

**ORGANIZATIONAL AND PERSONNEL
NEEDS STUDY
OF
THE SCHENECTADY FIRE DEPARTMENT**

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CHAPTER 1

INTRODUCTION

The University City Science Center is pleased to submit this report which examines the organizational and personnel needs of the Schenectady Fire Department. The proposal to the city established several principles that guided the study. The principles focused on developing a cost containment strategy for providing fire and emergency medical services to the community. Emphasis was placed on the possible modification of operating procedures to improve efficiency. To the extent possible cost containment recommendations were to strive for maintaining and/or improving the quality of service provided to the citizenry.

Our assessment indicated that it is possible for the city to make alterations in fire and emergency medical operations that will result in considerable cost savings without significantly reducing the emergency response needs of the community. In addition, an opportunity exists to increase the quality of suppression and inspection services by implementing additional training requirements and by establishing a series of performance standards for both firefighters and officers. Emphasis in this report is placed on identifying not only personnel training and readiness needs but also the number of personnel needed in the fire department.

Our assessment of the fire department is that it is an effective operation. The quality of service provided and the dedication of the personnel at all levels in the department are commendable. While we have found that citizens are well served by the department, we have also found that the provision of these services is expensive. The expense is a function of the salaries and fringe benefits paid to firefighters as well as the number of personnel in the department. Personnel costs consume more than 90% of the total fire budget. In the report that follows recommendations are made to allow the city to control expenditures for fire protection and emergency medical services.

Members of the department were very cooperative and supportive of the study effort. Personnel and records were made readily available to the

STUDY METHODS

The study was conducted by a team of public management and fire specialists during June through November of 1986. During this period the consultants interviewed command personnel and union leaders in the department, reviewed documentation and collected information about the organization of the department and operational procedures. The following methods were used by the study team:

- Personal interviews were held with the the Mayor, the Director of Administrative serves, Fire chief, assistant chiefs and the captain in charge of emergency medical services (EMS).
- An analysis was conducted of service demands and fire and EMS company responses to these demands. The analysis included a detailed review of 3400 service incidents. Information about each of these incidents was computerized to aid in the analysis.
- A survey of fire departments in cities of comparable size in New York State was conducted. The following cities participated in the survey:

Albany
Niagara Falls

Mount Vernon

- Fire expenditures and budgets were reviewed for the 1982-87 period, and projections were made through 1991.
- Population and employment trends for the past several decades and projections through the year 2000 were reviewed.

Upon completion of the onsite phase of the study, both the Mayor and Fire Chief were briefed about our observations. A draft report of findings and recommendations was prepared and submitted to the Mayor and Chief for review and comment. After an extensive review the report was finalized.

CHAPTER 2

BACKGROUND

In the past decade Schenectady has gone through a considerable amount of change. In previous decades Schenectady was a much larger city. Exhibit 1 displays past population levels in the city and projections through the year 2000. Between 1950 and 1980 the city experienced considerable population decline (26%). This decline was typical of many Northeastern cities as businesses and residents abandoned the city for suburban areas. While the population of the city declined, that of the surrounding area increased. The population decline slowed during the latter part of the 70's and leveled off during the early 80's. Between 1980 and 1984 the population remained virtually unchanged. Projections compiled by the Capital regional planning Commission, predict the population will decline slightly during the remainder of the century. The magnitude of the decline is unlikely to have any significant impact on fire and emergency medical service demand levels.

EXHIBIT 1
Population Trends, 1950-2000

Year	Population	% Change
1950	91,785	-
1960	81,682	-11%
1970	77,958	-5%
1980	67,950	-13%
1990	63,100	-7%
2000	65,650	-4%

Exhibit 2 provides information about per capita costs for fire and emergency medical services. In FY86 it cost approximately \$116 per capita to provide emergency protection services to the community. Per capita costs increased 33% between FY82 and FY86. The increase was the result of changes in personnel costs. As part of this study the Science Center collected information about fire operations and costs from three other cities of similar size in New York State. Per capita costs in the comparison cities ranged from a low of \$73 in Mount Vernon to \$131 in Albany in FY86. Schenectady, at \$121, was 14% above the median of \$106 for the cities surveyed.

The average cost per firefighter in the cities surveyed was \$43,347. Cost per firefighter in Schenectady in FY86 was \$47,573 10% above the average for the comparison cities. In 1987 it will cost Schenectady approximately \$48,000 to equip and deploy each firefighter and officer assigned to the department. Appendix A2 contains the comparative cost information.

In addition to the actual costs for public fire protection Exhibit 2 contains information about costs for services standardized to 1982 dollars. By using 1982 dollars based on the consumer price index (CPI) for the Buffalo metropolitan area, it is possible to estimate the impact of inflation on the fire department budget. The CPI data indicate that expenditures have been rising at a pace slightly faster than inflation. During this period per capita cost increases were 7% above the rate of inflation. The increase would have been higher had it not been for slight decreases in personnel levels in the department. A review of the current labor contract indicates raises of 6% in 1987 and 4% in 1988. In all likelihood these raises will exceed the rate of inflation.

Budgetary projections through 1991 were computed by applying linear regression to per firefighter expenditures and multiplying this figure by the number of firefighters and officers (173). Analysis of the regression line indicates that costs per officer will rise approximately 4% annually, the current rate of inflation. This a conservative method to estimate future costs. Our estimates will be low depending on the extent to which wage arrangements exceed inflation. Our estimates indicate that it will cost the city nearly \$10 million to operate the fire department in 1991 or \$148 per capita if operational practices remain unchanged. Per officer costs will be in

EXHIBIT 2
FISCAL ANALYSIS
(CONTINUED)

1987	1988	1989	1990	1991	1982-86	1986-1991
67981	67981	67981	67981	67981		
177	177	177	177	177	-2.75%	0.00%
173	173	173	173	173	-2.26%	0.00%
4	4	4	4	4	-20.00%	0.00%
260	260	260	260	260	-2.75%	0.00%
					24.06%	
					22.96%	
					27.19%	
					26.93%	
					57.55%	
					65.79%	
\$8,370,071	\$8,792,630	\$9,215,189	\$9,637,747	\$10,060,306	25.06%	28.04%
\$123.12	\$129.34	\$135.56	\$141.77	\$147.99	25.06%	28.04%
6.53%	5.05%	4.81%	4.59%	4.38%		
\$48,382	\$50,824	\$53,267	\$55,710	\$58,152	27.95%	28.04%
331.29	344.55	358.32	372.66	387.57	19.22%	21.67%
4.00%	4.00%	4.00%	4.00%	4.00%		
\$6,750,832	\$6,818,722	\$6,871,786	\$6,910,337	\$6,935,815	4.89%	5.24%
\$99.30	\$100.30	\$101.08	\$101.65	\$102.03	4.89%	5.24%
2.43%	1.01%	0.78%	0.56%	0.37%		

EXHIBIT 4

NUMBER OF RELATED PERSONNEL AND RELATED COSTS

YEAR COST PER FF * OF FF	1987 \$48,382	1988 \$50,825	1989 \$53,267	1990 \$55,710	1991 \$58,152
173	\$8,370,086	\$8,792,725	\$9,215,191	\$9,637,830	\$10,060,296
168	\$8,128,176	\$8,538,600	\$8,948,856	\$9,359,280	\$9,769,536
163	\$7,886,266	\$8,284,475	\$8,682,521	\$9,080,730	\$9,478,776
158	\$7,644,356	\$8,030,350	\$8,416,186	\$8,802,180	\$9,188,016
153	\$7,402,446	\$7,776,225	\$8,149,851	\$8,523,630	\$8,897,256
148	\$7,160,536	\$7,522,100	\$7,883,516	\$8,245,080	\$8,606,496

ORGANIZATION AND STAFFING OF THE DEPARTMENT

Exhibit 5 displays the organizational structure of the department. The department has an authorized strength of 177 personnel - 173 firefighters and officers and four civilians. At the present time the department has only 163 sworn personnel and is relying on the extensive use of overtime to staff the existing apparatus. Hiring of personnel has been postponed pending the outcome of this assessment.

Overtime costs for the department have been very expensive. The work could have been accomplished more economically by hiring sufficient firefighters to staff the authorized apparatus. The need to use overtime has also been detrimental to the maintenance of a compensation structure that maintains pay separation between the ranks. It is not uncommon for lower ranking personnel in the department to earn more than their supervisors. Examples of this are listed below.

Rank	Base Salary	Average Maximum	% Above Base
Chief	\$39,095	\$39,095 (1)	0%
Assistant Chief	\$34,761	\$34,761 (2)	0%
Deputy Chief	\$28,428	\$35,262 (4)	25%
Captain	\$27,192	\$37,913 (5)	39%
Lieutenant	\$25,956	\$37,264 (5)	44%
Firefighter	\$24,632	\$32,769 (5)	33%

Because firefighters and officers, like other employees of the city receive sick, vacation and holiday time off and must fulfill training commitments more than 33 personnel must be assigned to each shift in order to ensure that a full complement of personnel are on duty to staff the apparatus. The department estimates that approximately 42 personnel should be assigned to each shift in order to staff the apparatus. At a minimum the suppression division needs a total of 168 personnel to operate efficiently. At the present time the division is 10 personnel short.

RECOMMENDATIONS

1. The department should create a training division commanded by a deputy chief. This would be a new position. The deputy chief should be supported by a captain. This deputy chief should be paramedic-certified so that he can manage the paramedic training program.
2. Sufficient personnel should be hired to substantially reduce the overtime budget of the department. The overtime is a direct result of continuing to deploy all apparatus with a reduced personnel contingent. If the number of personnel in the department are not reduced then apparatus should be taken out of service to control overtime costs.
3. The salaries of the Chief and Assistant Chiefs should be adjusted annually so that they are compensated at a level of at least 10% above the rate of the highest paid person below them in rank.

CHAPTER 3

FIRE SUPPRESSION SERVICES

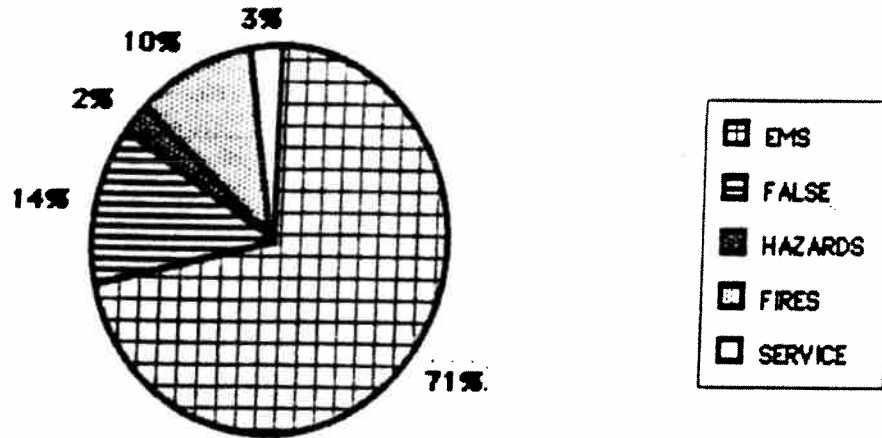
The fire suppression division is the most costly and visible component of the Schenectady fire protection system. In addition to providing fire services the division is also responsible for emergency medical services (EMS). EMS activities are discussed in Chapter 4 of this report. One hundred and sixty-nine firefighters and officers or 98% of the sworn personnel are assigned to this division. At the present time the division is operating with a total of 158 personnel - 7% below the allocated compliment. Approximately 20% of the firefighters are assigned to the EMS function. The division consumes approximately 95% of the \$7.9 million annual fire department budget. As a consequence, decisions about the structure and the ways in which services are delivered have major implications for fire department costs. The purpose of this chapter is to describe fire service demands in Schenectady, review engine and ladder company responses patterns and analyze the feasibility of consolidating and moving stations and fire companies to provide fire suppression services in a more productive and cost effective manner.

SUPPRESSION DIVISION ACTIVITIES

The suppression division provides a variety of services to the community. These services include investigating hazardous conditions, putting out fires, attending to false alarms and providing first aid. Exhibit 5 displays alarm responses for the past seven years. The workload of the department has changed substantially since the late 1970's. The major change has involved the development of an emergency medical component. Prior to 1979 the department provided only fire and minor service functions. The development of an EMS capability has resulted in the tripling of the department's workload. In 1985 the division responded to 6995 incidents. This amounts to approximately 19 incidents per day.

EXHIBIT 6

TYPES OF ALARMS IN 1985 6995 ALARMS



risks, while fires in open areas pose less of a threat. Schenectady, like other cities, experienced a variety of different **types of fires** in 1985. These are displayed in Exhibit 7. Of the 712 fires in 1985 375 occurred in structures. It is noted that not all fires in structures involve the structure itself. Many of these fires were confined to objects in the structures. Fires in structures have the most potential for causing economic loss and pose the most serious threat to life safety. The outside fires involve trash, grass and other miscellaneous fires. The majority of these fires involve little or no economic loss. In 1985 there were 98 auto fires.

EXHIBIT 8-A

FIRES IN STRUCTURES IN 1985 378 FIRES

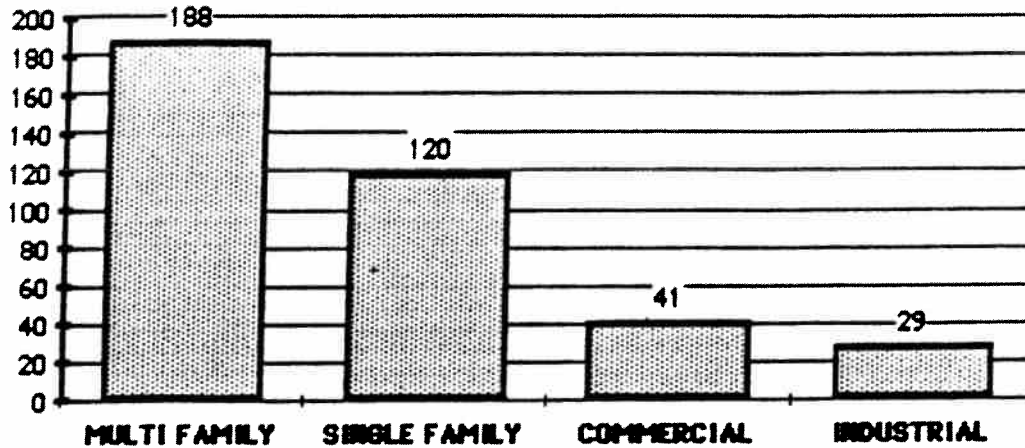
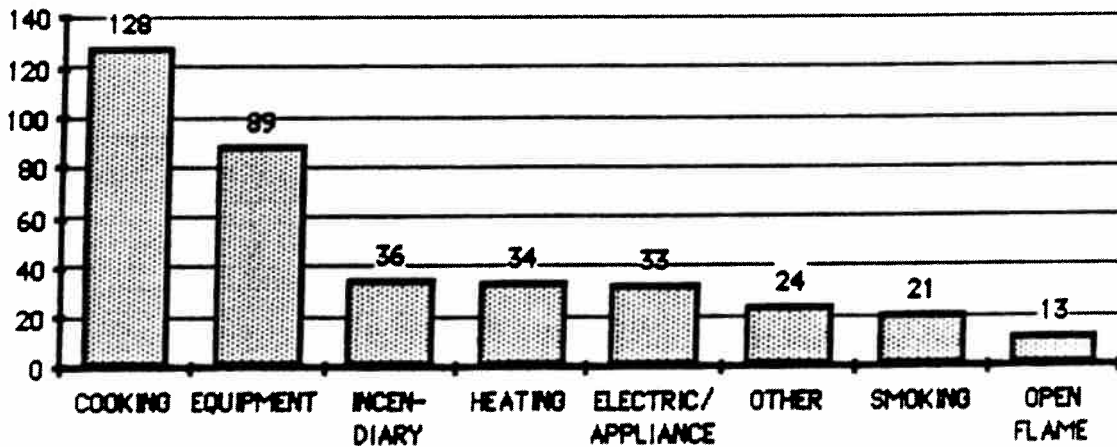


EXHIBIT 8-B

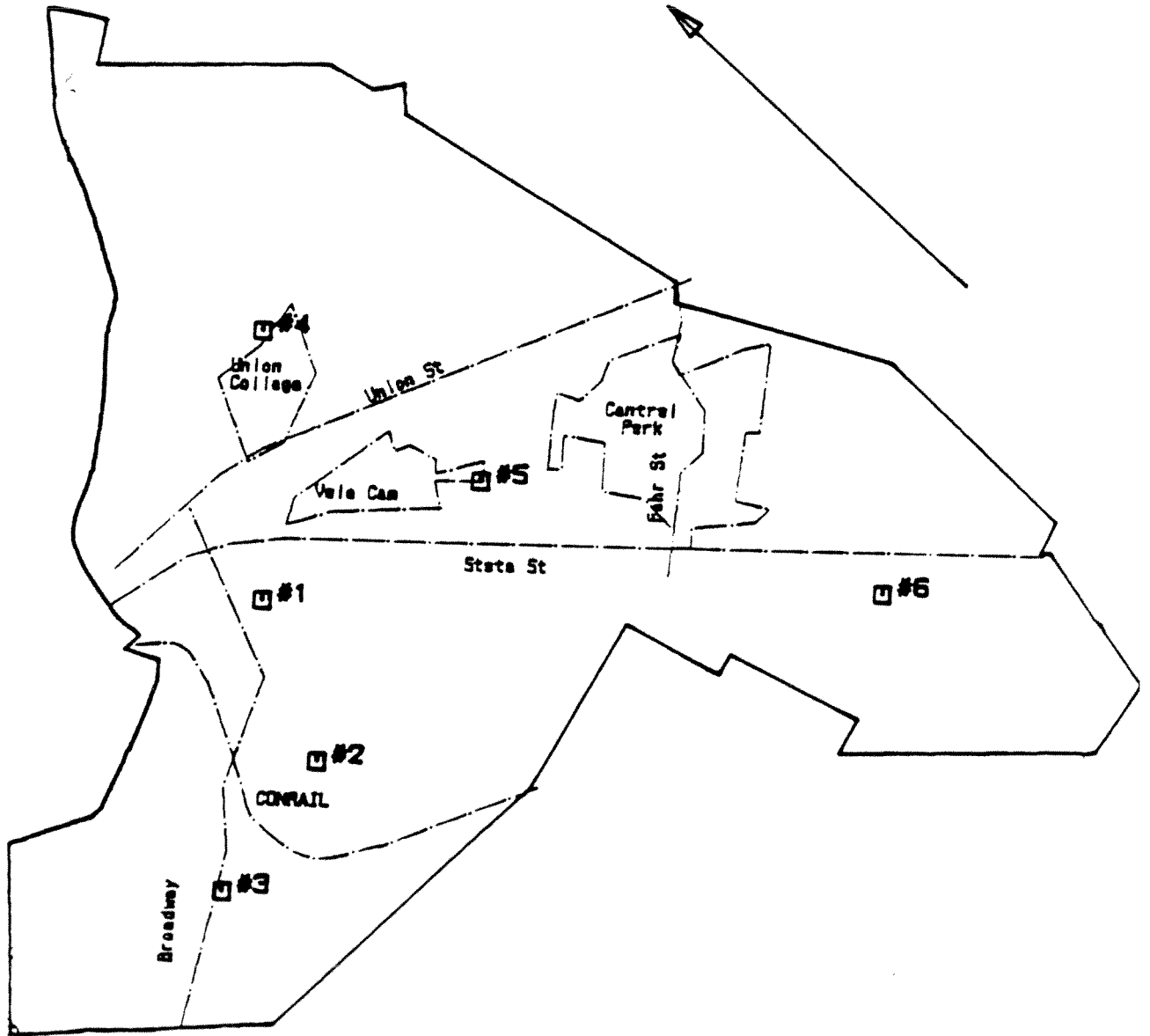
CAUSES OF FIRES IN STRUCTURES IN 1985 378 FIRES



SERVICE DEMAND PATTERNS

Several factors contribute to the effectiveness of fire suppression activities. First, the division must be **adequately staffed**. This means that

EXHIBIT 9
SCHENECTADY'S FIRE STATIONS
MAJOR ROADWAYS AND BARRIERS



than could be done by using census tract areas. Thus, the city was divided into approximately 160 one sixteenth mile squares. Fire department personnel translated the addresses for each incident into grid coordinates to allow computer analysis of the data. By using the flexible grid pattern it is possible to alter the location of stations and company response areas and compute the effect of these alterations on travel distances and response times, two critical emergency performance measures.

Exhibits 10 and 11 display the results of the grid analysis. Each of the 737 structure fire incidents are located on the squares of the map. The map indicates there is a substantial amount of incident clustering. To facilitate the task of identifying the high incident locations Exhibit 11 has been graphically enhanced to indicate the level of alarms in each grid. If structure fires were distributed evenly throughout the grids slightly less than five would be expected in each grid. The analysis can be summarized as follows.

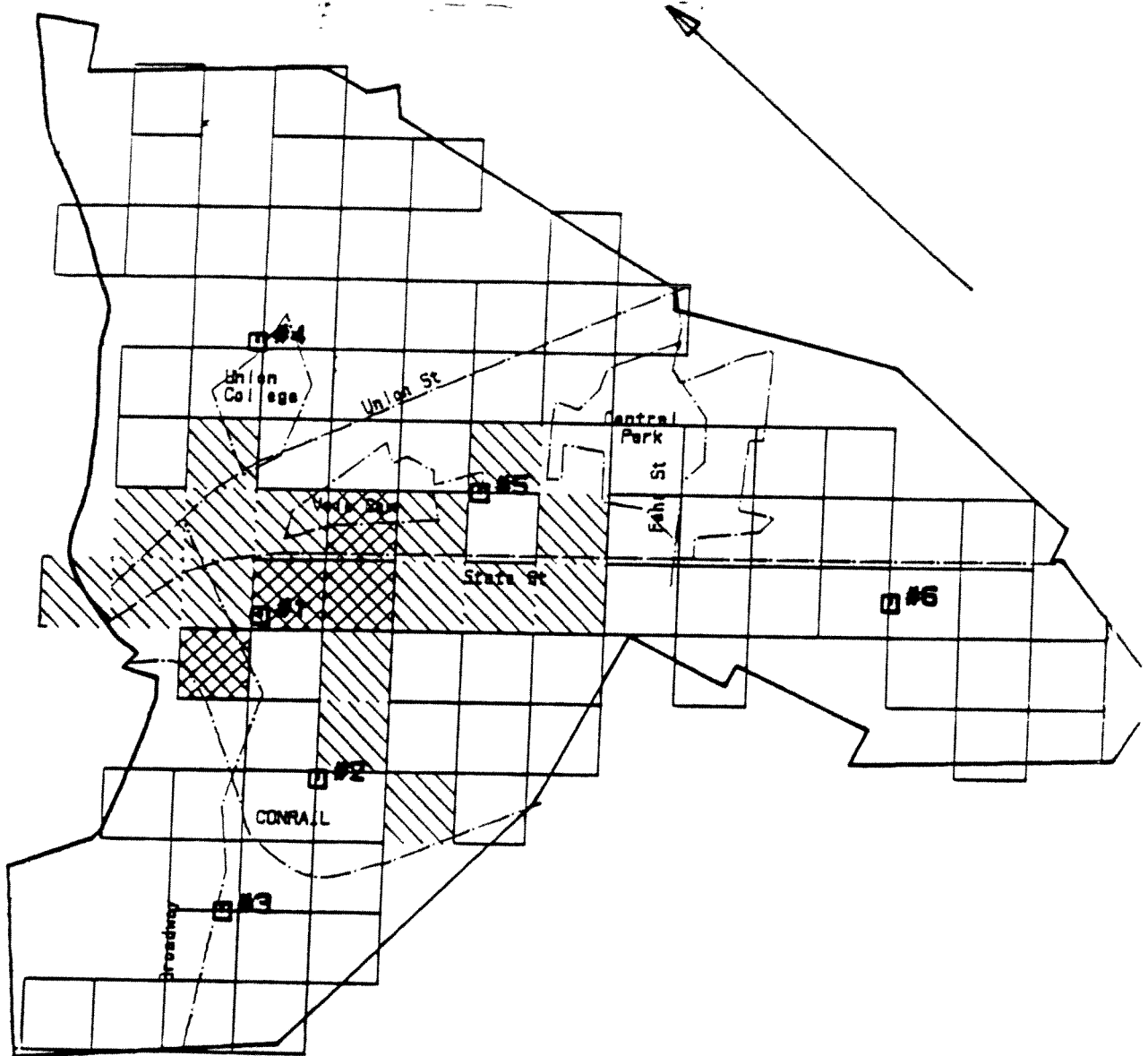
Large open areas - No structure fires occurred in these areas during the four year study period. Many of these grids cluster along the western boundary and the northeast corner of the community.

Clear squares - Between two and seven structure fires occurred in these grids during the two year study period. 72 grids are in this group.

Single crosshatch - From eight to 22 fires occurred in these grids. The 16 grids in this category cover approximately one square mile in area. Nearly all of these high incident areas are located in the central downtown area of the city. These sixteen grids (10% of the city) accounted for 146 structure fires or nearly 20% of the total.




Double crosshatch - Three squares had 23 or more fires during the study period. These squares comprise less than two percent of the city's area, yet they contain approximately 43% percent of the city's structure fires.

EXHIBIT 11



STRUCTURAL FIRE FREQUENCY - 1984-1985

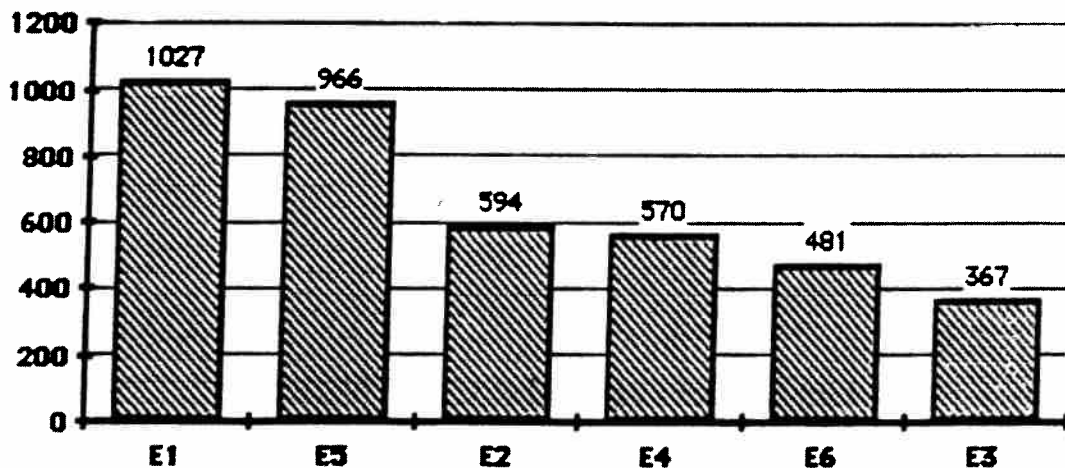
LEGEND: Based upon 737 Structural Fires

-  -- From 2 to 7 Fires (Less than 1% of structural fires)
-  -- From 8 to 22 Fires (From 1% - 3%)
-  -- 23 or more Fires (More than 3.0%)

Response levels for the two **ladder companies** exhibit substantial variability. Truck 1 responded to 957 incidents in 1985 compared to 328 responses by Truck 2. The extreme disparity in the workload is a function of the clustering of fire incidents in the city and the location of the ladders. Truck 1 is located in the busy downtown core of the city at fire headquarters while Truck 2 is located at Station 2 in Mont Pleasant. The department is extremely limited in where it can house a second ladder company. The Station in Mont Pleasant is the only station that is large enough to house a 100 foot ladder truck. If a new station were built this problem could be corrected. A more suitable location for a ladder truck in terms of fire demand patterns would be station 5.

EXHIBIT 12

TOTAL NUMBER OF RUNS BY ENGINE COMPANY IN 1985



- Easy access to roadways that would enable the apparatus to service its first due response area.
- Equalizing the fire service workload among the various engine companies.
- The availability of land on which a station could be constructed.

Two locations met the established criteria. They were the intersection of **State and Fehr** as a possible location to consolidate stations (engines) 5 and 6 and the southern terminus of the **Oak Street bridge** as a possible location to consolidate Stations (engines) 2 and 3. The State and Fehr location would allow one station to service the Eastern end of the city. In addition, Fehr provides easy access to the north west section of the city so that the engine located there could act as a backup to Engine 4. The Oak Street Bridge is an ideal location from which to service the extreme southern portion of the city and the Mont Pleasant area. Exhibit 15 on page 32 displays the alternate station locations. In addition, it is recommended that 2 engine companies be located at Station 1 because of the high workload in that area.

Decisions concerning the location of fire stations and the number of fire stations in a community have usually revolved around the distance between station and the population it serves as well as the hazards at particular locations. Thus, stations are spread throughout a community and sometimes located near major high risk facilities. The location of fire stations is based on the theory that a rapid response is essential to protecting life and property since fire spread is largely a function of time. Based on this theory Schenectady has scattered fire stations throughout the city as a means of decreasing the time in which emergency equipment arrives at the incident scene.

While rapid response to a fire is a primary fire suppression goal, it should be noted that response time is a multi-faceted function. The time interval between when a fire begins and when the fire department arrives at the scene is a function of a number of variables including the detection of the fire, reporting of the fire to the department, dispatch of the fire apparatus, turn-out time, travel time to the fire scene

PERFORMANCE ANALYSIS

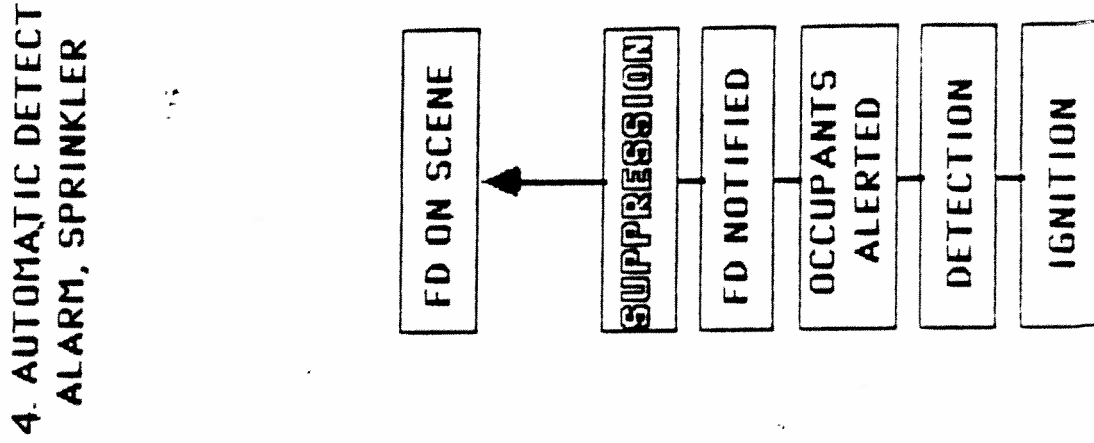
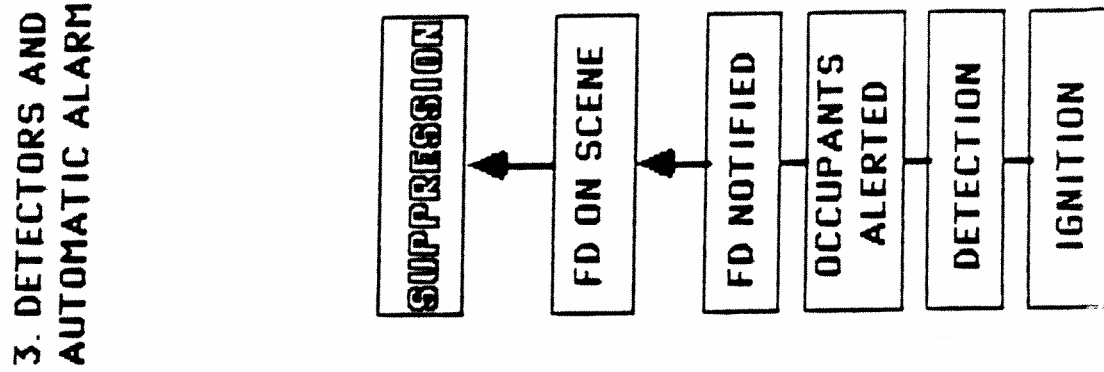
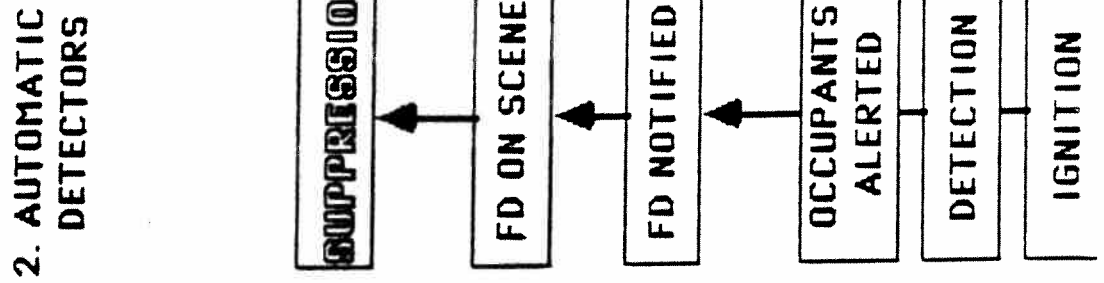
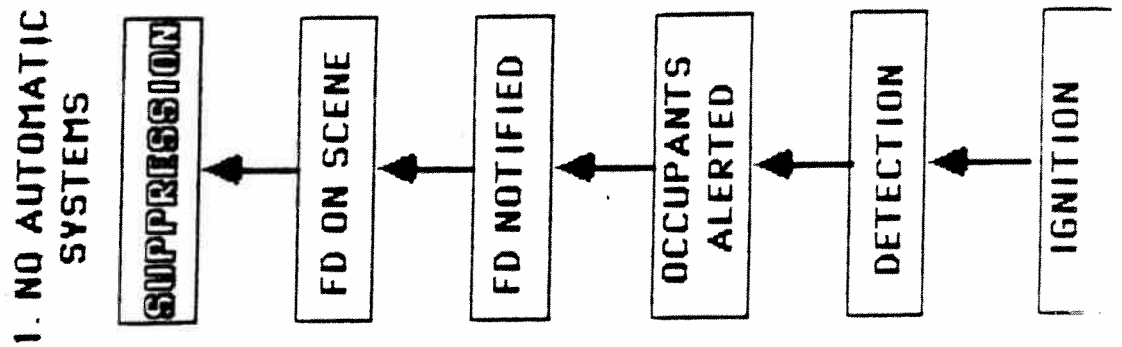
The purpose of this section is to explore the impact which different numbers of fire stations (fire engine companies) would have on travel distances and response times to fires. More stations mean quicker response times while fewer stations mean slower response times. Here we are concerned with the total time it takes an engine company to arrive at the scene of an incident after it has been notified by the dispatch center. Thus, we are concerned with the time it takes firefighters to board their apparatus and travel to the incident. This is only a portion of the time interval between when a fire begins and when firefighters arrive at the scene.

The basic principle for allocation of suppression forces is to disperse units throughout the city to allow approximately equal travel distances and response times to all locations. Tests in cities have shown that average travel distance is a function of the area protected and the number of stations/engines available to respond. For example, if a city of 12 square miles was protected by six engines, each engine would have one sixth of the city (two square miles) to protect. If an engine were in the middle of each square, an average run would be .7 of a mile.

Increasing or decreasing the number of engine companies does not result in proportionate changes in travel distances and travel times. If, for example, there were three engine companies in the city, the protection areas for each engine company would double to four square miles. This would yield a square of two miles on each side with an average travel distance of one mile from the center of the square to its border. Thus, while the size of the area protected increased from two to four square miles or 100%, the average travel distance would increase from approximately .7 of a mile to 1 mile, an increase of approximately 42%. This would result in a travel time increase of approximately 35 seconds from 118 seconds to 154 seconds, an increase of 30%. The purpose of this example is to illustrate the non-linear relationship between the number of engine companies and corresponding run distances and response times.

EXHIBIT 14

FIRE PROTECTION SCENARIOS AND SPEED OF SUPPRESSION



Calculated 1 - refers to the response time that we estimated using a formula developed by the Rand Corporation. This is the calculated time for the current station locations.

Calculated 2 - refers to the response time that we estimated using the Rand formulas for the proposed new station locations.

The Rand formula for calculating the average response time to incidents has been tested in a number of cities. An explanation of the formula is contained in Appendix B. The formula assumes that emergency response units travel at about 35 m.p.h. once they are running. We have found it to be fairly accurate in other cities. Furthermore, it corresponds quite closely to actual response times in Schenectady.

More important to the analysis than the difference between the actual response time and the calculated time is the difference between Calculated Time 1 and Calculated Time 2. These response times evaluate the impact of combining companies and relocating the stations. Exhibit 15 evaluates the impact of consolidating Engines 5 and 6 into a single company at the intersection of State and Fehr Streets. The exhibit contains response time data for Engine 4 since the consolidation will involve changing the response districts of that engine company. The changes in the response times are minimal. The average response time in Engine district 4 for 88 incidents increases by six seconds while there is a six second decline in the response time for old Engine 5 district calls that will be in the new State and Fehr engine district. The average response time for 33 calls from old Engine district 6 will increase by an average of 30 seconds. Because of the redistricting and improvements in response time in selected areas the average response time for 121 incidents assigned to the new station does not change.

all runs and 59% of all first due fire responses. Exhibit 18 displays the distribution of structure fire calls among the engine companies if Engines 2 and 3 and engines 5 and 6 are each consolidated into single companies and two engine companies are located at station 1. Although there is still some disparity in the workload it is not nearly as great as it is under present conditions. For example, the workload of the busiest company would drop from approximately 216 structure fires per year to 106 while that of the least busy company would increase from 17 structure fires to 44.

COST IMPLICATIONS OF THE RECOMMENDATIONS

1. The consolidation of four engine companies into two and the addition of one company at station 1 will result in a net reduction of one engine company. While the station consolidation will result in expenditures by the city to build two new fire stations these costs are easily outweighed by the cost savings of eliminating one fire company. Station construction is essentially a one time expenditure that can be amortized over a number of years whereas personnel are a continuing expense that increases each year.

Cost Savings - Elimination of 16 firefighter positions.
1987 Savings \$775,000
1991 Savings \$930,000

CHAPTER 4

FIRE PREVENTION

Effective fire prevention is the keystone to modern municipal fire protection systems. Those communities which devote significant time and effort toward developing a well managed and productive fire prevention capability are rewarded by a reduction in fire incidence and a resultant reduction in property and life loss. But, the effectiveness of fire prevention activities is almost impossible to document. When a building is struck by fire, the damage can be easily described in dollar amounts, and every city can judge its fire problem by the amount of fire loss suffered each year. However, it is not so simple to quantify the effects of aggressive prevention efforts. How can a dollar amount be attributed to a fire which never occurs?

Measuring the effectiveness of fire prevention activities can be further complicated by aberrations in fire incidence rates. It is not unusual to find the fire loss in a community rise a year or two after the initiation of an active fire prevention program only because a few major fires caused a large amount of damage or killed a number of people. Fire prevention, therefore, must be judged over a long time period, and its effectiveness must be viewed in light of general trends as opposed to specific dollar amounts.

The United States suffers the worst fire loss record of any industrialized nation in the world. Our per capita fire loss, both in terms of deaths and in terms of property loss, is several times that of most of Europe and parts of Asia. The reasons for this disparity are many, but the overriding reason is that fire is considered a much more serious offense in other cultures. In some Scandinavian countries a person causing an accidental fire can be charged with a criminal offense. In Japan, even the families of those causing a fire will be ostracized.

In the United States, however, we tend to view fire as something which will always strike someone else. And, if we do happen to be the unlucky one, we are at least partially rewarded for our misfortune by insurance payments and the concern exhibited by our neighbors and friends. Our fire problem in the United States is largely the result of a cavalier attitude toward fire, an attitude which fails to give proper weight to the possibility, let alone the probability that we will be the victims.

Department. The transfer of fire prevention responsibilities was designed to better coordinate code compliance activities. However, the practical effect has been to reduce the emphasis on fire prevention within the city.

While all fire prevention positions within the fire department were eliminated with the transfer of responsibilities to the building department, no corresponding positions were established within the building department to handle the extra workload. Work by previous consultants suggested that current staff would be able to manage the fire inspection workload. That has not been the case. While inspections based on complaints have continued, routine prevention inspections have been reduced.

The lack of a proactive emphasis on fire prevention on the part of the building department is not necessarily the fault of the Building Inspector or his staff. With a staff of seven, including two supervisors, this department made 2,799 inspections involving 3,592 units under the New York State Multiple Residence Law in 1985. In addition, these same inspectors carried out some 3,400 inspections of new construction; the plumbing inspector carried out 1,200 inspections; and the electrical inspector, who is technically an employee of the New York Board of Fire Underwriters and works part-time for the city, made 701 inspections. To expect them to take the added load of fire related inspections, which averaged more than four inspections a day per man, is unrealistic.

The attempt on the part of the city to consolidate and coordinate code administration is to be commended. In many cases elsewhere in the country, this consolidation has placed the building inspector, health inspector, planning and zoning and other similar functions under the fire department. The actual location of the reorganized entity is not so important as is the staffing of all subfunctions. Since the city has chosen the building department as the appropriate location for these functions, causing another relocation at this time would be counterproductive.

Fire Prevention and Control and the National Fire Academy in designing an effective, year-round educational effort targeted at the high risk population of the city. Three priority areas of concern for this person are to promote universal installation and maintenance of smoke detectors in all residences in accordance with a present city ordinance; to promote the installation of residential sprinkler systems; and to continue and expand the juvenile firesetter program.

The data reviewed for this study indicate that the city has made great stride in implementing its smoke detector program. However, our review of 757 fires in structures revealed that in nearly one-third of the incidents no detectors were present in the building. The city has recently enacted a smoke detector ordinance which gives the department the ability to issue summons to those who are not in compliance. The rigorous enforcement of this ordinance should go a long way to improving fire safety in the community.

Our review of fires in structures revealed that the presence of an operating smoke detector was strongly related to the extent to which fire situations were out of control when the fire department arrived at the scene and the amount of damage caused by the fire. This is displayed in Exhibit 19. When a smoke detector was located in the same room as the fire the department encountered only overheating or smoke when they arrived on the scene in 94% of the incidents. When there was no detector open flames were encountered 45% of the time. The presence of an operating smoke detector also limited the amount of flame damage. When a smoke detector operated the flame damage was confined to the object of origin 80% of the time. When there was no detector the fire spread beyond the object of origin nearly 60% of the time. More importantly, smoke detectors save lives by alerting residents in sufficient time to allow escape. The probability of injury or death where a smoke detector is not present is considerably higher than when it is. And, a smaller fire upon arrival of the fire department means less damage and less threat to firefighters themselves.

The residential sprinkler is now an economically viable fire protection device. The public education effort of the fire department should center around laying the groundwork for a local ordinance which mandates the installation of residential sprinklers in all new residential construction including single family homes and retroactively in multi-family occupancies.

Juvenile firesetting is a major national problem, and Schenectady is not immune. In 1985, 75 **suspicious or incendiary** fires were reported in the city, and 19 children were identified as being involved in 8 of them. In 1986 to date, some 33 children have been identified as being involved in 10 similar incidents. The Schenectady Fire Department has in place a juvenile firesetter program which identifies fire related youths, evaluates the severity of their disturbance, and refers them to appropriate treatment. A child psychologist is working with the fire department in this effort, and the results of this program look very promising. This program must be retained and expanded if these youths at risk are to be effectively treated and helped to overcome their problems. A very high percentage of adult arsonists started their careers as juvenile firesetters, and Schenectady can look forward to the same results if the juvenile firesetter program is allowed to die.

Several excellent school curricula exist which teach children basic fire prevention procedures and, perhaps more importantly, how to survive if involved in a fire. The public education officer will be immediately responsible for working with school administrators and teachers to introduce a school fire education into the primary and secondary schools. It should be noted that New York state law mandates the teaching of fire safety in all classes to the extent of 45 minutes per month.

One public fire educator cannot accomplish all the tasks necessary to establish an extensive fire prevention program throughout the city. Therefore, **fire suppression forces** should be involved in the public education effort. Many firefighters may not see their role in fire prevention, and an education process may be necessary to convince them that the best service they can provide to the community entails preventing fires before they start. Again, help in accomplishing this can be obtained from the State Office of Fire Prevention and Control and the National Fire Academy.



The elimination of the positive fire prevention efforts on the part of fire department with the transfer of prevention responsibilities to the building department is most unfortunate. The greatest productivity of a fire department comes from preventing a fire, not in putting it out once it starts.

CHAPTER 5

EMERGENCY MEDICAL SERVICES

Emergency medical services are a very important component of the fire department's program. This was not always the case. The program originated in the 1978-79 period. Adoption of the program is part of a nationwide trend on the part of fire departments to increase their levels of productivity by providing additional services. As we indicated in Chapter 3 EMS activities account for approximately 70% of the department's workload.

During 1985 the fire department responded to nearly 5,000 EMS incidents. The EMS call rate in Schenectady is substantially higher than the national average. General planning formula indicate that a community can expect approximately one EMS call per day per 10,000 population. Using this formula Schenectady could expect, on average, seven calls per day. The city is and has been experiencing approximately 14 calls per day, double the expected level.

Several factors may account for the high EMS demand level in Schenectady. First, population demographics are a significant influence. Particularly important are the age and income characteristics of the population. Elderly populations require higher service levels. Normally over 50% of the trauma-emergency patients in hospitals are over 65 years of age. In addition, the over 65 population generally accounts for 65% of all trauma deaths. The higher level of emergency medical care and ambulance assistance required by the elderly may be a factor in Schenectady's high call rate. 16.7% of the patients in Schenectady are over 65 years of age. This is 36% above the statewide average. Income levels in Schenectady are below the statewide average. Median family income in 1980 was slightly over \$13,000, some 22% below the statewide average.

A second factor for the higher EMS call rate is related to the management and recording of information about service incidents. A review of more than 400 EMS reports for January 1986 revealed that over 170 were classified as "other". Furthermore because of inadequacies in the incident reporting form it was not possible to analyze the etiology of the incidents or

the costs to provide this service. Schenectady has already made the decision to offer its citizens the highest level of pre-hospital care. The study team considers the City's decision to be both medically and politically prudent. Provision of advanced life support in any community provides for the greatest reduction of mortality and morbidity of citizens suffering from critical illness and trauma and therefore is complementary to maintenance and enhancement of the quality of life.

EXHIBIT 21

DEFINITIONS OF LEVEL OF CARE

First Responder - individual trained in accordance with DOT guidelines, usually 40 hours, and capable of initiating basic emergency care for sudden illnesses, such as cardiopulmonary resuscitation (BLS-CPR) and managing traumatic events until an ambulance arrives.

Emergency Medical Technician - Ambulance: individual trained in accordance with DOT guidelines, usually 110 hours and capable of providing basic life support emergency medical care. The state and department require recertification every three years.

Emergency Medical Technician - Paramedic: individual trained in accordance with DOT guidelines, usually 550 of formal classroom training and 100 hours of on-the-job training and capable of definitive **advanced life support** emergency medical care. Paramedics work under medical control and are capable of using selected pharmacologic agents, fluids and invasive techniques. The state and department require recertification every three years.

- B. The fire department provides EMS care and private ambulance service transports patients (current system).
 - C. Private carriers provide both EMS care and transportation.
2. The city should explore the feasibility of recovering its costs for providing EMS care. There are several reasons for this. First, the city expends precious resources to provide a dedicated service at the highest pre-hospital care level available. The program costs approximately \$1.5 annually or \$300 per EMS call. Second, service charges would tend to limit some of the non-emergency calls to which the department currently responds. Third, many of the calls are reimbursable at fixed levels from third party providers (state welfare, mental health and medicare-medicaid).
 3. The city should require that any employee who undertakes EMS and paramedic training must maintain his/her certification as a job requirement and must take EMS assignments as needed by the department.

Personnel in the department are trained at two different levels. Firefighters who entered the department prior to 1985 are not required to have any EMS training. Training for these personnel has been on a voluntary basis. All firefighters hired since 1985 are trained to the EMT level. EMT certification requires 120 hours of training. Recertification requires 37 hours of training every three years. Paramedic training requires 460 hours of training and an 80 hour refresher course every three years.

Overview of Current System

The fire department operates three advanced life support units. They operate from the Headquarters, Brandywine and Nott Street stations. These units serve as a first response to calls for assistance via the City's emergency reporting system. Other units of the respond to fire service calls that involve personal injury, e.g., motor vehicle accidents or structural fires. The level of EMS care provided by personnel on fire apparatus is dependent on the level to which they are certified. As older firefighters without EMT certification

identifying the high incident locations, Exhibit 23 has been graphically enhanced to indicate the levels of alarms in each grid. The analysis can be summarized as follows.

Large Open Areas - No incidents or one EMS incident occurred in these areas. These areas are clustered along the western border of the city, southeast corner and a strip in the northeast bordering the park.

Clear Squares - The number of EMS incidents in these squares ranged from two to nine per grid. Fifty grids had fewer than 9 fires in the study sample.

Single crosshatch - From 10 to 30 EMS runs occurred in these grids. There are twenty-seven grids in this category. These grids are clustered along the downtown State Street corridor and in Mont Pleasant.

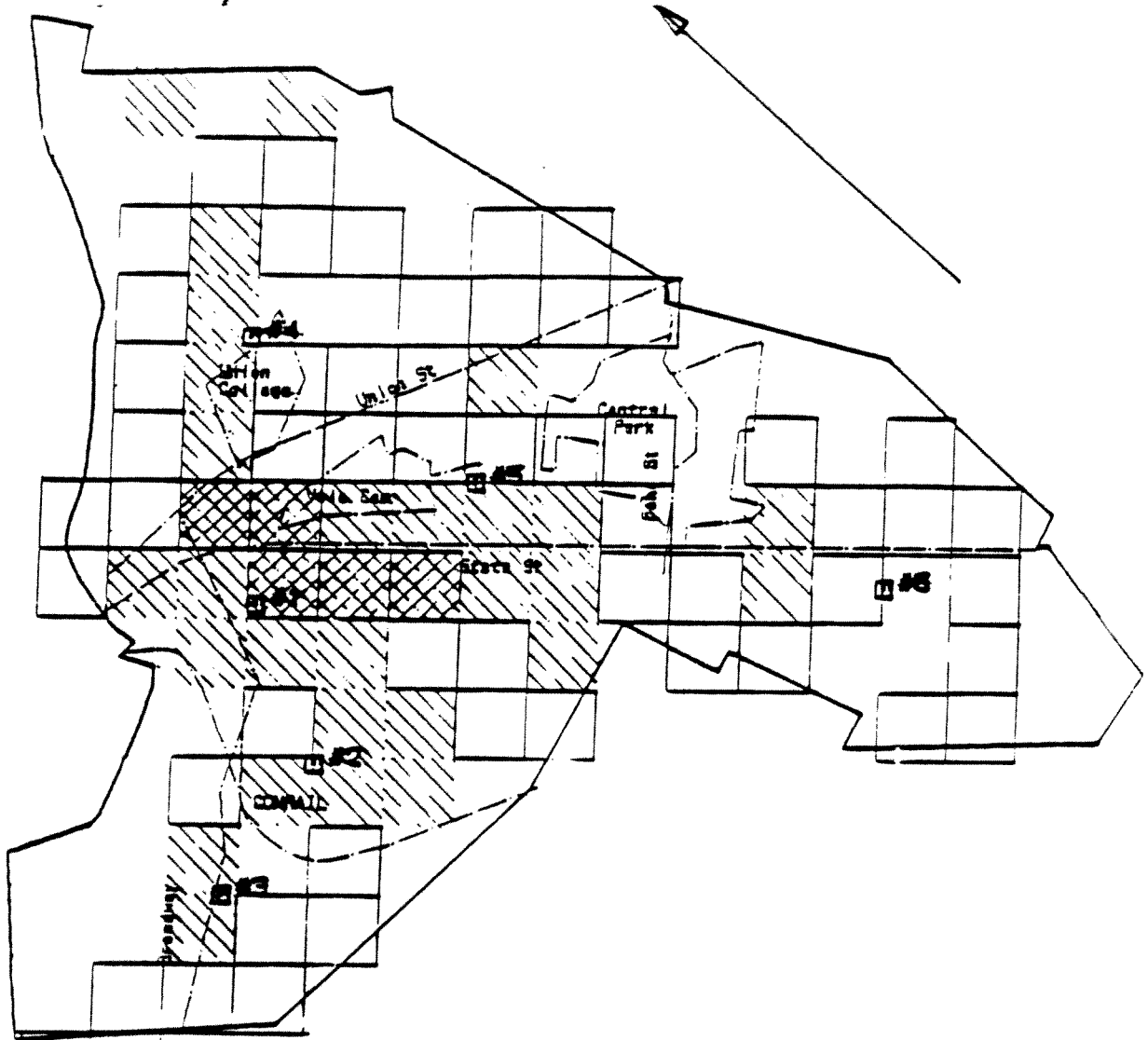
Double crosshatch - Five squares had 31 or more EMS runs. Each of these squares is located along State Street in close proximity to fire headquarters. The exhibit indicates that 254 (26% of all EMS incidents) occurred in these five squares (.31 square mile). The squares comprise less than 4% of the city's area yet represent more than a quarter of the EMS incidents.

Rescue Unit Levels of Work Loads

A factor in locating emergency response vehicles is the level of activity assigned to each vehicle. Generally, an effort is made to equalize workload across all companies in order to optimize the availability of a apparatus for an emergency response. As part of the study we analyzed company utilization rates in Schenectady.




The standard procedure for dispatching rescue units is to dispatch the closest unit to the incident. This procedure is followed in Schenectady. Consequently, because the community has high and low demands area the

EXHIBIT 23
Levels of Alarms



EMS RUN FREQUENCY - 1985

LEGEND: Based upon 994 RUNS (20% of 1985 EMS CALLS)

-  -- From 2 to 9 Runs (Less than 1% of total EMS)
-  -- From 10 to 30 Runs (From 1% - 3%)
-  -- 31 or more Runs (More than 3.0%)

several categories. By falling short we do not mean that the public is receiving inadequate emergency medical care but that because fire department resources are not adequately deployed the service is needlessly expensive and wasteful of available talent. Developing a productive program will demand attention from management as well as work rule concessions on the part of the fire union. Some of the work rules are a hold over from earlier days when labor was much less expensive than it is today.

Service Call Management

At the present time little effort is expended to judge the nature or severity of service calls before an EMS vehicle is dispatched to an incident. The failure to classify calls by nature and severity means that all calls are treated as dire emergencies. In such cases units respond on a priority basis and only highly trained paramedic units are dispatched as first responders. While this is appropriate in some instances, other methods of care can also be effective and more economical to provide. Triage methods of allocating medical resources have long been established in the area of emergency medical care. A triage system allows the EMS provider to assess incident and patient condition and make the appropriate assignment of resources.

RECOMMENDATIONS

1. The dispatch center in conjunction with the fire department should train dispatchers in EMS care and dispatching procedures. Guidelines and training materials are available from The National Highway Traffic Safety Administration, Department of Transportation.
2. To facilitate EMS care the city should adopt a comprehensive care program that involves public education and prevention as well as direct services. Direct services should be at three levels as described below.

First Responder - Police Department. Very often the police are the first units at emergency scenes and should be capable of initiating care until more highly trained and equipped personnel arrive at the incident.

Basic Life Support - Fire department EMTs.

Advanced Life Support - Fire department - paramedics.

3. The department should develop a public education program to train at-risk populations in basic cardiopulmonary resuscitation (CPR) techniques. Cities that have embarked on such programs have significantly reduced morbidity and mortality rates among its citizens who suffer cardiac arrest. Much as engine and truck companies should conduct fire safety inspections paramedics and EMT's should also be involved in CPR training for citizens.

Number and Location of Response Vehicles

Two factors play a primary role in the number and location of EMS vehicles in a community. They are the geographic decentralization of units in order to minimize response time and the level of workload that units are expected to perform. The department currently operates with three rescue rigs which provide more than adequate response time to emergency

RECOMMENDATIONS

1. The department should adopt a mixed system of emergency medical provision which involves both dedicated rescue units and EMT's assigned to fire apparatus. The system should involve a minimum of two dedicated rescue units staffed by paramedics and two engine companies staffed by a combination of paramedics and EMT's. The engine companies would perform a dual function - EMS and fire suppression services. This method of providing EMS/fire service is rapidly becoming a standard in the field. This would lead to the reduction in staff of one dedicated paramedic unit.

Cost Savings - Elimination of one paramedic unit.

1987 savings - \$480,000

1991 savings - \$580,000

2. One paramedic unit should be located at station number 1, fire headquarters, because of the high level of demand in this area. Locating the second unit at the proposed Oak Street bridge station would provide service to next highest service demand area and rapid backup to the high incident downtown area. To provide rapid service to the east and north sections of the community, which generate lower EMS demands the engine companies in these stations should be staffed with a paramedic and EMT trained firefighters. To implement this plan will require a minimum of 30 certified paramedics and an equal number of EMT's. Such a system would increase the number of points from which EMS trained personnel respond from three to four. In effect each community in the city would have trained EMS personnel in their neighborhoods.
3. To implement this plan will require restoring to management the authority to assign personnel to particular pieces of apparatus and fire stations. At the present time the Chief is not able to assign resources where they are most needed. Because of the bid system firefighters and not management determine their own job assignments. As a consequence,
Although the city has expended considerable resources to

APPENDIX A

1. DEMOGRAPHIC CHARACTERISTICS

City	Residential Population	Day Time Population	Residential Structures		Area Sq MI	ISO Grade
			Total	Occupied		
Albany	99,461	100,308	46,187	40,767	21.6	3
Mt. Vernon	75,000	63,055	26,177	25,377	4.0	
Niagara Falls	66,440	77,573	29,504	27,272	13.0	2
SCHENECTADY	67,981	88,048	30,249	27,747	10.2	3
Average	77,218	82,246	33,029	30,291	12.2	3

3. PERSONNEL RESOURCES

City	Firefighters/ Officers	Civilians	Total Personnel	FF per 1000 pop	Work Week	ADJ FF PER 1000 POP	Percent Supervisors
Albany	285	16	301	2.9	40	2.9	27%
Schenectady	173	6	178	2.5	40	2.5	30%
Niagara Falls	160	2	162	2.4	40	2.3	25%
Mt. Vernon	141	3	144	1.9	40	1.8	16%

Average				2.4	40	2.4	25%
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ADJ FF PER 1000/POP IS STANDARDIZED TO THE HOURS IN THE WORK WEEK AND THE NUMBER OF SUPPORT PERSONNEL.

5. APPARATUS AND STAFFING

City	Engines		Ladders		Total Fire Apparatus	POPULATION PER	EMS	
	Active	Staff	Active	Staff			Companies	Staff
Mt. Vernon	6	2	3	2	8	7,882	0	0
SCHENECTADY	6	3	2	3	8	11,006	3	2
Albany	9	3	4	3	13	7,716	4	2
Niagara Falls	6	4	2	3	8	9,697	0	0
Average		3		3				

**7. FIRE DEATHS, INJURIES & LOSSES
(THREE YEAR AVERAGE)**

CITY	DEATHS		INJURIES		PROPERTY LOSS	
	FIREFIGHTERS	CITIZENS*	FIREFIGHTERS	CITIZENS	Total Value	Per Capita**
SCHENECTADY	0	2.9	26	27		
Mt. Vernon	0	3.1			\$2,569,631	\$68
Niagara Falls	0	3.5	54	0	\$1,617,372	\$17
Albany	.7	4.0				
Average		3.4				\$38

*Deaths per 100,000 population.

**Three year average.

APPENDIX B

FIRE DEPARTMENT DEPLOYMENT ANALYSIS

A Public Policy Analysis Case Study

The Rand Fire Project

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As an alternative approach, a model of the street network can be constructed with arcs representing (directed) street segments. Then travel distances may be computed as the shortest paths in the network connecting points i and j .

ESTIMATING AVERAGE TRAVEL DISTANCES IN A REGION

To estimate the average travel distance of the first-arriving company to alarms in a particular region, suppose that the area of the region is A square miles and $E(N)$ is the expected (average) number of firehouses in the region from which engines are available to respond. Then the expected (or average) distance traveled by the first-arriving engine ($E(D)$) is given by the square-root law:

$$E(D) = k \sqrt{\frac{A}{E(N)}}$$

The constant k depends on the geometry of the particular situation, but it varied little among regions where it was tested. It is approximately 0.55 in most situations. The area (A) can be measured in a variety of ways: for example, by counting grid squares on a map or by using a planimeter. The average number of firehouses with engine companies available to respond can be estimated by subtracting the average number of companies busy in the region from the number of stations housing engines. The average number of busy engine companies can be estimated from alarm rate and work time statistics (Chapter 7). The square-root law is usually applied separately for engines and ladders. Average travel distances for second-arriving units can also be estimated using the square-root law. The only change is in the value of k , which is approximately 1.0 for second-arriving units.

ESTIMATING POINT-TO-POINT TRAVEL TIMES

To estimate the time to travel between two specific points when the distance between them is known, it is necessary to relate travel time to distance traveled. The travel time depends primarily on the distance between the points, but it may also depend on the time of day, the type of apparatus, the driver, the traffic encountered, the types of roads, etc. In several cities it has been found that:

Time of day has only a small effect. Travel times between the same pair

Average cruising speeds are similar in different regions of the same city, and in different cities. They fall in the range of 35 to 40 mph.

Travel time increases with the square root of distance for short trips on side streets and with a significant number of accelerations and decelerations—and increases linearly for longer trips. This can be expressed by the following mathematical model relating the travel distance, D_u , between points i and j , and the expected time to travel between the two points, $E(T_{ij})$:

$$E(T_{ij}) = \begin{cases} c\sqrt{D_u} & D_u \leq d \\ a + bD_u & D_u \geq d \end{cases}$$

The values of the parameters a , b , c , and d can be estimated from empirical data for any city or region. However, as a result of collecting such data in several cities, it has been found that the values of these parameters vary surprisingly little from city to city. Therefore, it may be possible to obtain useful travel time estimates without carrying out detailed data collection by using the following relationship:

$$E(T_{ij}) = \begin{cases} 2.10\sqrt{D_u} & D_u \leq 0.38 \text{ miles} \\ 0.65 + 1.70D_u & D_u \geq 0.38 \text{ miles} \end{cases}$$

where T_{ij} is given in minutes, and D_u in miles.

If travel times on street segments are known, point-to-point travel times can be constructed by finding the shortest time path through the network of streets and roads.

ESTIMATING AVERAGE TRAVEL TIMES IN A REGION

One way of estimating the average travel time in a region is to average the appropriate point-to-point travel times, taking into account the proportion of regional trips that are accounted for by each point-to-point trip. This calculation can be quite tedious. A useful approximation is obtained by combining the model for estimating average regional distances and the time vs. distance function for point-to-point trips. The following formulas for estimating regional average travel times result in regions where average travel distances are short enough (say, ≈ 0.4 mile) for the square-root part of the time vs. distance function to hold. We have

$$E(T) = r \left(\frac{A}{E(N)} \right)^{0.33}$$

Results from the two models suggest that $r = 1.36$ should be used.

