delaware	438/747	559	Saturday
Montgomery	621/931	757	Friday
4-County Area	1,644/2,653	2,060	Saturday

It is evident that the heaviest demand for emergency medical services is over the weekend period - Friday through Sunday - and that the highest single-day need is Saturday (Figure 20). It should also be noted that the peak daily range exceeds the average by as high as 38% in one county indicating the quantity of services established for this area must consider peak load periods rather than averages to maintain satisfactory service at all times.

Hour of Day

Figures 21 through 25 indicate the wide variation in accident occurrence by hour of day in each of the four counties. Figure 25 indicates that 6:00 a.m., which was the low point in the 24 hour period for injury producing accidents was the beginning of a sharp rise which peaked at 8:00 a.m. and bottomed at 10:00 a.m. By 1:00 p.m. the increased frequency equalled the 8:00 a.m. peak and continued rising until 5:00 p.m. at which time it began decreasing steadily dropping below the 8:00 a.m. peak to 9:00 p.m. until it reached the 6:00 a.m. low.

It was noted that 77% of all accidents occurred between 7:00 a.m. and 9:00 p.m. at which time the helicopter ambulance was available; seventy-five percent (75%) of the injury producing accidents and 54% of the fatal accidents occurred during this period. It was also noted that 84% of the fatal accidents occurred between 1:00 p.m. and 5:00 a.m.

The hourly injury accident occurrence distribution by county is summarized as follows:

TABLE 5
HOURLY FREQUENCY OF INJURY ACCIDENTS

	Number of Injury Accidents		
	Range (Min./Max.)	Average	High Hour
Bucks	20/248	120	5-6 p.m.
Chester	32/241	97	4-5 p.m.
Delaware	28/379	163	4-5 p.m.
Montgomery	37/491	220	4-5 p.m.
4-County Area	108/1,354	600	4-5 p.m.

This indicates the extreme variation in injury accident frequency by hour. Over the four county area the low hour was 18% of the average hourly frequency while the highest hour was 225% of the average. It was noted that between 3:00 a.m. and 7:00 a.m. the injury accident occurrence averaged 171 accidents/hour or 29% of the average hourly rate. During this period only 1.2% of the total injury accidents occurred, which indicated only a minimum of emergency medical services are required as compared to other periods of the 24 hour day.

The figures illustrate that the hourly variations are consistent in each of the four counties. With the exception of Bucks, more injury accidents occurred during 4-5 p.m. than any other hourly period. This is normally the heavy traffic flow period. During this hour, a total of 4,294 accidents occurred of which 1,354 resulted in injuries and 18 fatalities.

The above data indicates that 4-5 p.m. is the peak hour, Saturday is the peak day and May the peak month. This does not mean, however, that the highest hour accident occurrence is 4-5 p.m. on a Saturday in May. It does mean that 4-5 p.m. will be the busiest hour, Saturday, the busiest day and May, the busiest month for emergency medical services. To determine the personnel and equipment required to provide an adequate level of emergency medical service during peak accident periods it would be necessary to analyze accident histories hour by hour throughout the year within the area under consideration.

Additional accident data is included in the appendix.

Accident Occurrence by Local Government

The accident density map, Figure 26, illustrates the geographical distribution of fatal and injury accidents as they occurred within each local government in the four county area. The area of the circles, which are plotted at the centroid of each local government, is proportional to the number of accidents.

The locations of the two helicopter ambulance bases are also identified. Concentric circles from the Exton base illustrate the average response time zones based upon a two minute lift-off plus an average cruising speed of 91 mph.

Figures 27 through 30 for each county illustrate the accident frequency distribution within local government during the study year. A comparison is made between total and fatal and injury occurrence.

ACCIDENT FREQUENCY BY HOUR OF DAY

(October 1, 1967 - September 30, 1968)

FIGURE 21

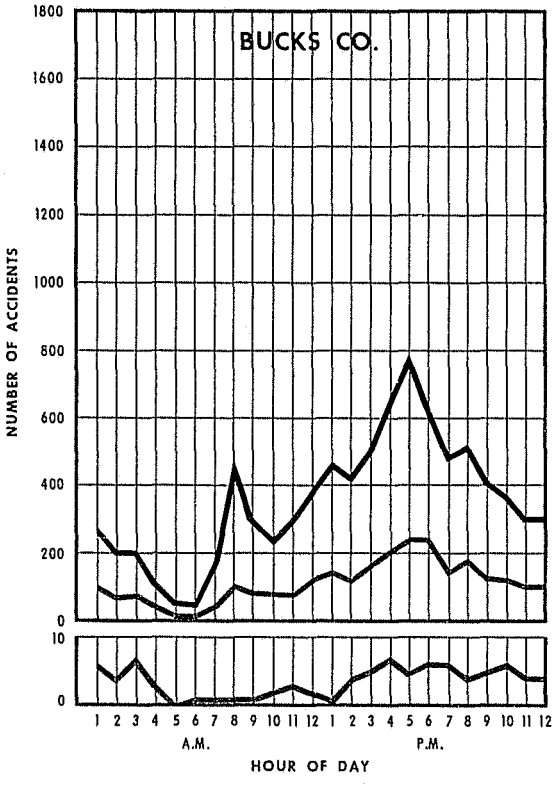
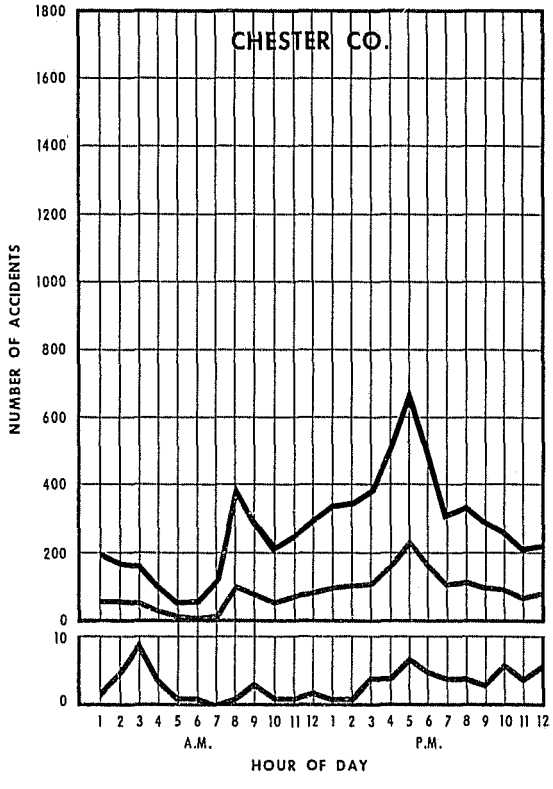


FIGURE 22



INJURY FATAL TOTAL

FIGURE 23

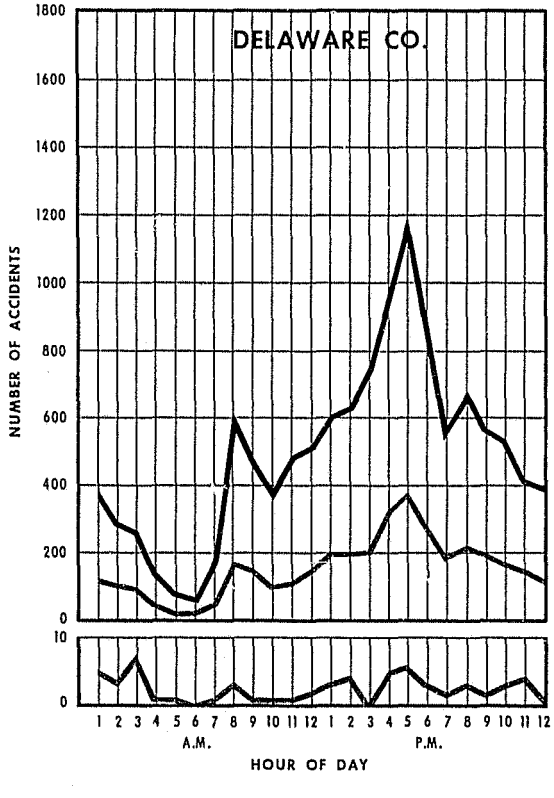


FIGURE 24

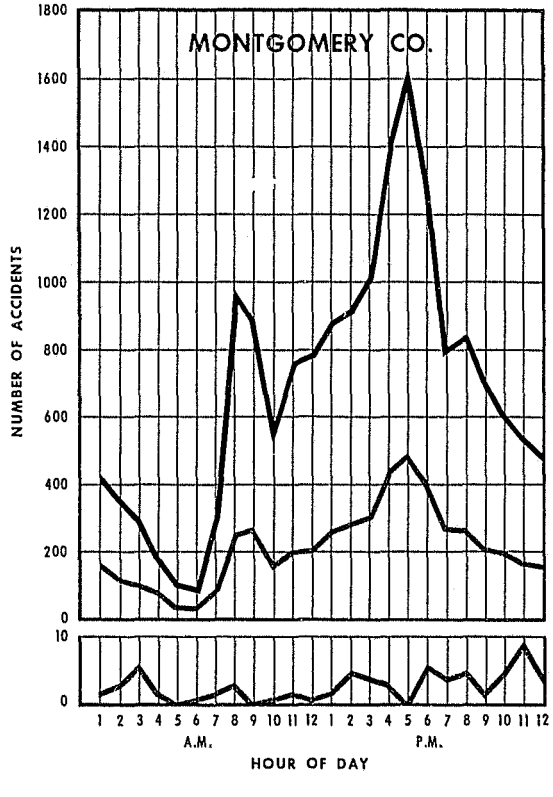
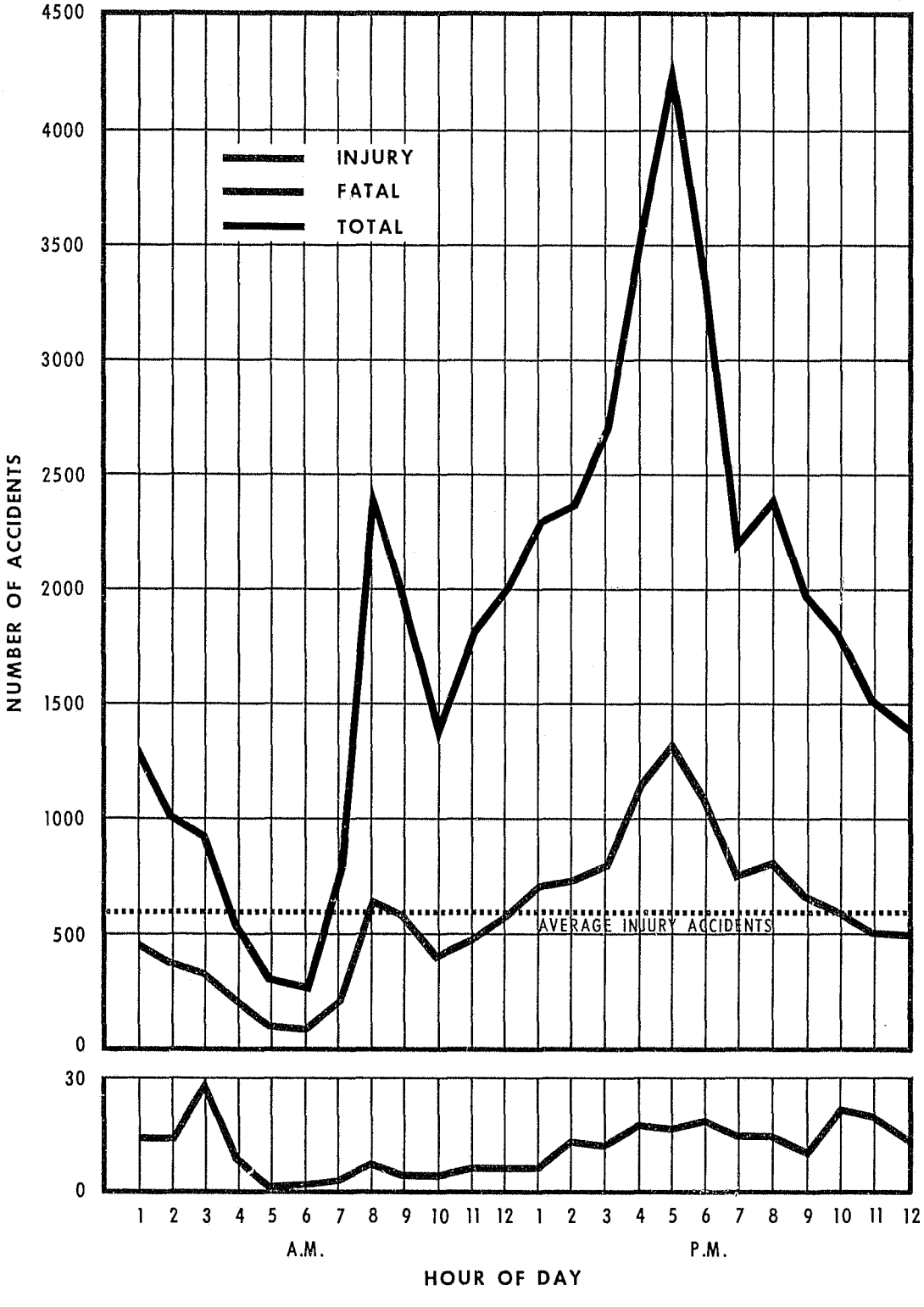


FIGURE 25

ACCIDENT FREQUENCY SUMMARY BY HOUR OF DAY

(4 County Total)



There are a total of 237 local governments in the four counties. It is evident in each of the counties that a relatively small number of the local governments have a small proportion of the total number of accidents. For example, only four communities in Chester County sustained 100 or more injury and fatal accidents during the year which averages about two accidents per week. This indicates the need for adjacent local governments to combine efforts in providing effective emergency medical services on a regional rather than local basis to achieve the most efficient utilization of personnel and equipment furnished with the available financial resources.

Approximately one-third of the 45.261 accidents occurring were injury producing. A cursory study of accidents occurring during December of 1967, showed that approximately 25% of the injury accidents required the services of an ambulance. This would indicate that one accident in twelve required the services of an ambulance and on this basis, during the study year, approximately 3,700 traffic accidents require ambulance services. It was noted that the number of persons injured averaged 1.5 persons per injury accident. Therefore, it can be estimated that 5,600 persons in the four county area required emergency ambulance services as a result of traffic accidents during the study year.

FATAL & INJURY ACCIDENTS
FIGURE 26

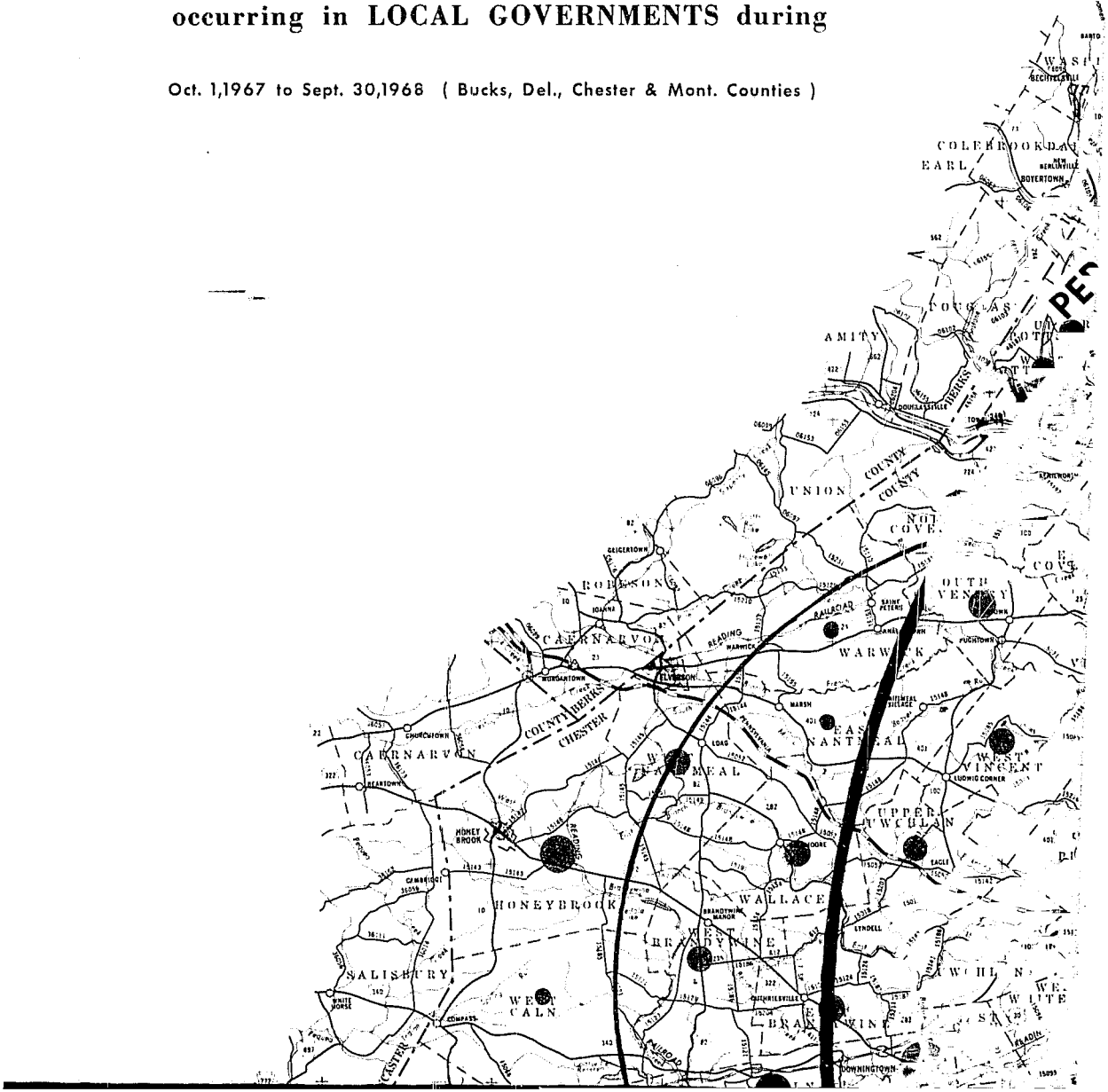
FIGURE 26

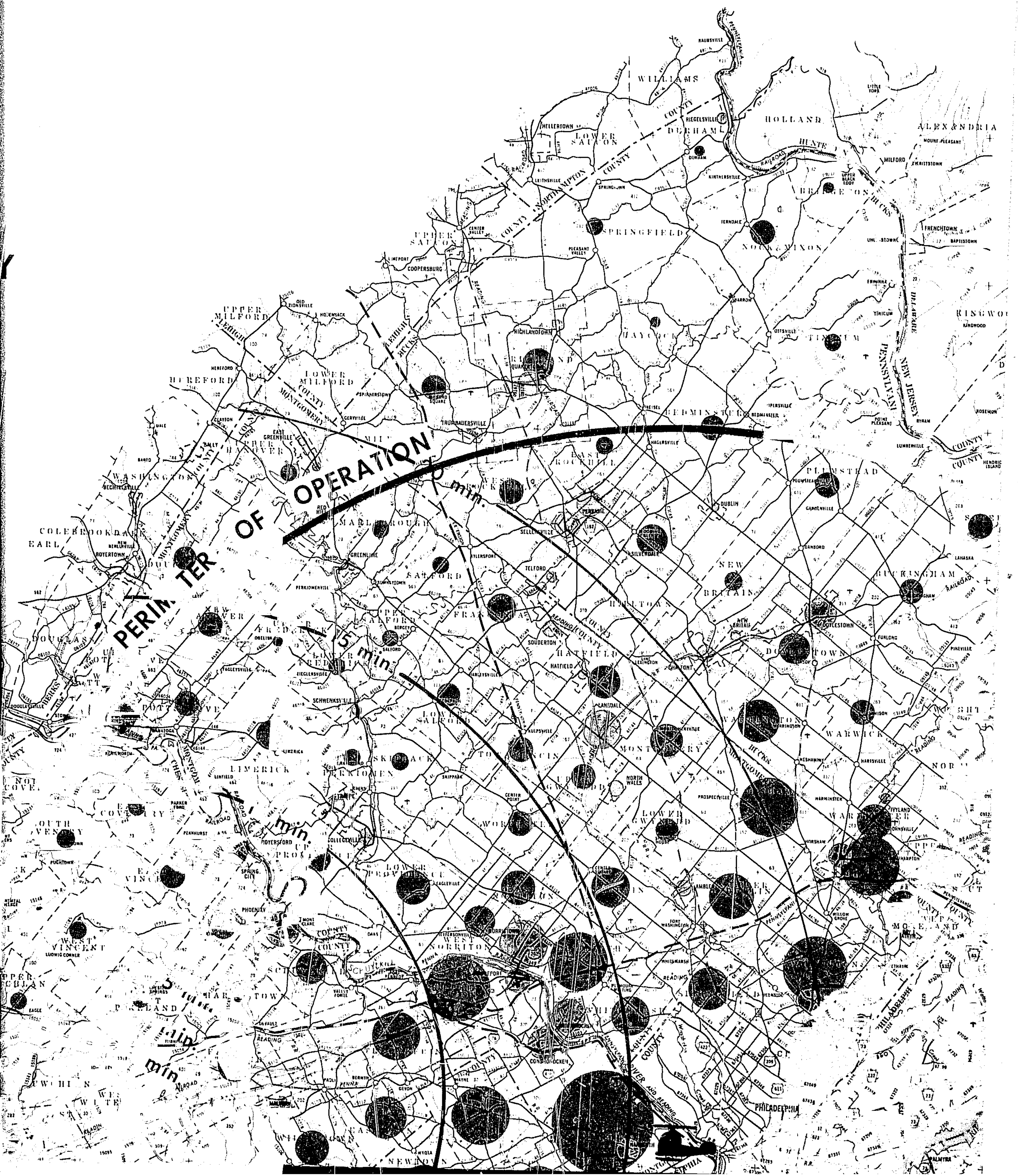
HELICOPTER AMBULANCE STUDY

FATAL & INJURY ACCIDENTS

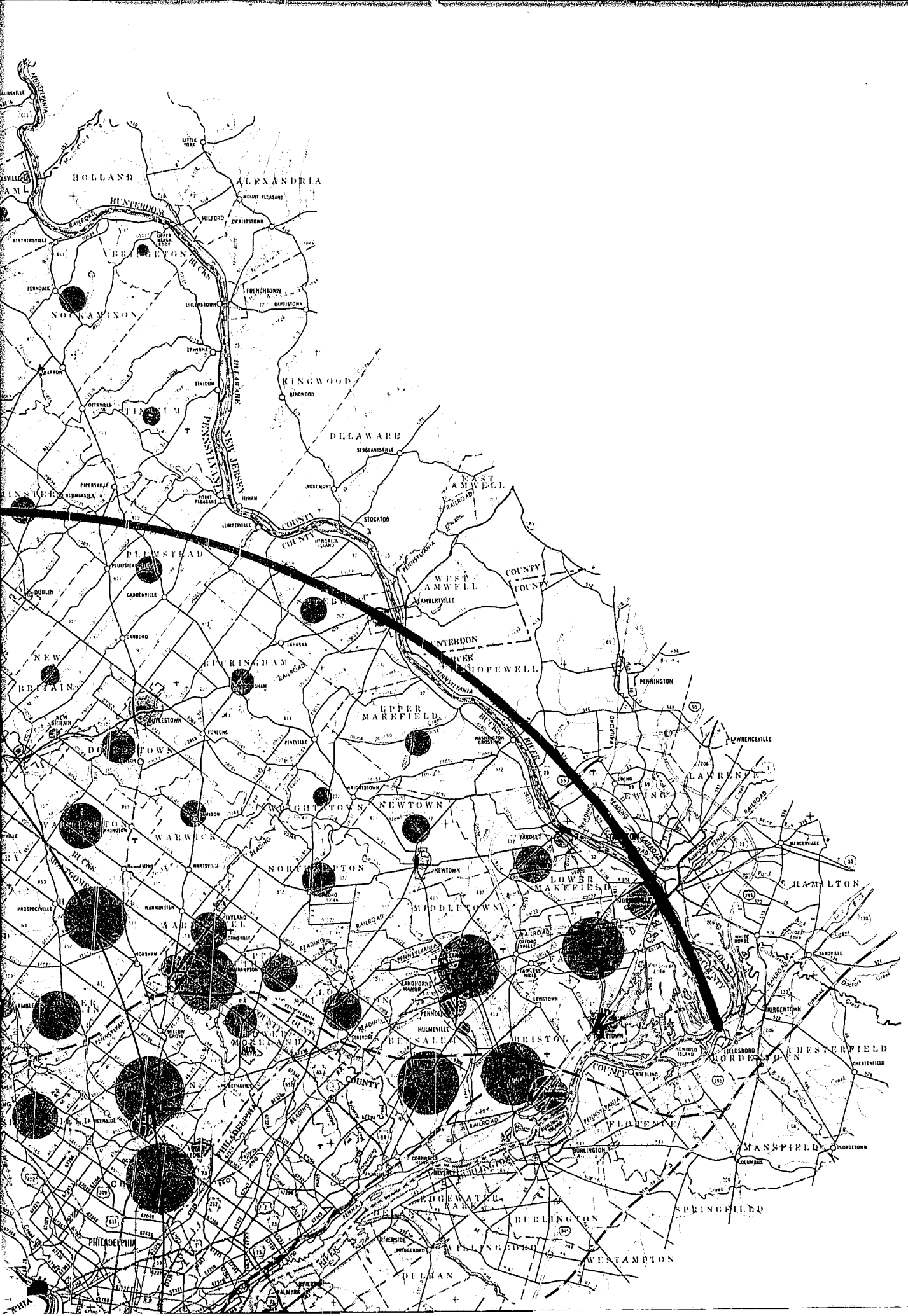
occurring in LOCAL GOVERNMENTS during

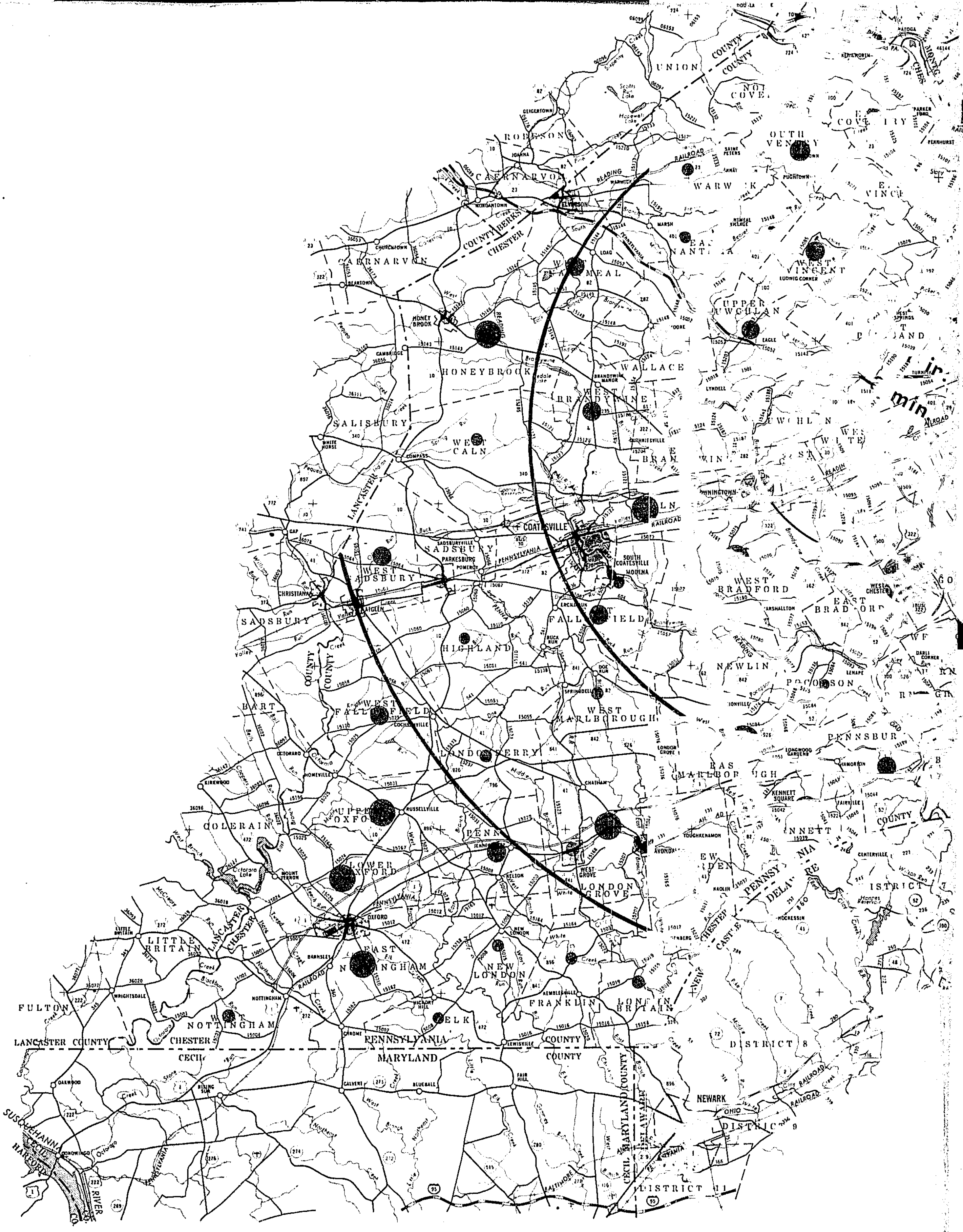
Oct. 1,1967 to Sept. 30,1968 (Bucks, Del., Chester & Mont. Counties)





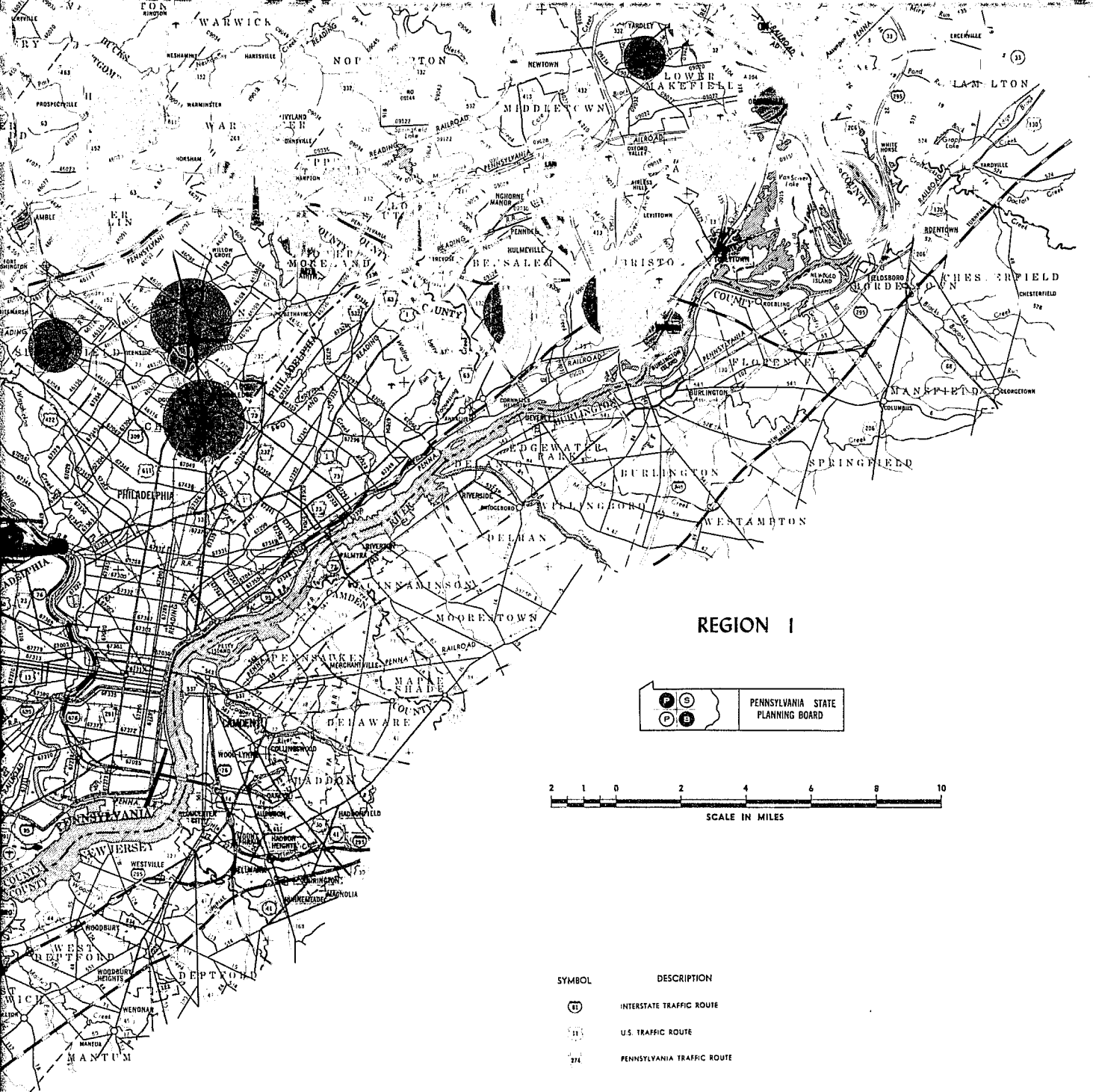
PERIMETER OF OPERATION
5 min.
min.
WILLIAMS
HOLLAND
DURHAM
LOWER SAUCON
SPRINGFIELD
UPPER SAUCON
COOPERSBURG
UPPER MILFORD
LOWER MILFORD
HEREFORD
RICHLANDTOWN
TRUMBAUERSVILLE
BEDMINSTER
EAST ROCKHILL
PLUMSTEAD
DUBLIN
PERKASIE
SELLERSVILLE
TELFORD
SOUDERTON
HATFIELD
NEW BRITAIN
HILLTOWN
BUCKINGHAM
DOYLESTOWN
WARWICK
WARMINSTER
HORSHAM
NORTH WALES
LANSDALE
SCHWENKSVILLE
LIMERICK
BOYERTOWN
SALFORD
COLLEGEVILLE
PHOENIXVILLE
WEST NORRITON
CONSHOHOCKEN
WHITEMARSH
FORT WASHINGTON
AMBLER
WILLOW GROVE
PHILADELPHIA
PAOLI
WAYNE
NEW JERSEY
DELAWARE
PENNSYLVANIA
FRENCHTOWN
MILFORD
ALEXANDRIA
TINICUM
LUMBERVILLE
PALMYRA


HOLLAND
ALEXANDRIA
HUNTERDON
MILFORD
FRENCHTOWN
BUCKS
DELAWARE
RINGWOOD
NEW JERSEY
PENNSYLVANIA
DELAWARE RIVER
STOCKTON
COUNTY
PLUMSTEAD
NEW BRITAIN
WARWICK
WARRINGTON
NEWTOWN
NORTHAMPTON
MIDDLETOWN
UPPER MAKEFIELD
LOWER MAKEFIELD
WEST AMWELL
EAST AMWELL
HOPEWELL
PENNINGTON
LAWRENCEVILLE
LAWRENCE
EWING
HAMILTON
MORELAND
BENSALEM
BRISTOL
BRISTOL TOWNSHIP
LEVITTOWN
CHESTERFIELD
BURLINGTON
MANSFIELD
SPRINGFIELD
EDGEWATER PARK
BURLINGTON
WESTAMPTON
DELRAN
PHILADELPHIA
RIVERSIDE
PALMYRA
READING RAILROAD
PENNSYLVANIA RAILROAD
PHILADELPHIA AND READING RAILROAD
PENNSYLVANIA-READING SEASHORE LINES
DELAWARE AND RARITAN CANAL
DELAWARE RIVER

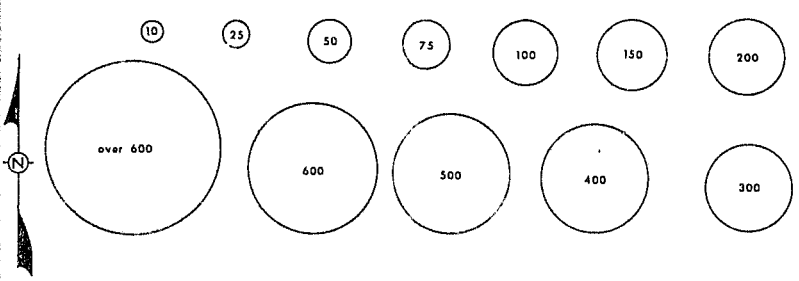


UNION
ROBESON
CAERNARVON
COUNTY BERKS
CHESTER
WEST NANTMEAL
WARWICK
WEST VINCENT
UPPER UWCHLAN
HONEY BROOK
HONEYBROOK
WALLACE
WEST BRANDYWINE
SALISBURY
WEST CALN
COATESVILLE
SOUTH COATESVILLE
SADSBURY
PARKESBURG
WEST SADSBURY
CHRISTIANA
ATGLEN
FALLOWFIELD
WEST BRADFORD
EAST BRADFORD
HIGHLAND
NEWLIN
POCOPSON
WEST MARLBOROUGH
BART
WEST FALLOWFIELD
LONDONDERRY
EAST MARLBOROUGH
PENNSBURY
KENNETT SQUARE
COLERAIN
UPPER OXFORD
LOWER OXFORD
WEST GROVE
LONDON GROVE
AVONDALE
OXFORD
LITTLE BRITAIN
LANCASTER
EAST NOTTINGHAM
NEW LONDON
FRANKLIN
LONDON BRITAIN
ELK
WEST NOTTINGHAM
FULTON
LANCASTER COUNTY
CHESTER COUNTY
PENNSYLVANIA
MARYLAND
CECIL COUNTY
DISTRICT 8
NEWARK
DISTRICT 9
DISTRICT 11
CECIL MARYLAND COUNTY
DELAWARE
SUSQUEHANNA
HARFORD
RIVER
READING RAILROAD
PENNSYLVANIA RAILROAD


10 min.
5 min.
10
25
50
over 600
600
N



Key & Scale



------ *Boroughs & Cities*

----- *Townships*

--- *Helicopter bases*

DISTRIBUTION OF ACCIDENTS IN LOCAL GOVERNMENTS

(October 1, 1967 - September 30, 1968)

FIGURE 27

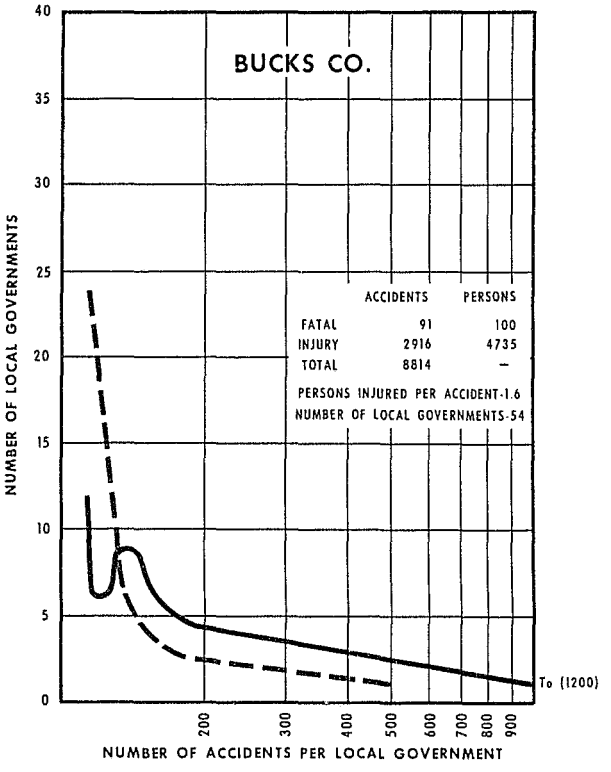
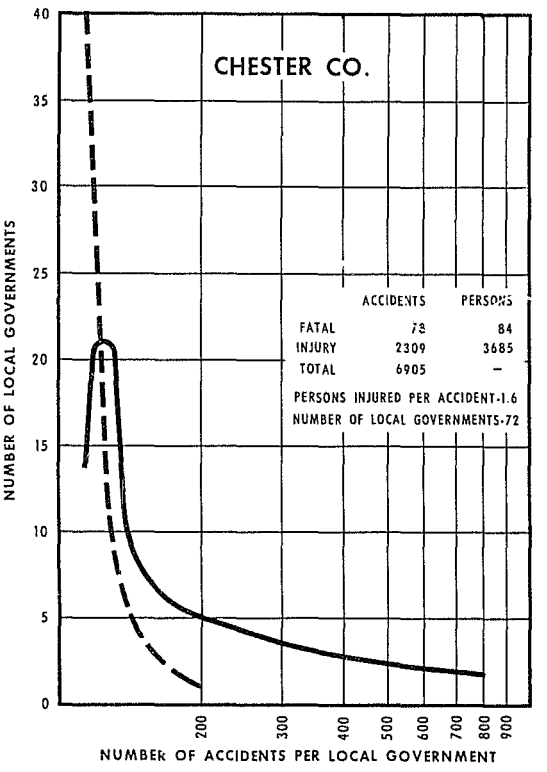


FIGURE 28



INJURY & FATAL — TOTAL

FIGURE 29

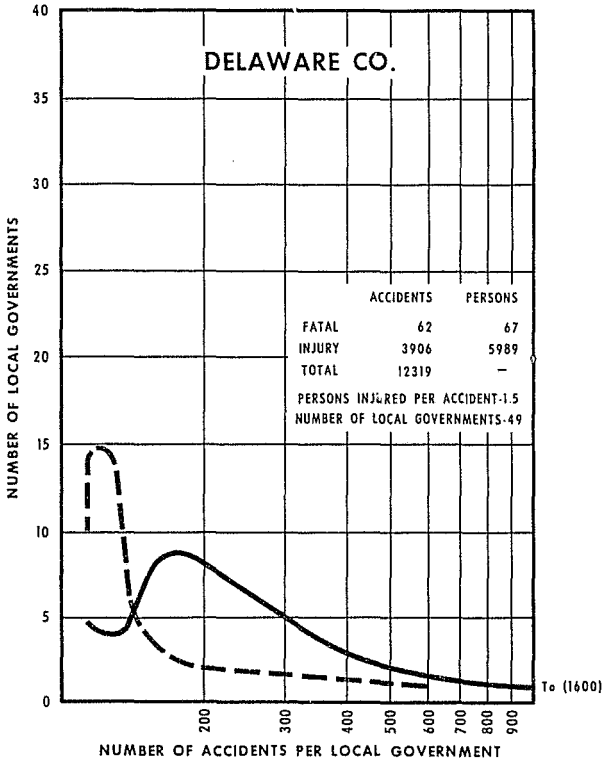
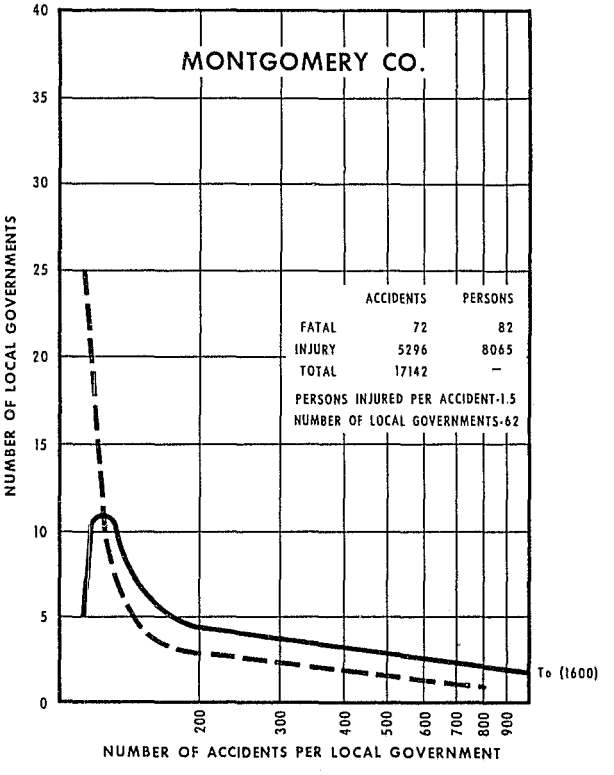


FIGURE 30



EXISTING EMERGENCY MEDICAL SERVICES

The 900 square mile area in which the study was conducted ranged in character from densely populated urban valleys and highly industrialized sections common to large metropolitan regions to sparsely settled rural environment consisting of farm land and small villages. Correspondingly, the hospitals and ambulance companies serving the area consisted of a wide variety of organizations, procedures, equipment and quality of service.

LOCATIONS OF ALL HOSPITALS IN STUDY AREA

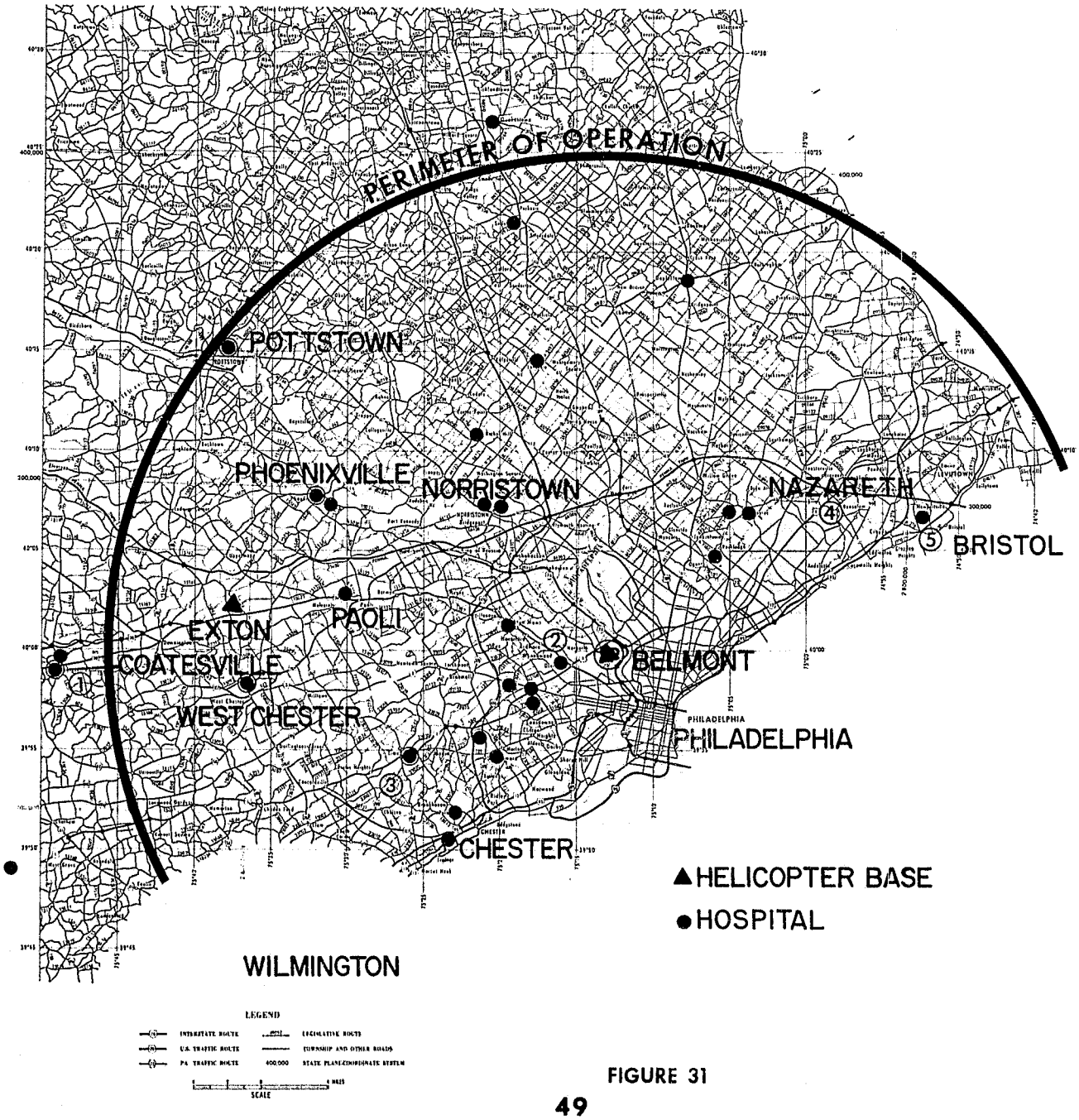


FIGURE 31

The area is served by 29 general hospitals and 93 ambulance companies, the majority of which are operated by non-paid volunteers. Figure 31 shows the locations of the general hospitals. The original five hospitals participating in the study, plus the three hospitals added later as the study progressed, are shown by name. Figure 32 shows the locations of the ambulance companies considered in the study and although some are located outside the perimeter of the study area, they nevertheless provided emergency service over portions of the study area.

EXISTING AMBULANCE SERVICE CLUBS IN STUDY AREA

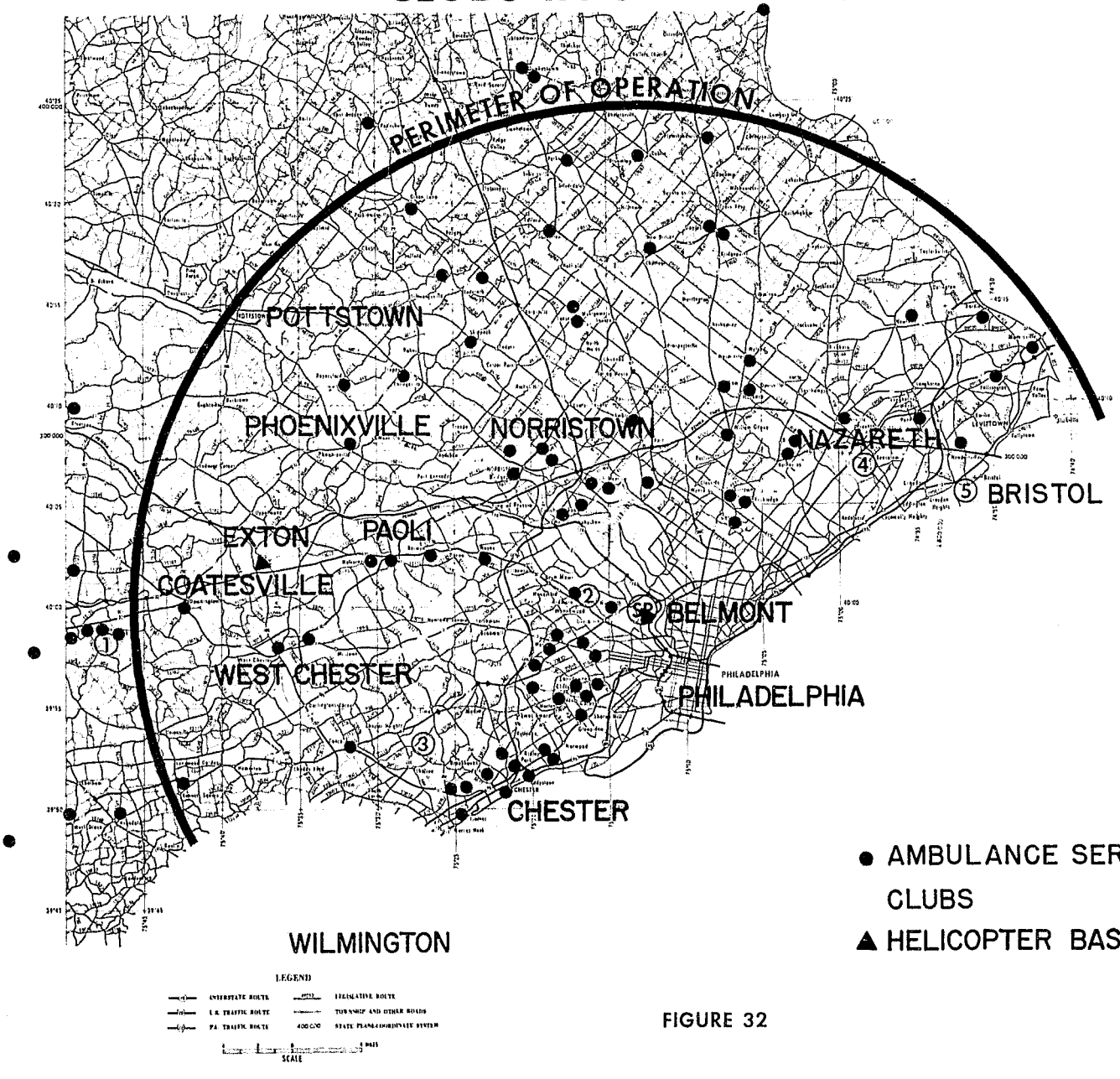


FIGURE 32

In spite of the great variety of services among ambulance companies, it was rather significant that neither from direct inquiry at major hospitals within the four county area nor from day to day experience of working with the project was there any indication or feeling of inadequacy of the service these companies provided their communities. Officials from six of the seven hospitals queried rated the ambulance services as adequate or good.

Ambulance Company Survey[1]

To better understand the available services, questionnaire forms were sent to 55 of the major ambulance companies, as listed in the Health Department's ambulance directory for this area. Thirty companies responded and a complete tabulation of results is given in the Appendix. While the returns represent a 33% sample of all companies within the area, the sample was not truly random although it is believed to represent the larger and perhaps better equipped and better organized ambulance services within the area.

Operations 1967: Figure 33 illustrates the normal operational area serviced by each of the 30 companies responding to the questionnaire (see appendix for company identification). The overlapping of geographical areas is apparent, where some sections are serviced by as many as 3 ambulance companies. Other areas indicate no service although this date is based upon a one-third sample. Sixteen of the thirty companies reported having personnel on duty 24 hours per day. Six other companies had personnel on duty for variable periods of time but less than 24 hours daily. Two-thirds of the companies reported having one vehicle while one-third had more than one vehicle. The following table illustrates the variety in size and activities among the companies:

TABLE 6
VARIATIONS IN AMBULANCE CLUB OPERATIONS

1967 Records	Low	High	Average
Active members	11	100	44
Trips completed	120	2,225	
emergency	89	1,190	285
transfer	13	682	180
Trips per vehicle	98	1,000	420
Miles per vehicle	1,000	14,000	6,800

[1] Ed. Note: The terms "Ambulance Company" and "Ambulance Club" are synonymous in this report.

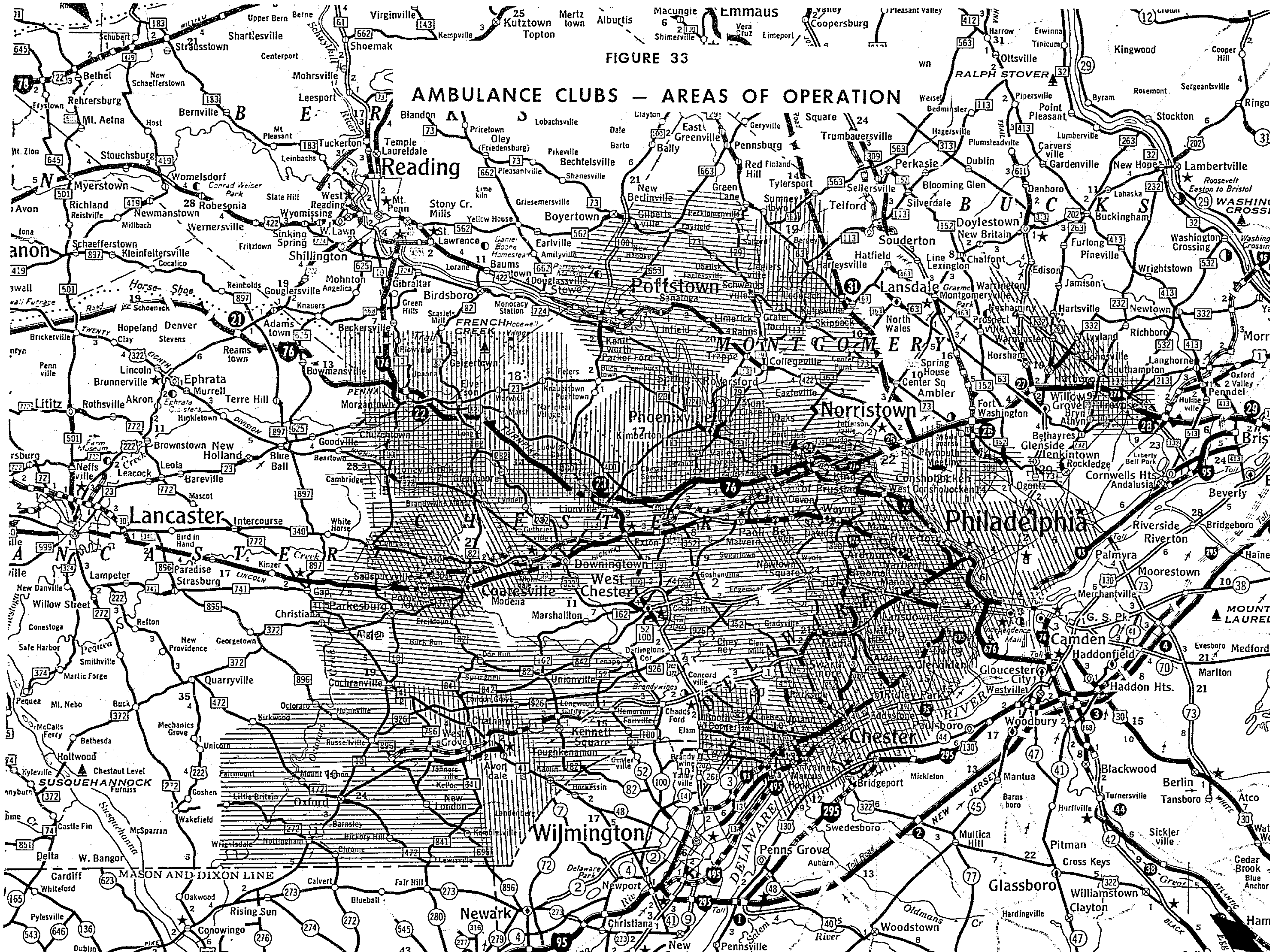


FIGURE 33

AMBULANCE CLUBS — AREAS OF OPERATION

FIGURE 34

AVERAGE MONTHLY TRIP FREQUENCY OF AMBULANCE COMPANIES WITHIN STUDY AREA

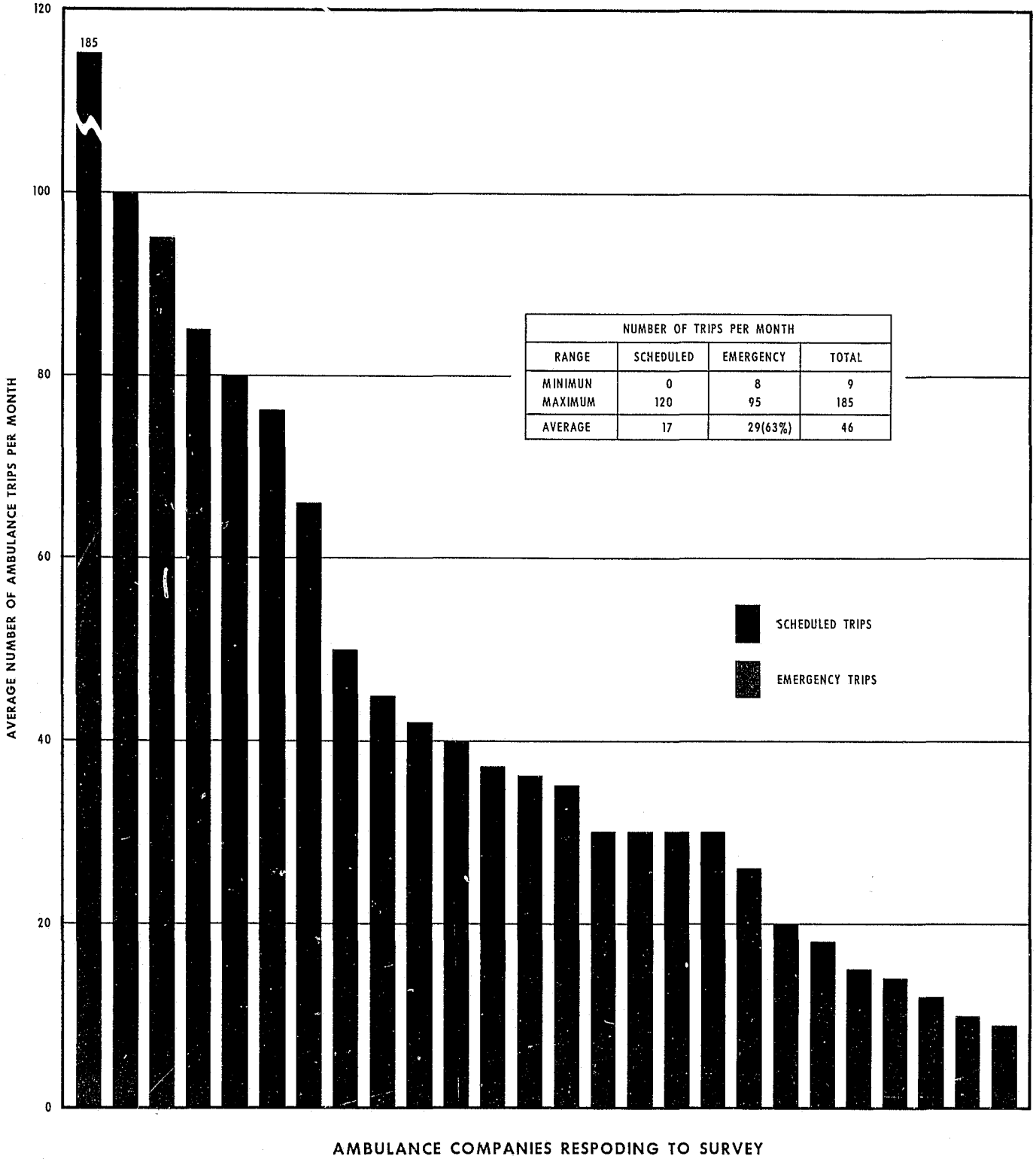


Figure 34 illustrates a distribution of the trip frequency of ambulance companies for an average month. Note that the average ambulance company makes 46 trips per month in which two-thirds were classed as emergencies.

Equipment: Although two-thirds of the companies had only one ambulance, only 4 of the 30 were limited to 1 victim per vehicle. Most ambulances could carry 2 injured persons. One company with 5 vehicles had a total capacity of 13 victims.

All vehicles were equipped with two-way radio communications. There were 17 different frequencies reported indicating many separate networks within this area even though Chester, Delaware and Montgomery Counties, where most of the ambulance services were located, have county-wide networks. Most companies indicated, however, that they were satisfied with their communications on the basis of an "excellent", "good", "fair" and "poor" ratings. All but 4 companies were rated as excellent or good.

Costs for ambulance vehicles varied widely but the average ambulance company paid $10,000 per vehicle including trade-in allowance. With the exception of one company, all ambulance vehicles were reported to be properly equipped for emergency medical work. The costs of equipment and supplies were not given on most questionnaires, however, of the eleven companies that reported, the costs varied from $400 to $5,000.

Fee Schedule: The costs for ambulance service varied widely. Some companies reported fees per trip varying from $7.50 to $25.00. Some had mileage rates varying from 50¢ to $2.00 per mile. Many had listed family memberships of $2.00 to $3.00 in which presumably there was not an additional trip charge for members using the service. Several companies indicated operating funds were raised by donations, community chest contributions, etc.

Operating Costs: Data on the questionnaire forms regarding 1967 operating costs were also incomplete. Those companies which did report indicated costs ranging from $800 for one vehicle to $39,000 for 4 vehicles. On the basis of an estimate of a direct cost per mile of 25¢, the average company would have an expense of $1,700.00 annually per vehicle for gas, oil, maintenance and insurance.

The cost records of most companies are apparently incomplete or do not follow standard accounting procedures, probably due to many reasons. Funds are raised through many methods and expenses are also met by a variety of ways. For example, many actual costs such as housing or radio communications may be included in budgets of fire companies or police. Fuel may be provided in part by contributions from local oil companies. It appeared that financing of costs for ambulance service was not a problem for most companies because of the community support given to various methods of raising funds.

Personnel: The annual turnover of active membership was reported to be less than 10% on the average although one company reported turnover as high as 66%. All members received the basic Red Cross First-Aid training and many received Advanced First-Aid and ambulance attendants courses sponsored by the Pennsylvania Department of Health. The number of active members trained annually varied from 9% to 100%, but averaged 35%. Most companies indicated that members receive refresher training every 3 years.

Emergency Ambulance Trips: Thirteen ambulance companies were asked to keep special trip logs of their emergencies for a 2 to 4 week period so that response times and other operational information could be compared directly with the helicopter ambulance logs. Table 7 summarizes the results as reported by these companies. Data for each company is included in the Appendix, however, individual companies are not identified because of the nature of the information recorded. In many instances the data forms were not complete apparently because of the difficulty experienced by ambulance crews

TABLE 7

AMBULANCE COMPANIES EMERGENCY MISSIONS [1]

Ambulance Company	Number of trips in sample	Time to depart (min.)	Travel time to scene (min.)	Distance to scene (miles)	Time at scene (min.)	Travel time to hospital (min.)	Distance to hospital (miles)	Time at hospital (min.)	Total mission time (min.)	Total mission distance (miles)	Persons evacuated per trip
A	41	2.5	4.5	--	8.0	7.0	--	--	43	15	1.1
B	6	5.5	8.5	--	5.0	10.5	--	--	43	13	1.0
C	13	4.0	4.0	--	8.0	13.0	--	--	52	19	1.2
D	8	2.0	2.5	--	5.0	7.0	--	--	28	--	1.3
E	15	2.0	4.5	3.0	6.0	7.0	5.0	--	25	6	1.2
F	8	6.0	5.0	2.5	11.0	22.0	15.0	44	92	33	1.8
G	11	3.0	3.0	--	5.0	10.5	--	40	63	9	1.2
H	34	--	--	--	--	--	--	--	60	11	1.1
I	14	2.0	5.0	5.0	7.0	7.0	4.5	--	27	8	1.3
J	9	4.0	7.5	--	6.5	12.0	--	--	59	17	1.0
K	45	2.0	4.5	4.0	5.0	13.0	--	--	56	24	1.2
L	36	3.5	7.0	4.0	10.5	9.5	5.0	--	65	10	1.3
M	9	1.0	4.5	2.0	8.0	6.0	2.0	6	30	10	1.3

[1] Above averages are based upon data collected by each cooperating ambulance company for this study. Because data forms were not completed in their entirety resulting in a limited number of samples in many cases, statistical analysis of data was not completed. All quantities in chart are numerical averages of data submitted.

in recording time and distance information when they were servicing actual emergencies. The number of trips recorded for example varied from 6 for one company to 45 for another. It was not known whether these actually represent all emergency missions for a selected period of time within the 2 to 4 week period as requested or whether they represent samples recorded only by certain members of each company when they were on duty. Also it was believed that some of the data may have been recorded after the fact in which case its accuracy depended upon the memory of the recorder. In addition, many data forms were incomplete which resulted in a wide range of sample sizes for various questions asked. It was believed, however, that the information summarized, does indicate general limits which can be compared to data recorded by the helicopter crews.

Table 8 shows a comparison of response and trip times between the ambulances and helicopter.

TABLE 8
AMBULANCE - HELICOPTER TRIP TIME COMPARISON

	Helicopter Ambulance		Conventional Ambulances	
Time Sequence	Average (1)	Range (1)	Average (1)	Range (1)
Alert to departure	2.0	1-5	2.8	2-8.5
Base to scene	7.5	1-35	5.0	7-22
Time at scene	5.4	1-48	7.3	5-11
Scene to Hospital	5.8	2-27	10.0	6-22
Total (alert to delivery to hospital)	19.5		25.1	

(1) Time is shown in minutes.

It should be pointed out that the helicopter data represents 49 airlifts in the same approximate area serviced by these 13 ambulance companies so that the trip distances for the helicopter are higher than those of the ambulance comapnies. For example, the average distance from the helicopter to base to accident site was 8 miles while similar distances for ambulance companies ranged between 2 to 5 miles. Nevertheless, it is evident from the data submitted, the helicopter was able to establish lower response times than reported by conventional ambulance companies.

Test Car vs Helicopter: A second method of developing a correlation between the conventional ambulance and helicopter response times involved the use of a test car to make the trip from the base to the accident site and then to the hospital along the route followed by the ambulance. For each of 45 accident locations from which the helicopter airlifted an injured person, an unmarked passenger car made a test run to the hospital used by the helicopter, observing all speed limits, traffic signals and other regulations. Runs were made at approximately the same hour of day and same day of week of the actual accident to duplicate conditions as closely as possible. The most significant difference was the fact that the test car was not equipped with siren or flashing lights nor marked as an ambulance. The operator was instructed to drive as quickly as possible but observe all traffic regulations. Therefore, the test car had to stop in many instances

where an ambulance would have kept moving even if at a slow speed, being restricted principally by traffic density.

Figure 35 shows a comparison of the trip times between the test car during its simulated run and the helicopter during its actual emergency flight. The test car speed from base to accident site varied from 14 mph, to 50 mph, with an average of 34 mph, for the 46 runs. From the accident site to the hospital the speed ranged from 14 mph, to 45 mph, with an average of 33 mph. The question of what speeds would ambulances have been able to maintain for the same conditions encountered by the test cars, unfortunately, cannot be answered precisely. However, in the actual emergency trips made by the 13 ambulance companies where both trip times and distances were recorded, the average speeds ranged from 32 to 53 mph, as shown in Table 9.

TABLE 9

AMBULANCE SPEEDS ON EMERGENCY TRIPS

Ambulance Company	Number of Trips	Average Speed (MPH)	
		Base to Scene	Scene to Hospital
A	36	32	32
B	8	32	41
C	7	49	--
D	6	50	49
E	4	53	49
F	2	40	40
Test Car	46	34	33

While some individual runs completed by the test car produced average trip speeds far below those of ambulances operating during actual emergencies, the average speeds attained by the test car of 33-34 mph, falls within the range of averages of the ambulances and is 8 mph below the median of that range. Speeds achieved by ambulances undoubtedly depend upon the character of the road network, traffic volumes and traffic controls and trip lengths. It also depends upon the practices of individual companies and drivers. This may account for the wide range of average speeds among the six companies shown in Table 9, although it should be noted that samples are small, except for company A.

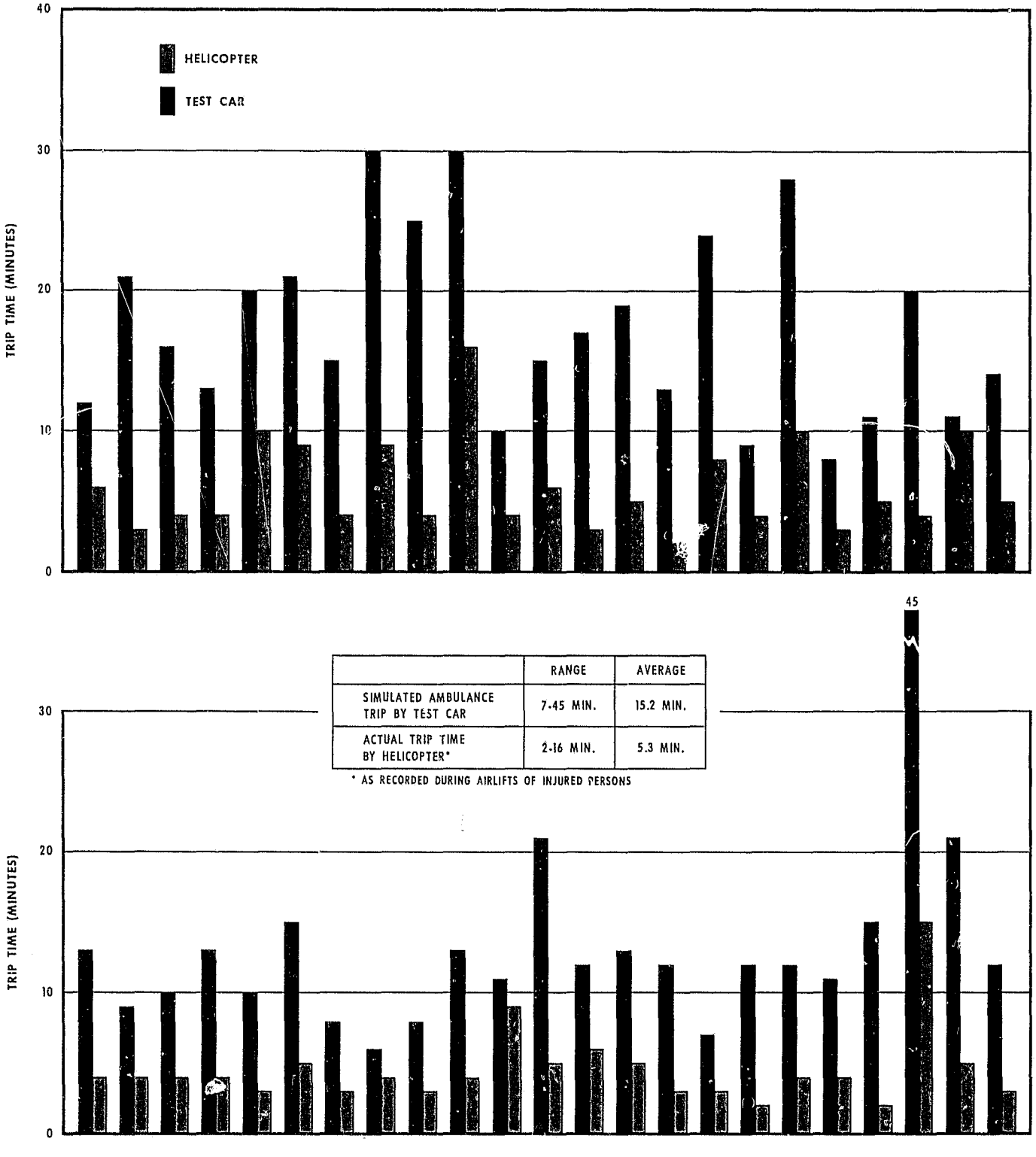
Based upon the available data it is believed the test car speeds are within 5-10 mph of speeds that would have been attained by ambulances on actual emergency trips under similar highway and traffic conditions. Therefore, the average trip time for the test car shown in Figure 35 is estimated to be 1/3 higher than trip times achieved by ambulances on emergency runs.

It is recognized that time rather than speed is important to the welfare of the injured person. However, it was believed that actual speeds under various conditions should be determined, and it was unfortunate that sufficient time-distance data was not recorded so that average speeds could be computed for commonly encountered conditions, such as, peak traffic flow.

FIGURE 35

TRIP TIMES FROM ACCIDENT SITES TO HOSPITALS

COMPARISON OF HELICOPTER VS. TEST CAR



	RANGE	AVERAGE
SIMULATED AMBULANCE TRIP BY TEST CAR	7-45 MIN.	15.2 MIN.
ACTUAL TRIP TIME BY HELICOPTER*	2-16 MIN.	5.3 MIN.

* AS RECORDED DURING AIRLIFTS OF INJURED PERSONS

West Goshen Township

Through the cooperation of the West Goshen Township officials and the Good Fellowship Ambulance Club of West Chester, the helicopter was based at the Township building for a two-week period functioning as a vehicle in the ambulance club. This was done to involve the helicopter in the daily activities of a well-established ambulance company in order to evaluate it further as an ambulance vehicle.

The Good Fellowship Club provided an attendant to ride with the State Trooper in the helicopter to all accident alerts. The ambulance attendant administered to the injured and accompanied him to the hospital while the trooper remained at the accident scene to assist until the helicopter returned for him.

The helicopter crew was quartered most of the day in the Township police radio room which gave them immediate access to the following communications:

(1) State Police radio
(2) Chester County radio (base and patrol)
(3) Delaware County radio
(4) 3 phone lines

During the two week period the helicopter crew responded to 11 reports of accidents which resulted in completing 7 airlifts of injured persons.

There were no opinions relative to helicopter utility expressed by the ambulance attendants who accompanied the helicopter that were at variance with observations previously recorded from pilots, troopers and engineers. The ability of the aircraft to surmount congested traffic conditions was markedly appreciated. Two negative observations noted that having an exterior storage cabinet was a disadvantage (blanket and splints are not reachable from the aircraft interior) and also that if the victim had to be treated for shock by elevating his feet this was impossible or difficult due to the seating arrangement.

The closeness of the aircrews to several good communications sources was highly appreciated. Of the seven airlifts of victims accomplished (discussed below) six of these were responses made by monitoring radio reports of the accidents and without waiting for a formal request for the helicopter to assist. The main dispatch center for this general area is Chester County Police Radio, being several miles closer to West Chester, and especially being on the West Chester side of a large mountain, seemed to improve communications reception.

Relations with the public that became involved in the undertaking as well as with the governmental units that were contacted were universally good.

The 7 airlifts made of traffic-accident victims in this two-week period are described as follows:

The first airlift was of a traffic-accident victim from Birmingham Township, Rt. 202 south of West Chester. The aircrew responded by overhearing Chester County Radio discussing this accident. It was a multiple accident and the resulting congestion closed the traffic lanes. The township chief on the scene requested the helicopter. While the aircraft was enroute to the scene it received the formal request for its services.

The second airlift was in the same township area, Birmingham-Thornbury. Again the crew responded after overhearing Chester Radio. While enroute they received a request to assist on the accident.

The third airlift was in Edgmont Township, Delaware County. This was also an overheard report, this time from Media State Police asking Exton Barracks to send the helicopter.

The fourth airlift was again in Birmingham-Thornbury. Again the aircrew responded after overhearing Media State Police talking with one of their patrol cars. Enroute the helicopter received the request for assistance.

The fifth airlift was in Willistown Township, Chester County. The aircrew overheard a telephoned report of the accident being received in the Chester County radio room. They scrambled immediately without waiting to be requested.

The sixth airlift was in E. Goshen Township. The aircrew responded to a direct call from Exton Sub-station State Police by telephone. A private person had telephoned to Exton to report the accident.

The seventh airlift was in W. Whiteland Township, Chester County in response to a telephoned request from Exton Barracks State Police. While enroute the helicopter was requested by Chester radio to assist.

Six of the seven responses could perhaps have been made through Exton radio but it happened that the aircraft was enroute each time through monitoring before the request came in. One police officer noted that a police radio dispatcher is often directed by the police officer at the scene as to what ambulance unit is to be notified. Some of the local ambulance units make a regular practice of listening to police radio and they will respond to a report of an accident before being directly requested. So the several instances of being enroute when the actual request for assistance is received is quite in common with ground ambulance experience.

In addition to these accident emergencies, nine simulated accidents were planned to provide a direct comparison in trip speeds or response time between the helicopter and an ambulance, under nearly identical conditions. Both an ambulance and the helicopter, located at the Township Building, received an alert simultaneously to proceed to selected locations which had actual accident histories. Tests were run on Sunday mornings when traffic volumes were low and ambulance drivers using flashing lights, observed extreme caution. Table 10 shows the results of these tests and Figure 36 illustrates locations of the sites with respect to the W. Goshen base.

TABLE 10
SIMULATED ACCIDENT TEST RUNS FOR HELICOPTER AND AMBULANCE

	Ambulance			Helicopter		
Run No.	Road Miles	Time (Minutes)	Rate (MPH.)	Air Miles	Time (Minutes)	Rate (MPH.)
1	3.5	4	52	2.3	3	46
2	3.7	6	37	3.0	12 (3)*	60
3	5.5	6	55	4.1	4	61
3-H	6.5	7	56	5.2	6	52
4	10.5	13	48	7.9	10	47
4-H	9.5	12	47	7.7	7	66
5	4	5	48	3.2	3	64
5-H	4	6	40	3.6	5	43
6	10	11	54	7.7	9	52
Mean	6.3	7.8	49	5.0	5.5	55

Note: -1-(No.-H) This numbering shows a run made from the accident site to the Chester County Hospital.

2-* This run involved the helicopter over-flying the accident site (3 min.) then returning (12 min.)

3- The rate was computed by: $\frac{\text{Rate} = \text{Miles}}{\text{Time in Min.}} \times \frac{60 \text{ Min.}}{\text{Hour}}$

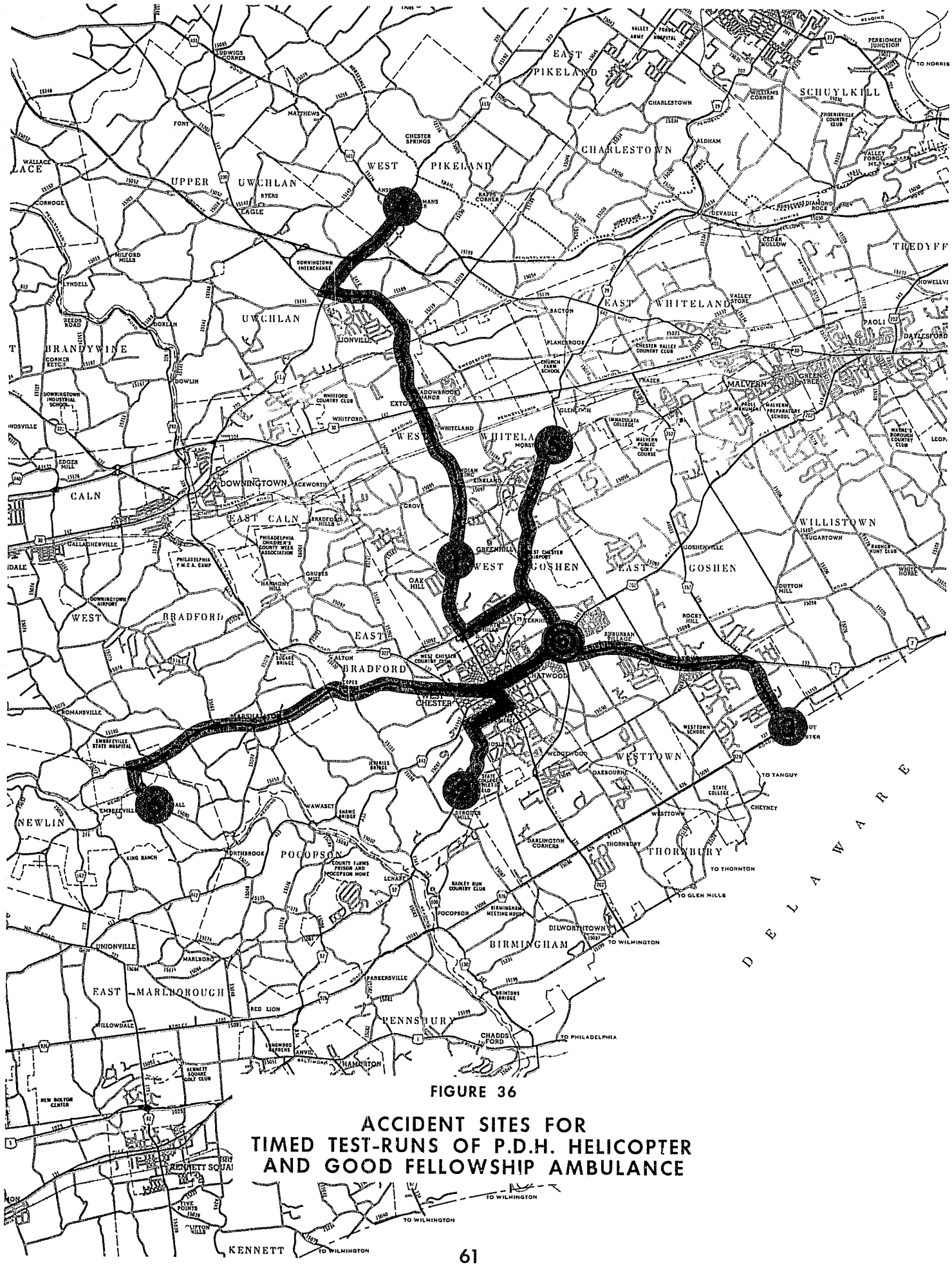


FIGURE 36

ACCIDENT SITES FOR
TIMED TEST-RUNS OF P.D.H. HELICOPTER
AND GOOD FELLOWSHIP AMBULANCE

For these nine simulations the average trip time was 7.8 minutes for the ambulance and 5.5 minutes for the helicopter or a difference of 2.3 minutes. The average ambulance speed of 49 mph, under known low traffic volume conditions corresponds to the higher speed ranges attained by ambulances during actual emergencies as shown in Table 9, although the Good Fellowship Club averaged 40 mph, for those trips in which they reported time and distance data. The average speed of 55 mph, for the helicopter was surprisingly low, particularly since far higher speeds were achieved during actual emergency airlifts. On the other hand, it should be noted that the cruising speed of this model is only one-third greater than speeds easily reached by ground ambulances so that small operational difference in speeds should not be unexpected.

During this two-week period, Good Fellowship Ambulance Club responded to 38 requests for service as follows:

traffic accidents	12
other emergencies	15
routine transfer	10
other	1
Total	38

Seventy-two percent (72%) of these requests were emergency in nature.

All agencies involved in the two-week evaluation period were extremely receptive and helpful. Discussions with personnel participating in the tests led to the conclusion that the single greatest difference between the Exton and West Goshen locations was the improved communications available. Close monitoring of both base station and patrol transmissions, permitted the helicopter to respond quickly at the first report of an accident. Also it was believed that the close working relationship of the project during this period with the West Goshen and West Chester police radio perhaps encouraged greater cooperation in requesting helicopter service.

Ambulance Service in Exton Area

During the period the helicopter was based at Exton the State Police stationed at the sub-station investigated 534 traffic accidents of which 289 were personal injuries; ambulances were required for 168 accidents. Table 11 shows the 10 ambulance companies which were called to the major proportion of these accidents as well as the hospitals to which the injured persons were delivered. It was noted that 43% of the accidents were serviced by 3 ambulance companies. The helicopter was called to 6%. Victims from 79% of the accidents were taken to either one of three of the five principle hospitals in the area.

TABLE 11

LOCAL AMBULANCE COMPANY CALLED TO ACCIDENTS
INVESTIGATED BY EXTON PERSONNEL

(4/29/68 - - - 11/16/68)

	Accidents
Elverson Fire Company	3
Goshen Fire Company	7
Goodfellowship Ambulance Club	27
Honeybrook Fire Company	9
Minquas Fire Company	29
Parkesburg Fire Company	2
West End Fire (Coatesville)	2
West End Fire (Phoenixville)	16
Christiana Ambulance	4
Goodwill Ambulance (Pottstown)	8
Other	
Helicopter	10
Motorists	31
Other (ambulance or police)	20
Total	168

HOSPITALS USED

Coatesville	29
Chester County	76
Pottstown Medical Center	16
Phoenixville	21
Ephrata	3
Others	14
Total	159

LOCATIONS OF HELICOPTER AIRLIFTS

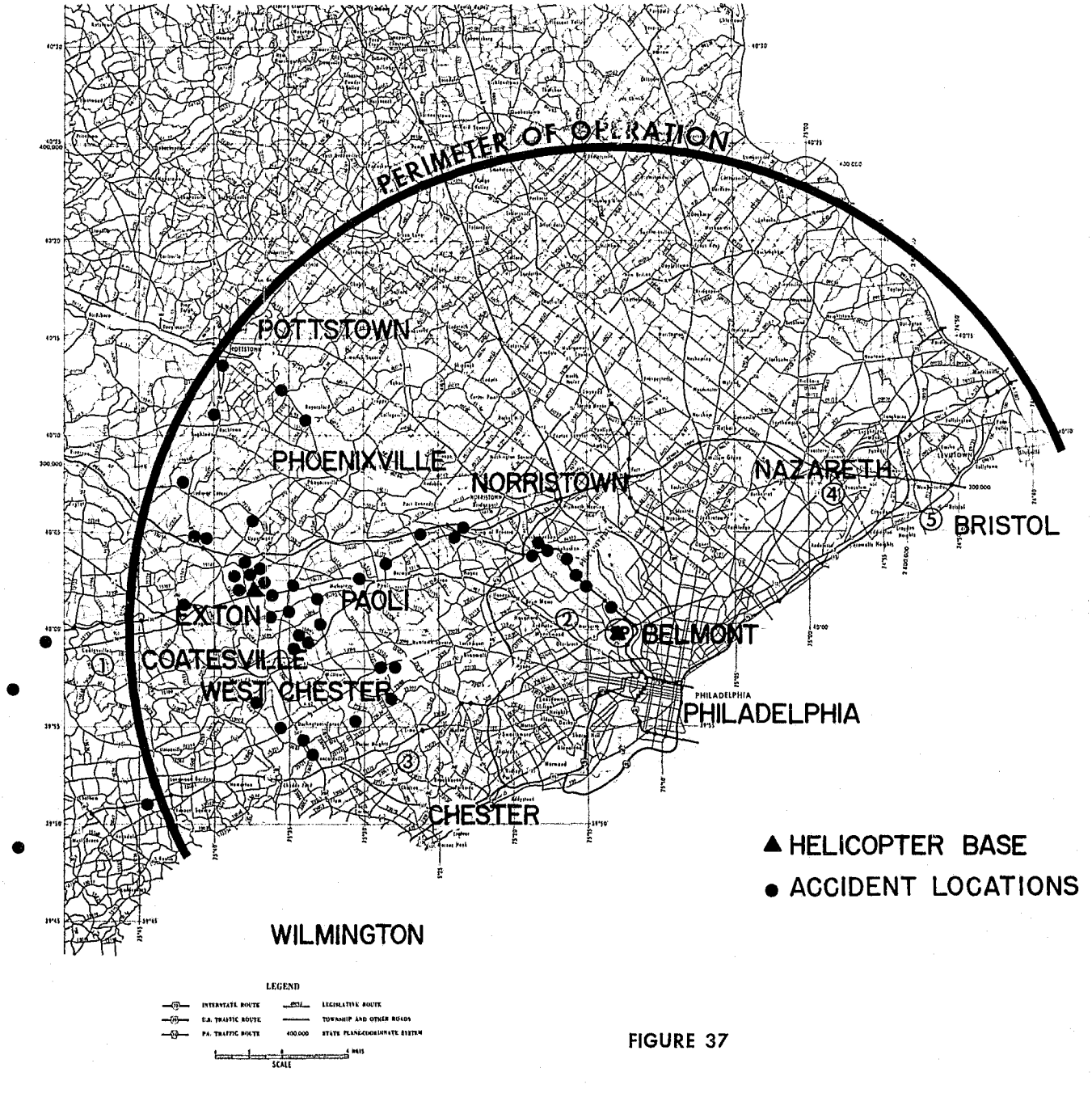


FIGURE 37

MEDICAL EMERGENCIES SERVICED BY HELICOPTER

The helicopter has proved its value in military operations in bringing the wounded to proper medical care quickly compared to ground transportation. This has also been found true in a civilian application although the environment, the operating procedures, and communications are substantially different.

Figure 37 shows the locations of the medical emergencies from which the helicopter airlifted victims. While the majority of these locations were in the Exton - West Chester region, some accident sites were as far as 18 miles distant from the Exton base. Six accident alerts were received while the helicopter was on patrol and in some instances the length of trip to the accident scene was considerably longer than 18 miles.

Figure 38 illustrates the distribution of helicopter trip times. For the 49 actual airlifts completed, the overall response time from the initial alert to delivery of victim to the hospital averaged 19.5 minutes. The average time from base to accident scene was 7.5 minutes and from accident scene to hospital 5.8 minutes.

The range of response times for the helicopter in first reaching the accident site and then the hospital varied widely because of the location of the accidents with respect to the helicopter and hospital, as well as the wind conditions. The log shows for example, during airlift number two at Exton, the alert was received while the helicopter was in flight but because of strong headwinds, the trip to the accident site required 35 minutes even though the air distance was only 35 miles.

The airlifts included a variety of injury types which for simplicity have been classified as follows:

Type of Injury	Number of Victims
Lacerations (head, arms, legs)	27
Fractures	4
Chest, back and internal injuries	8
Other	10

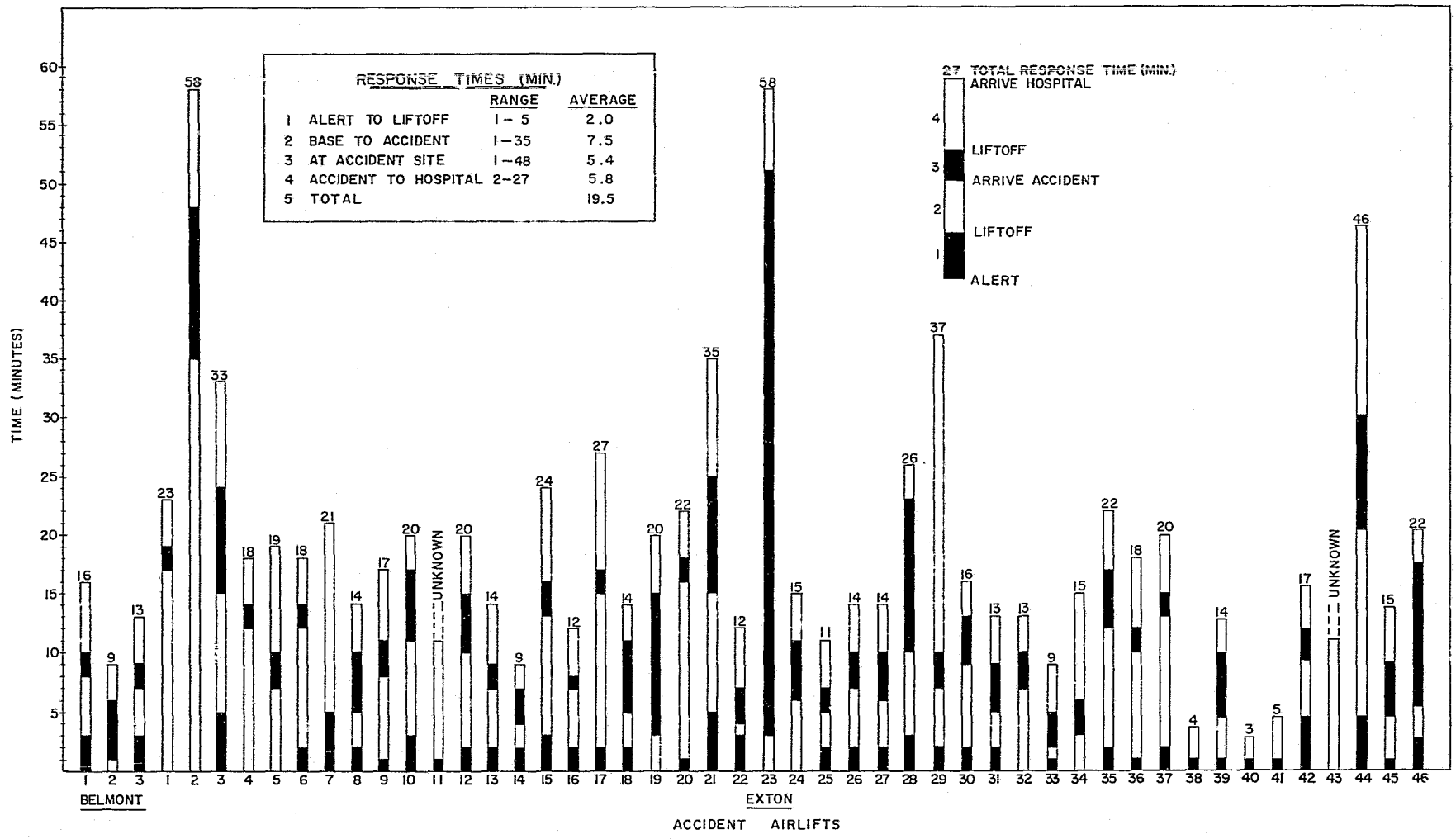
In many of the accidents the time factor in getting the victim to the hospital was not critical, however, it was often not known at the scene of the accident whether or not an injury was or was not critical. Of the 49 accident victims, six had injuries which were later classified as "life-threatening". Of these six, two of the victims died after they arrived at the hospital.

The entire project staff was disappointed that a greater number of airlifts could not have been completed. Also it was hoped that situations would have required transporting physicians to the scene of an accident when needed. After one accident, a physician did accompany a victim, who sustained a serious head injury, to the Wilmington Hospital (Delaware) after initial examination at a small rural hospital indicated more extensive medical facilities were required.

The helicopter performed well under various conditions and fortunately there were no accidents as a result of flying, which is attributed to the capability and judgement of the pilots used in this project. Although the trooper was in comand of the aircraft during normal operations, the pilot made the decision on whether a given procedure, such as landing, could be carried out safely. Landings were completed on busy highways

FIGURE 38

DISTRIBUTION OF TRIP TIMES FOR ACCIDENT EVACUATIONS



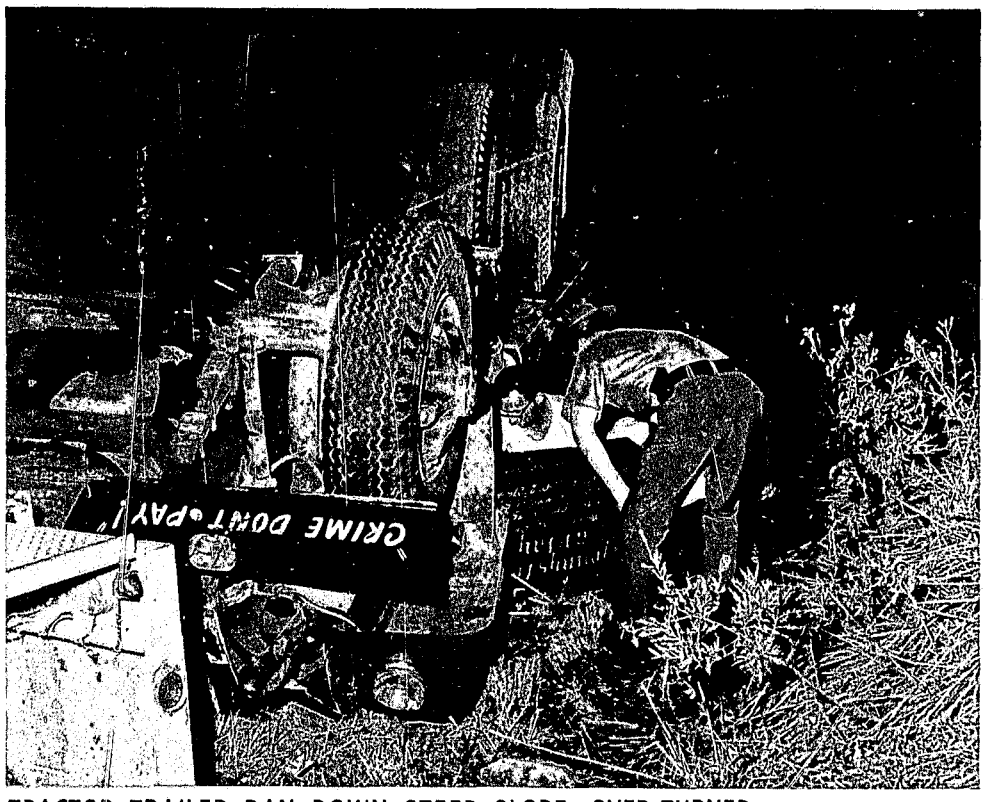


FIGURE 39

TRACTOR TRAILER RAN DOWN STEEP SLOPE, OVER-TURNED, PINNING DRIVER UNDERNEATH.

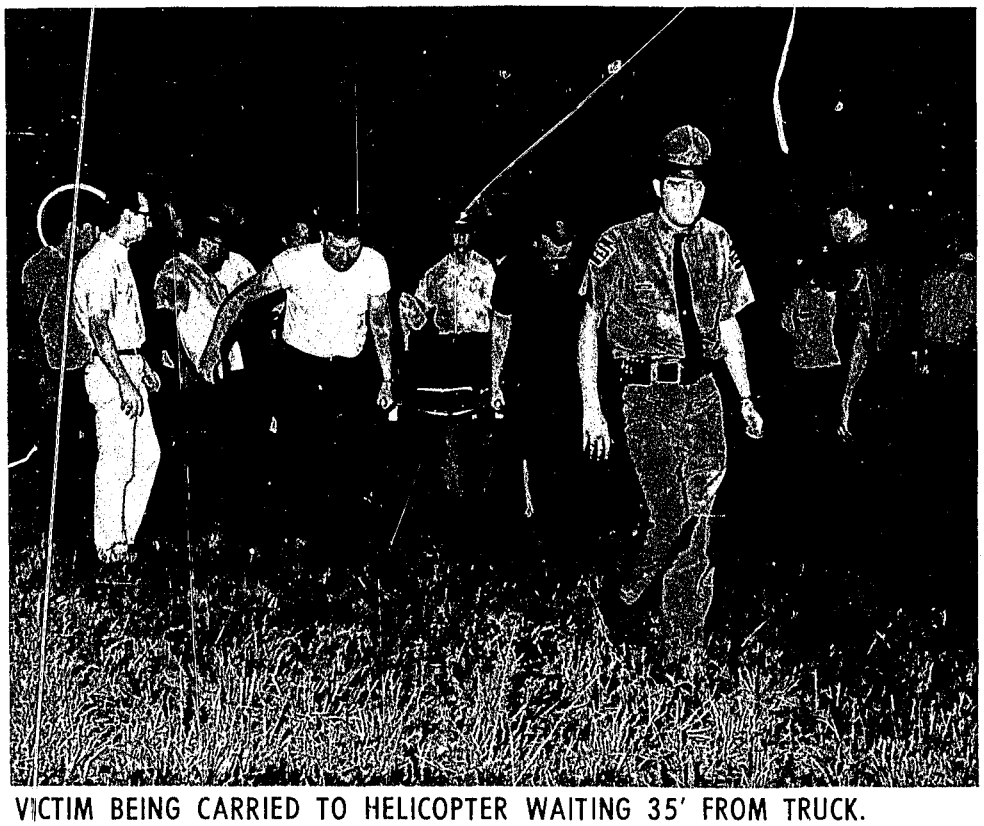


FIGURE 40

VICTIM BEING CARRIED TO HELICOPTER WAITING 35' FROM TRUCK.

FIGURE 41

INJURED TRUCK DRIVER IS PLACED ABOARD HELICOPTER.

FIGURE 42

PILOT PREPARES FOR TAKEOFF. 10 MINUTES LATER VICTIM WAS IN HOSPITAL.

during daylight hours and adjacent to highways and during periods of darkness with the assistance of troopers on the ground.

Figures 39 through 42 show an actual accident from which an injured person was airlifted to the hospital.

The following three examples illustrate the procedures followed by the helicopter crew and the other agencies involved in airlifting injured persons to hospitals:

Case I

This accident occurred on U.S. 1, June 9, one and one-half mile west of Route 82. A tractor trailer had run off the roadway through a guardrail and down a 30% embankment, turned over and pinned the driver in the cab. The request for the helicopter ambulance service by the Avondale State Police, was received at the Exton Sub-station at 2005 hours. The helicopter, on standby at the base, lifted off at 2007 and arrived at the accident scene 14 air miles away, at 2020. A local ambulance arrived at the same time. The trooper on the ground indicated the landing area with flares approximately 35 feet from the overturned truck. The local ambulance crew assisted in removing the victim and placing him aboard the helicopter. Carrying the victim to the ambulance parked on the roadway shoulder above would have been difficult because of the steepness of the slope. The helicopter took off at 2022 arriving at the hospital 10 air miles distant, at 2032 where another ambulance company waiting at the landing site, transported him into the emergency room 375 feet away. During the flight oxygen had been administered to the victim.

The victim had sustained chest and internal injuries as well as a cerebral concussion. Although he succumbed at 0300 (June 10), the physician stated he probably would have died during a conventional ambulance trip to the hospital and would not have had a chance to receive the intensive care available only in the emergency room. He believed this case definately demonstrated the value of helicopter transportation. The case also demonstrated the value of cooperation between local ambulance companies and the helicopter crew at the origin as well as the destination of this emergency trip.

Case II

On May 13 at 1532 hours the Tredyffrin Township police requested (by phone) the helicopter ambulance to assist in an emergency involving a workman who had touched a high tension wire while he was checking loaded freight cars. The location, which was one-half mile north of U.S. 30 just off U.S. 202, was 13 ground miles from the Exton base. The helicopter was airborne at 1545 and landed at 1553 in a parking lot one-fourth mile from the accident victim. Local fire and ambulance companies who were removing the victim from the top of the freight car brought him to the parking lot and transferred him to the helicopter at 1558. The helicopter was airborne at 1559 and landed at the hospital (8 ground miles distant) at 1602 where it was met by hospital personnel. The victim, who was severely burned, was transferred to the emergency room by wheeled stretcher where he was given an emergency tracheotomy. Trip time via conventional ambulance at that period of the day is estimated at 20 to 25 minutes whereas via helicopter it was three minutes. The physician stated in his opinion the victim would have died had it not been for the rapid delivery to the hospital.

This exemplified cooperation between several agencies where the best capabilities of each were fully utilized to the ultimate benefit of the victim.

Case III

On May 7 ground patrol from Phila., Troop K investigating an accident on I-76 (Schuylkill Expressway) requested the helicopter ambulance because of the severe traffic congestion created by the accident. The call was received at Exton at 0728 hours and the crew was airborne at 0730. It arrived at the scene 15 air miles from Exton, and landed on the highway at 0740. With the help of the ground patrol the injured person was placed aboard the helicopter which lifted off at 0742. It arrived at the hospital at 0746 where hospital personnel were waiting to take the victim to the emergency room. He had sustained a back injury, however, x-rays, tests and examination revealed the injury was not serious and he was later discharged in care of his own physician.

This case illustrates several pertinent points which should be noted.

(1) The accident occurred during the time traffic flow was approaching the capacity of the highway and severe congestion rapidly developed in all four lanes.

(2) A local ambulance had been called but because the officer, believing traffic congestion might delay its arrival, elected to request the helicopter even though it was based 15 miles away.

(3) All traffic was stopped by the officers when the helicopter approached to permit landing directly on the highway adjacent to the accident. It was at the scene for two minutes and immediately after lift-off the officers were able to begin moving one lane of traffic in each direction. It is not known what this time interval might have been before traffic flow could be resumed had an ambulance been required to remove the victim.

(4) The local ambulance arrived 15 minutes after the helicopter had departed from the scene with the injured person. It would have had an 18 mile trip to the hospital from the accident site which would have required an estimated 30-35 minutes travel time during this period of the day. It was 9 air miles and four minutes for the helicopter.

(5) The communications involved the trooper at the scene radioing the Troop K Headquarters first for the ambulance and then the helicopter. The station in turn radioed the Exton Sub-station which dispatched the helicopter. The helicopter notified Troop K Station it was enroute. Troop K dispatcher notified the trooper at the scene and alerted hospital (by phone). The hospital later reported they had 8 minutes advance notification prior to arrival of the victim.

(6) Fortunately the victim had not been seriously injured. The physician stated "although this man's injuries were not serious, they might well have been, considering the apparent condition on arrival - I definately feel that rapid transportation was (of) benefit to him."

MEDICAL APPRAISAL

As pointed out previously the majority of the airlifts involved victims who had sustained minor type injuries where the time factor in reaching the hospital was not critical. There were, however, other accidents in which time was crucial.

The basic question, can a helicopter ambulance reduce response time and thereby save lives or reduce consequences of serious injuries was partially answered; it can save time. To conclusively determine that a life was or was not saved because of time saving, however, is far more difficult and most physicians, understandably, are reluctant to so state positively.

A medical review of the six life-threatening injuries showed that one life was "probably saved because of rapid transport to the hospital." This victim was not a highway casualty but had come in contact with high tension wires and was severely burned. An ambulance transported him from a rail siding where the accident occurred to the helicopter which was waiting at a parking lot approximately 1/4 mile from the siding. The helicopter took the victim to the hospital in three minutes, ambulance trip time at that time, 4:00 p.m., was estimated by police to have been 20 to 25 minutes (8 miles).

In another case, the medical report indicated that a life was "probably" saved and that hospitalization time was definately reduced because of rapid transport. In this instance, the total response time from alert to delivery of the victim to the hospital was 14 minutes; trip time from the accident scene to the hospital was five minutes.

In a third instance, a severely injured truck driver had sustained chest and internal injuries as well as cerebral concussion. Although he succumbed 4½ hours after he arrived at the hospital, the physicians stated this was an example of the value of the helicopter ambulance since the victim probably would not have had a chance to receive intensive care available in the emergency room.

There were no recorded cases where permanent impairments were avoided in any of the accidents serviced by the helicopter.

Of the analyses made of the other victims, there was not a single instance reported, where the flight had adversely affected their condition. A survey of the victims after they were discharged from the hospital showed that they experienced little or no fear or other ill effects to being transported by helicopter.

Perhaps the comment recorded most frequently by the physicians at the participating hospitals was the fact that they were surprised at the speed at which the victims were delivered to the hospital. Such comments as "astounded by speed," "terrific service," were typical. There were physicians, however, who felt that the conventional ambulance was more than adequate except in suburban areas where traffic congestion is a frequent problem.

Additional general comments regarding helicopter ambulance service by the physicians and emergency room nurses has brought out many salient features about this specific program which should be enumerated.

1. This program was carried out in an area where there is particularly good coverage of competent, well equipped, well trained ambulance companies who are well known to do a superb job in emergency medical services. These services are around the clock, have good communications, and good discipline and are credited with a very fine coverage and service. This is also in a densely populated area with numerous ambulance

services with short runs to accidents and pretty good elapsed times. However, traffic density is a definite problem to them particularly at certain times. All physicians and hospitals were high in the praise of the ambulance companies, their equipment and their training.

2. Usual patterns of rapport are hard to change and usual methods prevail. Therefore, notification of our services were often after thoughts to the communications people.

3. The rapidity of action both in responding to a call and in transporting a victim is unquestioned in helicopter service. All physicians agreed that in many instances of life threatening situations, such as hemorrhage, ruptured internal organs, chest injuries, and severe head injuries the availability of rapid evacuation to definitive medical facility would save precious time.

4. Practice sessions must be carried out with the various facilities involved as this requires precision timing and planning. An example is that if the waiting litter is too close to the landing site, covering can be blown away by the slip stream.

5. Training of helicopter personnel should be the same as high grade ambulance personnel. In-hospital training could be made a routine part of this training.

6. Helicopter evacuation from hospital to hospital is time saving where long trips are involved, but requires much changing around of the patient. Standard interchangeable litter equipment would obviate some of these objections. As more hospitals acquire landing areas of their own then inter-hospital transportation will become much more feasible but where airports have to be used, the advantages are questionable.

The medical supplies and equipment carried by the helicopter was rather limited as compared to a modern ground ambulance because of space and weight limitations. The litter type and arrangement within the cabin was substandard to those found in well-equipped conventional ambulances. Care of the victims by the attendant was also limited because of space and seat belt restrictions. External bleeding could be controlled and oxygen administered. However, other resuscitation methods such as clearing air passages or external heart massage and common methods of treating shock were extremely difficult. It was found that there was, in fact, little time for treatment during the flight because of the relatively short trip time to the hospital. It was believed that this shorter trip time might lead to a new appraisal of the emergency medical techniques. In many instances, there would not be sufficient time to administer treatment as is done in the ambulance.

Basic questions raised as the study progressed relative to internal space requirements, equipment to be carried and whether efforts should be directed at stabilizing the victims condition at the accident scene followed by a slow trip to the hospital via ambulance or provide minimal first aid at the scene with rapid transport to the hospital via helicopter. To supplement answers given above to these questions and to evaluate fully the utility of the helicopter as an ambulance from a medical viewpoint, not only during this study but, as a future mode of transportation, the opinion of several physicians was sought relative to the needs of emergency medical services and the capabilities of the helicopter in serving these needs.

Transporting the Physician to the Accident Scene

Most physicians agreed that it was of prime importance to get expert personnel and equipment to the accident scene as quickly as possible, and even if the victims condition is successfully stabilized at the scene, rapid transport to definitive medical

care is still essential. Yet there was varied opinion on the practicality of taking a physician to the accident scene, however, the vast majority of physicians felt that except for unusual circumstances, it would not be necessary to transport a physician to the accident. While he could make a definitive diagnosis, the physician would probably provide no more benefit at the average accident than a well-trained medic who was accustomed to attending victims at the accident scene. Also because of the shortage of physicians, it would be an inefficient and costly use of the physician's time to have him assigned to ambulance crews waiting to service accidents.

It was believed that highly trained para-medics such as those used in the Freedom House ambulance in Pittsburgh provide the kind of expertise that is needed. These medics, using specially equipped ambulance vehicles, service approximately 20 calls a day of which 10% are serious life-threatening emergencies. Trip time averaged between 10 and 20 minutes with a maximum of ½ hour. Results of this project at the time of inquiry by this study, indicate that 35 cardiac victims had been stabilized by these para-medics using pulmonary resuscitation at the scene (and five enroute) without the assistance of a physician. The keys to this successful operation, are; (1) highly trained para-medics and (2) getting them to the scene quickly with proper equipment.

Most ambulance companies in Pennsylvania are composed of volunteers on a part-time basis who have received the standard ambulance attendant courses. In contrast, the Freedom House para-medics receive eight months of intensive training and they serve on a full term basis. It was believed that the medics being discharged from the military service would provide an excellent source of paramedic personnel and who would require little or no additional training. It was also felt that the present experienced volunteer ambulance attendants would require three months training to reach the level of proficiency of these paramedics and, that they should continue to be used extensively in future emergency medical services even on a part-time or volunteer basis.

Response Time

The other essential part is getting to the victim as quickly as possible. What is meant by "quickly"? Can a time standard or criteria be established for responding to various types of injuries or illnesses? While it is acknowledged that deterioration of a physical condition or injury without treatment is a function of time, it is extremely difficult to establish a critical time in which various classes of injuries must be treated in order to prevent death or serious impariment. It was, however, possible to set some guidelines which could be used for planning purposes in developing response time goals for servicing traffic accidents and other emergencies. For life-threatening emergencies such as head, chest, other internal injuries, multiple fractures, etc., minutes are important. A heart stoppage can cause permanent damage to the brain within four to seven minutes and even though, in many instances, the heart can be repaired, the brain cannot be. Trauma may cause normal healthy organs such as liver, kidneys, etc. to deteriorate within 30 to 60 minutes. Ordinary fractures on the other hand, may not adversely affect the victim, other than discomfort, within one to two hours or more.

It is believed that many deaths are a result of asphyxiation caused by otherwise relatively minor injuries and such deaths could have been prevented by providing rapid airway care and artificial ventilation.

The other aspect of time is that of human suffering whether or not the injury is life-threatening and a rapid response time could result in lowering human suffering.

It is possible to classify injuries in three general time groups based upon maximum response time required for proper medical attention without attempting to designate the specific injury types:

(1) 0 - 10 minutes
(2) 10 - 30 minutes
(3) Over 30 minutes

These time classes can be useful in evaluating existing emergency medical services within a given geographical area. They can serve as a measure of the level of medical service being provided by comparing the number of injured persons in each class with the number that actually received proper medical care within the time frame specified for each class.

This classification can also serve as a guide in planning future emergency medical services by classifying injury accidents that have occurred by maximum response time classes and relating these to accident locations, ambulance bases, hospitals and response and travel times required to service the accidents. Such an analysis would show, for example, whether a series of class No. 1 accidents occurring within a specific area or at a specific hour could be adequately serviced within the criteria established by the community.

Minimum Equipment Needed

Will the short trip time to the hospital (say six minutes) modify medical procedures or equipment required for the conventional ambulance service? Probably not. Even though stabilization may be achieved at the scene, provisions must be made to maintain clear airway and circulation during the trip to the hospital. The helicopter, therefore, should be equipped with suction apparatus, oxygen, resuscitation equipment in addition to inflatable splints and first aid equipment. Some physicians believe the helicopter should be capable of carrying other equipment such as a cardiac defibrillator and physician's kit to be available at the scene even though they would not normally be used in flight. The use of this kind of equipment would require a larger helicopter than either of those used in this study.

Helicopter Interior, Size and Arrangement

The helicopter used in the study had one litter located laterally across the helicopter in which special molded doors were used to accommodate the handles of the litter. The litter was strapped to a base mounted on the floor. The trooper who served as a medical attendant sat on a removable seat located over the feet of the victim. When the victim was placed into the helicopter on the litter, it was necessary to guide his feet under the seat.

The recommended standards for a conventional ambulance with respect to interior dimensions are as follows:

minimum height	4.4'
minimum width	6.0'
minimum length	9.2'

In addition, the stretcher should be capable of tilting 15 degrees (head down) and the head end 60 degrees (head up).

There have been no similar standards developed for a helicopter ambulance. While it was believed the interior should be somewhat comparable in size to the ambulance standards, it was recognized that to achieve them would require a helicopter larger than either the Bell 47 J2A or the Fairchild Hiller FH 1100, and may not be economically feasible.

It is most important that sufficient space be provided for the attendant at the head of the litter for servicing the victim's needs. Since the attendant would normally be wearing a seat belt, medical equipment and supplies should be within reach from a sitting position. There should also be space along the length of the stretcher as well as overhead to permit external heart massage.

It was not attempted in this study to match these minimum desirable requirements with a specific helicopter production model, nor determine the cabin modifications necessary to any particular model to achieve reasonable compliance with these standards.

Communications

It was the concensus of opinion of physicians interviewed that radio communications between the helicopter and the hospital would be desirable so the hospital could be ready for the arrival of an injured person. Early in the study the helicopter was forced to wait as long as five minutes for hospital personnel to remove the victim from the helicopter even though the hospital had been notified by phone by the State Police barracks prior to its arrival. The rapid trip time simply was not anticipated by hospital personnel. It was recognized, however, that monitoring a transceiver in the hospital could cause problems at many hospitals because of personnel shortages or physical facilities.

In future emergency medical functions constant telemetering of the victim's condition to the hospital would permit the physician to advise the medic on proper treatment at the scene, as well as enroute to the hospital. Until this technique becomes available, normal radio communications between the paramedic or attendant and a physician would be beneficial and would eliminate possible delays or errors in communication which could result when a third party is used through which information has to be relayed.

Future Potential

It is the belief of the majority of physicians that the capabilities of helicopter transport in medical emergencies could best be utilized if it were part of a regional emergency medical service connected with and operating out of an emergency medical center. While it is not possible to establish definite response times required for successfully servicing specific types of injuries, the helicopter should carry a paramedic employed full-time to be taken to the accident scene as quickly as possible to render proper medical aid and determine the victim's needs for transportation and hospital care.

All ambulance services in the area should be part of the regional organization to work efficiently, prevent overlap of jurisdiction and duplication of service. Total communications within the emergency medical service are essential and the helicopter should carry equipment and have working space available comparable to that of conventional ambulances. However, specific standards should be developed for helicopter ambulances.

It could be used for hospital to hospital transfer only when not on emergency call. Service should be self-supporting through standard fee charges payable by insurance. Certification of the injured transported by helicopter by emergency room should be re-

quired to prevent abuse of using helicopter for non-critical purposes. Finally the physicians believe that legislation should be introduced to establish emergency medical services on a regional rather than local basis.

AIRCRAFT EVALUATION

The contractor recommended using a Bell Helicopter Model 47-J2 which was powered by a reciprocating engine and had a rated cruising speed of 91 mph. Normally a 4-place craft, the helicopter was modified to accommodate a litter placed laterally across the cabin behind the pilot. Specially formed doors were used to effectively widen the cabin. Litter handles slipped into special nacelles molded into the doors for that purpose. These doors were designed to utilize two litters, one above the other, however, there would not have been sufficient seating space for a medical attendant if two litters had been used. Therefore it was decided to use only one litter since it was believed that the presence of a medical attendant was necessary on all trips. Other modifications in the cabin include the installation of drop seats for the trooper-medic and other passengers. On one occasion two persons who sustained minor injuries were carried to the hospital as seat passengers.

The 47-J2 was recommended initially because litter configuration had received FAA certification. The equipment was available as were qualified pilots and maintenance.personnel. As the study progressed, however, it was found that the J2 had serious shortcomings. Available power limitations and performance prevented operations from many areas. Vertical take-off was rarely attempted because of power requirements and high stresses created problems on the roter assembly. High temperatures in the summer restricted lifting capabilities and low temperatures in winter required long and frequent warm-ups as the helicopter was housed in an open field. Strong headwinds reduced ground speed and slowed response time. In some instances the ground ambulances appeared to average higher speeds than the helicopter. Weather prevented flights 15% of the time. Fog, high winds, snow and heavy rainfall were the most prevalent conditions causing flight cancellations. The internal arrangement with the trooper-medic seating over the feet of the litter patient made treatment during flight difficult. Loading and unloading a litter patient was cumbersome as illustrated in the following series of photographs:

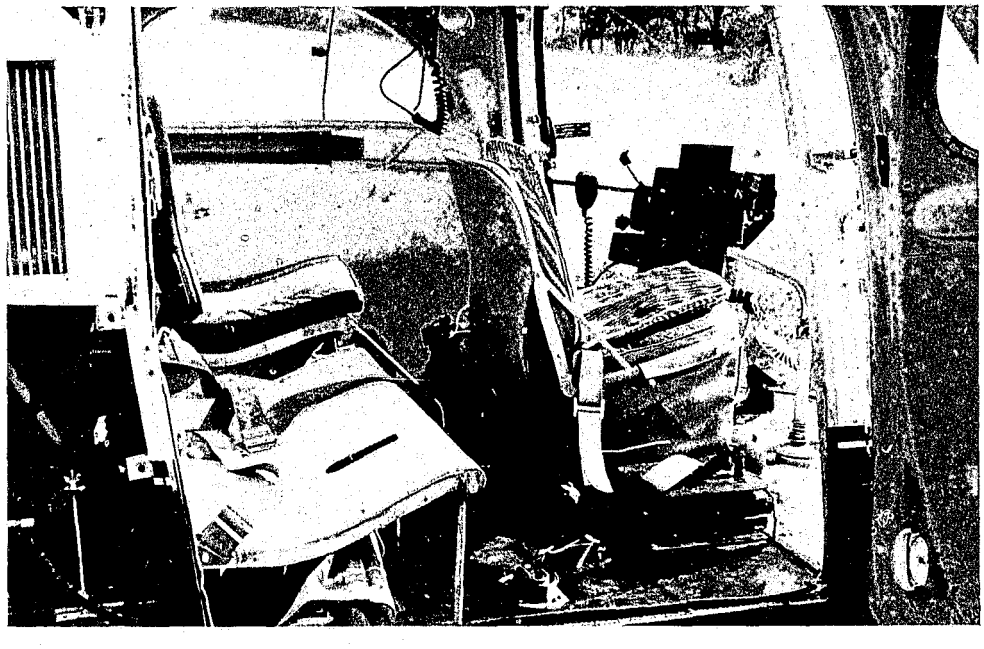


FIGURE 43

Figure 43 shows the interior of the J2. Two drop seats are used, one for the trooper and one for other seat passengers. Only the trooper's seat can be used with a litter. Note the folding "army type" litter carried beneath the seats.

FIGURE 44

Upon landing at an accident, the trooper attends to the injured persons while the pilot readies the cabin for the litter as shown in Figure 44. It is necessary to open the lock which secures the drop seat leg to the floor, using a screwdriver (½ twist). The seat is then raised and secured to the rear bulkhead using a hookeye.

FIGURE 45

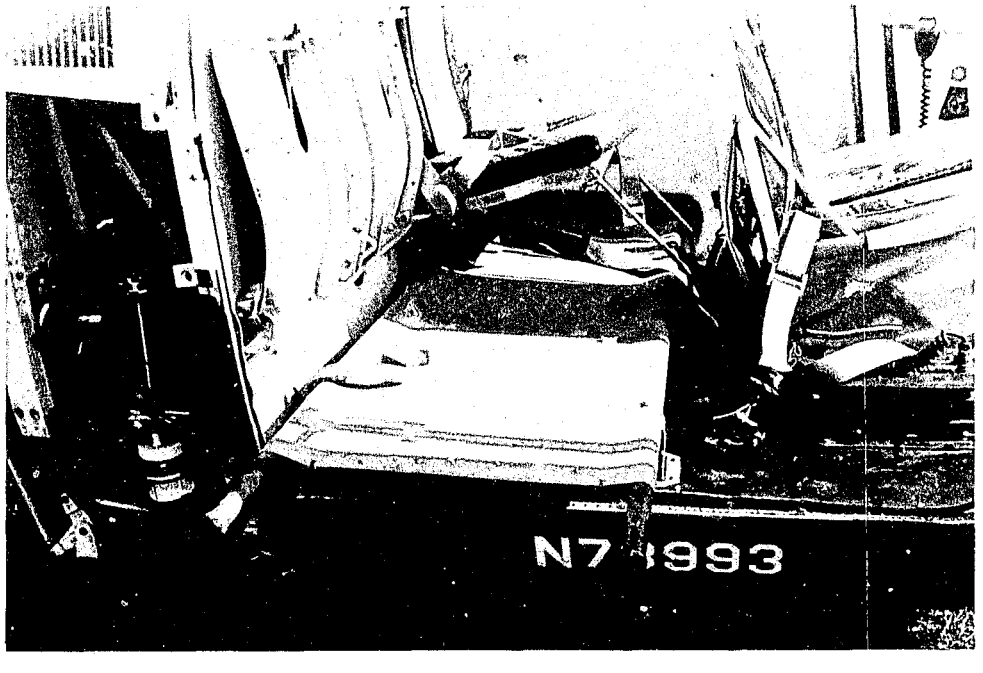


Figure 45 shows an empty litter in place and the straps used to secure the patient and the litter to the deck.

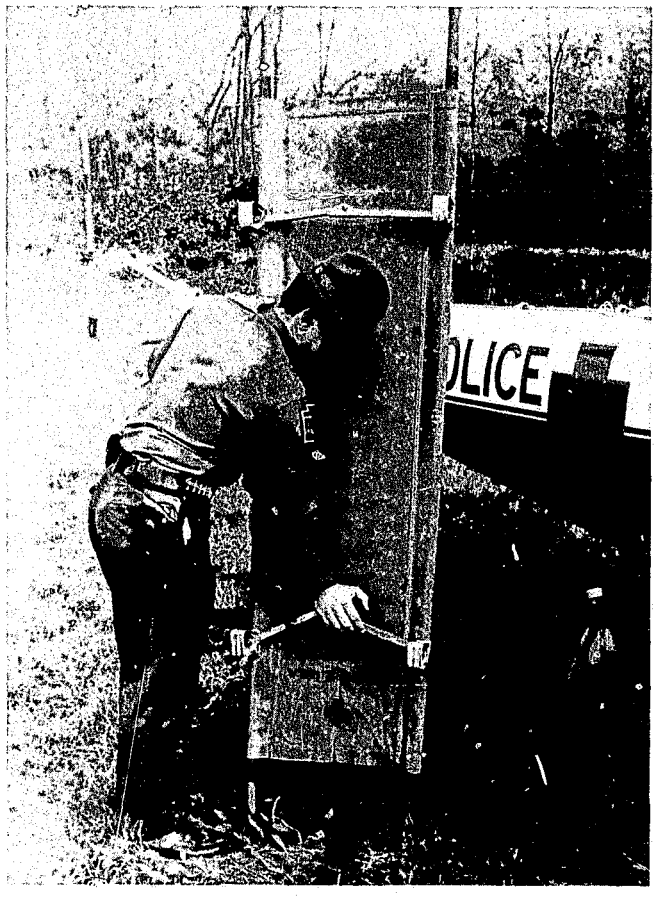


FIGURE 46

Figure 46 shows the trooper opening the litter, by spreading and locking the braces open.

FIGURE 47

If no help is available the trooper and pilot place the victim on the litter and move him into the helicopter as illustrated in Figure 47. This could be difficult on a windy day because the helicopter door could not be locked open and would blow shut against the trooper or litter.

FIGURE 48

Figure 48 shows the trooper moving to the other side of the cabin while the pilot supports one end of the litter. The litter is ready to be slid into floor sockets.

FIGURE 49

As the litter is slid into place, the trooper guides the victim's feet under the trooper's drop seat. This seat can be raised but was usually left in place as shown in Figure 49 to eliminate delays.

FIGURE 50

After the litter appears to be in place, the pilot wiggles the handles slightly to lock the litter feet into the floor sockets, as demonstrated in Figure 50. The trooper does the same to lock his end of the litter. Note that the handles of the litter will extend into the door nacelles, as the doors are closed and locked.

FIGURE 51

Two straps as shown in Figure 51 are fastened across the victim and the litter. Pilot and trooper board helicopter, close doors and helicopter is ready for takeoff.

While this series of steps to prepare the helicopter and load an injured person appear to be time consuming and complicated, in practice the procedure functioned smoothly and quickly. Fortunately there were always other persons at the accident scene available to assist the helicopter crew and in most instances the pilot could remain in the helicopter while the injured person was being loaded.

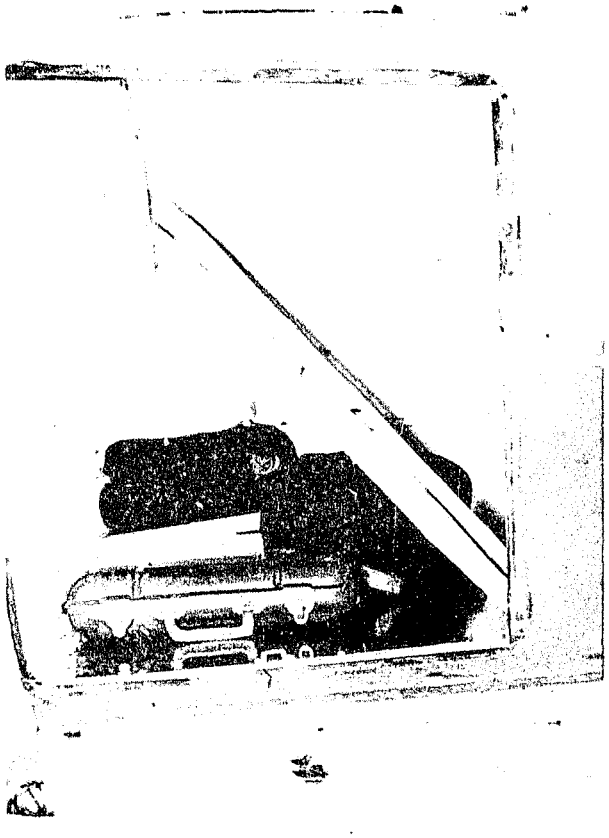


FIGURE 52

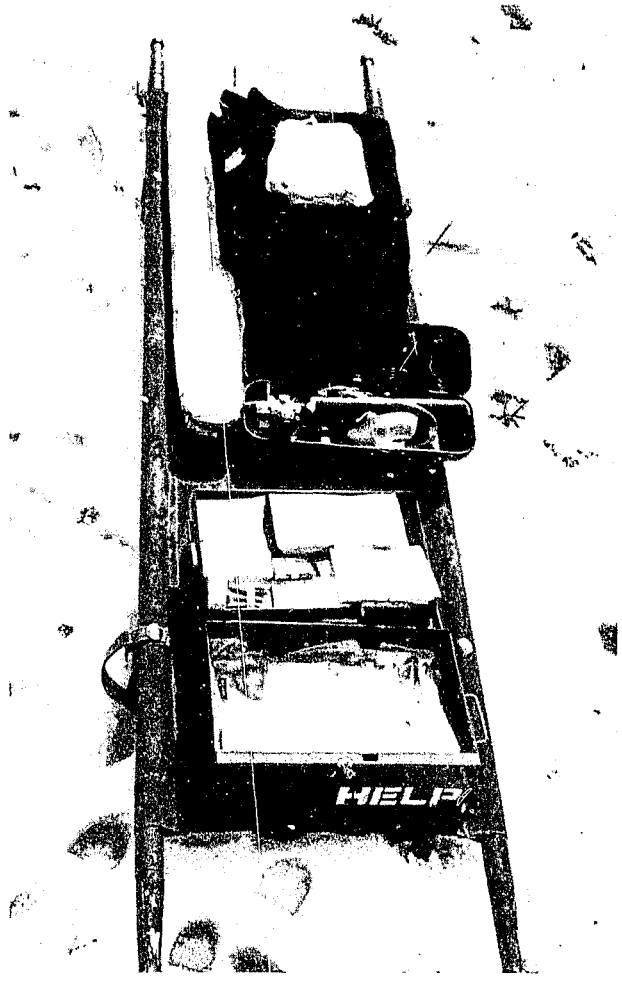


FIGURE 53

Figure 52 shows the storage compartment located to the rear of the cabin which holds the medical supplies and equipment; it measures 30" high, 26" wide, and 26" deep and has a weight capacity of 250 pounds. Figure 53 shows the equipment. This includes splints, oxygen, blankets, sheets and a first-aid kit.

Fairchild Hiller Aircraft loaned the contractor its ambulance-equipped Model FH-1100 for test and evaluation on the project for a two-week period. This model which was turbine powered was equipped with twin-basket-type litters (see Figures 54 & 55). Chart 12 compares the size and performance characteristics with the J2. In addition to the higher cruising speed, the FH-1100 required little warmup time which is an advantage in cold weather. The double doors and interior configuration provide easy access for loading and unloading litter patients. The trooper-medic is in a better location to administer to the injured persons' needs during flight, although the working space available is still substantially less than the recommendations for ambulances.

Flight crews were impressed with the speed, available power, and the low noise ratio of this aircraft. It was capable of lifting greater loads on hot days without reaching the limits of available power. During the 2-week testing period an actual airlift was completed of a victim who weighed 315 pounds. The pilot stated he doubted if the J2 could have carried the trooper with this patient because of the temperature and humidity that existed at the time of the airlift.

FIGURE 54

FAIRCHILD HILLER MODEL FH 1100 - TURBINE POWERED

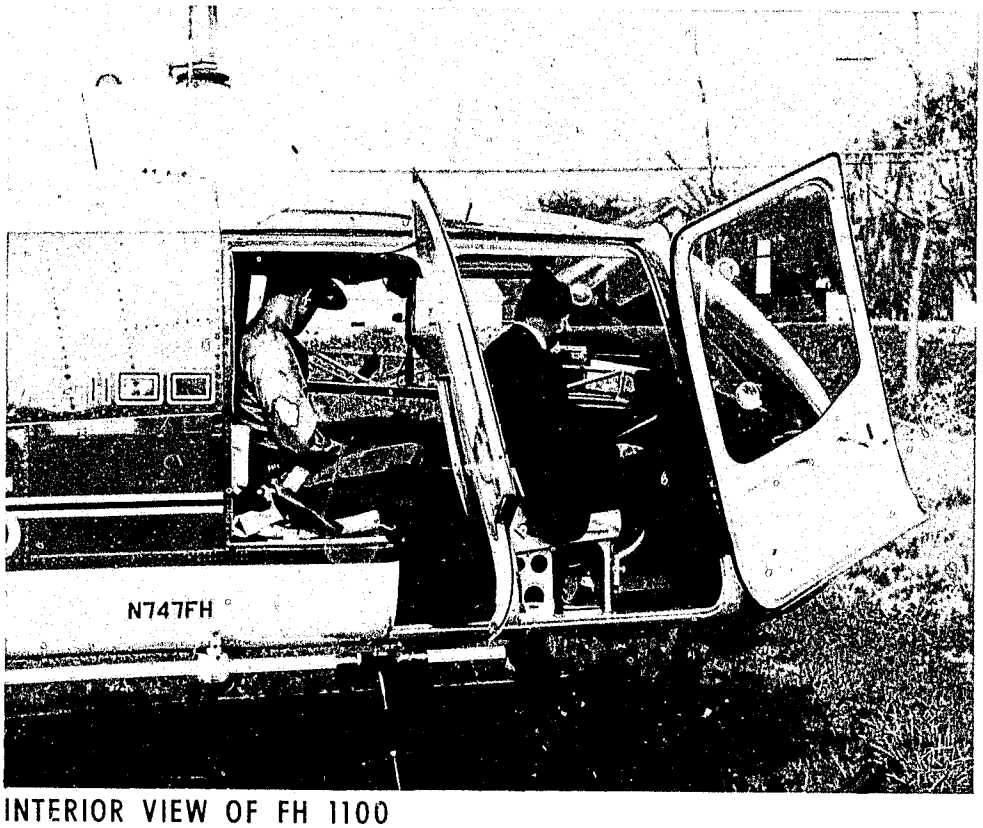


FIGURE 55

INTERIOR VIEW OF FH 1100

TABLE 12

COMPARISON CF HELICOPTER SIZE AND PERFORMANCE CHARACTERISTICS

	BELL 47 J-2	FAIRCHILD HILLER FH 1100
Capacity (Plus Pilot & Medic)		
Number of Litters	1*	2
Litter Loading	Lateral	Fore-Aft
Gross Weight (lbs.)	2,950	2,750
Payload Weight (lbs.)	659	733
Engine Type	Piston	Turbine
Cruising Speed (mph)	91	142
Fuel Consumption (gal/hr)	17	20
Range (at Max. Payload) (miles)	200	396

* A second litter may be used if medic does not accompany helicopter; or capacity permits two persons in a sitting position in addition to medic and pilot.

The FH-1100 was also used on several police assignments with successful results. In one case the trooper followed suspects in a get-a-way car from a bank robbery until road blocks were set up by ground patrols.

Only two accident simulations were completed with the FH-1100 because of difficulty in scheduling, at times suitable to all agencies. It was felt by the flight crews, however, that sufficient use had been made of this aircraft to demonstrate the advantages of its better performance characteristics over the J2.

Although top cruising speeds for the J2 and FH-1100 were 91 and 142 mph, respectively, these speeds were seldom achieved as averages in actual use because of the relatively short distances involved. The J2 often averaged 60 to 70 mph. On one simulated accident the FH-1100 averaged 84 mph for a trip to the hospital from the "accident" site of 7 air miles. On other simulations it averaged 112 mph for a 15 mile trip and 60 mph on a 2 mile trip. This indicates that trip times are significantly responsive to trip distance regardless of equipment characteristics and it is a factor which should receive consideration when planning emergency medical services within a specified area, particularly if the area under consideration is small.

In addition to Fairchild Hiller, other manufacturers were invited to test the Bell Jet Ranger and Sikorsky S-55 but neither models were available.

During the year, hundreds of take-offs and landings were completed without incident. The helicopter landed on busy, limited access highways under direction of troopers and on narrow two-lane highways. Pick-up points were parking lots, school yards, fields adjacent to highways and intersections of local streets in residential areas. The helicopter also performed a variety of tasks other than medical emergencies Because regular maintenance was performed in accord with FAA requirements, mechanical failure and resulting down-time was minor. Records indicate that one patrol was forced down in a field due to generator over-heating and approximately 16 patrols were either terminated early or cancelled entirely because of equipment failure or abnormal operation.

Since this study was limited principally to one type of aircraft with a brief exposure to a second type, the following information from a study recently completed of emergency ambulance service by Dunlap & Associates[1] as it relates to helicopter operation, is included as follows:

> The aircraft chosen for emergency ambulance use is a prime factor in determining response and service time, enroute patient care and the cost of operation. The most critical factors involve payload capacity, cabin configuration, maximum cruising speed of the aircraft and range of the aircraft. (Almost all helicopters, new or used, available on today's market, provide sufficient performance in terms of service ceiling, hovering and climbing capability, etc., so that these performance factors need not be evaluated directly.) The helicopter payload capacity for emergency ambulance use (not considering mass disasters) should be sufficient to carry two litter patients in addition to a pilot and a medical attendant. Any aircraft which is capable of carrying more than four litter patients will be underutilized and exhibit excessive operating and maintenance costs. For civilian use, the cabin configuration and size should be such that the litters can be carried internally and the attendant can have access to the patient in flight. The maximum cruising speed of the helicopter will range from 80 to 150 statute miles per hour, depending upon engine type and size and gross weight characteristics. Helicopters selected for ambulance use, especially in rural areas where long distances may be involved, should have sufficient fuel capacity to permit at least three hours of flying without the necessity for refueling stops or reserve tanks which reduce payload capabilities. In addition to these criteria, the noise and vibration levels within the cabin should be sufficiently low to avoid patient discomfort and the stability of the aircraft should be such that the patient receives a smooth ride under all but the most severe turbulence conditions. For some types of helicopters, this may mean inclusion of a Stability Augmentation System as part of the avionics complement. The aircraft should also be equipped with a full communication capability and with sufficient flight instructions and navigational aids to permit full flight capability under helicopter VFR (Visual Flight Rule) conditions. In addition, the basic cabin configuration will have to be modified to accommodate entry, placement and securing of the litters. This normally involves removal of bulkheads and seats and may require a modification to the cabin door. These modifications can be performed either at the factory or by specialists in aircraft conversion and, in either case, will have to pass FAA certification.

[1] See references, page 109.

HOSPITAL LANDING SITES

Landing sites at each hospital had been checked and approved by the Pennsylvania Aeronautics Commission as having the minimum requirements for approach clearance. Minimum standards require eight feet horizontal clearance for each one foot of vertical height. Thus an approach of 320 feet would be required to clear 40 foot trees such as existed at one hospital.

Table 13 shows the hospitals and identifies the airlifts made to each. Of the five original hospitals invited to participate in the study, there were no victims taken to either Lower Bucks or Nazareth because there were no airlifts made in that area. Both hospitals are approximately 22 air miles from the Exton base.

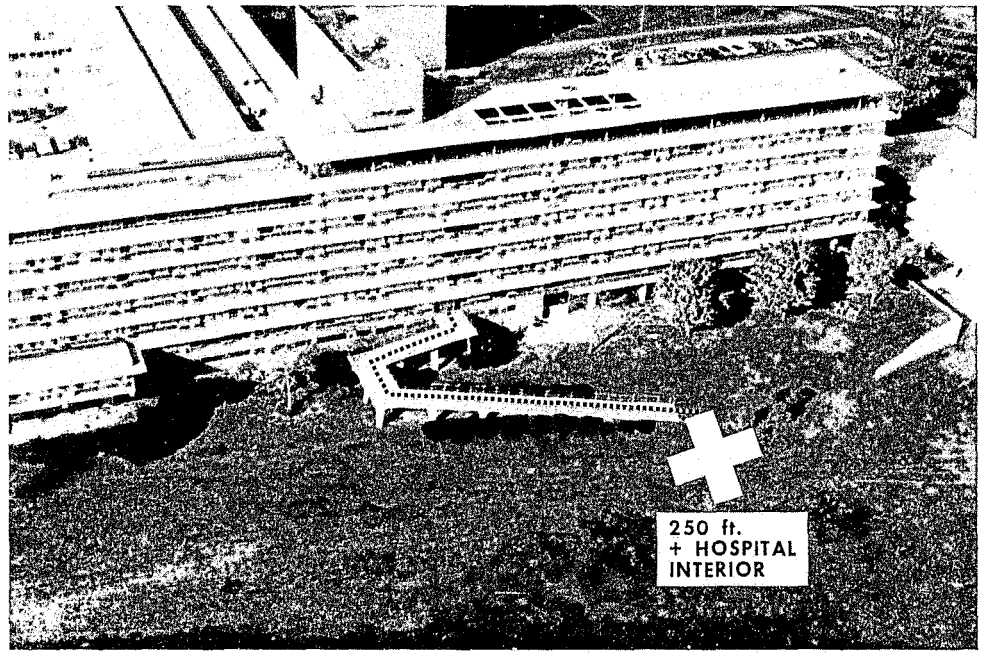
TABLE 13
HOSPITALS USED FOR VICTIMS AIRLIFTED BY HELICOPTER
November 16, 1967 - November 16, 1968

HOSPITALS	REPRESENTATIVE PHYSICIAN	AIRLIFTS TO HOSPITALS Airlift No.	Total
* 1. Coatesville	C. T. McChesney	5, 11	2
* 2. Lower Bucks County	Hernando Truvillo	0	0
* 3. Lankenau	Richard N. Myers	1B, 2B, 3B, 3, 6, 15, 20 35, 36, 45	10
* 4. Nazareth	V. J. Cattie	0	0
* 5. Riddle	J. H. Conner	4, 28, 30	3
6. Chester County	Frank H. Ridgley	8, 9, 13, 14, 16, 17, 18, 19, 21 22, 23, 25, 26, 27, 31, 32, 33, 37, 38, 39, 40, 41, 42	23
7. Pottstown		24, 43	2
8. Phoenixville	Robert E. Brant	1, 2, 10, 12, 34, 46	6
9. Wilmington (Del.)		7, 44	2
10. Glenville		29	1
		Total	49

* Five original participating hospitals

The following photographs show the landing facilities at each of the hospitals used except Glenville and Wilmington.

FIGURE 56



Only one hospital, Lankenau (Figure 56), had facilities previously designed to accommodate helicopter operations. Here the helicopter could land on a sodded area at the foot of a long ramp over which victims were transported in a wheeled litter to the emergency room. This distance was 250 feet from point of landing to hospital door, plus an undetermined interior distance to the emergency room.

FIGURE 57

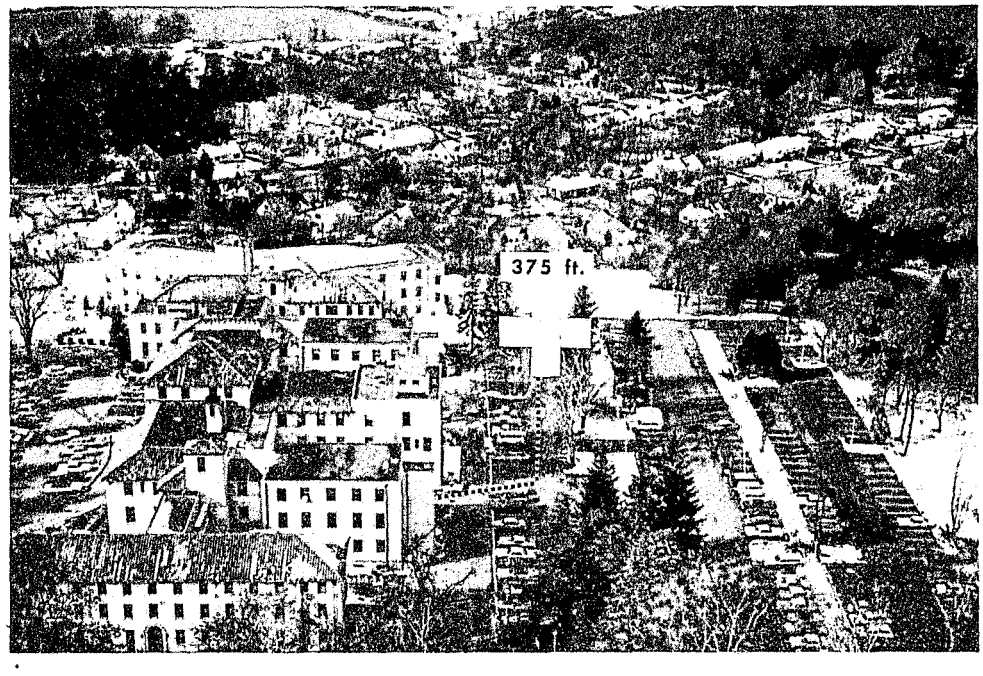


FIGURE 58

Figure 57 illustrates the approach to the Chester County Hospital where 23 victims were airlifted. The landing point on the edge of a parking lot is 375 feet from the emergency room entrance. A wheeled litter is kept at the site to be used for transporting the injured to the emergency room. See Figure 58. In all instances the Good Fellowship Ambulance Club of West Chester assisted in removing the victims from the helicopter and transporting them to the emergency room. In cases of severe injury or inclement weather their ambulance was used for transport.

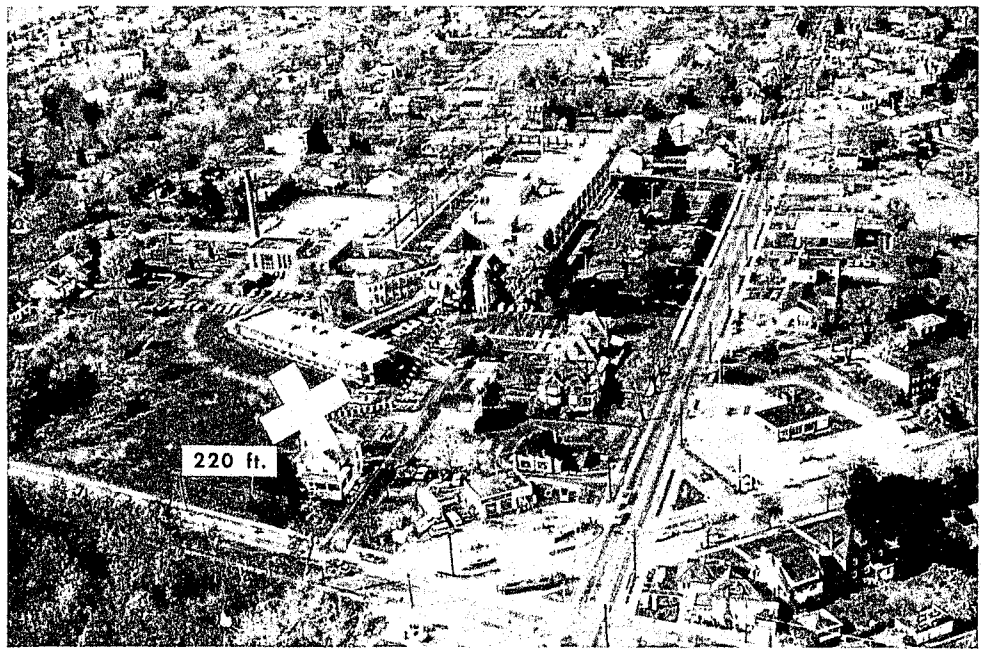
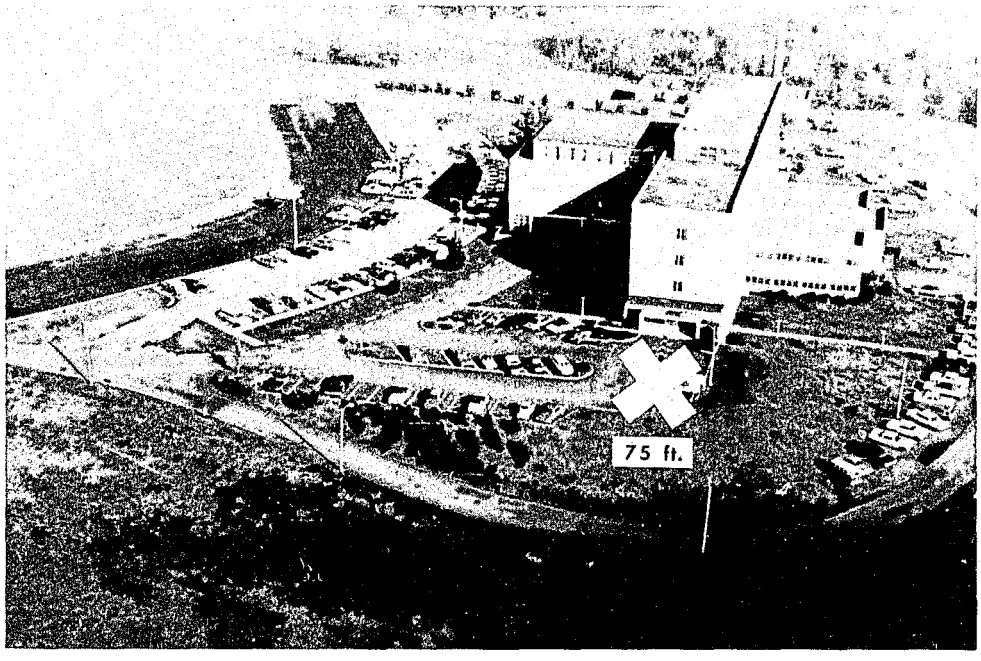


FIGURE 59

Figure 59 shows the Phoenixville Hospital where the landing site was on a sodded area adjacent to the parking lot. It was 220 feet to the emergency room entrance.

FIGURE 60



At Riddle Hospital (Figure 60) the helicopter landed on the paved parking area at a point 75 feet from the emergency entrance, and at Coatesville (Figure 61) the landing point was also on a paved parking area although it was 875 feet distant from the emergency room entrance. Wheeled litters were used for transportation.

FIGURE 61

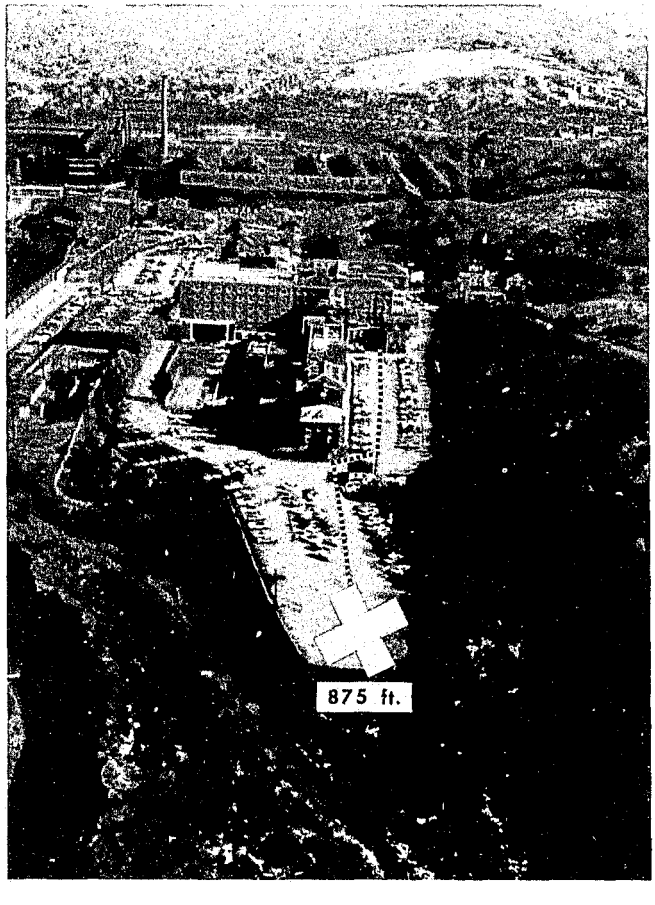


FIGURE 62

In Pottstown the helicopter used a sodded area of a ball field two blocks from the emergency entrance although a circuitous route was required to reach to entrance (Figure 62) via ambulance. On Sundays, however, a section of the parking lot was made available 75 feet from the emergency entrance.

It is evident that landing sites and conditions varied extensively among the hospitals. The necessity of transferring the litter from the helicopter to the ambulance for transport to the emergency room was time-consuming, and undoubtedly distressing to the injured person, and should be avoided where possible particularly when planning new facilities. It was also believed that landing sites should be so located to limit the trip by wheeled litter to not more than 100 feet to the hospital entrance.

Recommendations for a heliport together with standard markings are illustrated in Figure 63. These standard designs meet the requirements of the Pennsylvania Aeronautics Commission and should be followed by agencies constructing a heliport.

MINIMUM REQUIREMENTS FOR HELIPORTS IN THE COMMONWEALTH OF PENNA.

The following requirements are set up to provide a landing area which facilitates the expeditious loading and unloading of helicopters and the efficient coordination of ground and helicopter transportation.

1. Minimum size of landing area shall be 200 feet square or a circle with a diameter of 200 feet.
2. The landing pad shall be of a minimum size of 60 feet square.
3. Approaches shall be clear and be 500 feet in length and 200 feet in width.
4. The site should be approachable from at least two sides, and provide sufficient clearance as to allow take-offs from the outer limits of the touch down pad of 8:1 ratio.
5. A site located adjacent to water shall have a boat, such as a row boat, tied at the landing pad to aid rescue operations.

6. A wind direction indicator shall be provided. In the case of night operation, the navigation facility shall be lighted. Shown below are the markers that that are to be used to distinguish a heliport from an airport.

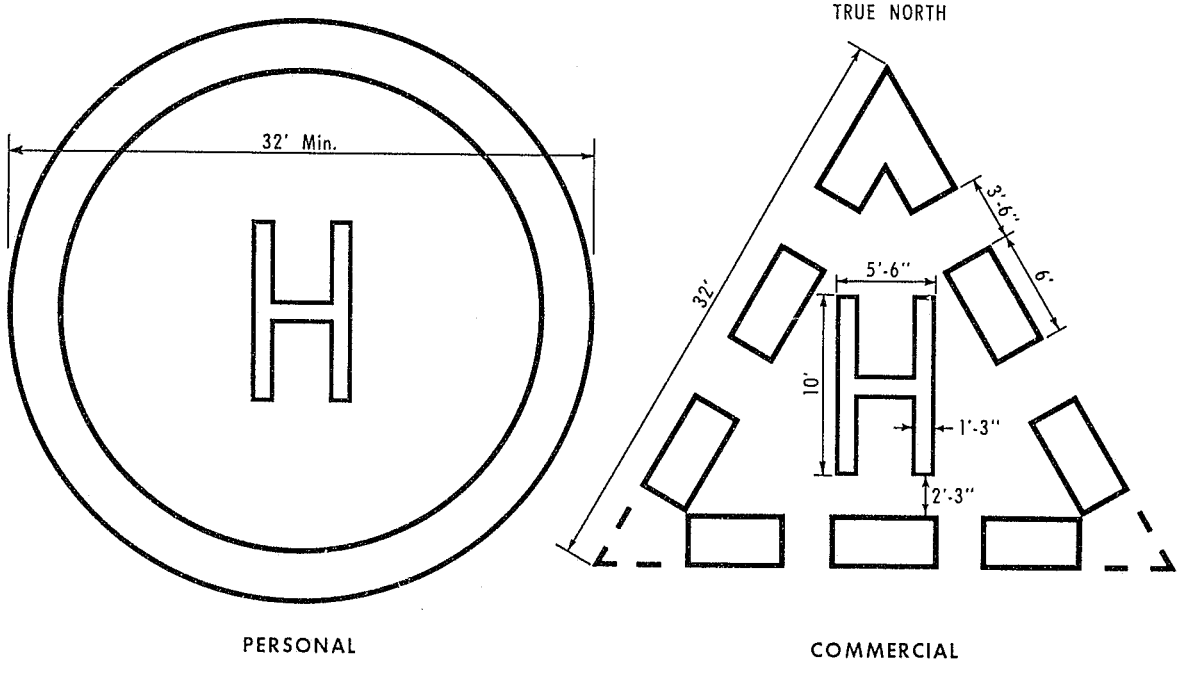


FIGURE 63
HELIPORT DAY MARKERS

COMMUNICATIONS

From the instant of collision, the communications process must involve detection and reporting of the accident, dispatching emergency vehicles to the scene and, in case of injury, notification of hospitals. This procedure requires a responsive communication net which must include many separate agencies.

Prior knowledge of the multiplicity of local communications systems which existed throughout the study area in the planning stages of this study lead to the conclusion that the State Police radio net was the only available system covering the four county area that could be utilized without large expenditures for new communications. Studies completed later confirmed the fact that an array of communication capability existed including law enforcement, emergency radio, citizens band, Bell Telephone, Philadelphia Municipal Telephone Short Wave (PAX), commercial radio, Blue Cross Teletype, Civil Defense and others. Each system undoubtedly performed a vital function for the agency it served, however, it was beyond the scope and resources of this project to link or recommend linkage of any individual systems into one common net for the purposes of this project. To completely superimpose a new communications system over the area for this project was considered impractical and a waste of funds. Therefore, the State Police radio was used as described previously and illustrated in Figure 10.

Communications difficulties were encountered the first seven weeks of the study within the State Police net because the contractor was unable to furnish the proper transceiver for the helicopter. A State Police portable unit was used but its low power and antenna configuration were inadequate for satisfactory operation. Installation of the fixed transceiver, however did provide adequate transmission and reception. The back-up helicopter was equipped with an antenna, cables, mounting rack, switches, etc. which enabled quick transfer of the unit to the back-up helicopter when necessary.

The contractor recommended initially, and consideration was given to the installation of VHF units in each participating hospital however, this was not done. With the exception of the first several airlifts arriving at the hospitals sooner than anticipated, notification of the hospital by phone of a pending arrival presented little problem and the helicopter was met promptly after landing, by hospital personnel.

While improvements could have undoubtedly been made in the existing communications systems to increase the helicopter ambulance efficiency, the major communications problem encountered was the lack of notification of the helicopter ambulance of an accident. In the majority of instances, it was a personal decision not to request the helicopter rather than a communications hardware deficiency. This fact was substantiated during the two week period of operations at West Goshen Township.

There was concern throughout the study that the helicopter was not being used sufficiently for ambulance purposes. It was believed that usage could be increased if other emergency radio nets could be monitored so that the helicopter could be dispatched on the basis of information overheard even though specific requests for helicopter service had not been received. It was further believed that a control center functioning with minimum equipment - radio receiver monitors and a direct phone line to Exton substation could be evaluated for its ability to discern information received and dispatch the helicopter to those emergencies requiring ambulance services. Evaluations could also be made in terms of accident coverage, data logs, and personnel requirements. Receivers for monitoring the county radio nets of Chester, Delaware, and Montgomery

Counties were loaned to the project for this purpose. The Chester County monitor was used at the Exton dispatch desk for both emergency medical services and regular police purposes. Even though it was limited to Chester County, this monitor enabled the helicopter ambulance to respond to many accidents on the basis of intercepted messages.

One of the study tasks was to review the existing communication systems, develop the functional requirements for a system that would optimize a helicopter ambulance operation, and identify modifications or additions to the present communications that would be required to implement it. Preliminary efforts, however, indicated that such a task was beyond the scope of this study and other than compile lists of existing radio nets no other work was completed on this task.

Records at Exton substation showed that two-thirds of all requests for medical assistance were sent by state or local police; one-third came from private citizens. Thirty-nine percent (39%) of the requests were received by radio, 54% by phone. State Police contacting Exton used the phone in preference to radio 25% of the time.

No matter how effective the ambulance capability may be in getting aid to the injured quickly, it is evident that the time lapse between the instant of collision and discovery and notification of ambulance authorities is a critical link in the total response time so far as the victim's condition is concerned.

Studies[1] are underway to evaluate means of locating and communicating with disabled vehicles. Some of the methods being studied undoubtedly would apply to detecting accidents, particularly the single vehicle type accident which occurs at night beyond the view of others. Some methods of detection being studied include specialized patrols and signalizing devices utilizing pneumatic, visual, optical, accoustical and electromagnetic principles.

The Department of Highways Indepth Accident Investigation Teams record the time between the accident occurrence and the time the police first received the call which is some measure of detection time. In 34 accidents occurring throughout the state which were studied by these teams, the average detection time was 10.8 minutes, although the range varied from 0 to 40 minutes. Twenty-five percent (25%) of the accidents were not reported for 15 or more minutes after occurrence. For others there were periods in which long time elapses were recorded. Unfortunately, data surrounding these accidents was not available and it is not known in any of these instances if an ambulance had been called prior to police notification. It is believed that improved communications development in this area could have a significant effect in lowering overall response time in an emergency medical system.

Another current problem involving communications is that of too many ambulance companies rushing to the scene of the same accident. It is the practice of many companies to monitor emergency radio transmissions and to go to an accident without being requested. The helicopter crew was compelled to follow this practice on several occassions. While this may work for the benefit of injured persons in some instances, it has resulted in "jurisdictional" disputes over "who gets the victim." It is a needless waste of manpower and equipment. It is believed that a central dispatch agency together with definition of service areas is necessary to avoid duplication of services. Planning an emergency medical services function which involves both helicopters and conventional ambulances should give communications a high priority in the development of an effective program.

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[1] See references, page 109.

THE POLICE FUNCTION AND OTHER ALTERNATE USES OF HELICOPTER

Perhaps the principle disadvantage of using a helicopter for ambulance purposes is its operational cost compared with standard surface ambulance vehicles. Therefore, unless it is used frequently, its cost per flight would probably be considered excessively high for emergency transportation in normal day to day conditions.

It was anticipated that alternate usage would be essential for economic purposes although it was recognized that the very nature of the ambulance function requires it to be available quickly when a medical emergency arises. Therefore, one of the goals of the study was to determine if it is practical for a helicopter ambulance to function for both medical emergencies and other scheduled and non-scheduled uses without decreasing its ability to respond promptly to the medical emergency when needed.

Police Function

The normal police function which includes traffic surveillance, patrol, and enforcement is closely related to traffic safety and accident prevention. Initially, in the study, regular patrols were flown during morning and afternoon peak traffic periods, although other periods of the day were also used. Specific patrol routes were determined by the trooper flying patrol who generally selected heavy traffic corridors where records indicated traffic incidences were the most likely to occur. Although numerous minor accidents were observed prior to the time ground patrols had been notified or had reached the scene, there were no instances where the helicopter crew observed a serious accident which warranted their assistance prior to arrival of ground police.

However, patrols did provide a valuable service such as spotting disabled vehicles and dispatching ground assistance. The P.A. system was frequently used to communicate with the stranded motorist which eliminated the necessity of landing. In 55% of the instances the motorist did require assistance.

There was no data collected and therefore no comparison made between helicopter and ground patrol of the time lapse from "breakdown" to "discovery" and subsequent arrival of aid although the fact that the helicopter did observe disabled vehicles which needed assistance prior to the ground patrol suggests the increased level of service that would be possible for the stranded motorist particularly on a limited-access highway. In addition, there was no way of determining the reductions in accident potential as a result of more rapid servicing of disabled vehicles.

Similarly, there was no measure to determine the effect the frequent appearance of the helicopter patrols may have had in discouraging either traffic or criminal offences within the area, although it is common knowledge that conventional police vehicles significantly affect driving habits while the patrol is within vision of the driver.

As a police vehicle, the helicopter was dispatched to 55 criminal incidents, 24 civil searches, and 30 miscellaneous police cases. It completed 244 patrols (39% of the total) in which no incidences, criminal or traffic service, were recorded.

It was mentioned previously that 17 troopers were initially selected for the program at Troop K Headquarters. Although 14 troopers participated during the 3 ½ months period at that location, two troopers flew in 39 of the 85 completed missions.

At the Exton Substation four troopers were selected to participate in the project on an expressed interest and completely voluntary basis. The helicopter was made available for use on the police function when it was not being utilized in its primary mission as an ambulance. In addition, the aircraft was identified as a police vehicle by colors and lettering, which were visible at a distance (1200'); it was also identified as an ambulance (Red Cross) and lettering which were visible at close range (300').

A state police radio transceiver was installed replacing a portable unit which had limited range. Lines of authority were clearly established between departments in order to reduce confusion in issuance of operating orders.

The relocation to Exton and patrol utilization of the craft began to produce significant results. It soon became evident that the helicopter easily fit into the operational pattern of a State Police installation without any major changes or adjustments in station procedures. The participating State Policemen, who had been selected on a voluntary basis, performed their duties enthusiastically. Other station personnel provided complete cooperation as they accepted the craft as another police tool. A Departmental directive was sent to the commanders of State Police installations adjoining the Exton area of operation advising them of the availability of the helicopter for emergency evacuation of accident victims. The response helped to increase the number of emergency airlifts. Departmental procedures were established to perform evaluation tests in the police traffic patrol function. This was done with the intention of determining the influence of a helicopter line patrol on the ratio of traffic violations and traffic accidents in a given patrol zone. Unfortunately, this traffic related test was not performed, since it was emphasized that the aircraft would be utilized primarily as an ambulance vehicle and any other use must remain secondary in nature.

From the police standpoint, the use of helicopters in the police function was a qualified success at Exton. This opinion is not based on mere conjecture but on documented results in matters requiring police attention. As a patrol vehicle, it excelled for obvious reasons. With rare exceptions, it could become airborne or land in numerous locations. It provided the trooper with the advantageous position of being able to view wide stretches of highways at a glance; to see people, places, or objects observed from the ground patrolmen's view. It had the ability to cover police patrol zones in a faster and more efficient manner. The lofty position was a deciding factor in incidents which required support and coordination of ground units and directly contributed to criminal apprehensions, locating persons, assisting disabled motorists, and relieving traffic congestion. While these statements are broad in nature, but nevertheless true, it is felt that citing some specific examples will help to illustrate and establish credibility of that has been stated. Extracts from Exton Substation's records illustrate some of the successful missions performed.

1. March 6, 1968 - An aerial search by helicopter resulted in the sighting of a vehicle used in committing an armed robbery. This sighting provided a considerable saving in man hours and man days of work.
2. April 29, 1968 - The Atglen Bank of Chester County was held up by three men. Later that same day, all three individuals were apprehended through the searching activity of the helicopter which had confined the criminals to a limited hiding area, prevented their escape, and placed them in a vulnerable position for ground forces.
3. June 8, 1968 - The helicopter was pressed into service after it was learned that three people were killed along the Penn Central railroad tracks in New Jersey, as they attempted to view the Robert F. Kennedy funeral cortege. The helicopter flew line coverage over the track prior to passage of the train through Pennsylvania.

4. July 7, 1968 - State Police at Troop "L" Reading, Berks County, requested service of the helicopter in transporting U.S. Army Ordinance personnel from Indiantown Gap Military Reservation, in Lebanon County, to an Apartment Housing Unit near the Reading Barracks. The ordinance men were relayed to the scene where a successful bomb disarmament was accomplished.
5. July 12, 1968 - Three prisoners escaped from the Montgomery County Prison and a request was made by the State Police at Troop "K", Schwenksville, to assist in the search for the escapees. Within one-half hour of departure from the base at Exton, the helicopter crew sighted the escapees along a railraod track and directed ground units in their apprehension.
6. September 29, 1968 - The helicopter was used in the search for a missing twenty-one month old boy. The helicopter indirectly created a unique set of circumstances which directly resulted in finding the child. As the helicopter circled in its search activity, it aroused the curiosity of a seven year old boy. The boy climbed a farm corncrib to view the activity and sighted the crying child in an alfalfa field.
7. October 17, 1968 - The helicopter was instrumental in apprehending four persons in a stolen vehicle after a request was made by State Police, Troop "L", Reading. This apprehension led to the elimination of a car theft ring in a remote area of Berks County.

These incidents portray the more vivid illustrations that tend to glamorize the activities of the helicopter as a patrol vehicle. It is important to remember that a great deal of common everyday police work is not glamorous in nature, yet it is constantly present and requires some police action. When a service is rendered to the general public, and more appropriately to the specific individual requesting and needing it, the type of service takes on a different dimension. Letters of appreciation attest to the person's satisfaction or, conversely derogatory letters proclaim their dissatisfaction. In regard to the services performed by the helicopter crew, it can be said that only complimentary letters were received. Public opinion was definately in favor of police helicopter since not a single adverse comment was received.

Public awareness of the helicopter's activities were more evident in the Exton area for three reasons: (1) The aircraft was identified as a police vehicle, (2) Helicopter sightings were not as common to this area when compared to the heavy Philadelphia air traffic, (3) A greater amount of planned publicity was provided through the news media, along with the unplanned publicity that followed in the wake of some services performed by the aircraft.

Demonstrations

The helicopter participated in 53 demonstrations at hospitals, schools, ambulance club meetings and local governments within the study area. They included explanation of the project, description of the helicopter's capabilities, and usually an airlift of a volunteer "accident victim." While accurate counts of persons attending these demonstrations were not made, the estimated attendance averaged 50 to 75 persons although one statewide meeting attracted 1,200 persons. In most instances local press attended and gave coverage in local papers, radio and T.V. It was believed that these demonstrations were highly beneficial because they acquainted persons directly concerned with safety not only with this project but with the overall safety program as well. In addition, they served as a reminder to local police who investigate the majority of accidents, that the helicopter ambulance was available.

Accident Simulations

The helicopter crew participated in 15 accident simulations some which were carried out in cooperation with, and for the benefit of, hospitals and ambulance clubs.

It was the initial intent to design accident situations which would simulate progressively more difficult conditions encountered by the helicopter crew in terms of injury severity and physical obstructions. It was also a goal of the task to compare the operating characteristics of a piston engine to those of a turbine engine craft in servicing accidents.

However, because of difficulties in scheduling the simulations in which all agencies involved would be available, only two of the simulated airlifts were completed in the manner originally intended. These were conducted during off-peak traffic periods and on routes carrying low traffic volumes, and extreme safety measures were taken to avoid creating accidents as a result of the tests.

Engineering Surveys

During the study year, the Department of Highways used the helicopter nine times for engineering surveys within the study area. At these times the trooper remained at the substation until the mission was completed. In event of a request for ambulance service the copter would return to the substation, pick up the trooper, and proceed to the accident scene. Separate cost records were kept for this work so the project could be reimbursed for costs from proper funding sources.

The helicopter was used 186 times for other than emergency medical purposes. During these periods, radio contact was maintained with Exton substation for accident emergency requests.

LEGAL ASPECTS

Because of the unique aspects of using a helicopter in regular ambulance functions, it was believed essential to explore the legality problems connected with operating a helicopter as an ambulance within the Commonwealth of Pennsylvania.

The opinion of the Attorney General's office was sought with reference to applicable statutes, court decisions which establish precedents, and liability responsibilities of the ambulance operating agency, pilot and medical attendants. Specific questions referred to in Item IV of the opinion request were:

What are the legal responsibilities when:

a. a helicopter crash injures or kills an accident victim being transported?
b. a helicopter crash injures or kills persons on ground; also property damages as result of crash?
c. a rotor blade injures or kills persons (medical attendants or by-standers) while helicopter was servicing an emergency?
d. a suit is filed by person claiming emotional or physical stress or proeprty damage caused by noise, vibration, dust, etc., during landing and take-off?

The following opinion, which is quoted in its entirety, was prepared by the Assistant Attorney General, Joseph L. Cohen, who is assigned to the Pennsylvania Department of Health:

"Under the provisions of the Act of May 25, 1933, P.L. 1001, as amended, 2 P.S., 1460, et seq., known as "The Aeronautical Code", the rules which govern liability for injury or damage resulting from the operation of aircraft are no different from the rules applicable to torts on land. The Aeronatuical Code, supra, Article IV, Sections 403, 406. Inasmuch as helicopters are aircraft, the provisions of The Aeronautical Code, supra, relative to tort liability relate also to the operation of helicopters.

In the use of helicopters as ambulances, reference must be made to the provisions of the Act of September 9, 1965, P.L. 498, as amended, 12 P.S., 1643. This act, commonly referred to as the "Good Samaritan Act", reads as follows:

> "Any fireman, policeman or member of a volunteer ambulance or rescue squad who renders emergency care, first aid or rescue while in the performance of his duties at the scene of an emergency, or moves the person receiving such care, first aid and rescue to a hospital or other place of medical care, shall not be liable to such person for any civil damages as a result of any acts or omissions in rendering the emergency care, first aid or rescue, or moving the person receiving the same to a hospital or other place of medical care, except any acts or omissions intentionally designed to harm or any grossly negligent acts or omissions which result in harm to the person receiving the emergency care, first aid or rescue or being moved to a hospital or other place of medical care but nothing herein shall relieve a driver of an ambulance or other emergency or rescue vehicle from liability arising from operation or use of such vehicle. In order for any fireman, policeman or member of a volunteer ambulance or rescue squad to receive the benefit of the exemption from civil liability provided for in this act, he must first have taken and successfully completed a standard first aid course recognized or

approved by the American Red Cross and further he shall have a valid certification from the American Red Cross that he has successfully completed any necessary training or refresher course, or shall have successfully completed a first aid course having standards at least equal to a first aid course recognized or approved by the American Red Cross." (Emphasis added.)

Under the provisions of this act, the named persons are exempt from liability for harm to the person to whom they are rendering service in an emergency situation for ordinary negligence. This exemption, however, only applies to those persons who have taken the requisite training, as specified in the act. The act does not grant an exemption, however, to the driver of an ambulance or other emergency or rescue vehicle from liability arising out of the operation of such vehicle.

It is clear that the Good Samaritan Act has legal implications with respect to the use of helicopters as ambulances. It should be mentioned, at this point, that there are no relevant legal distinctions, for the purpose of tort liability, between the use of the usual ambulance and use of helicopters as ambulances. This follows from two considerations: (1) the provisions of The Aeronautical Code, supra, and (2) the definition of "vehicle", as that term is defined in the Statutory Construction Act, the Act of May 28, 1937, P.L. 1019, as amended, 46 P.S., 501, et seq. Section 101 of that act defines "vehicle" as "a conveyance in or on which persons or property may be carried." This definition applies to the term "vehicle", therefore, as used in the Good Samaritan Act, supra.

The Good Samaritan Act only exempts the persons named therein from liability for ordinary negligence in the performance of their duties with respect to a person in need of first aid or other emergency care to the extent that the operation of the vehicle is not involved. Thus, liability for injury or damage resulting from the operation of a helicopter does not come within the exemption set forth in the Good Samaritan Act. Thus, under Item III of the outline which you submitted to me relative to the helicopter ambulance study, it can be stated as follows:

1. That insofar as rendering the needed care is concerned, the ambulance crew is only liable - assuming all other provisions of the Good Samaritan Act are met - for intentional acts and omissions designed to do harm, or grossly negligent acts or omissions which result in harm to the person receiving the emergency care;
2. As to helicopter flight operations generally, the pilot is bound to use reasonable care in the operation of the helicopter to protect its passengers;
3. With respect to the issue of private or public ownership for operation of a helicopter ambulance, the following considerations should be kept in mind: if the public body owning or operating the ambulance is the State government or an instrumentality of the State, the State may not be held liable for the acts of any of its agents in operating the helicopter unless the State consents to suit by appropriate legislative enactment. Constitution of Pennsylvania, Art. I, Section 11. At present, the Commonwealth has not consented to be sued in tort. Therefore, it could not be held liable for any negligent act of its employers in connection with the operation of an ambulance helicopter owned or operated by it.

In the case of private persons operating a helicopter ambulance service, not only may the employee be liable in tort, under certain circumstances, but the employer also may be liable for the negligence of the employee if the negligence occurred while the employee was engaged in the business of the employer.

Here, again, the Good Samaritan Act may possibly mitigate the ordinary rules of negligence in an appropriate case.

The specific questions referred to in Item IV of the outline may be answered as follows:

> The owner or pilot of a helicopter would be legally liable for injuries to an accident victim being transported therein as the result of a helicopter crash only in the event that the pilot did not exercise reasonable care under the circumstances. Rennekemp v. Blair, 375 Pa. 620, 101 A2d 669 (1954).
>
> With regard to injuries to persons or damage to property on the ground, the ordinary rules of tort law apply. Thus, the owner or operator of the aircraft, or helicopter, would be liable for failure to use due care under the circumstances if that failure was the proximate cause of the injury or damage.
>
> Liability for injury or death caused by the rotor blades of a helicopter, again, could only be predicted upon negligence. In such a circumstance, there may be a defense of contributory negligence - i.e., that the person injured or killed would not have been injured or killed if he had used due care for his own safety. In that event, there would be no liability for such injury or death.
>
> Whether a person owning or operating a helicopter, or other aircraft, is legally liable for the emotional or physical stress or property damage caused by noise, vibration, dust, etc., during landing and takeoff, is a question which cannot be answered with definiteness. There are many considerations involved, one of which is whether there has been an intentional or negligent invasion of the personal or property rights of the person alleging the injury or damage.
>
> However, in the case of political subdivisions of the State, they are only immune from tort liability in the performance of a governmental function. If a political subdivision is carrying out a proprietary function, it is not immune from tort liability.
>
> While the distinction between what is governmental and what is proprietary is ofttimes obscure and hazy, the operation of a helicopter ambulance service by a political subdivision would, in all probability, be held to be a non-governmental, or proprietary function. Hence, in such a situation, the political subdivision would not be immune from tort liability.
>
> Regardless of whether a governmental agency would be immune from tort liability for operating a helicopter ambulance service, the actual personnel involved in the rendition of its service would not be immune from tort liability. Their rights and obligations would be governed by the provisions of the Good Samaritan Act insofar as it applied to them.

Much has been written upon the legal aspects of aeronautics. There are good discussions on many of these problems in the following legal texts: (1) RHINE, AVIATION ACCIDENT LAW (1947), and (2) BILLYOU AIR LAW (1964) 2d Ed."

COST ANALYSIS

Even though it is acknowledged that the helicopter could serve a useful purpose as an ambulance in bringing medical aid to the accident victim and/or taking the accident victim to the hospital, there still remains the question of cost. Can we afford it? An answer to this question necessitates placing a dollar value on life and bodily injury; the former is most difficult even on an analytic basis which neglects completely, human emotions, misery and distress. However, the National Safety Council points out that our society has assigned dollar values on human life in terms of life insurance policies, compensation laws, damage awards by courts, etc., so that objections to a cost analysis procedure should not become obstacles to completing analyses.

Cost of Motor Vehicle Accidents

The National Safety Council, accordingly, has computed a schedule of costs for traffic accidents based upon wage loss, medical expense, insurance administrative costs, and property damage. These average costs per case in 1967 were:

Death	$37,000
Non-Fatal Injury	$ 2,200
Property Damage	$ 360

The death cost is broken down into:

Wage Loss	88%
Insurance Costs	9%
Property Damage	2%
Medical Expense	1%

The largest value-wage loss-is based upon the current value of future earnings (less personal consumption). It varies widely with age group, sex, and color.

Based upon the average proportion of occurrences between fatal, injury and property damage accidents the National Safety Council has computed a rounded value of $200,000 cost per death for all accidents. This average varies widely, however, from $125,000 in rural areas to $365,000 in urban areas because of the differences in ratios of non-fatal injuries and property damage accidents per death.

Table 14 shows the accident ratios and costs for each of the four counties in the study area based upon National Safety Council 1967 Cost Schedule.[1]

It should be noted that there is a substantial difference in costs for death between the rural counties (Bucks and Chester) and the more urban counties (Delaware and Montgomery) which confirms the national averages used by the National Safety Council. The total accident costs of $73 million dollars was computed taking into account the variation in costs between counties.

[1] Salaries for medics were not included in these costs in order to keep them on a comparable basis with existing ambulance services which are most often manned by non-paid volunteers. Present trends in modern emergency medical services, however, indicate greater use of highly-trained, full-time, salaried paramedics. Assuming an annual salary of $10,000 where 50% of the time would be directly chargeable to an airlift service, the cost per airlift would be increased $3.00 to $4.00 in the 10 to 15 airlift per day range.

TABLE 14
ACCIDENT OCCURRENCE AND COSTS
October 1, 1967 to September 30, 1968

	Number of Fatal Accidents	Number of Deaths	Fatal/Injury/ Property Damage Ratio	Total Costs per Death	Total Annual Costs (millions)
Bucks	92	101	1:29:58	$ 158,000	$ 16.05
Chester	79	86	1:27:53	152,000	13.12
Delaware	62	67	1:58:125	280,000	18.69
Montgomery	73	85	1:62:148	295,000	25.05
			Total Costs		$ 72.91
N.S.C.	-- --		1:35:240	$ 200,000	--

Helicopter Ambulance Service Costs

The total cost for the pilot study was $161,250. Separate cost records were not maintained for medical and police functions since many were interrelated and separate identification would have been difficult. Therefore, except for engineering surveys, it was not possible to compute costs for each function.

However, with the helicopter costs known, together with the operational experience gained from traffic accident services, it is possible to estimate the costs which would be incurred by, as well as the benefits of, a helicopter ambulance service at various usage rates. The analysis is considered on the basis of cost to the individual user as well as cost-effectiveness of the helicopter service.

Helicopter Ambulance Costs

Based upon the contract price for the helicopter leased during the study year, the following costs for ambulance service were incurred:

Standby for Immediate Use	$17.00/hour
Actual Flight	35.00/hour
Total Cost When Flying	$52.00/hour

These costs, which include the pilot but not the trooper, were for a 14-hour day, 7 days per week. Thus, typical daily costs with 3 hours flight time would be $238.00 standby plus $105.00 flight time, totaling $343.00. Records indicated that the overall average time for servicing each accident was 19.5 minutes, although the actual flight time averaged only 13.3 minutes. In many instances, however, the engine continued to run during down time at the accident scene and this is properly chargeable as flight time so a rounded average of 20 minutes per airlift is reasonable for estimating purposes from alert delivery of victim to hospital. Ten minutes is estimated to allow the helicopter to return to its base so the total time to service one accident would require an

average of 30 minutes of flight time. On this basis the 49 airlifts completed during this study incurred a direct cost of $26.00 each or a total of $1,270.00. This, of course, does not consider the large standby charge which accummulated while waiting to service accidents.

Figure 64 illustrates the variation of costs per airlift based upon a 24 hour/day service period where the daily standby charges totaled $410.00. This curve indicates the rapid decrease in costs/airlift as the number of airlifts increase per day because of the fixed standby charge whether the helicopter is used or not. One airlift per day would cost $428.00, while 5/day would cost $100.00 per airlift. The rate of decrease reduces rapidly above 5 airlifts per day as illustrated by the changing slope of the curve. An increase in the number of airlifts from 10 to 15 per day reduces the costs from $59.00 to $45.00 per airlift. This is an increase of usage of 50% but a decrease in costs of 25%. From 15 to 30 calls per day would represent an increase in usage of 100% but further decrease in costs of only 25%. At 30 calls per day the charge per call would be $31.00.

It would appear that an established helicopter ambulance service should include a service area sufficiently large that would produce on the average of 10 to 15 airlifts per day to keep the costs per trip ($45 to $59) within acceptable levels. Even this range is approximately two times the current rates charged by many existing ambulance services.[1]

Cost Effectiveness

It is shown in Figure 64 that the average cost per airlift is $59.00 when 10 airlifts are completed per day. On a monthly basis this would average 300 airlifts (150 flight hours) at a cost of $17,700. National Safety Council places a value of $37,000.00 as the cost of each person killed, and $2,200 for each person injured.

Therefore prevention of a death would result in a net saving to society of:

$ 37,000 - cost per life
2,200 - cost per injury
$ 34,800 - net saving

If one life were saved per month as a result of helicopter ambulance service (1 in 300 airlifts) the benefit-cost ratio would be:

$$\frac{\text{benefit}}{\text{cost}} = \frac{34,800}{17,700} = 1.97$$

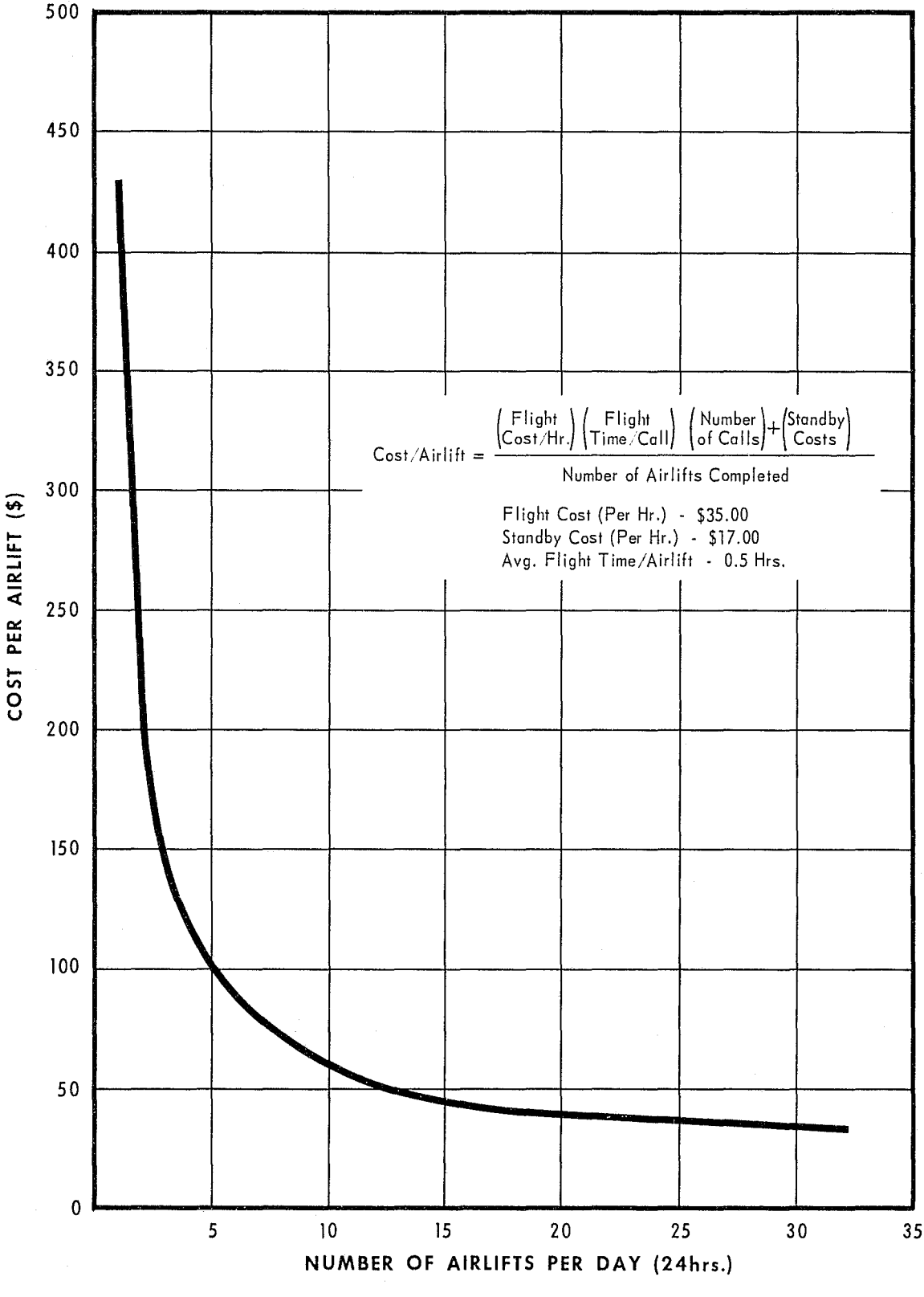
Therefore, the helicopter ambulance would be cost effective if one or more lives were saved for each 600 airlifts completed.[2]

A service charge of $59.00 is not believed to be unreasonable if a better service is created particularly if it provides a potential to prevent deaths by a means not possible by conventional ambulance service. Obvisouly the helicopter ambulance must be used frequently because of high overhead charges. Is the usage rate of 10 airlifts per 24-hour day too high for practical day-to-day service operations? The answer is not known. Most ambulance companies in the study area average 0.3 to 6 trips per day (all trips - not just emergencies) although the areas they service are for smaller than the area a helicopter would cover. The Freedom House Ambulance in Pittsburgh, while covering only a portion of the City, averages 20 calls per day.

[2] California uses a direct cost of $6,800.00 for each life saved. On this basis, the saving of one life in every 100 airlifts completed would make the service cost-effective, provided the rate of 10 airlifts per day were maintained.

FIGURE 64

COST OF HELICOPTER AMBULANCE SERVICE



In the 4-County area during the study year, 5,500 persons injured in traffic crashes required ambulance service while at the same time 339 persons were fatally-injured. This is an average of 15 injured persons per day in a 900 square mile area. One helicopter could not adequately service all of these accidents because of sequence of occurrence, darkness, distance, weather, obstruction to landing, etc. It is apparent that even this large highly urbanized area does not produce a sufficient number of highway casualties to maintain a 10 airlift per day average per helicopter. Therefore, it would be necessary for the helicopter ambulance to service other medical emergencies if it is to maintain that daily usage rate.

Using National Safety Council values, 6 lives saved per year, at a usage rate of 10 airlifts per day would make a helicopter ambulance service cost-effective. This does not include any benefits that may accrue from reduced convalescense time for injury accidents or the reduction in human suffering and misery which would be a result of prompt service.

In the 49 airlifts completed, conservative medical opinion believes that two lives were "probably" saved as a result of quick transfer of the victim to the hospital. Thus while the study itself was not cost-effective, and was not expected to be, it clearly demonstrated the rate of one or more lives saved per 600 airlifts can be achieved in practice, which means the extra costs of helicopter transportation service can be self-supporting.

The problem in paying these extra costs, however, lie in the fact that the $34,800 saved by the prevention of a traffic fatality is not a sum paid directly to anyone by anyone. The benefit is derived, of course, by the victim and his family (and his employer) who are spared the direct financial loss from medical expenses, future earnings, etc. Therefore, National Safety Council regards fatal accident losses as losses to society as a whole. Consequently, it would be reasonable to expect society to pay for the means of reducing those losses since it would be the ultimate beneficiary. Thus, one approach to reduce cost/trip to helicopter ambulance users would be for society, through some acceptable method of financing, to provide helicopter ambulances as a public service on a standby basis. The victim using the services would pay only the direct charges. If this were done the cost per trip for the user (at 10 per day rate) would be reduced from $59.00 to $17.00. Another approach would be use of the helicopter for other than emergency medical purposes as discussed in other sections of this report.

Finally, the usage rate of 10 trips per day (or 300 per month) would cost $17,700 per month. There may be other areas in the chain of events cited previously, between accident occurrence and final treatment and recovery of the injured person, where expenditures at this level might produce greater benefits in terms of lives saved than would helicopter transport. For example, up-grading of substandard ambulance services by providing highly trained medics, reorganization and coordination of emergency services within a given area to eliminate duplication or by improving hospital facilities and staffing.

The contractor presented an approach to cost analysis for helicopter ambulance service which is included in the Appendix.

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11. "Community-Wide Emergency Medical Services" recommendations by the Committee on Acute Medicine of the American Society of Anesthesiologists published by Journal of the American Medical Association, May 13, 1968, Vol. 204, No. 7.
12. Individual conferences with several physicians regarding specific aspects of helicopter use in emergency medical services:

    Dr. Frank H. Ridgley
    Chester County Hospital
    West Chester, Pennsylvania

    Dr. Robert E. Brant
    Phoenixville Hospital
    Phoenixville, Pennsylvania

    Dr. Angelo P. Angelides
    Lankenau Hospital
    Philadelphia, Pennsylvania

    Drs. Peter Safar, Donald Benson, and David J. Torpey
    University of Pittsburgh
    School of Medicine, Pittsburgh, Pennsylvania

APPENDIX

CONTENTS IN APPENDIX

CONTENTS IN APPENDIX (CONTINUED)

AS-4 (REV 8-68)

HELICOPTER AMBULANCE STUDY

DAILY ACTIVITY SUMMARY

1. DATE

2. STATION

3. TROOPER

4. PILOT

HELICOPTER ARRIVAL TIME:

5. TOUR OF DUTY

FROM: TO:

7. PROGRAM HOURS THIS DATE

FLIGHT HOURS

PATROL	EMERGENCY

FLIGHT LOG

	LOCATION	TIME	LOCATION	TIME	LOCATION	TIME	LOCATION	TIME
LIFT OFF								
LANDED AT								
TOTAL TIME								

SIGHTINGS

ACTIVITY	TIME	LOCATION	ACTIVITY	TIME	LOCATION

ASSISTANCE RENDERED

INCIDENT	TIME	LOCATION	INCIDENT	TIME	LOCATION
INCIDENT	TIME	LOCATION	INCIDENT	TIME	LOCATION
INCIDENT	TIME	LOCATION	INCIDENT	TIME	LOCATION

11. REMARKS

12. AREA PATROLLED

☐ OVER (CHECK IF APPLICABLE)

SPTF-2

PENNSYLVANIA STATE POLICE

HELICOPTER AMBULANCE STUDY

1. DATE | 2. NO.

3. SUBMITTED BY

NOTIFICATION

4. TIME OF REQUEST | 5. SOURCE | 6. TYPE OF EMERGENCY ☐ ACCIDENT ☐ OTHER (SPECI

7. LOCATION OF ACCIDENT - EMERGENCY

8. LOCATION WHEN NOTIFIED | 11. CREW MEMBERS (LIST NAMES)

9. TIME DEPARTED TO SCENE | 10. TIME ARRIVED AT SCENE

12. TRAFFIC CONDITIONS AS VIEWED BY AIR

SITUATION

13. AMBULANCE PRESENT ☐ YES ☐ NO | NAME OF AMBULANCE | 14. WAS AMBULANCE CALLED? ☐ YES ☐ NO | 15. TIME OF ARRIVAL

16. POLICE PRESENT ☐ YES ☐ NO | NAME OF OFFICER | DEPARTMENT

17. TRAFFIC CONDITIONS AT SCENE

18. WAS DOCTOR PRESENT ☐ YES ☐ NO | NAME OF DOCTOR | 19. WAS AIRLIFT REQUIRED? ☐ YES ☐ NO IF YES, INDICATE TIME REQUIRED

20. ACCIDENT INVESTIGATED BY (NAME) | DEPARTMENT | LOCATION

EVACUATION

21. REQUIRED TRANSPORTATION TO A HOSPITAL (INDICATE NO. OF PEOPLE)

22. NO. AIRLIFTED | 23. NO. OF FLIGHTS REQUIRED | 24. NO. USED AMBULANCE | 25. NO. USED OTHER MEANS

26. DID ANY ONE REFUSE TO USE HELICOPTER ☐ YES ☐ N IF YES, EXPLAIN BELOW

27. HOSPITAL NOTIFIED TO MEET AIRCRAFT ☐ YES ☐ NO

28. INFORMED OF TYPE OF INJURIES ☐ YES ☐ NO

29. PATIENTS AIRLIFTED

NAME OF PATIENT	DESCRIPTION OF INJURIES	CONSCIOUS YES	CONSCIOUS NO	FIRST AID GIVE YES	FIRST AID GIVE NO

30. HOSPITAL TAKEN TO (GIVE NAME)

31. WAS ANY DELAY ENCOUNTERED IN TRANSFERRING PATIENT FROM AIRCRAFT TO HOSPITAL ☐ NO ☐ YES (EXPLAIN BELOW)

32. NARRATIVE - DETAILS (USE ADDITIONAL PAGES FOR CONTINUATION)

-2 (11-67)

HELICOPTER AMBULANCE STUDY

A JOINT RESEARCH PROJECT - NATIONAL HIGHWAY SAFETY BUREAU

COMMONWEALTH OF PENNSYLVANIA

(INFORMATION REQUESTED FOR RESEARCH USE ONLY)

RT I

ADMISSION DATA

NAME OF HOSPITAL	2. NAME OF PHYSICAN	3. ADMITTED	
		DATE	TIME

PATIENT'S CONDITION

DESCRIPTION OF INJURIES

. EMERGENCY TREATMENT GIVEN

. DISPOSITION OF CASE

. IF HOSPITAL PHYSICIAN WAS AIRLIFTED TO ACCIDENT GIVE			9. MEDICAL SERVICES WERE PERFORMED AT ACCIDENT SCENE BY:
IME NOTIFIED	TIME DEPARTED	TIME ARRIVED	☐ PHYSICIAN ☐ STATE POLICE ☐ OTHERS

. DESCRIBE MEDICAL TREATMENT OR FIRST AID GIVEN

PART II ASSESSMENT OF HELICOPTER AMBULANCE SERVICE

11. DID FLIGHT ADVERSELY AFFECT VICTIM'S CONDITION?

☐ NO ☐ YES (EXPLAIN DETAILS BELOW)

12. WAS LIFE SAVED OR SERIOUS INJURY AVERTED?

☐ YES ☐ NO (EXPLAIN DETAILS BELOW)

13. WILL IT REDUCE RECOVERY PERIOD?

☐ YES ☐ NO

14. APPRAISAL OF FIRST AID PROCEDURES PERFORMED BEFORE ADMISSION

15. WHAT WAS PATIENT'S REACTION TO BEING AIRLIFTED TO HOSPITAL?

16. REMARKS: RESEARCHERS WELCOME ANY ADDITIONAL COMMENTS OR SUGGESTIONS BY PHYSICIAN WHICH WOULD ENABLE THEM TO BETTER EVALUATE THE USE OF HELICOPTER VERSUS CONVENTIONAL AMBULANCE TRANSPORT.

MAIL COMPLETED FORM TO J. STANLEY SMITH M.D., ROOM 907, HEALTH & WELFARE BLDG., HARRISBURG

HAS-4(10-68)

HELICOPTER AMBULANCE STUDY
Commonwealth of Pa. – National Highway Safety Bureal

APPRAISAL BY
ACCIDENT VICTIMS AIRLIFTED

1. NAME	2. HOSPITAL	3. DATE ADMITTED REPORT NO.
4. NATURE OF INJURIES		5. SERVERITY LIFE THREATENING ☐ OTHER ☐

6. FIRST AID ADMINISTERED NONE ☐ AT ACCIDENT SCENE ☐ DURING FLIGHT ☐
DESCRIBE

7. WAS LITTER USED YES ☐ NO ☐

8. WERE YOU CONSCIOUS DURING FLIGHT YES ☐ NO ☐

9. HAD YOU EVER FLOWN BEFORE NO ☐ OCCASIONALY ☐ FREQUENTLY ☐

10. WHAT WAS YOUR REACTION TO BEING AIRLIFTED

11. WOULD YOU HAVE PREFERRED BEING TRANSPORTED TO HOSPITAL BY GROUND AMBULANCE YES ☐ NO ☐
WHY

12. WHAT WAS YOUR MOST SIGNIFICANT IMPRESSION OF THE HELICOPTER AMBULANCE TRIP

13. DO YOU FEEL THAT REDUCED TRAVEL TIME TO HOSPITAL WAS BENEFICIAL TO YOU

DEFINITELY ☐ SOMEWHAT ☐ NO ☐

14. DO YOU BELIEVE HELICOPTER AMBULANCES CAN OFFER BENEFITS IN HIGHWAY TRAFFIC ACCIDENTS OR OTHER EMERGENCIES IN FUTURE YEARS.

YES ☐ NO ☐

IF YES, IN WHAT WAY

15. HAVE YOU EVER REQUIRED AN AMBULANCE BEFORE YES ☐ NO ☐

IF YES, DESCRIBE CIRCUMSTANCES

16. GROUND AMBULANCES COST $15.00 TO $40.00 PER TRIP DEPENDING UPON DISTANCES AND OTHER FACTORS. HOW MUCH ADDITIONAL COSTS WOULD YOU BE WILLING TO PAY (THRU CLUB MEMBERSHIP FEE OR TRIP CHARGE) FOR HELICOPTER TRANSPORT.

NONE ☐ 50% MORE ☐ 100% MORE ☐ 200% MORE ☐

17. ADDITIONAL COMMENTS WHICH WOULD BE HELPFUL TO RESEARCHERS IN EVALUATION OF HELICOPTER AS AN AMBULANCE

18. COMMENTS BY INTERVIEWER

INTERVIEWED BY	DATE

HELICOPTER AMBULANCE STUDY

Pennsylvania Department of Highways

Pennsylvania Department of Health

General Information

DATE _____

Ambulance Company _____

Address _____
Street City County

Telephone No. _____

Where are Ambulances Kept? _____
Street City County

Affiliation with other Agency? _____

Is there someone on duty at the ambulance base at any time or at all times?

(Give Hours) _____

_____

No. of Vehicles _____

No. of Calls (1967) _____ What is your fee? _____

Scheduled _____ _____

Emergency _____ _____

Limits of Response (Street, City, County) _____

_____

_____

_____

Hospitals Used:	No. of Times Used During 1967 EMERGENCY	TRANSFER
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

General Information

No. Miles Logged per Year _____

Operating Costs per Year (Avg.) _____

How are Costs Met? _____

_____

_____

_____

How many trips are generally made per month?

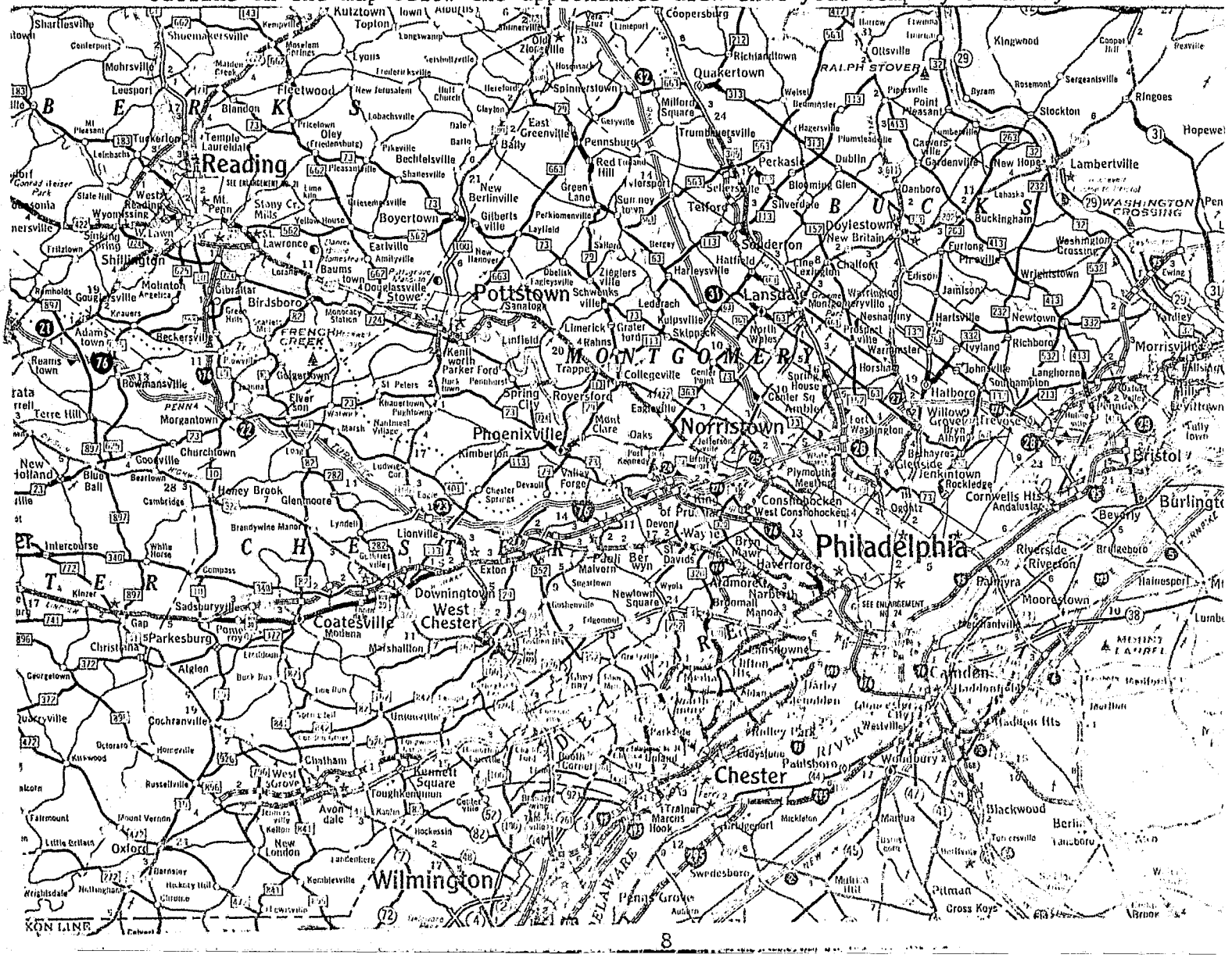
Emergency _____

Transfer _____

What is the average length of trip?_____ Miles

What was the longest trip made during 1968? _____ Miles

Outline on the map below the approximate area that your company normally serves?



General Information

Equipment Survey

A. Vehicles

Type (Year, Model)	Capacity (In Litters)	Available Time (%)
1. _____	_____	_____
2. _____	_____	_____
3. _____	_____	_____
4. _____	_____	_____
5. _____	_____	_____
6. _____	_____	_____

	Vehicle 1	Vehicle 2
A.(1) Month/Year purchased _____	_____	_____
Total Cost _____		
Less trade-in on old ambulance _____	_____	_____
Net cost to your company _____		
Annual Costs		
Insurance _____		
Gas & Oil, Lub, etc. _____		
_ Repairs _____		
Other (License, etc.) _____		
Total Annual Operating Costs	_____	_____
Estimated Annual Depreciation	_____	_____

B. Equipment Carried in Vehicles (by vehcile number)

NAME	TYPE	CAPACITY	COST

C. Any New or Unusual Emergency Equipment? _____

_____

_____

_____

D. Communications:

Do you have Radio communications? Yes _____ No _____

If yes, what frequency & band? _____

Location of central dispatch _____
Street City County

Is there a fixed transceiver at the station? Yes _____ No _____

Are there mobile units on-board the vehicles? Yes _____ No _____

If yes, which vehicles (by number) _____

_____

_____

In your own words, how do you rate your communications? _____

_____

_____

_____

Age of Equipment? _____

_____

Power (in watts)_____

_____

Area serviced by radio band _____

_____

Other agencies using radio band _____

_____

_____

If no radio, describe communications (source of calls, how answered, etc.)

_____

_____

_____

Personnel Survey

Personnel

Number _____

Paid _____ Volunteer _____

Turnover Rate (persons per year %) _____

Training

Type (given by whom, length of course) _____

_____

_____

_____

_____

Number trained per year _____

Cost (for new training per man) _____

Paid by whom? _____

Is there any recurring training? Yes _____ No _____

Cost (for all recurring training per man) _____

Paid by whom? _____

No. Retrained per year _____

How often does a person receive retraining? _____

On-Call Procedure

Number of persons on duty at any one time _____

Rotation _____

_____

_____

_____

Name of person filling out form

_____

Title

COMMONWEALTH OF PENNSYLVANIA

DEPARTMENT OF HEALTH

THOMAS W. GEORGES, JR., M.D.
SECRETARY OF HEALTH

P. O. BOX 90
HARRISBURG 17120

August 9, 1968

Subject: Helicopter Ambulance Study

Gentlemen:

As you may know the Pennsylvania Department of Highways received a Federal Grant from the National Highway Safety Bureau for the purpose of studying the use of helicopters as ambulance vehicles for traffic accident victims. This study is being conducted for a period of one year in cooperation with the Department of Health, the State Police, the Aeronautics Commission and several area hospitals located in the Philadelphia suburban region. The study area includes Delaware County and parts of Chester, Bucks and Montgomery Counties.

Part of this research includes a survey of existing ambulance services within the study area. The attached questionnaire form illustrates the kind of data which is required for this research.

I would appreciate your help by completing the questionnaire as it applies to your ambulance service and returning it to my office by August 23, 1968, using the self-addressed envelope. If you have any questions concerning it, please call Mr. Louis Soffer of our Philadelphia Office who will be available to assist you as needed in completing this form. His telephone number is 568-4000, Extension 6792.

The information which you provide will be considered confidential and your ambulance company will in no way be identified with specific information furnished. Survey data will be summarized and you will be sent a copy of the completed report for your records.

Sincerely yours,

Henry L. Albert
Director
Division of Environmental Safety

Enclosures

Report # _____

C O N F I D E N T I A L

Helicopter Ambulance Study

Pennsylvania Department of Highways

Pennsylvania Department of Health

Ground Ambulance Mission Report Form

DATE _____

TIME: SPEEDOMETER READING:

Of Incident _____

Notified _____

Departed _____ _____

Arrived at Scene _____ _____

Departed Scene _____

Arrived at Hospital _____ _____

Delay at Hospital _____

Arrived at Base _____ _____

Route Followed _____

_____

_____

_____

Report # _____

C O N F I D E N T I A L

DATE _____

No. of Ambulance Personnel _____

Type of Response:

Scheduled _____

Emergency _____

How Notified:

Police _____

Telephone _____

Radio _____

Other, Specify _____

Weather:

Fair _____

Rain _____

Snow _____

Fog _____

Cloudy _____

Roadway:

Dry _____

Wet _____

Snow _____

Ice _____

Location (Route No. or Street Name, City, County) _____

_____

_____

Hospital Used _____

What was nature of call (Traffic Accident, Transfer, Etc.)_____

_____

_____

_____

No. of Persons Evacuated _____

No. of Persons Injured (and/or ill) _____

Report # _____

C O N F I D E N T I A L

Patient:

Age (Approx.) _____

Sex _____

Describe Patient's Condition at Scene:

Life-Threatening _____

Other _____

What was the Apparent Injury _____

Other, Specify _____

Describe Treatment Rendered at Scene _____

Description of Patient's Condition, Treatment During Transit and Additional Comments _____

Additional Comments Which Would be Helpful to Researchers _____

SPTF-2

PENNSYLVANIA STATE POLICE

HELICOPTER AMBULANCE STUDY

1. DATE: 13 April 1968 | 2. NO.: #4

3. SUBMITTED BY: Tpr. James L. Boyle

NOTIFICATION

4. TIME OF REQUEST: 1557 | 5. SOURCE: State Police Media | 6. TYPE OF EMERGENCY: [X] ACCIDENT [ ] OTHER (SPE

7. LOCATION OF ACCIDENT - EMERGENCY: Rt.#3 3 10 of a mile East of Providence Rd. Edmont Twp., Delaware Co., Penna.

8. LOCATION WHEN NOTIFIED: Exton, Pa. I F | 11. CREW MEMBERS (LIST NAMES): John D'ANGLO

9. TIME DEPARTED TO SCENE: 1557 | 10. TIME ARRIVED AT SCENE: 1609

12. TRAFFIC CONDITIONS AS VIEWED BY AIR: Stopped East bound.

SITUATION

13. AMBULANCE PRESENT: [X] YES [ ] NO | NAME OF AMBULANCE: Newtown Square | 14. WAS AMBULANCE CALLED? [X] YES [ ] NO | 15. TIME OF ARRIVAL: 1609 hrs.

16. POLICE PRESENT: [X] YES [ ] NO | NAME OF OFFICER: Tpr. James KEARNES | DEPARTMENT: State Police Media

17. TRAFFIC CONDITIONS AT SCENE: Traffic was stopped both directions for aircraft's landing.

18. WAS DOCTOR PRESENT: [ ] YES [X] NO | NAME OF DOCTOR | 19. WAS AIRLIFT REQUIRED? [ ] YES [X] NO | IF YES, INDICATE TIME REQUIRED

20. ACCIDENT INVESTIGATED BY (NAME): Tpr. James KEARNES | DEPARTMENT: Pa. State Police | LOCATION: Media, Pa. | Incident No. K2-49401

EVACUATION

21. REQUIRED TRANSPORTATION TO A HOSPITAL (INDICATE NO. OF PEOPLE)

22. NO. AIRLIFTED	23. NO. OF FLIGHTS REQUIRED	24. NO. USED AMBULANCE	25. NO. USED OTHER MEANS
1	1	1	

26. DID ANY ONE REFUSE TO U... HELICOPTER [ ] YES [ ] ... IF YES, EXPLAIN BELOW

27. HOSPITAL NOTIFIED TO MEET AIRCRAFT [X] YES [ ] NO

28. INFORMED OF TYPE OF INJURIES [X] YES [ ] N...

29. PATIENTS AIRLIFTED

NAME OF PATIENT	DESCRIPTION OF INJURIES	CONSCIOUS YES	CONSCIOUS NO	FIRST AID YES
[redacted]	[redacted]			

30. HOSPITAL TAKEN TO (GIVE NAME): Riddle Memorial Hospital, Lima, Pa.

31. WAS ANY DELAY ENCOUNTERED IN TRANSFERRING PATIENT FROM A... CRAFT TO HOSPITAL [X] NO [ ] YES (EXPLAIN BELOW)

32. NARRATIVE - DETAILS (USE ADDITIONAL PAGES FOR CONTINUATION)

Aircraft had just lifted off from base and enroute on patrol when base station advised accident on Rt.#3 in Delaware County. Time 1557 Hrs. Writer contacted Media via radio and requested directions to the scene. Directions furnished and aircraft proceeded to scene.

Aircraft arrived over scene at 1609 Hrs. and requested to set down. Traffic was contro... by Troopers from Media Barracks. With the professional type aid from the ground of Tpr. KEARNES, aircraft was guided to a landing approximately 50 feet East of the scene.

Writer with litter, proceeded to the victim and with the aid of the ambulance crew, vi... was placed on the litter and carried to the aircraft.

Aircraft off at scene at 1611 hrs. and proceeding to Riddle Memorial Hospital. While enroute to hospital, Writer requested Media Barracks to advise hospital of aircrafts pend... arrival and that the victim has possible back injury.

Aircraft on the ground at hospital at 1615 hrs. Victim removed from aircraft via wheel... type stretcher.

Aircraft covered 14 miles to scene in 12 minutes, on ground at scene 2 minutes, ... from scene to hospital in 4 minutes. Total time for complete mission, 18 minutes.

B-2 (11-67)

HELICOPTER AMBULANCE STUDY

A JOINT RESEARCH PROJECT - NATIONAL HIGHWAY SAFETY BUREAU

COMMONWEALTH OF PENNSYLVANIA

(INFORMATION REQUESTED FOR RESEARCH USE ONLY)

PART I — ADMISSION DATA

1. NAME OF HOSPITAL	2. NAME OF PHYSICAN	3. ADMITTED	
		DATE	TIME
RIDDLE Hospital	Dr David	4-13-68	4:17 PM

4. PATIENT'S CONDITION

[redacted] Phila — Age 18

5. DESCRIPTION OF INJURIES

Multiple Lacerations —
Concussion of BRAIN —
Loss of Consciousness
Lacerations of { Both Knees —
Feet —
one maxillary tooth Broken

6. EMERGENCY TREATMENT GIVEN

Treatment of Laceration
Admitted Hospital To further BRAIN Concussion
STUDIES

7. DISPOSITION OF CASE

Admitted To Hospital

8. IF HOSPITAL PHYSICIAN WAS AIRLIFTED TO ACCIDENT GIVE			9. MEDICAL SERVICES WERE PERFORMED AT ACCIDENT SCENE BY:
TIME NOTIFIED	TIME DEPARTED	TIME ARRIVED	☐ PHYSICIAN ☐ STATE POLICE ☐ OTHERS
4:12 PM		4:15 PM	

10. DESCRIBE MEDICAL TREATMENT OR FIRST AID GIVEN

APR 22 1968

(OVER)

PART II — **ASSESSMENT OF HELICOPTER AMBULANCE SERVICE**

11. DID FLIGHT ADVERSELY AFFECT VICTIM'S CONDITION?	12. WAS LIFE SAVED OR SERIOUS INJURY AVERTED?	13. WILL IT REDUCE RECOVERY PERIOD?
☒ NO ☐ YES (EXPLAIN DETAILS BELOW)	☐ YES ☒ NO (EXPLAIN DETAILS BELOW)	☐ YES ☒ NO

14. APPRAISAL OF FIRST AID PROCEDURES PERFORMED BEFORE ADMISSION

Because of Quick action - No need to give first aid in Copter IN this Case -

15. WHAT WAS PATIENT'S REACTION TO BEING AIRLIFTED TO HOSPITAL?

None

16. REMARKS: RESEARCHERS WELCOME ANY ADDITIONAL COMMENTS OR SUGGESTIONS BY PHYSICIAN WHICH WOULD ENABLE THEM TO BETTER EVALUATE THE USE OF HELICOPTER VERSUS CONVENTIONAL AMBULANCE TRANSPORT.

Suggested Medical Coverage on Helicopter To be a complete coverage. -

SPEED of Helicopter is wonderful Now to add the Medical aspect.

J. Davis M.D.

MAIL COMPLETED FORM TO J. STANLEY SMITH M.D., ROOM 907, HEALTH & WELFARE BLDG., HARRISBURG

2

PENNSYLVANIA STATE POLICE

HELICOPTER AMBULANCE STUDY

1. DATE: May 31, 1968
2. NO.: #13
3. SUBMITTED BY: Tpr. James L. Boyle

4. TIME OF REQUEST: 0853
5. SOURCE: private party near scene
6. TYPE OF EMERGENCY: [X] ACCIDENT [ ] OTHER (SPECIFY)

7. LOCATION OF ACCIDENT - EMERGENCY: RT. 100, 2 miles North of Pa. Turn Pike, Upper Uwchlan Twp., Chester County, Pa.

8. LOCATION WHEN NOTIFIED: SB, Exton Barracks
11. CREW MEMBERS (LIST NAMES): Paul ZILL

9. TIME DEPARTED TO SCENE: 0855 hrs.
10. TIME ARRIVED AT SCENE: 0900 hrs.

12. TRAFFIC CONDITIONS AS VIEWED BY AIR: North lane blocked due overturned veh.

13. AMBULANCE PRESENT: [ ] YES [X] NO — NAME OF AMBULANCE: Downingtown Minquas Amb.
14. WAS AMBULANCE CALLED? [X] YES [ ] NO
15. TIME OF ARRIVAL: 0908 (estimated)

16. POLICE PRESENT: [X] YES [ ] NO — NAME OF OFFICER: Chief William ERICE — DEPARTMENT: Upper Uwchlan Twp. Police

17. TRAFFIC CONDITIONS AT SCENE: Controlled by Chief ERICE.

18. WAS DOCTOR PRESENT: [ ] YES [X] NO — NAME OF DOCTOR
19. WAS AIRLIFT REQUIRED? [ ] YES [X] NO — IF YES, INDICATE TIME REQUIRED

20. ACCIDENT INVESTIGATED BY (NAME): Chief ERICE — DEPARTMENT: Upper Uwchlan Twp. — LOCATION: Lionville Pa.

21. REQUIRED TRANSPORTATION TO A HOSPITAL (INDICATE NO. OF PEOPLE)

22. NO. AIRLIFTED	23. NO. OF FLIGHTS REQUIRED	24. NO. USED AMBULANCE	25. NO. USED OTHER MEANS
1	1	none	none

26. DID ANY ONE REFUSE TO USE HELICOPTER [ ] YES [X] NO — IF YES, EXPLAIN BELOW

27. HOSPITAL NOTIFIED TO MEET AIRCRAFT [X] YES [ ] NO

28. INFORMED OF TYPE OF INJURIES [X] YES [ ] NO

29. PATIENTS AIRLIFTED

NAME OF PATIENT	DESCRIPTION OF INJURIES	CONSCIOUS YES	CONSCIOUS NO	FIRST AID GIVEN YES	FIRST AID GIVEN NO
[redacted]	left shoulder inj. Lac. of scalp, Abr. of right leg		X		X

30. HOSPITAL TAKEN TO (GIVE NAME): Chester County

31. WAS ANY DELAY ENCOUNTERED IN TRANSFERRING PATIENT FROM AIRCRAFT TO HOSPITAL [X] NO [ ] YES (EXPLAIN BELOW)

NARRATIVE - DETAILS (USE ADDITIONAL PAGES FOR CONTINUATION)

At 0853 hrs., a Mr. Clifford ANDERSON, RD#1, Chester Springs called station and advised of accident near his home and that a ambulance and fire truck was needed(Mr. ANDERSON did not know if ambulance was needed, but he felt from looking from his home, one was needed)

Aircraft airborn at 0855 hrs. and proceeding to the scene, 4½ air miles away. As aircraft effected landing in field next to roadway, victim was observed laying on the West barn. 0900 h

Writer alighted from aircraft with litter. Victim's bleeding and breathing controlled at time of arrival. Victim placed in aircraft and off ground at 0902 hrs.

While enroute to Chester County Hospital, writer advised Exton Base to contact Hospital and advise of pending arrival.

Aircraft landed at Chester County Hospital at 0907 hrs., aircraft met by ambulance and victim removed to emergency room.

Address of victim: [redacted]
Father of victim: [redacted]

HAS-4 (REV 8-68)

HELICOPTER AMBULANCE STUDY

DAILY ACTIVITY SUMMARY

1. DATE: 4 Sep. 68

2. STATION: Exton

3. TROOPER: Tpr. J. L Boyle

4. HELICOPTER ARRIVAL TIME: 0700 hrs.

4. PILOT: Pal Zill

6. TOUR OF DUTY: FROM: 0700 TO: 1500

7. PROGRAM HOURS THIS DATE: 8 hrs.

FLIGHT HOURS: PATROL 1:40; EMERGENCY none

8. FLIGHT LOG

	LOCATION	TIME	LOCATION	TIME	LOCATION	TIME	LOCATION	TIME
LIFT OFF	Exton	0705	Goshen	1225	Phila	1405		
LANDED AT	Goshen	0710	Phila	1330	Exton	1435		
TOTAL TIME		:05		1:05		:30		

9. SIGHTINGS

ACTIVITY	TIME	LOCATION	ACTIVITY	TIME	LOCATION
Disabled Truck	1300	RT./100, Lionville			
Accident	1301	RT./100, Lionville			

10. ASSISTANCE RENDERED

INCIDENT	TIME	LOCATION	INCIDENT	TIME	LOCATION
INCIDENT	TIME	LOCATION	INCIDENT	TIME	LOCATION
INCIDENT	TIME	LOCATION	INCIDENT	TIME	LOCATION

11. REMARKS

While on patrol and over RT./100 in the Lionville area observed a truck tractor stopped in the South bound land and the driver directing traffic around rig. Aircraft radioed the Exton Station and advised that a patrol vehicle should be dispatched to control traffic.

Aircraft observed Uwchland Twp. Police on the scene of a accident just North of the above mentioned disabled truck. By use of the PA system, it was learned that no assistance needed.

12. AREA PATROLLED

Patrolling South over 202 to RT.1, North over 100 and 52 to 322, North over 322 to Downingtown, East over 30 to 100, North over 100 to Pa. Turn-pike. East over turn-pike to Valley Forge, South over Expressway and into Phila. Int. Airport. Returning to Phila. to Exton.

☐ OVER (CHECK IF APPLICABLE)

AS-4 (REV 8-68)

HELICOPTER AMBULANCE STUDY

DAILY ACTIVITY SUMMARY

1. DATE: 19 Sept 68
2. STATION: Exton
3. TROOPER: William B. Balchune
4. PILOT: Paul Zill

HELICOPTER ARRIVAL TIME: 1500

5. TOUR OF DUTY: FROM: 1500 TO: 2100
7. PROGRAM HOURS THIS DATE: 6
FLIGHT HOURS: PATROL: 0:49 EMERGENCY: 0:13

FLIGHT LOG

	LOCATION	TIME	LOCATION	TIME	LOCATION	TIME	LOCATION	TIME
LIFT OFF	Exton	1800	U.S. 322	1840	Pottstown	1913	Pa. 100	1921
LANDED AT	U.S. 322	1825	Pottstown	1855	Pa. 100	1917	Phoenixville	1930
TOTAL TIME		0:25		0:15		0:04		0:09

SIGHTINGS

ACTIVITY	TIME	LOCATION	ACTIVITY	TIME	LOCATION

ASSISTANCE RENDERED

INCIDENT	TIME	LOCATION	INCIDENT	TIME	LOCATION
J3-42831	1915	Pa. Rte. 100 North Coventry Twp. Chester Co.			

11. REMARKS

At the hour of 1913 the aircraft went airbourne from the Pottstown Airport at the same time this officer received a call from Tpr. Zimmerman requesting Helo # 1 to assist at an accident on Pa. Rte. 100. Aircraft was at the scene at 1917 hours, loaded victim aboard aircraft, enroute to Hosp. at 1921 hours, arrived at Phoenixville Hosp. at 1930 hours. Victim requested to be taken to Phoenixville Hosp.
Block # 8 Cont'd.

LIFT OFF	Phoenixville Hosp.	1937
LANDED AT	Exton	1946
TOTAL TIME		0:09

12. AREA PATROLLED

South on Pa. Rte. 100 to U.S. 30, west on 30 to U.S. 322, west on 322 to Pa. 82, set aircraft on north berm of 322 to observe traffic, north on Pa. 82 to Penna. Turnpike, east on Penna. Turnpike to Pa. 100, north on 100 to Pottstown Airport, Pottstown Airport south on 100 to scene of accident, Rte. 100 east to Phoenixville Hosp., Phoenixville Hosp. south to Exton.

☐ OVER (CHECK IF APPLICABLE)

SPTF-2

PENNSYLVANIA STATE POLICE

HELICOPTER AMBULANCE STUDY

1. DATE: 19-Sept-68
2. NO.: 034
3. SUBMITTED BY: William B. Balchune

NOTIFICATION

4. TIME OF REQUEST: 1915
5. SOURCE: Exton Car 8 Tpr. Zimmerman
6. TYPE OF EMERGENCY: [XX] ACCIDENT [ ] OTHER (SPEC
7. LOCATION OF ACCIDENT - EMERGENCY: Pa. Rte. 100, 1 mile south of Pa. 724. North Coventry Twp. Chester County
8. LOCATION WHEN NOTIFIED: Pa. Rte. 100 and Pa. Rte. 724
11. CREW MEMBERS (LIST NAM...): Paul Zill (Pilot)
9. TIME DEPARTED TO SCENE: 1915
10. TIME ARRIVED AT SCENE: 1917
12. TRAFFIC CONDITIONS AS VIEWED BY AIR: Normal

SITUATION

13. AMBULANCE PRESENT: [ ] YES [XX] NO — NAME OF AMBULANCE: N A
14. WAS AMBULANCE CALLED? [ ] YES [XX] NO
15. TIME OF ARRIVAL
16. POLICE PRESENT: [XX] YES [ ] NO — NAME OF OFFICER: Tpr. Gearald Zimmerman — DEPARTMENT: P.S.P. Exton Penna.
17. TRAFFIC CONDITIONS AT SCENE: Normal
18. WAS DOCTOR PRESENT: [ ] YES [XX] NO — NAME OF DOCTOR: N/A
19. WAS AIRLIFT REQUIRED? [ ] YES [XX] NO — IF YES, INDICATE TIME REQUIRED
20. ACCIDENT INVESTIGATED BY (NAME): Chief Charles Wilt — DEPARTMENT: North Coventry Twp. — LOCATION: Cedarville Penna.

EVACUATION

21. REQUIRED TRANSPORTATION TO A HOSPITAL (INDICATE NO. OF PEOPLE)

22. NO. AIRLIFTED	23. NO. OF FLIGHTS REQUIRED	24. NO. USED AMBULANCE	25. NO. USED OTHER MEANS
1	1	0	0

26. DID ANY ONE REFUSE TO USE HELICOPTER [ ] YES [XX] IF YES, EXPLAIN BELOW

27. HOSPITAL NOTIFIED TO MEET AIRCRAFT [XX] YES [ ] NO

28. INFORMED OF TYPE OF INJURIES [XX] YES [ ] NO

29. PATIENTS AIRLIFTED

NAME OF PATIENT	DESCRIPTION OF INJURIES	CONSCIOUS YES	CONSCIOUS NO	FIRST AID GIV YES	FIRST AID GIV NO
[redacted]	Right leg, up to knee	XX			XX

30. HOSPITAL TAKEN TO (GIVE NAME): Phoenixville Hospital

31. WAS ANY DELAY ENCOUNTERED IN TRANSFERRING PATIENT FROM AIRCRAFT TO HOSPITAL [XX] NO [ ] YES (EXPLAIN BELOW)

32. NARRATIVE - DETAILS (USE ADDITIONAL PAGES FOR CONTINUATION)

At 1915 hours this officer received a radio message from Tpr. Gerald Zimmerman of a Traffic accident on Pa. Rte. 100, approx. 1 mile south of Pa. Rte. 724, at this time aircraft was airbourne over the intersection of 100 and 724, aircraft responded to call, at scene at 1917 hours loaded victim aboard aircraft, left scene at 1921 hours landed at Phoenixville Hosp. at 1930 hours.

On the arrival of the aircraft at Hospital attendants met us with litter.

Victim requested Phoenixville Hospital.

"General Hospitals" In Highway District 6 *

BUCKS COUNTY

1 Bristol - Lower Bucks County Hospital. Bath Road & Orchard Avenue.

2 Doylestown - Doylestown Hospital. Belmont Avenue & Spruce St.

3 Quakertown - Quakertown Hospital. 11th St. & Park Ave.

4 Sellersville - Grand View Hospital. Lawn Avenue.

CHESTER COUNTY

5 Coatesville - Clement Atkinson Memorial Hospital. 824 E. Chestnut St.

6 Coatesville - Coatesville Hospital. 300 Strode Avenue.

7 Phoenixville - Phoenixville Hospital. 140 Nutt Road.

8 Phoenixville - Valley Forge General Hospital. Charlestown Road.

9 West Chester - Chester County Hospital. 500 E. Marshall St.

10 West Chester - Memorial Hospital of Chester County. 326 No. Walnut St.

11 West Grove - Community Memorial Hospital. Route 1.

DELAWARE COUNTY

12 Chester - Crozer-Chester Medical Center. 15th. St. & Upland Avenue.

13 Chester - Sacred Heart General Hospital. 9th & Wilson Sts.

14 Darby - Thomas M. Fitzgerald Mercy Hospital. Lansdowne Avenue & Bailey Road.

15 Drexel Hill - Delaware County Memorial Hospital. Lansdowne and Keystone Avenues.

16 Havertown - Haverford General Hospital. 2000 Old West Chester Pike.

* PHILA. EXCLUDED.

17 Media - Riddle Memorial Hospital. Highway 1, Baltimore Pike.

18 Ridley Park - Taylor Hospital. E. Chester Pike.

MONTGOMERY COUNTY

19 Abington - Abington Memorial Hospital. 1200 York Road.

20 Elkins Park - Rolling Hill Hospital and Diagnostic Center. 60 E. Twnshp Line.

21 Lansdale - North Penn Hospital. 7th and Broad Sts.

22 Meadowbrook - Holy Redeemer Hospital. 1648 Huntingdon Pike.

23 Norristown - Montgomery Hospital. Powell and Fornance Sts.

24 Norristown - Sacred Hea rt Hospital. 1430 DeKalb St.

25 Norristown - Valley Forge Medical Center and Heart Hospital. Germantown Pike.

26 Pottstown - Pottstown Memorial Medical Center. 1212 High St.

AMBULANCE SERVICES

Abington Township Police Department. 1176 Old York Road, Abington

Ambler Community Ambulance Association. 9 S. Chester Street, Ambler

Ambulance Association, Avondale Fire Company. Pennsylvania Ave., Avondale

Berwyn Fire Company. Bridge Avenue, Berwyn

Bryn Athyn Fire Company. Buck Road, Bryn Athyn

Bucks County Rescue Squad. Otter Street & Rte. 13, Bristol

Central Bucks Ambulance & REscue Unit. 14 E. Oakland Ave., Doylestown

Chalfront Fire Company. Chalfront

Cheltenham Township Police Department. 8230 York Road, Elkins Park, Cheltenham

Collingdale Fire Company #1. 504 Clifton Avenue, Collingdale

Community Ambulance Association. Green Lane

Darby Fire Company #1. 44 9th Street, Darby

Delaware Valley Volunteer Fire Company. Erwinna

Dublin Fire Company. Dublin

Eddystone Fire Company. 12th & Saville Ave., Eddystone

Elverson Fire Company #1. Elverson

Enterprise Fire Company Rescue Unit. 120 E. Montgomery Avenue, Hatboro

Essington Fire Company #1. E. 2nd Street, Essington

Fairmont Fire Company #1. Susquehanna Avenue & Court Street, Lansdale

Folcroft Ambulance Service #1. Primos Avenue, Folcroft

Franklin Fire Rescue Squad. 115 Concord Avenue, Chester

Friendship Fire Company #2. 1628 Huddell Street, Linwood

Friendship Fire Company. Green Street, Royersford

Good Fellowship Ambulance Club. 225 Walnut Street, West Chester

Goodwill Ambulance Fund. High & Bailey Sts., Pottstown

George Clay Fire Company. Ford Street, West Conshohocken

Goodwill Community Ambulance. 4th and Bush Streets, Bridgeport

Goshen Fire Company. Goshen

Harleysville Community Fire Company Ambulance. Alumni Avenue, Harleysville

Honey Brook Fire Company #1. Railroad Avenue, Honey Brook

Horsham Fire Company Ambulance Corps. Meetinghouse Road, Horsham

Huntingdon Valley Fire Company #1. 640 Red Lion Road, Huntingdon Valley

Jenkintown Police Department. West Avenue & Leedom Sts., Jenkintown

Kennett Fire Company. Broad & Linden Streets, Kennett Square

Ladies Auxiliary Clifton Heights Fire Company. Borough Hall, Baltimore Avenue, Clifton Heights

Levittown-Fairless Hills Rescue Squad. 7405 Newport-Fallington Road, Levittown

Linwood Fire Company #1. Friendship Ambulance. 1557 Huddell Ave., Linwoo

Llanerch Fire Company Ambulance Service. Llanerch

Lower Fredrick Fire Company. Spring Mount

Lower Merion Township Police Department. 69 Lancaster Ave., Ardmore

Lower Providence Community Center. Eagleville

Malvern Fire Company Ambulance Service. Malvern

Manoa Fire Company. 115 South Eagle Road, Havertown

Martin's Corner Fire Company. Martin's Corner

Media Boro Fire Company. Jackson & State Roads, Media

Milmont Fire Company Ambulance Service. Belmont & Forrest Avenues, Milmont Park, Ridley Park

Minquas Fire Company. Elverson

Modena Fire Company. Modena

Montgomery Hospital. Powell & Tornance Streets, Norristown

Morrisville Union Fire Company. North Delmore Avenue, Morrisville

Newtown-Morrell Smith American Legion, Post 440 Ambulance Unit, North Lincoln Avenue, Newtown

Norristown Yellow Cab Inc. 737 W. Elm Street, Norristown

Norwood Fire Company #1. Winona Avenue, Norwood

Ogden Fire Company #1. Ogden Avenue, Ogden

O.P. James Ambulance Corps. Doylestown Fire Company, Doylestown

Paoli Fire Company Rescue Squad. Route 30 (Lancaster Pike), Paoli

Parkesburg Fire Company. Parkesburg

Parkside Fire Company #1. S.W. Roland Road & Norfolk Lane, Parkside

Penndel-Middletown Emergency Squad. Rtes. 1 & 413, Penndel

Perkasie Fire Company. 7th and Arch Sts., Perkasie

Plumsteadville Fire Company. E. Stump Road. Plumsteadville

Plymouth Community Ambulance Association. 601 W. Germantown Pk. Plymouth Meeting

Pomeroy Fire Company. Pomeroy

Quakertown Community Hospital. Quakertown

Quakertown Fire Company #1. Fouth & Broad Sts., Quakertown

Radnor Fire Company Ambulance Division. 121 S. Wayne Ave., Wayne

Riegelsville Rescue Squad. Riegelsville

Second Alarmers. Davisvill & Everett Rds. Willow Grove

Skippack Community Ambulance Association. Skippack Park & Mench Rd. Skippack

Souderton Community Ambulance Association. Main Street, Souderton

Springfield Township Ambulance Service. Saxer Ave. & Powell Road, Springfield

Springfield Ambulance Association. 1510 Papermill Road, Philadelphia

Trainor Fire Company #1. 3rd & Price Streets, Trainor

Trappe Ambulance. Trappe

Trevose Heights Rescue Squad. 1440 Bridgetown Pike, Feasterville

Union Fire Company #1 Ambulance Division. 315 Market Street, Oxford

Upper Darby Fire Company #1. 7241 West Chester Pike, Upper Darby

Upper Darby Police Department (Township). Municipal Building. Upper Darby

Upper Perkiomen Valley Ambulance Association. (Pennsburg) 4th & Main Sts., East Greenville

Vauclain Fire Company. Chester Pike & Angelo Ave., Leiperville, Ridley Park

Volunteer Medical Service Corps. 1612 N. Broad Street, Lansdale

Volunteer Medical Service Corp of Narbeth. Narbeth

Warminster Fire Company #1 Ambulance Corps. Ivy & Madison Aves., Warminster

Washington Hose Company #1. 330 E. Lincoln Highway, Coatesville

Washington Fire Company. 15 W. Hector, Conshohocken

West End Fire Company. Coatesville

West End Fire Company. Phoenixville

West Grove Ambulance Association. West Grove

West Norriton Ambulance Squad. 1987 W. Main St., Jeffersonville

Whitemarsh Township Ambulance Association. Joshua Road, Lafayette Hill

Yardley-Makefield Consolidated Emergency Unit. Yardley.

TOTAL - 93

HELICOPTER AMBULANCE STUDY

AMBULANCE SERVICE CLUB INVENTORY SURVEY

Name	Affiliation with other agency	Personnel on Duty (hours)	Number of Vehicles	Number of Trips 1967 Total	Scheduled	%	Emergency	%	Fee Schedule (dollars) Min.	Max.	Fam. Rate. or other	No. of Trips Emer.	Transf.	Total Miles Driven 1967	Number of Hospitals Served	1967 Operating Cost
1. Avondale Fire Company	None		1	198	6	3%	192	97%	10.00	25.00		81	97	6,000	4	1,000
2. Malvern Fire Company	None	24 hrs.	2	400							3.00	60	336	10,000	3	7,500
3. Darby Fire Company #1	Collingdale to Yedon		1	912	118		620			10.00	3.00	620	292	7,000	6	
4. Warminster Fire Co. #2 Ambulance Corps	Fire Co.	14 hrs. weekdays 16 hrs. Sat.& Sun.	1	834	167	20%	667	80%	Donat.	15.00	3.00	741	92	14,000	3	
5. Honey Brook Amb. Division	Fire Co.	24 hrs. ans. serv.	1	120	20		100		0.50 per mile		3.00	99	23	5,000	6	1,470
6. Skippack Community Amb.	None	11 hrs.	2	196	86		110				Donations	111	111	6,263	5	
7. Kennett Fire Co. #1	None	24 hrs.	1	367	50		317			10.00	Club Members	367		5,500	4	2,137
8. Folcroft Fire Co. #1	None	7 hrs.	1	326	100		226				3.00	200	126	4,000	3	3,000
9. Clifton Heights Fire Co.	None	24 hrs.	1	450			280		10.00	15.00	2.00 Mem.	280	170	5,000	Many	3,000
10. Union Fire Co. #1	None	24 hrs.	2	469	215		254		10.00		0.40 per mile	458		16,996	[illegible]	3,500
11. Goodwill Fire Company	None	24 hrs.	4	2,225							3.00				2	38,000
12. Ladies Aux. Parkesburg [illegible]		24 hrs.	1	131	33		98		2.00 per mile			123	3	2,750	[illegible]	3,000
13. Minquas Fire Co. [illegible]	Fire Co.	24 hrs.	1	400	100		300		0.50 per mile		Comm. Chest	400			5	
14. Springfield Amb. Association	None	None	1	440	200		240		7.50	15.00	Membership	220	220	4,000	Many	5,000
15. Springfield Amb. Corps	None	None	2	975	682	70%	293	30%		20.00	3.00	325	650	15,000	Many	15,000
16. Manoa Fire Company	None	None	1	804	624		180		15.00		3.50	180	624	10,584	Many	1,65[illegible]
17. West End Fire Co. #3	None	24 hrs.	2	1025					15.00		3.00			14,730	4	
18. Elverson Fire Co. Amb. Assoc.	Fire Co.		1	138	35		103			20.00	3.00	322	21	7,577	22	866
19. Harleysville Comm. Fire Co.	None	None	1	102	13		89		10.00		Collections	68	11	2,185	7	801
20. Friendship Fire Company	None	None		514	257		257		10.00		2.00 per mem.			5,140	27	1,200
21. Whitemarsh Twp. Amb. Assoc.	None	24 hrs.	1	360	150		210				2.00	233	127	4,500	Many	1,500
22. Goodwill Fire Company	None	Varies	1	425							2.00			4,500	Many	5,000
23. Amb. Div. of Radnor Fire Co.	None	24 hrs.	1	750	563	75%	187	25%			Varies			6,000	Many	11,000
24. Berwyn Fire Company	None	24 hrs.	1	620	269		285				3.00			10,109	4	7,636
25. Trevose Heights Rescue Squad	None	12 hrs.	5	1600							Donations	1600	1600	40,000	4	24,000
26. Horsham Fire Co. #1 Amb. Co.	None	3 hrs.	2	2000							Donations			10,000	3	
27. Washington Hose Company #1		24 hrs.	1	458	210		248		10.00			190	120			
28. Twp. of L. Merion Police Dept.	None	24 hrs.	4	1190			1190							120,000	2	5,400
29. Jenkintown Police Department	None	24 hrs.	1	239	45		194					194	45	1,000	4	
30. Linwood Volunteer Fire Co. #1	None	24 hrs.	1	325	25		300				Donations	288	37	4,425	29	938

* Nursing Homes

HELICOPTER AMBULANCE STUDY

AMBULANCE SERVICE CLUB INVENTORY SURVEY

Name	Sources of Income				Average No. Trips/Month		Length of Trip Miles		Ambulance Vehicles					Annual Cost ($)		
	Trip Charge	Club Membership	Donations	Other	Emer.	Transf.	Avg.	Max.	No.	Avg. Age	Total Capacity	Time Available	Average Net Cost	Insur.	Gas, Oil, Lub.	Maint. Other
													$	$	$	$
1. Avondale Fire Company	yes	yes	yes		14	4	30	90	1	3	2	100%	7,550	200.00	400.00	400.00
2. Malvern Fire Company		yes		Fire Co.	10	20	25	120	2	1.5	6	100%	26,000			
3. Darby Fire Company #1	yes	yes			35	15	5	75	1	1968	1	100%	5,250	200.00		
4. Warminster-Fire Co. #2 Ambulance Corps	yes	yes	yes		70	15	7.5	45	1	1968	1	100%	9,200	200.00	1,000.00	300.00
5. Honey Brook Amb. Division	yes	yes			9	1	50	115	1	3	2	100%	14,000	400.00	570.00	700.00
6. Skippack Community Amb.			yes	Fund Drive	12	4	30	100	2	1-1 yr. 1-20 yr.	6	99%	13,800	1,100.00	650.00	38.00
7. Kennett Fire Co. #1	yes	yes			30	5	15	40	1	2	2	100%	5,750	414.00	891.56	831.00
8. Folcroft Fire Co. #1				Mem. Drive	25	5	8	1035	1	1	1	95%	9,000	600.00	1,150.00	1,950.00
9. Clifton Heights Fire Co.	yes	yes			26	10	6	60	1	1968	2	100%	18,000		1,500.00	
10. Union Fire Co. #1	yes				20	20	36	212	2	1-1 yr. 1-3 yr.	8	100%	[illegible]	868.00		
11. Goodwill Fire Company		yes					1	5	4	4	8			1,000.00	1,000.00	[illegible]
12. Ladies Aux. Parkesburg Fire Co.	yes				12	5	20	110	1	1968	3	99%	11,000	540.00	200.00	[illegible]
13. Minquas Fire Co. #7, Inc.	yes		yes	Comm. Contr.	5	5	15	30	1	1	3	100%	12,000			
14. Springfield Amb. Association	yes	yes			20	10	10	40	1	2	2	100%	15,000	1,000.00	800.00	
15. Springfield Amb. Corps	yes	yes			45	55	10	15	1	2	4	95%	18,000	600.00	1,000.00	2,000.00
16. Manoa Fire Company	yes	yes			15	50	10	15	1	1968	1	95%	12,734	500.00	1,000.00	
17. West End Fire Co. #3	yes	yes					5	100	1	4	7	100%	25,000	800.00	1,000.00	
18. Elverson Fire Co. Amb. Assoc.	yes	yes			10	0	54	80	1	1	4	100%	4,850	135.00	445.00	50.00
19. Harleysville Comm. Fire Co.	yes			News. Dr.	8	1	21	40	1	3	2	100%	9,100	306.00	500.00	
20. Friendship Fire Company	yes	yes	yes		21	21	10	40	1	5	6	100%	16,000		1,600.00	
21. Whitemarsh Twp. Amb. Assoc.		yes	yes		20	10	12	40	1	1	2	100%	9,000	640.00	300.00	
22. Goodwill Fire Company		yes	yes		36	36	10	25	1	1	2			800.00	700.00	
23. Amb. Div. of Radnor Fire Co.		yes	yes				20	20	1	1	2		6,950	288.89		
24. Berwyn Fire Company		yes	yes		25	20	16	25	1	1	2		8,418	464.17		
25. Trevose Heights Rescue Squad	yes	yes	yes	Various	65	120	11	385	5	10	13	85%	15,067	2,400.00	2,900.00	
26. Horsham Fire Co. #1 Amb. Co.			yes		85	15	15	113	2	2	6	100%	20,000	None	603.03	267.13
27. Washington Hose Company #1	yes				20	17	2	290	1	6	4	90%	13,500			
28. Twp. of L. Merion Police Dept.				Budgeted	95		2.5	6	4	1	4	100%	5,588			
29. Jenkintown Police Department				Taxes	18	2	2	3.5	1	1	1	100%	2,432	192.00		
30. Linwood Volunteer Fire Co. #1			yes		24	2	13.5	180	2	6	2	99%	9,275	300.00	403.36	

HELICOPTER AMBULANCE STUDY

AMBULANCE SERVICE CLUB INVENTORY SURVEY

Name	Annual Cost Total	Annual Depreciation	Equipment Carried: Complete Emergency	Cost ($)	Unique	Communications: Radio Communication	Frequency mc.	Is amb. equipped?	Is radio part of larger net?	Is central dispatch at Amb. base	No. of other agencies using	Age of Equip.
	$	$										
1. Avondale Fire Company	1,000	1,000	yes	975.00		yes	33.90	yes	yes	yes	4	15
2. Malvern Fire Company			no			yes		yes		yes	None	5
3. Darby Fire Company #1		2,500	yes		plastic splints	yes	39.42	yes		Yedon Boro	Police	
4. Warminster Fire Co. #2 Ambulance Corps	1,500	300				yes	46.10			yes	Fire Co.	
5. Honey Brook Amb. Division	1,470	2,000	yes	395.78		yes	33.90 & 33.94	yes	Chester, Lanc. & Berks Counties	yes	4 Fire Co.	3
6. Skippack Community Amb.		1,500	yes	1,000.00	ortho. stretcher	yes	45.34	yes	Montgomery County	Norristown Boro	Police Amb.	8
7. Kennett Fire Co. #1	2,138	1,445	yes			yes	33.90	yes	S. Chester, Del. & Maryland Counties	yes		15
8. Folcroft Fire Co. #1	3,000	1,000	yes	900.00		yes	45.46	yes		Sharon Hill		9
9. Clifton Heights Fire Co.	2,000	2,000	yes			yes	39.50 & 39.82	yes	Delaware County	Lansdown & Media	Lansdown Alden Police	
10. Union Fire Co. #1	3,300		yes	1,030	ortho. stretcher	yes	33.90	yes	Chester, Lanc. York, Dauphin, Lebanon Co.	yes	Fire & Amb.	5 & 4
11. Goodwill Fire Company			unknown			yes	64.00	unknown	Montgomery County	yes		7 to 8
12. Ladies Aux. Parkesburg Fire Co.	3,000		yes			yes	33.90	yes		yes	Fire Co.	
13. Minquas Fire Co. #2, Inc.	1,000	2,000	yes			yes		yes		yes	Fire & Police	11
14. Springfield Amb. Association	1,500		yes	3,000 to 5,000		yes		yes	Montgomery County	Court House Norristown, Pa.	Ambulance & Montgomery	
15. Springfield Amb. Corps	2,700	9,000	yes	1,500		yes	39.6	yes	Media, E.Del. Co.	yes	Area Police	3
16. Manoa Fire Comapny	1,680	3,500	yes	955		yes	39.9 & 46.42	yes	Delaware County	Havertown	Police & Fire	4
17. West End Fire Co. #3			yes			yes	46.8	yes	Phoenixville Proper	Phoenixville Boro		1 to 7
18. Elverson Fire Co. Amb. Assoc.	866	2,000	no	1,100		yes	33.90	not fully	Chester, Berks & Lancaster Counties	yes		3
19. Harleysville Comm. Fire Co.	822	1,400	yes			yes	45.46		Montgomery County	Norristown		3
20. Friendship Fire ompany	1,600	4,000	yes			yes	39.82	yes	Delaware County	Media	Police	11
21. Whitemarsh Twp. Amb. Assoc.	300	3,000	yes			yes	45.46	yes	Montgomery County	Norristown	Police	1
22. Goodwill Fire Company			yes			yes		yes	Norristown Area	Norristown	Police	4
23. Amb. Div. of Radnor Fire Co.			yes			yes	33.90	yes	Berwyn, Paoli, Malvern, E.&W. Whiteland	yes		
24. Berwyn Fire Company		4,000				yes	33.90		Chester County	yes		6
25. Trevose Heights Rescue Squad		2,000	yes	4,891		yes	47.46	yes	SPCA Doylestown	yes	SPCA Doylestown	13 & 15
26. Horsham Fire Co. #1 Amb. Co.		6,000	yes			yes		yes	Montgomery County	yes		7
27. Washington Hose Company #1			yes			yes	153.	yes		Coatesville Boro		15
28. Twp. of L. Merion Police Dept.			yes			yes	158.73	yes	Narberth Boro	yes		2
29. Jenkintown Police Department			yes	400		yes	39.18	yes	Abington, Jenkintown, U.Dublin & L. Moreland	Abington	4	1
30. Linwood Volunteer Fire Co. #1	650	2,000	yes			yes	39.82	yes	Delaware County	Delaware County		8

HELICOPTER AMBULANCE STUDY

AMBULANCE SERVICE CLUB INVENTORY SURVEY

	How do you rate your comm.	Area served by radio net If radio not used, describe	Number of Active members Total	Vol.	Paid	Annual Turnover	Ambulance Club Personnel & Training: Describe training Given to personnel	Persons Trained Annually	Training Costs $ per man	Paid by whom
1. Avondale Fire Company	Good	Chester, Lancaster, York & Dauphin Co.	11	yes		10%	Red Cross Training	Varies		
2. Malvern Fire Company	Good		50	yes		none	First Aid & Advanced First Aid	50(100%)		
3. Darby Fire Company #1	Good	Collingdale to Yedon	100	yes		66%	Red Cross Standard	32(32%)	1.00	Darby Fire Co. #1
4. Warminster Fire Co. #2 Ambulance Corps	Good		54	yes		18%	Red Cross & Hospital, Rescue C.D. Course	70		By person being trained
5. Honey Brook Amb. Division	Excellent	Chester, Lancaster, Berks Counties	30	yes		1%	Red Cross	10(30%)		
6. Skippack Community Amb.	Good	Montgomery County	35	yes		3%	Red Cross & Dept. of Health	3(9%)		
7. Kennett Fire Co. #1	Good	Chester, Delaware & Maryland	40	yes		none	Red Cross, Chester Co. Safety Committee	6-8(17%)		Amb. Com.
8. Folcroft Fire Co. #1	Good		40	yes		1%	Red Cross & State Course	20(50%)		
9. Clifton Heights Fire Co.	Excellent	Local & Delaware Co.	40	yes		25%	Red Cross	10(25%)		Clifton Hgts. Amb. Ass.
10. Union Fire Co. #1	Good	Chester, Lancaster, York, Dauphin & Lebanon Co.	75	74	1	1%	Pa. Amb. Course	50(66%)	4.00	Ambulance Fund
11. Goodwill Fire Company	Good		30	25	5					
12. Ladies Aux. Perkiomen Fire Co.	Good		2	yes	2	none	Red Cross, Hosp. & Safety			Fire Company
13. Minquas Fire Co. #1 Amb.	Good		25	yes			Red Cross, Pa. Amb. Atten. Course	15(60%)		
14. Springfield Amb. Association	Excellent	Montgomery County	45	yes		5%	Red Cross	10(22%)		
15. Springfield Amb. Corp.	Good	Springfield, Del. Co. Ac.Emg.Band	85	yes		10%	Red Cross	50(60%)		General Fund
16. Manoa Fire Company	Good	Delaware Co.	50	yes		2%	Red Cross	20		
17. West End Fire Co. #1	Excellent	Phoenixville	12	5	7	1%	Red Cross, Pa. Amb. Atten. Course	Varies		Individual
18. Elverson Fire Co. Amb. Assoc.	Good	Chester, Berks & Lancaster Co.	35	yes						
19. Harleysville Comm. Fire Co.	Fair	Montgomery County	67	yes		5%	Red Cross	15(22%)		
20. Friendship Fire Company	Good	Delaware County	50	yes		5%	Red Cross	4(8%)		Fire Company
21. Whitemarsh Twp. Amb. Assoc.	Good	Montgomery County	30	yes		none	Red Cross	3(10%)		
22. Goodwill Fire Company	Excellent	Norristown	30	yes		10%	Red Cross	4(13%)		Individual
23. Amb. Div. of Radnor Fire Co.	Fair	Berwyn, Paoli, Malvern. E.&W. Whiteland	35	yes			Red Cross		Cost of Books	Individual
24. Berwyn Fire Company		Chester County	40	yes		1%	Red Cross, Pa. Amb. Atten. Course	20(50%)	Self Help	
25. Trevose Heights Rescue Squad	Poor	Doylestown Remote Phone Installations	90	89	1	2%	Red Cross	25(28%)	30.00	Squad Funds
26. Horsham Fire Co. #1 Amb. Co.	Good	Montgomery Co.		35		1%	Red Cross			
27. Washington Hose Company #1	Fair		18	16	2		Red Cross, Pa. Amb. Atten. Course	15(83%)		
28. Twp. of L. Merion Police Dept.	Excellent	Narberth Boro	50	34	16	10%	Red Cross	14(28)		Lower Merion Twp.
29. Jenkintown Police Department	Excellent	Abington, Jenkingtown, Dublin & L. Moreland	15		15		Red Cross	Varies		
30. Linwood Volunteer Fire Co. #1	Good	Delaware County	58	yes			Red Cross	20(34)		

HELICOPTER AMBULANCE STUDY

AMBULANCE SERVICE CLUB INVENTORY SURVEY

Name	Refresher Training Courses: Given	By whom	No. of persons retrained/year	How often does each member receive refresher	
1. Avondale Fire Company	yes	Red Cross	Various	Upon expiration	
2. Malvern Fire Company	yes	Red Cross	50	Every 3 years	
3. Darby Fire Company #1	yes	Red Cross	16	Every 3 years	
4. Warminster Fire Co. #2 Ambulance Corps	yes	Red Cross		Upon expiration of current card	
5. Honey Brook Amb. Division	yes	Lukens Steel Company	20	Every 3 years	
6. Skippack Community Amb.	yes	Red Cross		Every 2 years	
7. Kennett Fire Co. #1	yes	Dept. of Health	15	As needed	
8. Folcroft Fire Co. #1	yes	Red Cross	as needed	Every 3 years	
9. Clifton Heights Fire Co.	yes	State Course Red Cross	10	Every 3 years	
10. Union Fire Company #1	yes	Pa. Amb. & Balt. Hosp.	8	Every 3-4 years	
11. Goodwill Fire Company			70		
12. Ladies Aux. Parkesburg Fire Co.	no			Once a year	
13. Minquas Fire Co. #2, Inc.	yes	Red Cross	15	As required	
14. Springfield Amb. Association	yes	Red Cross			
15. Springfield Amb. Corps.	yes	Red Cross	50	Variable	
16. Manoa Fire Company	~~yes~~	Red Cross	70	~~Twice~~ a year	
17. West End Fire Co. #3	yes	Red Cross	4	Every 3 years	
18. Elverson Fire Co. Amb. Assoc.	no				
19. Harleysville Comm. Fire Co.	yes	Red Cross	15	Every 3 years	
20. Friendship Fire Company	yes	Red Cross	Varies	Optional	
21. Whitemarsh Twp.Amb. Assoc.	yes	Red Cross	18	~~Monthly~~	
22. Goodwill Fire Company	yes	Red Cross		2 or 3 years	
23. Amb. Div. of Radnor Fire Co.	yes	Red Cross		As required by Red Cross	
24. Berwyn Fire Company	yes	Pa. Amb. Course		Every 3 years	
25. Trevose Heights Rescue Squad	yes	Red Cross	17	Every 3 years	
26. Horsham Fire Co. #1 Amb. Co.	yes	Red Cross		Every 6 months	
27. Washington Hose Company #1	yes	Red Cross	15	Every 6 months	
28. Twp. of L. Merion Police Dept.	yes	Red Cross		As required	
29. Jenkintown Police Department	yes		as needed	As needed	
30. Linwood Volunteer Fire Co. #1	yes	Red Cross Self-help	20	Every 2 years	

DISTANCE AND TRAVEL TIMES FOR ALL ACCIDENTS
FROM WHICH HELICOPTER-AMBULANCE AIRLIFTS WERE MADE

Acc. No.	Ground Ambulances (Simulated)				Helicopter-Ambulance			
	Base to Acc.		Acc. to Hosp.		Base to Acc.		Acc. to Hosp.	
	Dist. (mi.)	Time (min.)	Dist. (mi.)	Time (min.)	Dist. (mi.)	Time (min.)	Dist. (mi.)	Time (min.)
1	3.5	11	3.8	12	1.1	5	2.3	6
2	1.0	2.0	10.0	21.0	1.5	1	2.5	3
3	6.4	2.0	5.3	16	5.4	4	4.5	4
4	2.8	6	6.4	13	22.0	17	4.5	4
5	13.0	18.0	13.2	20.0	35.0	34	8.1	10
6	6.0	9.0	16.0	21.0	12.0	10	9.4	9
7	2.0	4	6.0	15.0	10.5	12	4.3	4
8	6	13	20.0	30.0	4.7	7	14.6	9
9	3.6	8	10.0	25	15.0	10	6.1	4
10	6.0	6	18.4	30	5.0	5	17.0	16
11	5.7	10	6.2	10	.7	3	4.8	4
12	9	14	9.0	14	8.0	7	7.7	6
13	4.9	13	9.9	17	13.7	8	4.9	3
14	5.4	10	5.2	9.0	15.0	10	4.0	Not Rec.
15	Location not closely identified					12		5
16	11.5	20	12.0	19	5.3	5	9.0	5
17	4	8	7.0	13	4.7	2	3.0	2
18	5	14	15.0	23	11.0	10	9.2	8
19	6.1	11	5.3	9	5.1	5	4.0	4
20	17	23	17.0	28	14.0	13	10.2	10
21	5.0	8.0	5.0	8.1	2.7	3	3.4	3
22	7.2	11	7.0	11	2.3	3	4.4	5
23	5.4	13	6.9	15	18.0	15	3.4	7
24	6.6	13	5.6	11	6.4	10	4.6	6
25	5	10	6.0	13	1.0	1	4.2	4

DISTANCE AND TRAVEL TIMES FOR ALL ACCIDENTS
FROM WHICH HELICOPTER-AMBULANCE AIRLIFTS WERE MADE

	Ground Ambulances (Simulated)				Helicopter-Ambulance			
	Base to Acc.		Acc. to Hosp.		Base to Acc.		Acc. to Hosp.	
Acc. No.	Dist. (mi.)	Time (min.)	Dist. (mi.)	Time (min.)	Dist. (mi.)	Time (min.)	Dist. (mi.)	Time (min.)
26			Location not closely identified.					7
27	16	7	7.3	13	9.0	6	4.9	6
28	5	8.0	5.3	9	.8	3	4.6	4
29	4	9	6.0	10	5.0	5	4.9	4
30	5.0	10	6.0	13	4.4	4	4.1	4
31	6.6	13	4.3	10	5.8	7	2.5	3
32	10.0	17	9.5	15	4.7	5	4.9	5
33	5	6	6.0	8	5.8	7	4.7	3
34	4.5	8	3.5	6	2.3	3	3.4	4
35	4.5	6	5.0	8	1.9	4	2.7	3
36	7	10	7.0	13	.4	1	5.4	4
37	2.5	7	3.0	11	.7	2	9.0	9
38	1	2	10.0	21	15.6	10	5.2	5
39	7	10	7.0	12	10.8	9	5.0	6
40	9.7	11	9.9	13	2.9	11	8.5	5
41	6.1	10	6.5	12	0	0	5.0	3
42	4.1	9	3.1	7	5.4	4	2.6	3
43	6.1	10	6.5	12	0	0	5.0	2
44	6.1	10	6.5	12	0	0	5.0	4
45	2	9	2.5	11	7.5	5	2.8	4
46	7	16	8.0	15	10.4	12	4.0	2
47	5.0	6.0	18.4	45	19.1	17	17.0	12
48	1.0	2.0	10.0	21	7.0	4	5.2	5
49	8	14	7.0	12	3.6	3	5.4	3

Tabulation of Ground Ambulance Mission Reports

This tabulation refers to Emergency runs only, not Scheduled ambulance runs.

Abbreviations:

tel.	-	telephone
em.	-	medical emergency
t.a.	-	traffic accident
rou.	-	routine transfer (a few slipped in but are identified.)
pol.	-	police (not further identified on original Mission Reports)
rad.	-	radio
-	-	the dashed line means that we have no data
0	-	the zero means less than a minute, or less than a mile, or less than an hour.
per.	-	in person (a motorist, or a pedestrian)
fire	-	self-explanatory
siren	-	self-explanatory
al.	-	a type of radio alert-system

It is apparent that "Emergency Run" does not mean that the victim is taken to the closest emergency facility. Maternity cases are often classified as "Emergency Run" but they may be taken 30 or more miles to the hospital of their choice. Judgment must be used in comparing "Emergency Runs."

No. of Pers. Evac - means the number of victims carried; occasionally relatives are not so counted.

The tabulation was checked as it was recorded but it may appear that errors were made due to certain improbabilities (such as an ambulance run of 26 miles in 19 minutes for example) - some errors may indeed appear - but these improbabilities are occasionally apparent in the original reports.

(1)

[redacted]

A

GROUND AMBULANCE MISSION REPORTS

Time to Depart	Trav.Time To Scene	Dist.	Time at Scene	Trav.Time To Hosp.	Dist.	Time at Hosp.	Tot.Mission Time	Tot.Mission Distance	Call	Mission Type	No. Pers. Evac.	
(min.)	(min.)	(mi.)	(min.)	(min.)	(mi.)	(min.)	(hr.-min.)	(mi.)				
1	5	-	3	4	-	-	0-28	5	tel.	-	1	
1	4	-	9	7	-	-	0-33	16	tel.	-	1	
3	7	-	8	8	-	-	0-46	15	tel.	em.	1	
4	3	-	5	5	-	-	0-30	22	tel.	em.	1	
1	2	-	10	3	-	-	-	8	tel.	em.	1	
1	2	-	3	4	-	-	0-29	8	tel	t.a.	1	
2	2	-	8	45	-	-	2-0	59	tel.	em.	1	
2	2	-	2	1	-	-	0-32	6	tel.	-	1	
1	17	-	2	17	-	-	1-19	-	tel.	em	1	
1	3	-	4	4	-	-	0-18	6	tel.	em.	1	
2	9	-	5	10	-	-	0-56	21	rad.	em.	1	
2	3	-	2	3	-	-	0-31	5	tel.	rou.	1	
0	12	-	53	5	-	-	1-50	14	tel.	em.	1	
1	1	-	20	3	-	-	0-44	4	tel	ta.	1	
5	5	-	3	5	-	-	0-52	27	tel.	em.	1	
2	2	-	8	15	-	-	0-54	6	tel.	em.	-	
3	3	-	5	22	-	-	1-27	30	tel.	em.	1	
2	10	-	0	7	-	-	0-32	10	tel.	em.	-	
3	5	-	12	-	-	-	0-28	-	rad.	fire	1	
3	3	-	4	6	-	-	0-23	6	tel.	em	1	
5	15	-	3	21	-	-	0-50	19	tel.	em.	1	
2	5	-	4	6	-	-	0-43	13	tel.	t.a.	2	
1	7	-	8	11	-	-	0-35	13	tel.	em	1	
1	1	-	6	1	-	-	0-24	3	tel.	t.a.	1	
1	2.	-	6	3	-	-	0-45	5	tel.	em.	1	
1	4	-	9	3	-	-	0-32	14	tel.	t.a.	2	
1	4	8	6	3	5	-	0-24	14	tel.	t.a.	2	
1	3	-	10	2	-	-	0-32	13	tel.	t.a.	1	
2	5	-	15	5	-	-	0-45	11	tel.	em.	1	
1	4	-	3	3	-	-	0-41	15	tel.	em.	1	
2	2	-	13	6	-	-	0-41	12	tel.	em.	-	
3	12	-	2	13	-	-	0-47	20	tel.	em.	1	
1	5	-	8	7	-	-	1-04	32	tel.	em.	1	
1	2	-	4	3	-	-	0-19	5	tel.	t.a.	-	
6	2	-	6	5	-	-	0-41	5	tel.	em.	1	
5	3	-	7	4	-	-	0-31	6	tel.	rou.	1	
-	5	-	10	5	-	-	-	6	tel.	em.	1	

GROUND AMBULANCE MISSION REPORTS

A

Time to Depart (min.)	Trav.Time To Scene (min.)	Dist. (mi.)	Time at Scene (min.)	Trav.Time To Hosp. (min.)	Dist. (mi.)	Time at Hosp. (min.)	Tot.Mission Time (hr.-min.)	Tot.Mission Distance (mi.)	Call	Mission Type	No. Pers. Evac.
2	2	-	7	3	-	-	0-31	6	tel	em	1
1	3	-	3	2	-	-	0-18	6	tel.	em	1
~~2~~	~~2~~		~~10~~	~~5~~	-	-	0-32	6	tel	rou.	1
2	3	-	11	5	-	-	0-41	9	tel.	em.	1
2	5	-	11	5	-	-	0-33	7	tel.	em.	1
81/41	194/41		318/41	289/40			1669/39	584/39			40/37
(2.0)	(4.7)		(7.8)	(7.2)			(43)	(15)			(1.08)

38

(2)

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B

GROUND AMBULANCE MISSION REPORTS

Time to Depart	Trav.Time To Scene	Dist.	Time at Scene	Trav.Time To Hosp.	Dist.	Time at Hosp.	Tot.Mission Time	Tot.Mission Distance	Call	Mission Type	No. Pers. Evac.	
(min.)	(min.)	(mi.)	(min.)	(min.)	(mi.)	(min.)	(hr.-min.)	(mi.)				
5	10	-	5	5	-	-	0-50	-	tel.	em.	1	
5	10	-	5	5	-	-	0-30	5	tel.	em.	1	
2	8	-	5	7	-	-	0-28	12	tel.	em.	1	
5	10	-	5	30	-	-	1-20	32	tel.	em.	1	
5	8	-	6	11	-	-	0-40	3	tel.	em.	1	
10	5	-	5	5	-	-	0-30	-	tel	t_a.	1	
(5.3)	(8.5)		(6.2)	(10.5)			(43)	(13)			(1.0)	

(3)

C

GROUND AMBULANCE MISSION REPORTS

Time to Depart	Trav. Time To Scene	Dist.	Time at Scene	Trav. Time To Hosp.	Dist.	Time at Hosp.	Tot. Mission Time	Tot. Mission Distance	Call	Mission Type	No. Pers. Evac.	
(min.)	(min.)	(mi.)	(min.)	(min.)	(mi.)	(min.)	(hr.-min.)	(mi.)				
1	3	-	7	15	-	-	0-53	31	tel	em.	1	
3	4	-	6	15	-	-	0-06	15	tel.	ta.	1	
9	3	-	11	27	-	-	1-20	30	-	em.	1	
4	4	-	8	7	-	-	0-53	12	tel.	ta.	1	
5	2	-	11	9	-	-	1-00	-	tel.	em.	1	
5	6	-	8	12	-	-	0-50	19	tel.	em.	1	
3	2	-	7	10	-	-	0-45	13	tel.	ta.	1	
4	3	-	4	9	-	-	0-36	12	tel.	ta.	2	
3	2	-	5	20	-	-	0-57	28	tel.	em.	1	
2	5	-	8	15	-	-	1-00	21	tel.	em.	1	
6	15	-	12	8	-	-	1-05	16	-	em.	1	
3	2	-	8	12	-	-	0-50	13	tel.	em.0	1	
2	4	-	9	7	-	-	1-00	15	tel.	ta.	2	
50/13 =	55/13 =		103/13	164/13 =			675/13 =	225/12 =			15/13	
(3.8)	(4.2)	-	(8)	(12.8)			(52)	(19)			(1.2)	

40

(4)

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D

GROUND AMBULANCE MISSION REPORTS

Time to Depart	Trav.Time To Scene	Dist.	Time at Scene	Trav.Time To Hosp.	Dist.	Time at Hosp.	Tot.Mission Time	Tot.Mission Distance	Call	Mission Type	No. Pers. Evac.	
(min.)	(min.)	(mi.)	(min.)	(min.)	(mi.)	(min.)	(hr.-min.)	(mi.)				
3	3	-	5	7	-	-	0-33	-	tel.	em.	1	
5	1	-	4	5	-	-	0-25	-	tel.	ta.	1	
2	2	-	-	-	-	-	0-35	-	tel.	ta.	1	
2	3	-	2	3	-	-	0-20	-	tel.	ta.	2	
1	2	-	5	10	-	-	0-38	-	-	ta.	2	
2	1	-	4	9	-	-	0-31	-	tel.	ta.	1	
0	2	-	8	10	-	-	0-30	-	per.	ta.	1	
1	4	-	5	5	-	-	0-25	-	per,	ta.	2	
	18											
(2)	(2.3.)		(5)	(7)			(28)				(1.3)	

41

(5)

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E

GROUND AMBULANCE MISSION REPORTS

Time to Depart (min.)	Trav.Time To Scene (min.)	Dist. (mi.)	Time at Scene (min.)	Trav.Time To Hosp. (min.)	Dist. (mi.)	Time at Hosp. (min.)	Tot.Mission Time (hr.-min.)	Tot.Mission Distance (mi.)	Call	Mission Type	No. Pers. Evac.
2	6	5	10	7	6	-	-	11	tel	em.	1
2	6	-	7	11	-	-	0-48	-	tel	em.	1
1	2	1	2	2	1	-	0-14	3	tel	em.	1
2	4	-	2	6	-	0-05	0-30	-	-	ta.	2
1	4	-	11	4	-	0-15	0-40	-	tel	ta.	2
0	10	-	10	15	-	0-05	0-50	-	tel	em.	1
-	3	-	3	3	-	-	0-15	5.5	tel	em.	1
-	2	-	2	-	-	-	0-20	16	tel.	em.	1
-	1	-	-	-	-	-	0-15	1.5	tel.	ta.	1
-	6	-	-	-	-	-	0-30	3	tel.	ta.	1
-	5	-	-	-	-	-	0-50	2	tel.	em.	1
-	1	-	-	-	-	-	-	1	tel.	ta.	1
-	2	-	-	-	-	-	0-15	1	tel.	em.	1
-	-	-	-	-	-	-	0-15	6	tel.	rou.	1
-	-	-	-	-	-	-	0-20	6	tel.	em.	1
-	10	-	-	-	-	-	0-20	10	tel.	ta.	1
-	-	-	-	-	-	-	0-25	7	tel.	ta.	2
0	2	-	-	-	-	-	0-15	3	tel.	em.	1
0	10	-	-	-	-	-	0-20	18	tel.	ta.	2
-	-	-	-	-	-	-	0-20	2	tel.	ta.	1
-	-	-	-	-	-	-	-	-	tel.	em.	1
~~0~~	~~15~~	~~3~~	~~6~~	~~19~~	~~8~~	~~-~~	~~-~~	~~-~~	~~tel~~	~~rou~~	~~1~~
0	1	-	6	1	-	-	0-14	-	tel.	em.	1
$\frac{8}{5}$ =	$\frac{75}{17}$ =	$\frac{9}{2}$	$\frac{53}{7}$	$\frac{48}{7}$	$\frac{15}{3}$		$\frac{476}{19}$	$\frac{90}{15}$ = 6.0			$\frac{24}{21}$ 1.2
(2)	4.4	3.0	(4)	(7)	(5)		(25)				

(6) (9)

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F

GROUND AMBULANCE MISSION REPORTS

Time to Depart (min.)	Trav.Time To Scene (min.)	Dist. (mi.)	Time at Scene (min.)	Trav.Time To Hosp. (min.)	Dist. (mi.)	Time at Hosp. (min.)	Tot. Mission Time (hr.-min.)	Tot.Mission Distance (mi.)	Call	Mission Type	No. Pers. Evac.
5	3	1	10	20	15	-	1-35	33	tel.	em.	1
5	3	2	12	20	15	-	1-20	34	tel.	ta.	2
5	8	5	7	20	8	-	-	37	tel.	ta.	4
5	2	1	8	20	23	1-15	1-45	49	tel.	em.	1
~~15~~	~~15~~	~~15~~	~~15~~								
10	2	1	10	23	12	0-40	1-45	27	tel.	ta.	3
5	10	6	5	20	10	0-20	1-30	31	tel.	em.	1
5	2	1	8	30	24	0-40	1-55	50	tel.	em.	1
5	8	3	30	-	-	-	0-55	6	tel.	ta.	0
(5.6)	(4.7)	(2.5)	(11)	(22)	(15)	(44)	(92)	(33)			(1.8)

(7)

[redacted]

G

GROUND AMBULANCE MISSION REPORTS

Time to Depart	Trav. Time To Scene	Dist.	Time at Scene	Trav. Time To Hosp.	Dist.	Time at Hosp.	Tot. Mission Time	Tot. Mission Distance	Call	Mission Type	No. Pers. Evac.
(min.)	(min.)	(mi.)	(min.)	(min.)	(mi.)	(min.)	(hr.-min.)	(mi.)			
5	0	-	5	5	-	-	0-45	8	tel.	ta.	1
-	-	-	-	-	-	-	0-55	7	per.	ta.	1
0	5	-	5	25	-	-	1-55	15	tel.	em.	1
0	2	-	3	15	-	-	0-35	7	-	ta.	1
2	2	-	6	5	-	-	0-50	7	tel.	em.	1
2	1	-	7	5	-	-	0-50	8	tel.	em.	1
1	1	-	3	10	-	1.15	1-35	11	tel.	ta.	-
1	1	-	8	5	-	1-20	1-40	7	rad.	fire	1
5	3	-	2	15	-	0-15	0-55	7	-	ta.	-
0	5	-	2	8	-	0-15	0-30	8	rad.	em.	1
3	2	-	5	10	-	0-30	1-05	11	tel.	em.	1
5	10	-	5	10	-	0-25	1-00	13	rad.	ta.	3
(3.0)	(3.2)		(4.6) (5.1)	(10.5)		(40)	(63)	(9)			(1.2)

(8)

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H

GROUND AMBULANCE MISSION REPORTS

Time to Depart (min.)	Trav.Time To Scene (min.)	Dist. (mi.)	Time at Scene (min.)	Trav.Time To Hosp. (min.)	Dist. (mi.)	Time at Hosp. (min.)	Tot.Mission Time (hr.-min.)	Tot.Mission Distance (mi.)	Call	Mission Type	No. Pers. Evac.
-	1	-	-	-	-	-	1-0	5	al.	em.	1
-	2	-	-	-	-	-	0-35	7	al.	t.a.	1
-	2	-	-	-	-	-	0.40	17	al.	em.	1
-	3	-	-	-	-	-	0.50	7	al.	t.a.	1
-	2	-	-	-	-	-	0-45	6	al.	em.	1
-	-	-	-	-	-	-	0.50	2	al.	doa.	0
-	-	-	-	-	-	-	0-50	11	al.	em.	1
-	-	-	-	-	-	-	1.20	16	al.	em.	1
-	-	-	-	-	-	-	1-15	8	al.	em.	1
-	-	-	-	-	-	-	0.45	9	al.	em.	1
-	-	-	-	-	-	-	0-55	12	al.	em.	1
-	-	-	-	-	-	-	0-40	8	al.	em.	1
-	-	-	-	-	-	-	1-0	9	al.	em.	1
-	-	-	-	-	-	-	0-25	5	al.	t.a.	1
-	-	-	-	-	-	-	1-10	6	al.	em.	1
-	-	-	-	-	-	-	1-35	17	al.	t.a.	1
-	-	-	-	-	-	-	0-50	11	al.	em.	1
-	-	-	-	-	-	-	0-45	13	al.	t.a.	1
-	-	-	-	-	-	-	1-10	23	al.	em.	1
-	-	-	-	-	-	-	1-50	14	al.	em.	1
-	-	-	-	-	-	-	0-45	5	al.	em.	1
-	-	-	-	-	-	-	0-40	9	al.	em.	1
-	-	-	-	-	-	-	0-35	5	al.	em.	1
-	-	-	-	-	-	-	1-20	15	al.	em.	1
-	-	-	-	-	-	-	1-10	14	al.	em.	1
-	-	-	-	-	-	-	0-40	5	al.	em.	1
-	-	-	-	-	-	-	1-15	15	al.	em.	2
-	-	-	-	-	-	-	0-55	5	al.	fire	0
-	-	-	-	-	-	-	0-40	6	al.	t.a.	2
-	-	-	-	-	-	-	1-15	5	al.	em.	1
-	-	-	-	-	-	-	1-05	21	al.	em.	1
-	-	-	-	-	-	-	0-30	10	al.	em.	1
-	-	-	-	-	-	-	1-15	18	al.	em.	1
-	-	-	-	-	-	-	0-50	6	al.	em.	1
-	-	-	-	-	-	-	0-33	11	al.	em.	1
-	-	-	-	-	-	-	1-20	15	rad.	em.	1
45	10						31 = 60	108			106

(9)

[redacted]s

I

GROUND AMBULANCE MISSION REPORTS

Time to Depart (min.)	Trav. Time To Scene (min.)	Dist. (mi.)	Time at Scene (min.)	Trav. Time To Hosp. (min.)	Dist. (mi.)	Time at Hosp. (min.)	Tot. Mission Time (hr.-min.)	Tot. Mission Distance (mi.)	Call	Mission Type	No. Pers. Evac.
2	7	7	4	-	-	-	0-32	14	tel.	ta.	-
2	8	9	5	13	-	-	-	13	tel.rad	ta.	-
10	6	-	1	-	-	-	0-21	7	siren	fire	0
1	3	3	23	-	-	-	0-32	6	tel.	fire	-
1	3	-	2	-	-	-	-	-	siren	fire	0
-	1	-	11	4	-	-	0-24	12	rad.	em.	1
-	6	-	7	7	-	-	0-49	15	tel.	ta.	1
1	3	1	8	2	2	-	0-30	5	tel.	em.	1
0	3	-	6	-	-	-	0-12	3	-	fire	-
1	8	-	3	6	-	-	0-43	7	-	em.	1
-	7	-	-	-	-	-	-	5	tel	em.	-
0	0	-	-	-	-	-	0-10	6	-	ta.	-
1	11	8	5	9	8	-	0-43	19	tel.	ta.	2
-	5	-	8	10	-	-	0-38	11	tel.	em.	1
2	2	-	5	5	3	-	0-33	6	tel.	em.	1
0	3	-	12	-	-	-	0-18	4	tel.	ta.	3
3	-	-	-	-	-	-	0-13	3	rad.	ta.	0
-	4	2	-	-	-	-	0-11	6	rad.	em.	1
(1.75)	(5)	(5)	(7)	(7)	(4.3)		(27)	(8)			(1.3)

(10) [redacted] E

J

(28)

GROUND AMBULANCE MISSION REPORTS

Time to Depart (min.)	Trav.Time To Scene (min.)	Dist. (mi.)	Time at Scene (min.)	Trav.Time To Hosp. (min.)	Dist. (mi.)	Time at Hosp. (min.)	Tot.Mission Time (hr.-min.)	Tot.Mission Distance (mi.)	Call	Mission Type	No. Pers. Evac.	
2	-	-	-	-	-	-	0-42	30	tel	em.	1	
0	-	-	-	-	-	-	0-50	24	tel	ta.	1	
-	-	-	-	-	-	-	0-55	17	tel.	ta.	1	
-	-	-	-	-	-	-	1-45	-	tel.	em.	1	
-	-	-	-	-	-	-	1-00	-	tel	em.	1	
-	-	-	-	-	-	-	0-40	6	tel	em.	1	
1	-	-	-	-	-	-	0-41	19	tel.	ta.	1	
1	-	-	-	-	-	-	1-16	26	tel.	em.	1	
2	15	-	5	10	-	-	1-07	26	tel	em.	1	
10	-	-	-	-	-	-	1-05	16	tel	em	1	
-	-	-	-	-	-	-	1-40	21	tel	em	1	
10	-	-	-	-	-	-	1-30	18	tel	em	1	
1	-	-	-	-	-	-	0016	5	tel	em	1	
5	-	-	-	-	-	-	0-55	14	tel	em	1	
1	2	-	7	12	-	-	0-50	-	per.	em	1	
0	9	-	5	15	-	-	1-11	22	tel	ta.	1	
5	3	-	7	5	-	-	0-35	4	tel	em.	1	
7	-	-	-	-	-	-	0-42	13	tel	em	1	
2	8	-	8	19	-	-	1-05	16	em	em	1	
	77											
(4)	(7.4)		(6.4)	(12.3)			(59)	(17)			(1.0)	

(13)

(11)

[redacted]

K

GROUND AMBULANCE MISSION REPORTS

Time to Depart (min.)	Trav.Time To Scene (min.)	Dist. (mi.)	Time at Scene (min.)	Trav.Time To Hosp. (min.)	Dist. (mi.)	Time at Hosp. (min.)	Tot.Mission Time (hr.-min.)	Tot.Mission Distance (mi.)	Call	Mission Type	No. Pers. Evac.
2	2	~~xxx~~	5	5	-	-	0-26	11	tel.	t.a.	1
5	15	-	8	10	-	-	0-50	22	tel.	em.	1
2	1	-	4	11	-	-	1-13	13	tel.	t.a.	3
0	6	-	3	30	-	-	1-14	-	tel.	em.	1
0	8	-	3	11	-	-	0-35	22	tel.	em.	1
0	7	-	3	13	-	-	0-47	26	tel.	em.	1
2	1	-	2	32	-	-	1-51	63	tel.	em.	1
1	13	-	5	17	-	-	1-28	44	tel.	em.	1
1	5	-	3	11	-	-	0-40	18	tel.	em.	1
5	7	-	5	22	-	-	1-15	37	tel.	em.	1
2	6	-	2	4	-	-	0-25	12	tel.	em.	2
2	4	-	3	48	-	-	1-47	53	tel.	em.	1
1	4	-	3	7	-	-	0-28	13	tel,	t.a.	2
1	1	-	5	12	-	-	0-38	11	tel.	t.a.	1
2	1	-	2	8	-	-	0-30	12	pers.	t.a.	2
1	1	-	3	6	-	-	0-35	11	tel.	em.	1
1	1	-	3	8	-	-	0-40	12	tel.	em.	1
1	7	-	8	1	-	-	0-36	12	tel.	t.a.	1
1	4	-	4	5	-	-	1-34	12	tel.	t.a.	2
2	7	~~6~~	3	5	-	-	0-32	14	tel.	em.	1
2	5	3	5	18	-	-	0-45	17	tel.	t.a.	1
1	4	3	3	4	-	-	0-25	14	tel,	em.	1
1	2	2	5	16	-	-	0-50	12	tel.	em.	1
1	4	2.5	5	6	-	-	0-37	13	pers.	ta.	2
1	1.	1	4	55	-	-	1-31	68	tel.	em.	1
2	7	6	8	4	-	-	0-52	24	tel.	em.	-
1	4	3	4	6	-	-	0-36	12	tel.	t.a.	1
9	3	2	9	10	-	-	1-02	14	tel.	em.	1
1	3	3	5	4	-	-	0-37	11	tel.	t.a.	2
2	6	6	4	5	-	-	0-32	25	tel.	em.	1
2	5	4	10	5	-	-	0-37	14	tel.	em.	1
5	11	6	10	10	-	-	1-55	46	tel.	em.	1
1	1	-	4	30	-	-	1-56	63	tel.	em.	1
5	6	6	4	30	-	-	1-30	76	tel.	em.	1
2	3	4	11	12	-	-	1-05	20	tel.	em.	1
1	3	3	22	4	-	-	1-13	12	tel.	em.	1
1	0	0	0	31	-	-	1-50	65	[redacted]	em.	1
1/C	162	60.5	190	515				513			13

48

[redacted] K p. 2

Time to Depart	Trav.Time To Scene	Dist.	Time at Scene	Trav.Time To Hosp.	Dist.	Time at Hosp.	Tot.Mission Time	Tot.Mission Distance	Call	Mission Type	No. Pers. Evac.	
(min.)	(min.)	(mi.)	(min.)	(min.)	(mi.)	(min.)	(hr.-min.)	(mi.)				
1	11	5	2	10	-	-	1-02	17	tel	em.	1	
1	1	0	2	7	-	-	0-59	13	tel	em.	1	
1	5	2	4	4	-	-	0-32	13	tel	em.	1	
1	6	6	4	25	-	-	2-00	48	tel	em.	1	
1	8	5	5	10	-	-	0-44	21	tel.	em.	1	
1	3	2.5	10	4	-	-	1-35	11	tel.	t.a.	3	
1	3	2.5	4	3	-	-	0-30	12	tel.	t..	1	
1	1	1	5	7	-	-	0-36	13	tel.	em.	1	
5	1	0	9	8	-	-	0-50	12	tel.	-	1	
83/43	201/45	85/23	235/45	593/46			2541/45	1073/45			55/45	
(1.9)	(4.5)	(3.7)	(5.2)	(12.8)			(56)	(24)			(1.2)	

(12)

[redacted]

L

GROUND AMBULANCE MISSION REPORTS

Time to Depart (min.)	Trav.Time To Scene (min.)	Dist. (mi.)	Time at Scene (min.)	Trav.Time To Hosp. (min.)	Dist. (mi.)	Time at Hosp. (min.)	Tot.Mission Time (hr.-min.)	Tot.Mission Distance (mi.)	Call	Mission Type	No. Pers. Evac.
5	3	0.5	12	4	1.5	-	0-50	4	tel	ta.	1
15	5	1	5	5	1	-	0-40	3	tel	em	1
1	15	2	10	10	1	-	0-55	5	tel	em	1
20	10	4	5	30	20	-	2-15	-	tel	em	1
2	8	4	10	10	3	-	0-40	8	tel	em	-
5	8	15	6	8	-	-	-	-	tel	ta.	1
5	7	-	13	15	-	-	-	21	tel	ta.	1
2	2	1	14	2	1	-	0-45	2	tel	ta.	1
1	8	5	11	15	4	-	1-15	10	tel	em	1
1	4	4	10	5	3	-	1-15	8	tel.	ta.	1
2	8	3	10	5	4	-	0-50	8	tel	ta.	1
2	6	3	5	22	10	-	1-18	24	tel	em	1
2	5	3	13	5	2	-	1-00	6	tel	em	1
1	7	2	10	5	1	-	0-23	7	tel	em	1
2	8	-	15	13	-	-	-	10	tel	ta.	1
2	8	-	5	10	-	-	-	9	tel	em	1
1	10	-	-	-	-	-	-	8	tel	ta.	4
5	18	6	9	13	5	-	1-00	12	tel	em	1
5	7	5	13	5	-	-	-	-	tel	em	1
1	9	4	8	7	4	-	-	9	tel	ta.	3
7	13	4	15	10	-	-	1-00	8	tel	em	-
3	2	2	15	15	-	-	1-15	7	tel	em.	1
1	7	2	50	7	2	-	1-51	5	tel.	em.	1
1	5	1	2	7	2	-	0-50	4	tel	em	1
1	6	4	8	5	4	-	0-30	8	tel.	ta.	1
2	6	3	4	6	3	-	-	-	tel	ta.	1
5	10	-	10	15	-	-	-	-	tel	em.	1
1	5	5	5	10	5	-	0-51	11	tel	em	1
3	8	6	3	17	6	-	1-18	20	tel.	ta.	2
1	4	3	8	8	3	-	0-35	7	tel.	ta.	1
2	5	2	10	5	3	-	0-40	6	tel.	ta.	2.
2	6	3	19	5	8	-	1-45	23	tel.	em.	1
2	5	3	10	6	3	-	0-53	7	tel.	em.	1
3	3	2.5	15	5	2.5	-	1-40	6	tel.	ta.	2
2	8	6	5	15	5	-	1-15	12	tel.	em.	1
50	5	3	5	5	5	-	-	-	tel.	em.	1
32	6 (7.0)	6 (3.7)	12 (10.5)	5 (9.3)	(4.9)	-	1-40 (1.5)	22 10	tel.	ta.	2 (1.3)

[redacted]

GROUND AMBULANCE MISSION REPORTS

Time to Depart	Trav. Time To Scene	Dist.	Time at Scene	Trav. Time To Hosp.	Dist.	Time at Hosp.	Tot. Mission Time	Tot. Mission Distance	Call	Mission Type	No. Pers. Evac.	
(min.)	(min.)	(mi.)	(min.)	(min.)	(mi.)	(min.)	(hr.-min.)	(mi.)				
2	10	4	10	10	3	-	1-22	8	tel.	em.	1	
1	14	5.5	10	15	5	-	2-10	12	tel.	ta.	2	
0	5	-	10	5	-	-	0-45	5	rad.	ta.	6	
1	3	1	5	6	2	-	0-40	4	tel.	ta.	2	

(13) [redacted] (20)

M

GROUND AMBULANCE MISSION REPORTS

Time to Depart (min.)	Trav. Time To Scene (min.)	Dist. (mi.)	Time at Scene (min.)	Trav. Time To Hosp. (min.)	Dist. (mi.)	Time at Hosp. (min.)	Tot. Mission Time (hr.-min.)	Tot. Mission Distance (mi.)	Call	Mission Type	No. Pers. Evac.
3	3	-	7	11	-	0-04	0-35	3	tel.	em.	1
0	15	-	15	15	-	0-10	-	61	tel.	em.	1
1	2	2	4	2	2	-	0-45	4	pol.	em.	1
1	2	1	7	3	1	-	0-40	2	tel.	em.	1
1	-	-	-	-	-	-	0-25	6	tel.	em.	1
0	5	-	6	11	-	0-05	0-40	9	pol.	ta.	5
0	5	-	2	4	-	0-05	0-25	6	tel.	em.	1
1	4	4	5	5	5	-	0-40	9	tel.	em.	1
1	4	-	-	-	-	-	0-23	5	tel.	em.	1
1	1	1	2	1	1	-	0-10	3	tel.	em.	1
0	2	-	4	3	-	0-05	0-20	4	tel. e	em.	1
	45										1
(1)	(4.3)	(3)	(8)	(6)	(2.2)	(6)	(30)	(10)			(1.3)

HELICOPTER RESPONSE TIMES

AIRLIFT NO.	CALL RECEIVED	LIFT-OFF	ARRIVAL AT SCENE	DEPART FROM SCENE	ARRIVAL AT HOSPITAL	TRIP TIME (MIN.)	TOTAL TIME (MIN.)
BELMONT							
1	1252	1255	1300	1302	1308	6	16
2	1627	in flight	1628	1633	1636	3	9
3	1207	1210	1214	1216	1220	4	13
EXTON							
1	1431	in flight	1448	1450	1454	4	23
2	1557	"	1632	1645	1655	10	58
3	1300	1305	1315	1324	1333	9	33
4	1557	in flight	1609	1611	1615	4	18
5	1217	1217	1224	1227	1236	9	19
6	0728	0730	0740	0742	0746	4	18
7	1905	in flight	1910	--	1926	16	21
8	0730	0732	0735	0740	0744	4	14
9	1635	1636	1643	1646	1652	6	17
10	1542	1545	1553	1559	1602	3	20
11	0835	0836	0846	not available		-	-
12	1920	1922	1930	1935	1940	5	20
13	0853	0855	0900	0902	0907	5	14
14	1843	1845	1847	1850	1852	2	9
15	1927	1930	1940	1943	1951	8	24
16	0740	0742	0747	0748	0752	4	12
17	2005	2007	2020	2022	2032	10	27
18	2018	2020	2023	2029	2032	3	14
19	1230	1230	1233	1245	1250	5	20
20	1249	1250	1305	1307	1311	4	22
21	1525	1530	1540	1550	1600	10	35
22	1640	1643	1644	1647	1652	5	12
23	1925	1925	1928	2016	2023	7	58
24	1730	1730	1736	1741	1745	4	15
25	1938	1940	1943	1945	1949	4	11
26	1718	1720	1725	1728	1732	4	14
27	1233	1235	1239	1243	1247	4	14
28	1615	1618	1625	1638	1641	3	26
29	1603	1605	1610	1613	1640	27	37
30	1701	1703	1710	1714	1717	3	16
31	1706	1708	1711	1715	1719	4	13
32	2005	in flight	2012	2015	2018	3	13
33	1820	1821	1822	1825	1829	4	9
34	1915	in flight	1917	1921	1930	9	15
35	1638	1640	1650	1655	1700	5	22

HELICOPTER RESPONSE TIMES

AIRLIFT NO.	CALL RECEIVED	LIFT-OFF	ARRIVAL AT SCENE	DEPART FROM SCENE	ARRIVAL AT HOSPITAL	TRIP TIME (MIN.)	TOTAL TIME (MIN.)
36	1454	1455	1504	1506	1512	6	18
37	0847	0849	0900	0902	0907	5	20
38*	1926	1927	-	-	1930	3	4
39	0724	0725	0729	0735	0738	3	14
40*	1647	1648	-	-	1650	2	3
41*	1530	1531	-	-	1535	4	5
42	1545	1550	1555	1558	1602	3	17
43	1700	1700	1712	not available		-	-
44**	1645	1650	1707	1715	1731	16	46
45	1325	1326	1330	1335	1340	5	15
46	1755	1758	1801	1814	1817	3	22
AVERAGE MINUTES		2.04	7.1	5.6		5.8	19.5

* Victim brought to Exton Barracks

** Trip transfer from Jennersville hospital to Wilmington ETA 1731

INDEX TO THE STATISTICAL SUMMARIES OF ACCIDENT DATA

FOR PERIOD OCTOBER 1, 1967 to SEPTEMBER 30, 1968

Summaries by time period

Summaries by Local Government

DIVISION OF TRAFFIC ACCIDENT ANALYSIS, BUREAU OF TRAFFIC, PENNSYLVANIA DEPARTMENT OF HIGHWAYS

MONTH OF OCCURRENCE VS. SEVERITY OF ACCIDENT

A STATISTICAL SUMMARY FOR THE PERIOD OCT THRU SEPT 67-6 ENCOMPASSING CO.S 09-15-23-46

MONTH OF OCCURRENCE	NUMBER OF ACCIDENTS			
	FATAL	INJURY	PROPERTY DAMAGE	TOTAL
JANUARY	15	1033	2895	3943
FEBRUARY	16	1043	2240	3299
MARCH	29	1108	2447	3584
APRIL	33	1160	2271	3464
MAY	26	1418	2870	4314
JUNE	17	1258	2607	3882
JULY	24	1186	2207	3417
AUGUST	25	1240	2228	3493
SEPTEMBER	33	1135	2315	3483
OCTOBER	26	1221	2372	3619
NOVEMBER	36	1270	2935	4241
DECEMBER	26	1378	3118	4522
TOTALS	306	14450	30505	45261

TABLE 1

DIVISION OF TRAFFIC ACCIDENT ANALYSIS, BUREAU OF TRAFFIC, PENNSYLVANIA DEPARTMENT OF HIGHWAYS

DAY OF OCCURRENCE VS. SEVERITY OF ACCIDENT

A STATISTICAL SUMMARY FOR THE PERIOD OCT THRU SEPT 67-6 ENCOMPASSING CO,S 09-15-23-46

DAY OF OCCURRENCE	NUMBER OF ACCIDENTS			
	FATAL	INJURY	PROPERTY DAMAGE	TOTAL
SUNDAY	31	1958	3445	5434
MONDAY	38	1644	3825	5507
TUESDAY	37	1822	3837	5696
WEDNESDAY	35	1834	3966	5835
THURSDAY	36	2017	4497	6550
FRIDAY	44	2520	5573	8137
SATURDAY	85	2653	5355	8093
UNKNOWN	0	2	7	9
TOTALS	306	14450	30505	45261

TABLE 2

DIVISION OF TRAFFIC ACCIDENT ANALYSIS, BUREAU OF TRAFFIC, PENNSYLVANIA DEPARTMENT OF HIGHWAYS

HOUR OF OCCURRENCE VS. SEVERITY OF ACCIDENT

A STATISTICAL SUMMARY FOR THE PERIOD OCT THRU SEPT 67-6 ENCOMPASSING CO.S 09-15-23-46

HOUR OF OCCURRENCE	NUMBER OF ACCIDENTS FATAL	INJURY	PROPERTY DAMAGE	TOTAL
12.01- 1.0AM	15	469	826	1310
1.01- 2.0AM	15	384	629	1028
2.01- 3.0AM	30	345	573	948
3.01- 4.0AM	10	231	308	549
4.01- 5.0AM	2	119	197	318
5.31- 6.0AM	3	108	173	284
6.01- 7.0AM	4	227	555	786
7.01- 8.0AM	8	652	1789	2449
8.01- 9.0AM	5	596	1366	1967
9.01-10.0AM	5	418	1013	1436
10.01-11.0AM	7	493	1317	1817
11.01 - NOON	7	589	1429	2025
12.01- 1.0PM	7	719	1577	2303
1.01- 2.0PM	14	739	1616	2369
2.01- 3.0PM	13	817	1879	2709
3.01- 4.0PM	19	1166	2399	3584
4.01- 5.0PM	18	1354	2922	4294
5.01- 6.0PM	20	1110	2258	3388
6.01- 7.0PM	16	765	1448	2229
7.01- 8.0PM	16	827	1557	2400
8.01- 9.0PM	12	665	1307	1984
9.01-10.0PM	23	604	1178	1805
10.01-11.0PM	21	516	982	1519
11.01-MDNITE	15	500	899	1414
UNKNOWN	1	37	308	346
TOTALS	306	14450	30505	45261

TABLE 3

DIVISION OF TRAFFIC ACCIDENT ANALYSIS, BUREAU OF TRAFFIC, PENNSYLVANIA DEPARTMENT OF HIGHWAYS

HOUR AND DAY OF OCCURRENCE VS. SEVERITY OF ACCIDENT

A STATISTICAL SUMMARY FOR THE PERIOD OCT THRU SEPT 67-6 ENCOMPASSING CO.S 09-15-23-46

	SUNDAY			MONDAY			TUESDAY			WEDNESDAY			THURSDAY			FRIDAY			SATURDAY		
HR	FAT	INJ	PD	FAT	INJ	PD	FAT	INJ	PD	FAT	INJ	PD	FAT	INJ	PD	FAT	INJ	PD	FAT	INJ	PD
1	2	128	185	2	27	72	2	34	63	2	38	81	0	57	88	2	49	117	5	136	220
2	2	115	149	1	26	55	3	16	43	0	27	45	1	34	54	3	46	72	5	120	201
3	9	93	153	1	19	43	2	25	38	2	23	37	2	34	32	5	30	62	9	120	208
4	2	86	82	0	14	25	1	16	20	1	15	27	0	18	29	0	25	37	6	57	88
5	0	36	51	0	5	19	1	10	17	0	6	19	0	14	19	1	16	25	0	32	47
6	1	28	33	1	11	18	0	9	29	0	13	18	0	7	20	1	11	24	0	29	31
7	3	21	33	1	35	86	0	39	89	0	31	100	0	21	59	0	40	107	0	40	71
8	0	24	56	2	110	347	0	115	297	1	102	334	1	119	300	2	140	345	2	42	110
9	0	23	49	3	119	250	0	81	225	0	89	242	1	111	224	0	111	257	1	62	119
10	0	47	84	0	59	141	0	62	169	2	53	139	2	55	132	1	66	167	0	76	181
11	0	50	152	1	65	145	1	66	178	0	58	152	2	92	204	0	72	211	3	90	275
12	0	60	138	1	56	164	1	75	160	2	81	182	0	95	259	0	92	228	3	130	298
13	1	112	219	0	83	181	1	89	182	1	77	195	0	91	264	2	117	236	2	150	300
14	2	139	251	0	77	170	3	92	190	0	84	168	2	91	237	4	107	266	3	149	314
15	0	131	255	1	90	218	2	104	238	3	103	224	4	98	264	1	145	311	2	146	369
16	0	134	242	6	100	349	0	177	341	2	165	336	5	167	352	3	194	415	3	169	364
17	0	126	221	0	188	436	3	185	407	4	215	425	4	209	485	4	245	536	3	186	412
18	1	106	165	5	144	318	3	169	331	3	168	321	2	162	389	3	206	455	3	155	279
19	1	103	171	4	78	150	1	105	172	1	105	192	1	117	221	3	133	298	5	124	244
20	2	116	179	4	71	171	0	103	154	2	96	183	2	127	226	0	163	370	6	151	274
21	1	91	189	2	74	138	1	65	145	1	79	171	1	84	159	3	123	280	3	148	224
22	3	77	133	1	55	123	3	77	137	4	86	142	1	79	152	2	132	264	9	98	227
23	0	62	124	0	34	111	5	56	88	3	56	98	2	69	141	3	118	215	8	121	205
24	0	47	56	2	36	67	4	48	85	1	61	85	3	59	128	1	129	221	4	118	226
TOTAL	30	1955	3000	38	1638	3797	37	1818	3798	35	1831	3936	36	2010	4458	44	2510	5519	85	2649	5287

TABLE 4

DIVISION OF TRAFFIC ACCIDENT ANALYSIS, BUREAU OF TRAFFIC, PENNSYLVANIA DEPARTMENT OF HIGHWAYS

MONTH OF OCCURRENCE VS. SEVERITY OF ACCIDENT

A STATISTICAL SUMMARY FOR THE PERIOD OCT 1967-SEPT 1968 ENCOMPASSING BUCKS

MONTH OF OCCURRENCE	NUMBER OF ACCIDENTS			
	FATAL	INJURY	PROPERTY DAMAGE	TOTAL
JANUARY	5	196	573	774
FEBRUARY	3	194	413	610
MARCH	12	211	502	725
APRIL	11	230	400	641
MAY	6	263	513	782
JUNE	8	271	494	773
JULY	5	265	439	709
AUGUST	4	280	450	734
SEPTEMBER	14	248	436	698
OCTOBER	5	247	505	757
NOVEMBER	11	242	506	759
DECEMBER	7	269	579	855
TOTALS	91	2916	5810	8817

T9 61

TABLE 5

DIVISION OF TRAFFIC ACCIDENT ANALYSIS, BUREAU OF TRAFFIC, PENNSYLVANIA DEPARTMENT OF HIGHWAYS

DAY OF OCCURRENCE VS. SEVERITY OF ACCIDENT

A STATISTICAL SUMMARY FOR THE PERIOD OCT 1967-SEPT 1968 ENCOMPASSING BUCKS

DAY OF OCCURRENCE	NUMBER OF ACCIDENTS			
	FATAL	INJURY	PROPERTY DAMAGE	TOTAL
SUNDAY	8	412	689	1109
MONDAY	14	342	723	1079
TUESDAY	10	340	713	1063
WEDNESDAY	10	388	763	1161
THURSDAY	7	405	854	1266
FRIDAY	10	481	1005	1496
SATURDAY	32	548	1058	1638
UNKNOWN	0	0	5	5
TOTALS	91	2916	5810	8817

TABLE 60

DIVISION OF TRAFFIC ACCIDENT ANALYSIS, BUREAU OF TRAFFIC, PENNSYLVANIA DEPARTMENT OF HIGHWAYS

HOUR OF OCCURRENCE VS. SEVERITY OF ACCIDENT

A STATISTICAL SUMMARY FOR THE PERIOD OCT 1967-SEPT 1968 ENCOMPASSING BUCKS

HOUR OF OCCURRENCE	NUMBER OF ACCIDENTS			
	FATAL	INJURY	PROPERTY DAMAGE	TOTAL
12.01- 1.0AM	6	109	161	276
1.01- 2.0AM	4	74	129	207
2.01- 3.0AM	7	80	120	207
3.01- 4.0AM	3	47	74	124
4.01- 5.0AM	0	23	39	62
5.01- 6.0AM	1	20	30	51
6.01- 7.0AM	1	51	127	179
7.01- 8.0AM	1	121	351	473
8.01- 9.0AM	1	92	210	303
9.01-10.0AM	2	80	161	243
10.01-11.0AM	3	79	223	305
11.01@ NOON	2	131	259	392
12.01- 1.0PM	1	149	318	468
1.01- 2.0PM	4	131	301	436
2.01- 3.0PM	5	166	351	522
3.01- 4.0PM	7	214	442	663
4.01- 5.0PM	5	243	533	781
5.01- 6.0PM	6	248	388	642
6.01- 7.0PM	6	177	307	490
7.01- 8.0PM	4	194	334	532
8.01- 9.0PM	5	139	264	408
9.01-10.0PM	8	127	248	383
10.01-11.0PM	4	108	195	307
11.01-MDNITE	4	109	191	304
UNKNOWN	1	4	54	59
TOTALS	91	2916	5810	8817

DIVISION OF TRAFFIC ACCIDENT ANALYSIS, BUREAU OF TRAFFIC, PENNSYLVANIA DEPARTMENT OF HIGHWAYS

HOUR AND DAY OF OCCURRENCE VS. SEVERITY OF ACCIDENT

A STATISTICAL SUMMARY FOR THE PERIOD OCT 1967-SEPT 1968 ENCOMPASSING BUCKS

	SUNDAY			MONDAY			TUESDAY			WEDNESDAY			THURSDAY			FRIDAY			SATURDAY		
HR	FAT	INJ	PD	FAT	INJ	PD	FAT	INJ	PD	FAT	INJ	PD	FAT	INJ	PD	FAT	INJ	PD	FAT	INJ	PD
1	0	30	40	1	5	6	0	5	10	2	10	19	0	16	11	1	15	26	2	28	49
2	0	26	32	0	5	11	2	4	10	0	6	9	0	4	11	0	7	19	2	22	37
3	0	19	36	1	4	15	0	7	6	0	7	6	1	12	6	1	5	12	4	26	39
4	0	21	20	0	4	5	1	4	4	0	2	7	0	1	7	0	4	9	2	11	22
5	0	8	12	0	0	8	0	2	1	0	1	5	0	3	3	0	1	3	0	A	7
6	1	6	5	0	3	4	0	2	5	0	4	4	0	0	1	0	2	4	0	3	7
7	1	5	6	0	6	19	0	7	28	0	9	18	0	4	17	0	11	21	0	9	18
8	0	7	9	0	22	67	0	22	54	0	23	79	0	19	61	0	18	63	1	10	18
9	0	1	8	1	15	33	0	12	32	0	16	38	0	18	35	0	15	39	0	15	25
10	0	9	15	0	11	20	0	9	29	1	13	22	1	4	29	0	18	21	0	16	25
11	0	11	31	1	13	24	0	14	37	0	8	35	0	13	33	0	9	24	2	11	39
12	0	15	24	0	18	31	0	18	35	0	19	33	0	19	37	0	16	46	2	26	53
13	1	23	42	0	21	39	0	20	39	0	11	39	0	16	64	0	32	43	0	26	52
14	2	28	47	0	12	37	1	20	37	0	15	31	0	16	38	1	14	43	0	26	68
15	0	24	59	0	24	39	2	16	45	2	23	37	0	23	40	0	24	59	1	32	72
16	0	25	52	3	35	68	0	33	54	1	26	64	1	26	56	1	33	70	1	36	78
17	0	25	43	0	22	76	0	32	72	1	38	78	0	44	94	2	42	89	2	40	81
18	1	27	35	1	32	50	1	29	47	1	40	56	1	33	68	0	48	76	1	39	56
19	0	28	33	3	24	30	0	22	40	0	26	49	0	32	57	0	22	45	3	23	53
20	0	15	35	1	22	32	0	25	31	0	27	35	1	31	52	0	39	89	2	35	60
21	0	19	39	1	16	26	0	9	27	0	18	33	1	20	37	2	28	57	1	29	45
22	1	18	28	0	8	36	1	11	26	2	23	28	0	21	31	1	26	46	3	20	53
23	0	14	17	0	7	29	1	9	23	0	12	20	1	16	23	0	20	42	2	30	41
24	0	7	16	1	11	14	1	8	15	0	11	14	0	14	37	1	32	48	1	25	46
TOTAL	7	411	684	14	340	719	10	340	707	10	388	759	7	405	848	10	481	994	32	547	1044

TABLE 8

DIV ION OF TRAFFIC ACCIDENT ANALYSIS, BUREAU F TRAFFIC, PENNSYLVANIA DEPARTMENT OF H WAYS

MONTH OF OCCURRENCE VS. SEVERITY OF ACCIDENT

A STATISTICAL SUMMARY FOR THE PERIOD OCT 1967-SEPT 1968 ENCOMPASSING CHESTER

MONTH OF OCCURRENCE	NUMBER OF ACCIDENTS			
	FATAL	INJURY	PROPERTY DAMAGE	TOTAL
JANUARY	5	172	434	611
FEBRUARY	4	173	317	494
MARCH	3	165	342	510
APRIL	11	176	329	516
MAY	8	248	435	691
JUNE	6	189	387	582
JULY	6	205	349	560
AUGUST	7	210	352	569
SEPTEMBER	11	203	366	580
OCTOBER	6	188	337	531
NOVEMBER	7	196	457	660
DECEMBER	5	201	451	657
TOTALS	79	2326	4556	6961

TABLE 9

DIVISION OF TRAFFIC ACCIDENT ANALYSIS, BUREAU OF TRAFFIC, PENNSYLVANIA DEPARTMENT OF HIGHWAYS

DAY OF OCCURRENCE VS. SEVERITY OF ACCIDENT

A STATISTICAL SUMMARY FOR THE PERIOD OCT 1967-SEPT 1968 ENCOMPASSING CHESTER

DAY OF OCCURRENCE	NUMBER OF ACCIDENTS			
	FATAL	INJURY	PROPERTY DAMAGE	TOTAL
SUNDAY	8	349	564	921
MONDAY	11	235	565	811
TUESDAY	12	289	539	840
WEDNESDAY	10	269	592	871
THURSDAY	10	320	676	1006
FRIDAY	7	412	832	1251
SATURDAY	21	452	788	1261
UNKNOWN	0	0	0	0
TOTALS	79	2326	4556	6961

TABLE 10

DIVISION OF TRAFFIC ACCIDENT ANALYSIS, BUREA OF TRAFFIC, PENNSYLVANIA DEPARTMENT OF HWAYS

HOUR OF OCCURRENCE VS. SEVERITY OF ACCIDENT

A STATISTICAL SUMMARY FOR THE PERIOD OCT 1967-SEPT 1968 ENCOMPASSING CHESTER

HOUR OF OCCURRENCE	NUMBER OF ACCIDENTS FATAL	INJURY	PROPERTY DAMAGE	TOTAL
12.01- 1.0AM	2	68	136	206
1.01- 2.0AM	5	70	98	173
2.01- 3.0AM	9	60	97	166
3.01- 4.0AM	4	44	50	98
4.01- 5.0AM	1	26	29	56
5.01- 6.0AM	1	23	37	61
6.01- 7.0AM	0	32	90	122
7.01- 8.0AM	1	116	276	393
8.01- 9.0AM	3	83	205	291
9.01-10.0AM	1	66	157	224
10.01-11.0AM	1	84	173	258
11.01@ NOON	2	91	210	303
12.01- 1.0PM	1	103	245	349
1.01- 2.0PM	1	117	235	353
2.01- 3.0PM	4	127	257	388
3.01- 4.0PM	4	176	357	537
4.01- 5.0PM	7	241	441	689
5.01- 6.0PM	5	172	340	517
6.01- 7.0PM	4	118	217	339
7.01- 8.0PM	4	129	214	347
8.01- 9.0PM	3	106	189	298
9.01-10.0PM	6	100	162	268
10.01-11.0PM	4	80	141	225
11.01-MDNITE	6	89	141	236
UNKNOWN	0	5	59	64
TOTALS	79	2326	4556	6961

TABLE 11

DIVISION OF TRAFFIC ACCIDENT ANALYSIS, BUREAU OF TRAFFIC, PENNSYLVANIA DEPARTMENT OF HIGHWAYS

HOUR AND DAY OF OCCURRENCE VS. SEVERITY OF ACCIDENT

A STATISTICAL SUMMARY FOR THE PERIOD OCT 1967-SEPT 1968 ENCOMPASSING CHESTER

	SUNDAY			MONDAY			TUESDAY			WEDNESDAY			THURSDAY			FRIDAY			SATURDAY		
HR	FAT	INJ	PD	FAT	INJ	PD	FAT	INJ	PD	FAT	INJ	PD	FAT	INJ	PD	FAT	INJ	PD	FAT	INJ	PD
1	1	22	31	0	3	14	1	6	11	0	3	10	0	7	14	0	6	23	0	21	33
2	1	11	23	0	6	12	1	6	7	0	6	10	0	7	7	0	13	13	3	21	26
3	2	19	35	0	1	7	2	5	9	0	4	9	0	3	3	3	8	8	2	20	26
4	1	13	14	0	2	7	0	6	7	1	1	4	0	3	3	0	6	8	2	13	7
5	0	6	6	0	0	1	1	2	5	0	2	7	0	2	4	0	4	2	0	10	4
6	0	7	7	1	2	5	0	2	4	0	4	6	0	4	2	0	2	6	0	2	7
7	0	3	7	0	4	12	0	8	14	0	3	14	0	2	10	0	5	14	0	7	19
8	0	4	6	1	24	60	0	19	46	0	22	45	0	17	52	0	24	48	0	6	19
9	0	7	12	1	17	35	0	9	37	0	16	25	1	12	37	0	13	40	1	9	19
10	0	6	15	0	10	25	0	12	27	0	5	22	0	9	17	1	10	24	0	14	27
11	0	9	20	0	11	22	0	5	14	0	10	23	0	19	23	0	10	30	1	20	41
12	0	7	24	1	6	28	0	7	21	0	19	26	0	18	44	0	14	28	1	20	39
13	0	18	34	0	3	19	1	17	28	0	12	29	0	13	39	0	18	48	0	22	48
14	0	32	43	0	10	21	0	12	23	0	10	37	0	17	38	0	13	38	1	23	35
15	0	28	38	0	15	30	0	15	21	1	11	30	3	16	35	0	25	49	0	17	54
16	0	25	30	2	19	48	0	27	45	1	32	42	0	21	65	0	25	71	1	27	56
17	0	34	38	0	36	66	3	22	62	1	33	67	2	29	65	1	57	86	0	30	57
18	0	17	32	2	14	41	1	29	47	1	19	52	0	32	62	0	29	62	1	32	44
19	1	25	26	0	9	18	0	16	29	1	13	31	1	15	27	0	15	47	1	25	39
20	1	19	32	1	11	23	0	15	20	1	9	28	0	24	32	0	23	36	1	28	45
21	0	15	29	1	9	17	1	10	16	0	6	27	0	16	25	0	22	42	1	28	33
22	1	11	22	0	11	16	1	14	14	0	12	20	1	13	25	0	25	35	3	14	30
23	0	3	16	0	6	24	0	13	9	2	7	16	0	6	19	2	22	29	0	23	28
24	0	8	12	1	5	10	0	12	13	1	10	10	2	14	18	0	21	35	2	19	43
TOTAL	8	349	552	11	234	561	12	289	529	10	269	590	10	319	666	7	410	822	21	451	777

TABLE 12

DIVISION OF TRAFFIC ACCIDENT ANALYSIS, BUREAU OF TRAFFIC, PENNSYLVANIA DEPARTMENT OF HIGHWAYS

MONTH OF OCCURRENCE VS. SEVERITY OF ACCIDENT

A STATISTICAL SUMMARY FOR THE PERIOD OCT 1967-SEPT 1968 ENCOMPASSING DELAWARE

MONTH OF OCCURRENCE	NUMBER OF ACCIDENTS			
	FATAL	INJURY	PROPERTY DAMAGE	TOTAL
JANUARY	2	271	736	1009
FEBRUARY	2	309	666	977
MARCH	7	324	674	1005
APRIL	6	331	668	1005
MAY	6	405	836	1247
JUNE	1	364	707	1072
JULY	4	288	596	888
AUGUST	5	313	581	899
SEPTEMBER	5	271	627	903
OCTOBER	6	314	607	927
NOVEMBER	8	346	739	1093
DECEMBER	10	377	926	1313
TOTALS	62	3913	8363	12338

TABLE 13

DIVISION OF TRAFFIC ACCIDENT ANALYSIS, BUREAU OF TRAFFIC, PENNSYLVANIA DEPARTMENT OF HIGHWAYS

DAY OF OCCURRENCE VS. SEVERITY OF ACCIDENT

A STATISTICAL SUMMARY FOR THE PERIOD OCT 1967-SEPT 1968 ENCOMPASSING DELAWARE

DAY OF OCCURRENCE	NUMBER OF ACCIDENTS			
	FATAL	INJURY	PROPERTY DAMAGE	TOTAL
SUNDAY	7	507	947	1461
MONDAY	4	438	1004	1446
TUESDAY	2	500	1038	1540
WEDNESDAY	11	492	1036	1539
THURSDAY	7	531	1199	1737
FRIDAY	13	696	1565	2274
SATURDAY	18	747	1573	2338
UNKNOWN	0	2	1	3
TOTALS	62	3913	8363	12338

TABLE 14

DIVISION OF TRAFFIC ACCIDENT ANALYSIS, BUREAU OF TRAFFIC, PENNSYLVANIA DEPARTMENT OF HIGHWAYS

HOUR OF OCCURRENCE VS. SEVERITY OF ACCIDENT

A STATISTICAL SUMMARY FOR THE PERIOD OCT 1967-SEPT 1968 ENCOMPASSING DELAWARE

HOUR OF OCCURRENCE	NUMBER OF ACCIDENTS			
	FATAL	INJURY	PROPERTY DAMAGE	TOTAL
12.01- 1.0AM	5	126	258	389
1.01- 2.0AM	3	105	186	294
2.01- 3.0AM	7	98	171	276
3.01- 4.0AM	1	49	93	143
4.01- 5.0AM	1	28	60	89
5.01- 6.0AM	0	28	50	78
6.01- 7.0AM	1	52	127	180
7.01- 8.0AM	3	152	445	610
8.01- 9.0AM	1	151	342	494
9.01-10.0AM	1	106	284	391
10.01-11.0AM	1	124	365	490
11.01@ NOON	2	154	379	535
12.01- 1.0PM	3	206	401	610
1.01- 2.0PM	4	203	439	646
2.01- 3.0PM	0	216	545	761
3.01- 4.0PM	5	331	628	964
4.01- 5.0PM	6	379	795	1180
5.01- 6.0PM	3	286	608	897
6.01- 7.0PM	2	195	382	579
7.01- 8.0PM	3	239	437	679
8.01- 9.0PM	2	200	374	576
9.01-10.0PM	3	176	362	541
10.01-11.0PM	4	154	281	439
11.01-MDNITE	1	132	266	399
UNKNOWN	0	13	85	98
TOTALS	62	3913	8363	12338

TABLE 15

DIVISION OF TRAFFIC ACCIDENT ANALYSIS, BUREAU OF TRAFFIC, PENNSYLVANIA DEPARTMENT OF HIGHWAYS

HOUR AND DAY OF OCCURRENCE VS. SEVERITY OF ACCIDENT

A STATISTICAL SUMMARY FOR THE PERIOD OCT 1967-SEPT 1968 ENCOMPASSING DELAWARE

	SUNDAY			MONDAY			TUESDAY			WEDNESDAY			THURSDAY			FRIDAY			SATURDAY		
HR	FAT	INJ	PD	FAT	INJ	PD	FAT	INJ	PD	FAT	INJ	PD	FAT	INJ	PD	FAT	INJ	PD	FAT	INJ	PD
1	1	37	63	0	6	21	0	6	24	0	5	23	0	18	31	1	10	35	3	44	61
2	1	35	46	1	8	11	0	3	11	0	6	15	0	8	21	1	11	20	0	34	62
3	4	26	39	0	8	8	0	7	14	2	2	10	0	9	5	0	8	22	1	37	73
4	0	20	25	0	2	8	0	4	5	0	1	8	0	4	8	0	5	9	1	13	30
5	0	10	15	0	2	6	0	1	9	0	2	4	0	2	4	1	3	7	0	8	15
6	0	6	9	0	0	3	0	5	8	0	1	4	0	2	11	0	4	8	0	10	7
7	1	8	8	0	6	22	0	9	16	0	4	17	0	7	12	0	9	38	0	9	14
8	0	7	18	1	28	83	0	25	60	0	22	82	0	29	78	1	35	86	1	16	38
9	0	4	13	1	31	63	0	18	65	0	20	67	0	36	40	0	29	62	0	13	32
10	0	9	26	0	10	35	0	21	46	1	14	40	0	16	33	0	19	44	0	17	60
11	0	9	33	0	24	44	0	13	37	0	16	40	1	30	55	0	19	63	0	13	93
12	0	16	37	0	12	45	0	22	35	2	17	36	0	22	72	0	30	69	0	35	85
13	0	35	69	0	22	48	0	25	50	1	24	44	0	26	52	1	28	50	1	46	88
14	0	35	72	0	28	33	1	25	52	0	28	51	1	18	62	2	37	81	0	32	88
15	0	28	69	0	16	58	0	26	78	0	30	65	0	23	80	0	36	80	0	57	115
16	0	38	56	1	53	84	0	53	101	0	44	98	1	41	89	2	53	104	1	49	96
17	0	30	55	0	54	112	0	58	111	2	58	109	2	60	145	1	67	144	1	52	119
18	0	27	41	0	35	93	0	54	92	0	49	80	1	41	106	1	46	118	1	34	78
19	0	19	45	0	18	42	1	21	41	0	24	39	0	35	54	1	42	94	0	36	67
20	0	35	46	0	15	52	0	34	47	0	29	53	1	28	65	0	56	107	2	42	67
21	0	20	50	0	22	43	0	21	41	1	35	47	0	17	41	0	39	83	1	45	68
22	0	22	39	0	18	34	0	23	43	1	29	44	0	19	41	0	35	90	2	30	71
23	0	22	31	0	9	28	0	15	24	1	15	24	0	22	44	1	35	69	2	36	61
24	0	8	28	0	9	20	0	11	19	0	17	24	0	15	37	0	35	70	1	37	68
TOTAL	7	506	933	4	436	996	2	500	1029	11	492	1024	7	528	1186	13	691	1553	18	745	1556

TABLE 16

DIVISION OF TRAFFIC ACCIDENT ANALYSIS, BUREAU OF TRAFFIC, PENNSYLVANIA DEPARTMENT OF HIGHWAYS

MONTH OF OCCURRENCE VS. SEVERITY OF ACCIDENT

A STATISTICAL SUMMARY FOR THE PERIOD OCT 1967-SEPT 1968 ENCOMPASSING MONTGOMERY

MONTH OF OCCURRENCE	NUMBER OF ACCIDENTS			
	FATAL	INJURY	PROPERTY DAMAGE	TOTAL
JANUARY	3	394	1153	1550
FEBRUARY	7	367	844	1218
MARCH	7	408	929	1344
APRIL	5	423	874	1302
MAY	6	502	1086	1594
JUNE	2	434	1019	1455
JULY	9	428	823	1260
AUGUST	9	437	845	1291
SEPTEMBER	3	413	886	1302
OCTOBER	7	474	923	1404
NOVEMBER	10	486	1233	1729
DECEMBER	4	531	1162	1697
TOTALS	72	5297	11777	17146

TABLE 17

DIVISION OF TRAFFIC ACCIDENT ANALYSIS, BUREAU OF TRAFFIC, PENNSYLVANIA DEPARTMENT OF HIGHWAYS

DAY OF OCCURRENCE VS. SEVERITY OF ACCIDENT

A STATISTICAL SUMMARY FOR THE PERIOD OCT 1967-SEPT 1968 ENCOMPASSING MONTGOMERY

DAY OF OCCURRENCE	NUMBER OF ACCIDENTS			
	FATAL	INJURY	PROPERTY DAMAGE	TOTAL
SUNDAY	7	691	1246	1944
MONDAY	9	629	1533	2171
TUESDAY	13	693	1547	2253
WEDNESDAY	3	686	1575	2264
THURSDAY	12	761	1768	2541
FRIDAY	14	931	2171	3116
SATURDAY	14	906	1936	2856
UNKNOWN	0	0	1	1
TOTALS	72	5297	11777	17146

TABLE 18

DIVISION OF TRAFFIC ACCIDENT ANALYSIS, BUREAU OF TRAFFIC, PENNSYLVANIA DEPARTMENT OF HIGHWAYS

HOUR OF OCCURRENCE VS. SEVERITY OF ACCIDENT

A STATISTICAL SUMMARY FOR THE PERIOD OCT 1967-SEPT 1968 ENCOMPASSING MONTGOMERY

HOUR OF OCCURRENCE	NUMBER OF ACCIDENTS			
	FATAL	INJURY	PROPERTY DAMAGE	TOTAL
12.01- 1.0AM	2	166	271	439
1.01- 2.0AM	3	135	216	354
2.01- 3.0AM	6	108	185	299
3.01- 4.0AM	2	91	91	184
4.01- 5.0AM	0	42	69	111
5.01- 6.0AM	1	37	56	94
6.01- 7.0AM	2	92	211	305
7.01- 8.0AM	3	253	717	973
8.01- 9.0AM	0	270	609	879
9.01-10.0AM	1	166	411	578
10.01-11.0AM	2	206	556	764
11.01@ NOON	1	213	581	795
12.01- 1.0PM	2	261	613	876
1.01- 2.0PM	5	288	641	934
2.01- 3.0PM	4	308	726	1038
3.01- 4.0PM	3	445	972	1420
4.01- 5.0PM	0	491	1154	1645
5.01- 6.0PM	6	404	922	1332
6.01- 7.0PM	4	275	542	821
7.01- 8.0PM	5	265	572	842
8.01- 9.0PM	2	220	480	702
9.01-10.0PM	5	202	406	613
10.01-11.0PM	9	174	365	548
11.01-MDNITE	4	170	301	475
UNKNOWN	0	15	110	125
TOTALS	72	5297	11777	17146

TABLE 19

DIVISION OF TRAFFIC ACCIDENT ANALYSIS, BUREAU OF TRAFFIC, PENNSYLVANIA DEPARTMENT OF HIGHWAYS

HOUR AND DAY OF OCCURRENCE VS. SEVERITY OF ACCIDENT

A STATISTICAL SUMMARY FOR THE PERIOD OCT 1967-SEPT 1968 ENCOMPASSING MONTGOMERY

	SUNDAY			MONDAY			TUESDAY			WEDNESDAY			THURSDAY			FRIDAY			SATURDAY		
HR	FAT	INJ	PD	FAT	INJ	PD	FAT	INJ	PD	FAT	INJ	PD	FAT	INJ	PD	FAT	INJ	PD	FAT	INJ	PD
1	0	39	51	1	13	31	1	17	18	0	20	29	0	16	32	0	18	33	0	43	77
2	0	43	48	0	7	21	0	3	15	0	9	11	1	15	25	2	15	20	0	43	76
3	2	30	43	0	6	13	0	6	9	0	10	12	1	10	18	1	9	20	2	37	70
4	1	32	23	0	6	5	0	2	4	0	11	8	0	10	11	0	10	11	1	20	29
5	0	12	18	0	3	4	0	5	2	0	1	3	0	7	8	0	8	13	0	6	21
6	0	9	12	0	6	6	0	0	12	0	4	4	0	1	6	1	3	6	0	14	10
7	1	5	12	1	19	33	0	15	31	0	15	51	0	8	30	0	15	34	0	15	20
8	0	6	23	0	36	137	0	49	137	1	35	128	1	54	109	1	63	148	0	10	35
9	0	11	16	0	56	119	0	42	91	0	37	112	0	45	112	0	54	116	0	25	43
10	0	23	28	0	28	61	0	20	67	0	21	55	1	26	53	0	19	78	0	29	69
11	0	21	68	0	17	55	1	34	90	0	24	54	1	30	93	0	34	94	0	46	102
12	0	22	53	0	20	60	1	28	69	0	26	87	0	36	106	0	32	85	0	49	121
13	0	36	74	0	37	75	0	27	65	0	30	83	0	36	109	1	39	95	1	56	112
14	0	44	89	0	27	79	1	35	78	0	31	69	1	40	99	1	43	104	2	68	123
15	0	51	89	1	35	91	0	47	94	0	39	92	1	36	109	1	60	123	1	40	128
16	0	46	104	0	53	149	0	64	141	0	63	132	3	79	142	0	83	170	0	57	134
17	0	37	86	0	76	182	0	73	162	0	86	171	0	76	181	0	79	217	0	64	155
18	0	35	57	2	63	134	1	57	145	1	60	133	0	56	153	2	83	199	0	50	101
19	0	31	67	1	27	60	0	46	62	0	42	73	0	35	83	2	54	112	1	40	85
20	1	47	66	2	23	64	0	29	56	1	31	67	0	44	77	0	45	138	1	46	104
21	1	37	71	0	27	52	0	25	61	0	20	64	0	31	56	1	34	98	0	46	78
22	1	26	44	1	18	37	1	29	54	0	23	50	0	26	55	1	46	93	1	34	73
23	0	23	60	0	12	30	4	19	32	0	22	38	1	25	55	0	41	75	4	32	75
24	0	24	30	0	13	23	3	17	38	0	23	37	1	16	36	0	41	68	0	36	69
TOTAL	7	690	1232	9	628	1521	13	689	1533	3	683	1563	12	758	1758	14	928	2150	14	906	1910

TABLE 20

Bucks County

HELICOPTER AMBULANCE STUDY

TRAFFIC ACCIDENTS October '67 - September '68

Local Government	Number of Accidents				Number Killed	Number Injured	Average Injury Per Acc.
	Fatal	Injury	Prop. Damage	Total			
Bedminster Twp.	2	24	34	60	2	44	1.8
Bensalem Twp.	7	231	490	728	8	384	1.7
Bridgeton Twp.	0	4	17	21	0	6	1.5
Buckingham Twp.	2	41	79	122	3	76	1.9
Doylestown Twp.	5	67	99	171	5	123	1.8
Durham Twp.	0	9	12	21	0	16	1.8
East Rockhill Twp.	0	17	40	57	0	33	1.9
Falls Twp.	4	295	590	889	4	481	1.6
Haycock Twp.	0	6	11	17	0	8	1.3
Hilltown Twp.	3	52	115	170	3	87	1.7
Lower Makefie Twp.	1	73	106	180	1	110	1.5
Lower Southampton Twp.	4	102	221	327	5	155	1.5
Middletown Twp.	5	263	518	786	6	418	1.6
Milford Twp.	3	41	48	92	4	59	1.4
New Britain Twp.	1	17	33	51	1	30	1.8
Newtown Twp.	3	30	67	100	3	45	1.5
Nockamixon Twp.	3	38	43	84	4	59	1.6
Northampton Twp.	4	56	113	173	4	95	1.7
Plumstead Twp.	6	39	55	100	6	69	1.8
Richland Twp.	3	50	83	136	4	87	1.7
Solebury Twp.	0	50	79	129	0	91	1.8
Springfield Twp.	1	17	40	58	1	34	2.0
Tinieum Twp.	1	22	19	42	1	41	1.9
Upper Makefie	3	45	42	90	3	84	1.9
Upper Southampton Twp.	2	97	184	283	3	161	1.7
Warminster Twp.	1	143	318	462	1	236	1.7
Warrington Twp.	3	99	140	242	3	172	1.7
Warwick Twp.	1	28	33	62	1	44	1.6
West Rockhill Twp.	2	33	82	117	2	50	1.5
Wrightstown Twp.	0	17	27	44	0	22	1.3
Bristol Twp.	12	406	770	1188	12	685	1.7
Bristol Boro	3	95	226	324	4	151	1.6
Chalfont Boro	1	12	25	38	1	13	1.1
Doylestown Boro	0	64	196	260	0	78	1.2
Dublin Boro	0	6	5	11	0	8	1.3
Humeville Boro	2	2	16	20	2	3	1.5
Ivyland Boro	0	6	2	8	0	10	1.7
Langhorne Boro	0	11	51	62	0	14	1.3
Langhorne Manor Boro	1	2	8	11	1	4	2.0
Morrisville Boro	0	84	192	276	0	119	1.4
New Britain Boro	0	6	20	26	0	7	1.2
New Hope Boro	1	11	30	42	1	17	1.5
Newtown Boro	0	11	39	50	1	18	1.6
Penndel Boro	1	34	76	111	1	60	1.8
Perkasie Boro	0	32	58	90	0	42	1.3
Quakertown Boro	0	33	139	172	0	55	1.7

TABLE 21

TABLE 21

Bucks County (Continued)

HELICOPTER AMBULANCE STUDY

TRAFFIC ACCIDENTS October '67 - September '68

Local Government	Number of Accidents				Number Killed	Number Injured	Avera Injur Per A
	Fatal	Injury	Prop. Damage	Total			
Richlandtown Boro	0	2	4	6	0	2	1.0
Riegelsville Boro	0	2	5	7	0	2	1.0
Sellersville Boro	0	20	46	66	0	27	1.4
Silverdale Boro	0	1	6	7	0	1	1.0
Trumbauersville Boro	0	2	4	6	0	2	1.0
Tullytown Boro	0	46	106	152	0	72	1.6
Yardley Boro	0	20	40	60	0	24	1.2
Telford Boro	0	1	6	7	0	1	1.0
	91	2916	5807	8814	100	4735	1.6

21 (CONT'D)

Chester County

HELICOPTER AMBULANCE STUDY

TRAFFIC ACCIDENTS October '67 - September '68

Local Government	Number of Accidents				Number Killed	Number Injured	Average Injury Per Acc.
	Fatal	Injury	Prop. Damage	Total			
irmingham Twp.	1	30	23	54	1	59	1.9
harlestown Twp.	2	37	65	104	2	58	1.6
ast Bradford Twp.	3	32	57	92	3	58	1.8
ast Brandywine Twp.	1	19	19	39	1	22	1.2
ast Caln Twp.	2	33	30	65	2	47	1.4
ast Coventry Twp.	1	24	33	58	1	42	1.7
ast Fallowfield Twp.	1	19	35	55	2	34	1.8
ast Goshen Twp.	1	46	69	116	1	73	1.6
ast Marlboro Twp.	2	35	46	83	2	58	1.7
East Nantmeal Twp.	0	10	25	35	0	17	1.7
ast Nottingham Twp.	1	28	36	65	1	47	1.7
East Pikeland Twp.	2	39	63	104	2	61	1.6
ast Tolon Twp.	1	104	178	283	1	178	1.7
East Vincent Twp.	0	40	55	95	0	64	1.6
East Whiteland Twp.	4	85	167	256	4	141	1.7
Elk Twp.	0	4	2	6	0	4	1.0
Franklin Twp.	0	9	17	26	0	13	1.4
Highland Twp.	0	10	8	18	0	19	1.9
Honeybrook Twp.	2	25	34	61	2	37	1.5
Kennett Twp.	1	29	57	87	1	46	1.6
London Britain Twp.	0	10	10	20	0	19	1.9
Londonderry Twp.	0	5	15	20	0	7	1.4
Londongrove Twp.	4	43	59	106	4	58	1.3
Lower Oxford Twp.	4	29	21	54	5	51	1.8
New Garden Twp.	3	68	106	177	4	113	1.7
Newlin Twp.	0	5	7	12	0	6	1.2
New London Twp.	0	7	10	17	0	8	1.1
N. Coventry Twp.	2	56	108	166	3	99	1.8
Penn Twp.	1	18	14	33	1	35	1.9
Pennsbury Twp.	0	17	17	34	0	27	1.6
Pocopson Twp.	1	9	20	30	1	18	2.0
Schuylkill Twp.	4	52	83	139	4	92	1.8
South Coventry Twp.	1	20	29	50	1	29	1.4
Thornbury Twp.	0	21	27	48	0	49	2.3
Tredyffrin Twp.	2	190	484	676	3	295	1.6
Upper Oxford Twp.	2	29	28	59	2	59	2.0
Upper Uwchlan Twp.	1	13	32	46	1	22	1.7
Uwchlan Twp.	0	40	93	133	0	70	1.7
Valley Twp.	2	15	32	49	2	27	1.7
Wallace Twp.	1	16	35	52	1	27	1.7
Warwick Twp.	0	9	8	17	0	14	1.6
West Bradford Twp.	2	33	52	87	2	60	1.7
West Brandywine Twp.	2	15	30	47	2	25	1.7
West Caln Twp.	0	7	26	33	0	9	1.3
Caln Twp.	3	65	119	187	3	100	1.5
Atglen Boro	0	3	12	15	0	8	2.7

TABLE 22

TABLE 22

Chester County (Continued)

HELICOPTER AMBULANCE STUDY

TRAFFIC ACCIDENTS October '67 - September '68

Local Government	Number of Accidents				Number Killed	Number Injured	Average Injury Per Acc.
	Fatal	Injury	Prop. Damage	Total			
Avondale Boro	0	13	32	45	0	22	1.7
Downingtown Boro	1	58	131	190	1	87	1.6
Elverson Boro	0	3	5	8	0	3	1.0
Honeybrook Boro	0	5	8	13	0	10	2.0
Kennett Square Boro	0	22	101	123	0	35	1.6
Malvern Boro	1	4	39	44	1	6	1.5
Modena Boro	0	2	1	3	0	2	1.0
Oxford Boro	0	16	60	76	0	35	2.2
Parkesburg Boro	0	4	23	27	0	6	1.5
Phoenixville Boro	2	98	218	318	2	136	1.4
South Coatesville Boro	0	6	7	13	0	11	1.8
Spring City Boro	0	6	28	34	0	6	1.0
West Chester Boro	2	134	465	601	2	184	1.4
West Grove Boro	0	9	19	28	0	12	1.3
Coatesville City	0	87	238	325	0	124	1.4
West Fallowfield Twp.	1	16	23	40	1	28	1.7
West Goshen Twp.	1	109	181	291	1	173	1.6
West Marlboro Twp.	0	9	12	21	0	12	1.3
West Nantmeal Twp.	0	20	28	48	0	36	1.8
West Nottingham Twp.	1	6	16	23	1	11	1.8
West Pikeland Twp.	2	14	27	43	2	34	2.4
West Sadsbury Twp.	2	15	17	34	3	31	2.1
West Town Twp.	2	39	69	110	2	71	1.8
West Vincent Twp.	0	18	16	34	0	21	1.2
West Whiteland Twp.	0	60	115	175	0	104	1.7
Willistown Twp.	3	83	143	229	3	138	1.7

22 (CONT'D)

elaware
ounty

HELICOPTER AMBULANCE STUDY

TRAFFIC ACCIDENTS October '67 - September '68

ocal Government	Number of Accidents Fatal	Injury	Prop. Damage	Total	Number Killed	Number Injured	Average Injury Per Acc.
ethel Twp.	1	33	53	87	1	41	1.2
irmingham Twp.	0	53	67	120	0	93	1.8
hester Twp.	1	17	26	44	1	37	2.2
oncord Twp.	2	94	130	226	2	167	1.8
dgmont Twp.	1	26	36	63	1	47	1.8
arple Twp.	4	161	358	523	4	262	1.6
iddletown Twp.	2	140	213	355	2	236	1.7
ewtown Twp.	4	87	180	271	4	118	1.4
hornburg Twp.	0	12	21	33	0	12	1.0
pper Providence Twp.	0	40	78	118	0	69	1.7
ston Twp.	2	53	111	166	2	83	1.6
arby Twp.	1	49	52	102	1	77	1.6
avorford Twp.	2	269	584	855	2	416	1.5
ower Chichester	2	26	60	88	2	41	1.6
ether Providence Twp.	3	80	140	223	3	131	1.6
adnor Twp.	4	296	739	1039	5	432	1.5
idley Twp.	6	235	476	717	6	395	1.7
pringfield Twp.	1	211	524	736	1	355	1.7
inicum Twp.	1	112	201	314	2	182	1.6
pper Chichester	2	58	135	195	2	95	1.6
pper Darby Twp.	4	572	1160	1736	6	848	1.5
lden Boro	0	27	45	72	0	44	1.6
rook Haven Boro	0	25	72	97	0	38	1.5
hester Heights Boro	1	40	39	80	1	57	1.4
lifton Heights Boro	0	57	158	215	0	93	1.6
ollingdale	1	58	77	136	1	91	1.6
olwyn Boro	1	2	8	11	1	2	1.0
arby Boro	0	48	122	170	0	65	1.4
ast Lansdowne	0	16	32	48	0	23	1.4
ddystone Boro	1	28	80	109	1	37	1.3
olcroft Boro	1	35	49	85	1	51	1.5
lenolden Boro	0	67	134	201	0	97	1.4
ansdowne Boro	2	91	179	272	2	133	1.5
arcus Hook	1	29	55	85	1	35	1.2
edia	0	63	238	301	0	81	1.3
illbourne	0	0	7	7	0	0	0.0
orton	1	14	37	52	1	19	1.4
orwood	1	21	55	77	1	26	1.2
arkside	0	3	14	17	0	4	1.3
rospect Park	1	43	78	122	2	58	1.3
idley Park	0	37	98	135	0	61	1.6
ose Valley	0	1	1	2	0	1	1.0
utledge	0	2	0	2	0	5	2.5
haron Hill	0	29	75	104	0	42	1.4
rainer	0	14	29	43	0	20	1.4
pland Boro	0	11	42	53	0	17	1.5
eadon	0	65	141	206	0	92	1.4
hester City	8	424	1039	1471	8	611	1.4
	62	3906	8351	12319	67	5989	1.5

TABLE 23

TABLE 23

Montgomery County

HELICOPTER AMBULANCE STUDY

TRAFFIC ACCIDENTS October '67 - September '68

Local Government	Number of Accidents				Number Killed	Number Injured	Average Injury Per Acc.
	Fatal	Injury	Prop. Damage	Total			
Douglas Twp.	0	32	61	93	0	55	1.7
E. Norriton Twp.	0	105	229	334	0	154	1.5
Franconia Twp.	0	54	66	120	0	100	1.9
Hatfield Twp.	2	83	143	228	2	130	1.6
Horsham Twp.	7	196	304	507	9	345	1.8
Limerick Twp.	2	62	90	154	2	95	1.5
Lower Frederick Twp.	1	10	19	30	1	15	1.5
Lower Gwynedd Twp.	2	54	96	152	3	93	1.7
Lower Providence Twp.	1	86	223	310	1	154	1.8
Lower Salford Twp.	2	38	38	78	3	85	2.2
Marlboro Twp.	1	13	20	34	1	21	1.6
Montgomery Twp.	2	70	148	220	2	122	1.7
New Hanover Twp.	2	28	45	75	3	40	1.4
Perkiomen Twp.	0	17	31	48	0	28	1.6
Salford Twp.	1	17	18	36	1	23	1.4
Skippack Twp.	0	23	35	58	0	31	1.3
Towamencin Twp.	1	27	51	79	1	37	1.4
Upper Frederick Twp.	0	10	15	25	0	16	1.6
Upper Gwynedd Twp.	0	48	116	164	0	67	1.4
Upper Hanover Twp.	0	21	36	57	0	33	2.7
Upper Merion Twp.	2	341	828	1171	2	523	1.5
Upper Pottsgrove Twp.	0	24	32	56	0	49	2.0
Upper Providence Twp.	1	32	62	94	1	59	1.8
Upper Salford Twp.	0	21	17	38	0	32	1.5
Whitemarsh Twp.	3	157	364	524	3	244	1.6
Whitpain Twp.	4	123	188	315	4	197	1.6
Worchester Twp.	1	48	86	135	1	65	1.4
Abington Twp.	4	377	879	1260	4	568	1.5
Cheltenham Twp.	3	390	791	1184	4	579	1.5
Lower Merion Twp.	7	724	1727	2458	7	1019	1.4
Lower Moreland Twp.	0	98	204	302	0	149	1.5
Lower Pottsgrove Twp.	0	35	51	86	0	46	1.3
Plymouth Twp.	2	203	387	592	3	369	1.8
Springfield Twp.	2	146	288	436	2	215	1.5
Upper Doublin Twp.	6	176	356	538	7	252	1.4
Upper Moreland Twp.	3	210	481	694	4	313	1.5
West Norriton Twp.	0	63	186	249	0	96	1.5
West Pottsgrove Twp.	1	13	44	58	1	16	1.2
Ambler Boro	0	20	77	97	0	27	1.4
Bridgeport Boro	0	42	119	161	0	57	1.4
Bryn Athyn Boro	0	7	20	27	0	8	1.1
Collegeville Boro	0	22	47	69	0	27	1.2
Conshohocken Boro	0	79	243	322	0	106	1.3
E. Greenville Boro	0	5	21	26	0	6	1.2
Greenlane Boro	0	8	14	22	0	13	1.6
Hatboro Boro	1	41	129	171	1	68	1.7

TABLE 24

TABLE 24

Montgomery County (Continued)

HELICOPTER AMBULANCE STUDY

TRAFFIC ACCIDENTS October '67 - September '68

Local Government	Number of Accidents				Number Killed	Number Injured	Average Injury Per Acc.
	Fatal	Injury	Prop. Damage	Total			
Hatfield Boro	0	6	19	25	0	8	1.3
Jenkintown Boro	0	45	147	192	0	67	1.5
Lansdale Boro	2	110	351	463	2	159	1.4
Narbreth Boro	0	27	80	107	0	33	1.2
Norristown, Boro	2	320	868	1190	2	446	1.4
North Wales Boro	0	12	47	59	0	14	1.2
Pennsburg Boro	1	9	38	48	1	10	1.1
Pottstown Boro	1	219	489	709	1	332	1.5
Red Hill Boro	0	3	6	9	0	4	1.3
Rock Ledge Boro	0	16	20	36	0	23	1.4
Royersford Boro	1	12	53	66	1	25	2.1
Schwenksville Boro	0	6	18	24	0	9	1.5
Souderton Boro	1	24	60	85	1	41	1.7
Telford Boro	0	10	20	30	0	11	1.1
Trappe Boro	0	22	26	48	0	32	1.5
West Conshohocken Boro	0	56	108	164	0	77	1.4
	72	5296	11774	17142	82	8065	1.5

24 (CONT'D)

PENNSYLVANIA AERONAUTICS COMMISSION
Harrisburg-York State Airport
New Cumberland, Pennsylvania

c/p Pa 7/24/62

APPLICATION FOR APPROVAL OF HELIPORT SITE
(Must be typewritten)

I/WE Holy Spirit Hospital of the Sisters of Christian Charity, CE 6-8050
(Name of Individual or Corporation) (Telephone No.)

N.21st.St.& Poplar Church Rd. Camp Hill, E.Pennsboro, Cumberland , Pa.
(Street & Number) (Post Office) (Township) (County) (State)

Hereby make application for approval of site for Personal Use Emergency personal use
Heliport ( ), Commercial Heliport ( ), Supplemental Heliport ( ) and

aver that we are/~~xxxx~~ the Owners of the property herein-
(Owner or Lessee)

after described. Holy Spirit Hospital Heliport, N.21st&St. Camp Hill, Pa.
(Name of Heliport) (Address)

DIRECTION AND DISTANCE OF HELIPORT FROM NEAREST CITIES OR TOWNS

One quatter mile North of Camp Hill, Pa.
Two miles West of Harrisburg, Pa.
Four miles NW of Harrisburg-York State Airport.

GEOGRAPHICAL POSITION OF HELIPORT

Latitude	Longitude	Altitude
40° 15' 30" North	76° 55' 00" West	448.0

DESCRIPTION OF APPROACH LANES

Open approach from North, South and West. 115 foot high Chimney on East approach which will belighted.

What fencing provisions will be made? None.

DESCRIPTION OF OBSTRUCTIONS

115 foot high Chimney which will have obstruction lights.

Name of nearest Airport and/or Heliport Harrisburg-York State Airpor
Direction SE Airline Distance 4 miles

Can landing area be kept clear and ready for use at all times? Yes
If not, give reasons: _____

AFFIDAVIT

COMMONWEALTH OF PENNSYLVANIA)
County of Dauphin) SS:

Sister M. Ursula, being first duly sworn according to law, deposes and says that the facts contained in this application and accompaning drawings are true and correct and thatShe is the authorized agent of owner of the above named heliport.
(Owner, authorized agent of owner, officer of corporation)

Subscribed and sworn to before me)
this ____ day of _____ 19___)
Signature of person administering)
oath _____)
Address of person administering)
oath _____)
My Commission expires _____ 19___)

* (Applicant sign in ink)

Sister M. Ursula
Print name in ink EXACTLY as it appears above in signature.

INSPECTOR'S RECOMMENDATIONS

Recommend Approval.

Charles W. Manton
(Inspector)

7/24/62
(Date)

-INSTRUCTIONS-

1. If applicant is lessee, attach one copy of lease affecting the heliport.

2. This application must be accompanied by a dimensional sketch drawn to a scale of 200 feet per inch, signed and dated by the applicant, drawn on back of a Topographic Chart with landing area properly placed on face of chart.

3. Forward application with accompanying information to the Pennsylvania Aeronautics Commission, Harrisburg-York State Airport, New Cumberland, Pennsylvania 17070.

-NOTE-

The rules and regulations promulgated by the Commission provide that "no person, firm, copartnership, association, corporation, county, city, incorporated town, borough, township, or other political subdivision of the Commonwealth shall hereinafter maintain or operate any heliport, landing field or intermediate landing field within this Commonwealth, unless a license therefor or approval shall be issued by the Commission. Provided, that this section shall not have application to heliports and landing fields established or controlled by the Government of the United States."

The Act of May 25, 1933, P.L. 1001, as amended, known as the Aeronautical Code, provides that any person violating any provision of the Code, (unless such violation is by the Code or other law of this Commonwealth declared to be a misdemeanor), or violating any of the rules and regulations adopted by the Commission pursuant to the Code, shall upon conviction thereof in any summary proceeding before any magistrate, alderman or justice of the peace, be sentenced to pay a fine of not less than twelve dollars and fifty cents ($ 12.50) and not more than two hundred dollars ($ 200.00) and, in default of the payment of such fine and costs, to undergo imprisonment in the county jail for a period not exceeding thirty (30) days.

* SIGNATURE: The application shall be signed by the owner or lessee, if a natural person and in the cases where the owner is a corporation, copartnership, or association, by an executive officer thereof or some person specifically authorized by said corporation, to sign the application, to which shall be attached written evidence of his authority.

In complying with the Instructions given on Page 3, outline approach areas to landing pad showing all obstructions.

See attached Plot Plan C - 1

Will the landing pad be hard surfaced?

No. Grass surface maintained.

Will fencing for the landing pad be provided? If so, what type fencing and what what will be the overall height of fence?

No

Where will operational headquarters be established?

At Emergency Desk in the Hospital.

How many persons will man the establishment?

5 per shift in the Emergency Department.

What will be the hours of operation?

24 Hours.

Will services be provided?

No

Will a repair station be established?

No

If the site is intended for other than a permanent establishment, explain uses for which site is intended.

Form CA-10 COPY

Commonwealth of Pennsylvania
Department of Military Affairs
PENNSYLVANIA AERONAUTICS COMMISSION

APPLICATION FOR LICENSE FOR AIRPORT OR LANDING FIELD

For Commission Use Only

Application Number	License Number

(TYPEWRITE ALL INFORMATION IN FULL)

I / We, HOLY SPIRIT HOSPITAL (Name of Individual or Corporation) HOLY SPIRIT HOSPITAL HELIPORT (Name of Airport) (Phone Number)

N. 21st & POPLAR CHURCH ROAD, CAMP HILL, E. PENNSBORO, CUMBERLAND, PENNA.
(Airport Address) (Post Office) (Township) (County) (State)

Hereby make application for license to operate EMERGENCY-PERSONAL USE (Municipal, County, Commercial, Private, Intermediate) airport or landing field,

and aver that ~~we~~ I am the OWNERS (Owner or Lessee) of the property hereinafter described:

NOTE:—If applicant is lessee, attach one copy of lease affecting airport or landing field:

Direction and Distance of 4 Nearby Cities or Towns

	CITY OR TOWN	DIRECTION TO AIRPORT	DISTANCE
1	CAMP HILL	N	¼ mile
2	HARRISBURG	W	2 miles
3			
4			

Geographical Position of Airport or Landing Field

LATITUDE (Degrees and Minutes)	LONGITUDE (Degrees and Minutes)	ALTITUDE ABOVE SEA LEVEL (Ft.)
40° 15' 30"	76° 55' 00"	448

Description and Size of Field to Be Actually Used

LENGTH	WIDTH	NUMBER ACRES	SHAPE (Square, Triangular, Etc.)

Length of Landing Runs Now Available as One Unit

NUMBER FEET	DIRECTION		LANDING STRIPS, IMPROVED LANDING STRIPS, HARD RUNWAYS
100	From	to	in diameter
	From	to	
	From	to	
	From	to	

Is entire area of field available for landing and taking off? Yes

Are approaches clear? 115 foot high chimney on east approach which will be lighted

Description of Obstructions

TYPE	HEIGHT	LOCATION
chimney	115 feet	east

Description of landing surface: grass

Airline distance and direction to nearest commercial airport: Harrisburg-York State Airport S/E 4 miles

Is any part of landing area crossed by a road or public or private right-of-way? NO

Can landing area be kept clear and ready for use at all times? YES If not, give reasons:

Description of Facilities Now Available

HANGAR	No.
FIRE FIGHTING EQUIPMENT	In hospital
FIRST-AID EQUIPMENT	In hospital
BULLETIN BOARD	No
CIRCLE-TIE-DOWNS	No
WIND INDICATOR	No
WEATHER INSTRUMENTS	No.
GASOLINE AND OIL	No
REPAIRS	No
COMMUNICATION	No
TRANSPORTATION	No.

Give complete description of all lighting equipment: No lighting

Is airport correctly marked for daylight operation, with boundary markers spaced 300' apart?

Yes for daylight operation as heliport

Personnel in Attendance

NUMBER	POSITION TITLE	DUTIES
None	This heliport for emergency use only.	

Is airport or landing field covered by public liability insurance?

Insurance Record

POLICY NUMBER	AMOUNT	COMPANY ISSUING POLICY	
		Name	Address

Remarks:

Affidavit

Commonwealth of Pennsylvania,
County of Cumberland } ss:

Sister Ursula, S.C.C., being first duly sworn according to law, deposes and says that the facts contained in this application and accompanying drawings are true and correct, and that she is the Administrator

(Owner, authorized agent of owner, officer of corporation)

of the above named airport or landing field.

SEAL

Subscribed and sworn to before me this .....

..... day of ..... 19.....

.....
(Signature in ink of person administering oath)

.....
(Address in ink of person administering oath)

My commission expires ..... 19.....

.....
*(Applicant's signature in ink)

Sister Ursula
(PRINT name in ink EXACTLY as it appears above in signature)

Instructions

This application must be accompanied by a dimensional sketch, on the back of a topographic chart with landing strip properly placed on the face of the chart, drawn to a scale of 200 feet per inch, signed and dated by the applicant and showing the layout of the airport, including landing area, landing strips, runways, airport marking, drives, tracks, location of buildings, and other structures, location of all night lighting equipment, and location and height of obstructions surrounding field, and direction of prevailing wind.

Application with accompanying information must be executed in duplicate and transmitted to the Department of Military Affairs, Pennsylvania Aeronautics Commission, Harrisburg, Pennsylvania.

Note

The rules and regulations promulgated by the Commission provide that "No person, firm, copartnership, association, corporation, county, city, incorporated town, borough, township or other political subdivision of the Commonwealth shall hereafter maintain or operate any airport, landing field or intermediate landing field within this Commonwealth, unless a license therefor or approval shall be issued by the Commission. Provided, that this section shall not have application to airports and landing fields established or controlled by the government of the United States."

The Act of May 25, 1933, P. L. 1001, as amended, known as the Aeronautical Code, provides that any person violating any provision of the code, (unless such violation is by the code or other law of this Commonwealth declared to be a misdemeanor), or violating any of the rules and regulations adopted by the Commission pursuant to the code, shall, upon conviction thereof in any summary proceeding before any magistrate, alderman or justice of the peace, be sentenced to pay a fine of not less than fifty dollars ($50.00) and not more than two hundred dollars ($200.00), and, in default of the payment of such fine and costs, to undergo imprisonment in the county jail for a period not exceeding thirty (30) days.

*SIGNATURE:—The application shall be signed by the owner or lessee, if a natural person, and in the cases where the owner is a corporation, copartnership, or association, by an executive officer thereof or some person specifically authorized by said corporation, to sign the application, to which shall be attached written evidence of his authority.

Inspector's Report
(FOR COMMISSION USE ONLY)

Date 5-6 19 64

Does inspection verify information shown on preceding pages? If not, explain discrepancies: As stated

Usable Field Measurements

LENGTH (FT.)	DIRECTION		LANDING STRIPS, IMPROVED LANDING STRIPS, HARD RUNWAYS
	From	to	
	From	to	
	From	to	
	From	to	

Describe obstructions: Smoke stack on premises - lighted.

In your opinion, is this airport safe for the operations that will be conducted here? Yes

Inspection made: 5-6-64

Letter of authority granted: No

Inspector's recommendations: Issue license.

C. Fred Osman
(Inspector)

COPY

Commonwealth of Pennsylvania

DEPARTMENT OF MILITARY AFFAIRS

PENNSYLVANIA AERONAUTICS COMMISSION

HARRISBURG, PENNSYLVANIA

AIRPORT LICENSE

No. P-302

THIS IS TO CERTIFY THAT ON APPLICATION OF HOLY SPIRIT HOSPITAL
HOLY SPIRIT HOSPITAL HELIPORT

LOCATED AT N. 21ST & POPLAR CHURCH ROAD, CAMP HILL, CUMBERLAND COUNTY, PENNA.

HAS BEEN FOUND ADEQUATE AND PROPERLY QUALIFIED AND SAFE FOR PRIVATE OPERATIONS

AND IS HEREBY LICENSED TO OPERATE AS

A PERSONAL USE HELIPORT

THIS LICENSE IS ISSUED SUBJECT TO COMPLIANCE WITH THE RULES AND REGULATIONS OF THE COMMISSION, THE PROVISIONS OF WHICH ARE MADE A PART HEREOF AS THOUGH WRITTEN HEREIN, AND WILL REMAIN IN FULL FORCE AND EFFECT FROM THIS DATE AND WILL BE RENEWED ANNUALLY UNLESS REVOKED FOR CAUSE.

INSPECTOR'S RENEWAL	DATE
	5-6-64

PENNSYLVANIA AERONAUTICS COMMISSION

BY J. W. MACFARLANE
EXECUTIVE DIRECTOR

NON-TRANSFERABLE

THIS LICENSE MUST BE CONSPICUOUSLY DISPLAYED AT THE ABOVE LOCATION

FORM CA-1

92

Annual Fixed Cost Allocations

In developing total costs of aircraft operation, it is customary to calculate separately those costs which are incurred on a term basis from those which accrue hour by hour through the direct operation of the equipment. The former are herein termed the Annual Fixed Costs and the later are referred to as the Variable Costs of Operation.

The aircraft-related fixed costs are as follows:

Depreciation - This is the annual pro-rated cost of the initial investment in the aircraft and its special equipment. It is calculated over seven years with a 15% residual value in the case of new helicopters, and over four years with a 15% residual value in the case of used helicopters.

Interest on Investment - This is the annual interest cost on the total investment for aircraft, special equipment, and initial parts. It is calculated at the rate of 6% per annum.

Hull Insurance - This is the premium cost for hull damage insurance. Premiums are calculated on a specified percentage of the value of the helicopter including installed equipment. The premium rates vary somewhat between aircraft depending whether they are new or used, high value or low, and in some cases by the past experience of specific models. Rates for the helicopters included in this study were estimated as follows:

Bell 47 J-2	11% of hull value
Bell Jet Ranger	12% of hull value
Hiller FH-1100	11% of hull value
Sikorsky S-55	11% of hull value
[illegible]	[illegible]
[illegible]	[illegible]

Aircraft Liability Insurance - This is insurance against claims for injury or damage to persons or property resulting from the operation of the aircraft. Excepted would be claims of injury to crew members, but injuries to passengers would be included. Premiums for liability insurance are normally quoted on a lump sum basis, not on a percentage basis. The costs employed herein are estimates based on recent quotes for $2,000,000. single limit coverage for representative commercial operations.

Hangar Rental - This is a rental fee established to compensate for the cost of providing alert base hangar facilities. It is calculated on the basis of $75.00 per month for the small helicopters and $150.00 per month for the larger models.

General Overhead - This is an amount estimated for items not directly assignable to other categories and includes such things as cost of heat, light, telephone, secretarial help, office supplies, subscriptions, licenses, fees, etc. The amount of $500. per month is used in the cost tabulations, which is somewhat less than the amount normally estimated for a commercial operation of broader scope.

The personnel-related fixed costs are as follows:

Annual Salaries - This represents salaries paid to pilots and mechanics required for the proposed operations. The salaries assigned to each employee category are the current rates for well-experienced personnel meeting professional standards of commercial helicopter operations.

The annual salaries assigned the various job categories are as follows:

Pilots - Full-Time	$10,000.
Pilots - Part-Time	$ 4,500.
A&P Mechanics - Full-Time	$ 8,500.
A&P Mechanics - Part-Time	$ 2,600.
Mech's Helpers - Full-Time	$ 6,000.
Mech's Helpers - Part-Time	$ 2,000.

COST TABULATION

	BELL 47-J2	JET RANGER	FH-1100	SIKORSKY S-55
Fixed Costs Per Year				
A. Aircraft Costs				
Depreciation	6,563.	13,965.	13,478.	11,433.
Interest	3,000.	7,260.	7,020.	3,828.
Hull Insurance	4,950.	13,800.	12,210.	5,918.
Liability Insurance	1,000.	1,000.	1,000.	2,200.
Hangar Rental	900.	900.	900.	1,800.
General Overhead	7,200.	7,200.	7,200.	7,200.
Sub-Total	23,613.	44,125.	41,808.	32,379.
B. Personnel Costs				
Pilots-Full Time	30,000.	30,000.	30,000.	30,000.
Part Time	4,500.	4,500.	4,500.	4,500.
Mechs.-Full Time	8,500.	8,500.	8,500.	17,000.
Part Time	2,600.	2,600.	2,600.	2,600.
Helpers-Full Time	6,000.	6,000.	6,000.	12,000.
Part Time				2,000.
Payroll Costs	5,160.	5,160.	5,160.	6,810.
Sub-Total	56,760.	56,760.	56,760.	74,910.
TOTAL FIXED COSTS	80,373.	100,885.	98,568.	107,289.
Variable Costs Per Flight Hour				
Fuel	8.	8.75	7.75	22.
Oil & Lubricants	.50	.50	.50	2.
Reserve for Parts & O/H				
Engine	6.	11.	10.	20.
Airframe	12.	15.	13.	20.
Accessories	1.	1.25	1.25	2.
Miscellaneous	.50	.50	.50	1.
TOTAL VARIABLE COSTS	28.	37.	33.	67.

COST TABULATION (Continued)

	BELL 47-J2	JET RANGER	FH-1100	SIKORSKY S-55
Total Yearly Costs	80,373.	100,885.	98,568.	107,289.
Variable Costs for 1440 Flight Hours	40,320.	53,280.	47,520.	96,480.
TOTAL	120,693.	154,165.	146,088.	203,769.

CAPITAL EQUIPMENT COSTS

Item	BELL 47-J2[1]	BELL[2] JET RANGER	FAIRCHILD[2] FH-1100	SIKORSKY[1] S-55
Basic Aircraft - Equipped	40,000.	110,000.	106,000.	50,000.
Special Accessories	5,000.	5,000.	5,000.	3,800.
Value for Depreciation	45,000.	115,000.	111,000.	53,800.
Initial Spare Parts for Airframe & Engine	5,000.	6,000.	6,000.	10,000.
Total Capitalization	50,000.	121,000.	117,000.	63,800.

1 - Used

2 - New

COST EFFECTIVENESS

for the

EMERGENCY MEDICAL SERVICE SYSTEM

In order to conduct a comprehensive evaluation of the relative effectiveness of helicopter ambulance service, it is necessary to define the level of the requirements which are imposed by the medical service activity. Such an evaluation minimizes the aforementioned possibility of a mis-use of resources through over-refining one of the elements at the expense of another.

The objective of the emergency service is to reduce the consequences of injuries suffered in a highway accident. The measure of the overall quality of the service provided can be identified as the "level of service." The criteria by which "level of service" can be measured are both humanistic and economic. Suggested measures are:

1. Humanistic criteria

   (a) Length of time of human suffering
   (b) Length of time of temporary impairment
   (c) The degree of permanent impairment
   (d) The number of fatalities

2. Economic Criteria

   (a) Medical and hospital expenses
   (b) Loss of income due to temporary impairment
   (c) Loss of income due to permanent impairment
   (d) Loss of income due to loss of life

Insofar as emergency medical services are concerned, an increase in the level of service will decrease the losses. Mathematically, these relations can be represented by: (1) $EL = EH + EDL$

where:

L = Losses (in humanistic and economic terms)

H = Humanistic Losses

DL = Dollar Losses

The suggested summations are possible only for dollar losses and for specific

types of humanistic values. For example, the dollar losses from medical expenses can be added to the economic losses of income. However, losses related to human suffering cannot be meaningfully added to number of fatalities, or to number and extent of permanent impairments. Therefore, individual summations will be much more useful to decision-makers, until such time as a weighted index of humanistic values gains acceptance.

(2) $L = f(S) = f(R)$

where:

S = Level of Service

R = Resources expended

Thus, the losses incurred from inadequate emergency medical services are a function of the quality of the service and, in turn, a function of the resources expended; i.e., the better the service, the more the service costs, and the lower the losses.

(3) $S = f\left(\frac{Q}{T}\right)$

where:

T = Time response

Q = Quality of medical service

The losses to an injured person is controlled by the speed with which competent medical service is provided. The higher the quality of the medical personnel and the greater the quality of the equipment, the better the chance of recovery and of less suffering. Equally critical is the response time, which must be reduced to a minimum to produce the greatest increase in level of service.

In qualitative terms, the relation between losses, level of service, and resources needed to be developed. As the level of service is increased, resources increase and losses decrease. A point is reached where a reduction in losses requires a relatively large increase in resources. Since suffering and fatalities are involved in the losses, it is not possible to identify a limiting point from such data. However, it is possible to compare the return in human values from increasing resources to highway emergency medical services, as compared to returns from improving other

It should also be noted that the resource considerations include medical doctors and specialists. Indiscriminate use of such limited manpower would have an influence on other medical services.

(4) Q = f (Manpower, equipment, facilities, communication, and administration)

(5) T = f (Transport equipment, communication, and administration)

One approach to decreasing the losses would be an across-the-board improvement of the elements that compose the quality of medical service and the elements that decrease the time responses. However, sharp increases in resources can accompany the elements for which there is the greatest reduction in losses for the smallest increases in resources.

The limited resource problem is perhaps most critical within the medical resource area itself. For example, it would hardly be good use of resources to send top medical specialists to all highway accidents as a means of reducing the time for the one in a thousand accidents which requires such a specialist.

The reduction in response time appears to offer the greatest potential for reducing losses. In addition, there is a relation between the extent of the injury and the time response required. Accordingly:

$$T = t_1 + t_2 + t_3 + t_4 \ldots\ldots + t_n$$

where:

t_1 to t_n = time responses for various components of the emergency service.

By considering each accident and each injury, or a reliable random sample, probability considerations can be introduced in such a way as to produce the greatest reduction in various types of losses for various levels of resources.

The preceding generalization covers the entire emergency medical service system. Therefore, it is possible to make a comparison of helicopter ambulance service with any other potential improvement. It should also be noted that the terms for measuring loses are general and in units comparable to other highway safety and public

health activities. As a result, helicopter service could be compared with other programs addressed to improving these values.

The representation is not complete in that the impact upon highway transportation is not provided. This larger problem involves costs, benefits, and losses of a much wider range, and is primarily relevant to the basic question of resource allocation to highway transport. The bearing of this larger problem upon the helicopter ambulance service will be felt in due course, but in a manner which limits the service, rather than in evaluating it.

THE EVALUATION PROCEDURE

The procedure for evaluating the relative effectiveness of helicopter ambulance services involves the following analyses:

1. Definition of the area to be studied
2. Existing losses
3. Existing resources
4. Existing level of service
5. Changes produced by helicopter ambulance service
6. Alternate techniques for improving level of service

Definition of the Area Studied

The area or region to which the evaluation is to apply must first be set. These boundaries become quite important as attempts to measure change are made. For example, efforts of any one State or one urban area are not likely to have a measurable effect upon the national picture. Consequently, a localized improvement in a city may have no measurable effect on the records of the state or even the urban area itself.

Existing losses

Losses that have developed in the past from highway accidents should be generated to the extent that the data exist. Past history can be used to predict the values for the time period of the study.

(To the extent these data are not available, two possibilities exist: (1) random

sample and extrapolation of number of accidents or (2) use of one or two that are available.)

Existing resources

The extent of the dollars expended and medical manpower used should be developed for several years to determine whether a significant change has been taking place.

The costs would include all direct expenditures properly associated with emergency medical services. For those services which overlap (i.e., general ambulance service) and estimate of the level for highway safety is needed.

For medical manpower, at least two categories are needed. One is the medics level, and the other is the medical doctors. If possible, use of specialists time would also be desirable.

Existing level of service

The existing level of service must be established. According to earlier analyses:

(3) $S = f\left(\frac{Q}{T}\right)$

For practical purposes, the level of service needs to be divided into components which reflect different influences on service.

The key requirements are influenced by the time responses of the following steps in the emergency medical services function:

Phase 1

1. Detection
2. Reporting
3. Dispatching
4. Transit to scene

Phase 2

5. Extrication from the wreckage
6. Medical service at scene
7. Transfer to medical center and treatment enroute

Phase 3

8. Admission to medical facility

9. Treatment at medical facility

Phase 4

10. Rehabilitation

Steps 1 through 4 are basic system reaction times which control and influence all subsequent response times. One of the most critical measures of the level of service is the time requirements to complete Phase 1. The time for completion of Phase 2 is a second major measure of service. Phase 3 completes the emergency and Phase 4 completes the loss cycle.

If economic and medical resources were not limited, the highest quality of medical service would be applied throughout the service. Since there is real limit to both types of resources, major subdivisions also exist for the time response of various levels of medical attention. Thus, what level of medical competence first arrives at the scene?

From a medical service view, the following are the time-critical activities:

1. Diagnosis

2. Treatment at scene

3. Treatment enroute

4. Emergency treatment at medical center

The relative importance of time savings to each of these activities and the values derived from providing the necessary medical services is a medical judgment.

To define existing level of service, then, the quality of the medical services must be rated by medical authorities for each of the four medical activities.

An estimate will also be needed of the time responses for each of the first three phases of the emergency service, as well as for the four medical activities.

The ultimate description of the level of service will not result in a single value, but in the preceding series of value systems. If a weighting system is

possible, a single index value of level of service could result. Otherwise, levels of service for different parts of the service would be the basis for further analysis.

Changes produced by helicopter ambulance service

The value of the helicopter as an ambulance lies in the reduction of the time responses. However, due to the more centralized nature of helicopter service, the upgrading of the quality of the medical service would be more possible; i.e., one doctor per helicopter is more feasible than one doctor per ground ambulance.

The total contribution of the helicopter is greatly influenced by the communication and management systems employed in the emergency services. Unless centralized management and radio communication for dispatches to scene to hospital is used in conjunction with the helicopter, it is likely to be under-used. It is also probable that the reduction in time responses of the helicopter -- used in the same way as a ground ambulance -- will not produce major improvements except where ground ambulances must cover large areas (twenty to fifty square miles per ambulance). The reduction in losses could be estimated by a direct medical appraisal of each victim's recovery cycle.

If a region is sufficiently large, the increase in resources and the decrease in losses produced by helicopter use may be insignificant. In such cases, a micro-analysis can be conducted. For example, the probable reduction in losses produced by the use of a helicopter rather than a ground ambulance could be estimated. The costs, as compared to additional ground ambulances, could then be estimated.

Alternate techniques for improving level of service

Cost effectiveness techniques are most helpful when specific goals are set. Goals for emergency medical services are difficult to establish because of the interactions and the dependency of the injured victims survival on the nature of the injury and the victim's physical condition. The scarcity of data also makes it difficult to set goals related to reducing losses. For example, a reduction in fatalities or in the number of permanent impairments, (even in terms of the number per highway accident), is difficult to trace to emergency medical services.

An alternate type of goal is one that would reduce response times to some level. For example, the diagnostic time response, or transit to scene. Again, in a large area, with good ground ambulance service, a decrease in the average time response may not be feasible except through a change other than ambulance.

One type of time response goal, however, would be to eliminate or minimize the number of excessively long time delays. Such delays occur for a variety of reasons, but frequently because of long distances or due to congested roads and streets.

If a goal such as time reduction is set, however, the whole emergency service activity must be examined for the most effective way to reduce losses through a reduction in time response. Detection, reporting, communication, transportation, management, and hospital emergency facilities areall alternate ways that should be considered. For example, it is highly probable that the greatest reduction in time response from the time of the accident to the first arrival of medical aid on the scene would be produced by a more effective detection system. It is not implied that the cost of such a system is comparable to other techniques for reducing time responses.

In the absence of specified goals, alternate techniques can be studied for achieving a reduction in losses (or time responses) with the same resources needed for helicopter ambulances.

The final result would be a comparison of reduction in losses (or reduction in time responses) for the same level of increase in resources.