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THE TOWN OF CARY COMPREHENSIVE FIRE PREVENTION & MANAGEMENT PLAN

A part of the Comprehensive Plan

Prepared For

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# introduction

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# INTRODUCTION: FIRE PREVENTION & MANAGEMENT PLAN

**THE FIRE SERVICE IS ONE OF THE OLDEST AND MOST IMPORTANT SERVICES A MUNICIPALITY PROVIDES ITS CITIZENS.** Fire service encompasses much more than the mere extinguishing of fires. The real success of the fire service lies in preventing fires through engineering, enforcement, and educational activities, and through fostering building construction that minimizes fire dangers.

In spite of the advancements toward meeting the challenge of today's fire problem, the cost for public fire protection in the traditional form has increased so rapidly that communities throughout the nation are being forced to reassess the costs and consider alternatives. It will become evident that some alternative to our traditional method should be considered to eliminate a continual expansion of the fire department to meet the requirement for adequate fire protection. Increased community fire problems cannot be successfully met by continually adding more stations, equipment and manpower. There is a threshold at which the adequacy of public fire protection has to be shifted to the private sector. Community fire protection refers to all of the public and private services which are provided to protect people and property from fire. City administrators and fire officials are increasingly recognizing that traditional methods of service delivery are no longer affordable. Fire safety is a primary function of local government, and fires and fire losses are a continuing problem. It is important to recognize that even if a fire company is placed at the front door of a high rise building, it may not be capable of containing a fire to the compartment of origin. The answer to this type of problem has to come from internal fire protection systems. Therefore, an important consideration in fire protection planning is what level of service should be provided by the private sector? This will be explored in greater detail in a later section of this document.

In recent years, there has been a marked trend toward professionalization of the fire services. In-service training is increasing and the number of institutions which provide training in fire fighting is increasing. Greater emphasis is being placed on upgrading the management of fire departments in order that citizens may not only obtain good fire protection, but may also obtain it at a reasonable cost.

In order to provide good fire protection for the Town through a cost effective system, all components of the fire service need to be examined. This can best be done through a comprehensive fire prevention and management plan. The Plan takes a broader approach to community fire protection, emphasizing fire prevention and fire safety education through a cost effective system based upon a concept of dual responsibility on the part of both the public and private sectors. Public sector fire protection consists of the manpower and facilities supplied by the city. **IN ADDITION TO THE JOB OF FIRE SUPPRESSION, PUBLIC PROTECTION, TO BE MOST EFFECTIVE, MUST INCLUDE:** 1) Structural design review, 2) Control of hazardous contents, 3) Fire code enforcement, 4) Continuing inspection and coordination of building, planning, engineering, law enforcement and public works activities as they relate to fire protection. **PRIVATE SECTOR FIRE PROTECTION CONSISTS OF:** 1) Fire resistive design of structures and materials, 2) Fire extinguishing, warning and detection systems. (Built-in protection is intended to limit the scope of the anticipated fire problem to manageable levels.) This dual role will help Cary meet its objective of providing an adequate level of fire protection at a reasonable community cost. Adequate fire protection for Cary will be the specific combination of public and private resources that provide the services which meet the needs of this community within an acceptable level of risk.

**IN THE 1980's**, fire prevention will become the primary focus of the fire safety delivery system. This broader approach requires fire departments to consider means of reducing fire incidence and loss beyond mere fire suppression. Adding more equipment and more personnel are not the only means of improving the level of service of the fire department, especially with budget restrictions and the desire to keep costs reasonable. The increased emphasis on fire prevention and built-in fire protection will help reduce the need for fire control forces by minimizing the number of fire suppression calls and the amount of time spent at each call.

**THIS PLAN WILL HELP CARY TO MEET ITS PRESENT AND FUTURE NEEDS IN FIRE PROTECTION, TO SERVE AS A BASIS FOR PROGRAM BUDGETING, AND TO IDENTIFY AND IMPLEMENT THE OPTIMUM COST-BENEFIT SOLUTIONS IN FIRE PROTECTION.** It will be a policy guide, helping to prevent the loss of life and property due to fire. It will be a flexible plan, changing and developing with the needs of the community. This Plan permits management of the recognized fire situation, instead of reacting to an undefined fire problem. For example, through information obtained from a fire data system, a fire management program can be developed. If a certain area of town is experiencing a high incidence of fires, this area should receive a concentrated fire inspections effort.

Comprehensive planning for community fire protection can also point out and solve other community problems. Deficiencies in a community's water distribution system and thoroughfare plan can be identified. Overall, Cary will benefit from the Plan through increased citizen awareness of fire risks and fire protection, increased private sector participation resulting in reduced public sector costs, reduced fire insurance premiums, and improved fire and building codes. The Plan provides an organized approach to defining, obtaining, and maintaining the level of fire protection and the fire prevention and control system desired by the community.

## **NEED FOR COMPREHENSIVE FIRE PREVENTION & MANAGEMENT PLAN**

Factors Contributing:

### **1) CARY'S POPULATION HAS MUSHROOMED.**

Between 1970-1978, Cary's population grew from 7,339 to 20,000, an increase of 172.5%. In December 1978, Cary's total population was 24,000. In cities with population over 10,000, Cary ranks 24th and is the fastest growing city in North Carolina.

### **2) NEED FOR PROTECTION TO MORE PEOPLE & LARGER LAND AREA.**

With Cary's population continuing to rise, coupled with future annexations and water and sewer extensions, the Town will have to provide fire protection to more people and to a larger land area. In order to provide effective and efficient fire protection, the Town will need to be ready. The Town's fire service will increase in size, but at the same time the Town will need to be managing this service in order to keep the costs reasonable. This can be achieved through the Plan.

The Plan which will emerge, involves a combination of public and private responsibilities. Cary will establish a firefighting capability by building a fire protection force and providing equipment to cope with an anticipated fire risk. Standards will be set to define the level of public fire protection which is adequate to meet the normal needs at a reasonable community cost. Above that anticipated level of fire risk, built-in protection should be provided by the private sector. The community fire protection system will include necessary public ordinances, codes, structural design review, and code enforcement procedures. In addition, inspection and maintenance programs are required to assure the reliability of built-in protection. Fires which exceed anticipated severity will require the implementation of emergency operation plans which include mutual aid with neighboring cities.

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## FIRE PROTECTION MASTER PLANNING: MODERN BASIS

The U. S. Fire Administration set up the model guidelines for community fire defense master planning. They believe that fire protection is a local problem that must be dealt with by local citizens and officials. With this new emphasis on fire prevention and control master planning, concern began to surface over those municipalities that relied too heavily on the grading schedule set up by the Insurance Services Office (ISO) as the basis of their fire protection system design. ISO makes fire insurance classification inspections in North Carolina. In the ISO grading schedule, the city classification is the basis for a key rate to cover the individual classes of property in the city.

The basic rate is affected by improvements or deteriorations in the fire defense of the city and may result in a change in classification. The grading is done from the point of view of the capability of the fire department to extinguish fires rapidly with a minimum loss of life and property. The grading is basically a measure of the quality aid level of resources devoted to fire protection in a community such as the availability of water, equipment, training, number of men, etc. These are fire service inputs. ISO is not designed to measure fire service outputs: fire incidence, fire loss, fire casualties. Outputs are true measures of fire service effectiveness. The ISO grade does not reflect efficiency and effectiveness of the local fire service and the grades do not necessarily correlate with fire loss experience.

Because of this limited capability of measuring fire service outputs, ISO has come under attack. Criticism centers around the idea that ISO discourages innovation, sets unrealistic standards, works from tradition rather than research, and inhibits or constrains the application of local government fire resources where they should be placed. Municipal fire protection managers who are reluctant to deviate from the insurance grading schedule criteria for fear their insurance rates would increase, tend to press for more personnel and more equipment to hold the line or to reduce insurance premiums. These options are adding costs to a town without a guarantee that fire incidence will be reduced by improving a city's classification through the addition of men and equipment. The protection class in which a city is placed affects a town's insurance rate but is only one of several elements involved in setting this rate. Other elements include the type of property and fire loss.

The standards used by ISO show a lack of concern with the economical expenditure of public funds in operating the fire department and are not compatible with today's concern for providing adequate fire protection at a reasonable cost to the community. The city of Alexandria, Virginia

conducted a study that concludes that the criteria of the grading schedule do not provide for the most effective and efficient fire suppression delivery system.<sup>1</sup> Other conclusions were:

- 1) Alternative allocation methods can provide approximately the same response time capability at reduced costs.
- 2) Alternative allocation methods require fewer resources and cost less, yet do not adversely affect the ISO town class.
- 3) Surprisingly, alternative allocation methods differ markedly in the number of fire stations required to meet the fire company distribution criteria specified in the grading schedule and still receive few deficiency points.

The ISO grading schedule should not be the sole or predominant basis for a local government's decision on how to improve its fire protection system. There needs to be a greater concern for fire service outputs. Suppression is still important, but a fire department needs to concern itself with saving lives and reducing the number of fires through better fire prevention and management techniques. Just putting out a fire does not show how effective a fire department is.

Local governments need to establish their own level of fire service and implement programs to meet this level. Although the grading schedule provides adequate guidelines for conflagration control, it is not intended to meet the total fire protection needs of cities since individual community goals and capabilities are not considered. This Comprehensive Fire Prevention and Management Plan will meet the total fire protection planning needs of Cary and establish an adequate level of fire service at a reasonable cost to the community while at the same time helping to save lives and property and reduce the number of fires.

The Plan will address all areas of fire protection raised by ISO. For example, the collection of data in a comprehensive plan on all areas of the fire service can help reduce the number of deficiency points. The implementation of model fire prevention and building codes can have a positive effect on the Town grade. Also, improvements in the adequacy and reliability of the water distribution system may be as important to the Town grade (if not more so) as the addition of equipment and personnel to the fire service. A properly engineered water supply system for fire protection is a key element of the Plan and is important to establishing adequate fire protection.

A Comprehensive Fire Prevention Plan should automatically lower a town's classification over time. The grading schedule standards can then be used as a data source and management option when developing programs to provide for an adequate level of fire protection. The Town of Cary will also consider fire insurance rates and upgrading as one of the economic benefits resulting from adequate fire protection. The fire insurance rating will receive continued evaluation and changes may be sought to improve community benefits.

### DEVELOPMENT & ORGANIZATION OF PLAN

The FIRE PREVENTION AND MANAGEMENT PLAN for the Town of Cary was developed jointly by the Cary Fire Department and the Department of Planning and Development. Additional assistance was provided for by other departments within Cary Town government.

## GOALS & OBJECTIVES

The goal of this Fire Prevention and Management Plan is to provide for an adequate level of fire protection at a reasonable cost. The objective is to establish guidelines for providing the most cost effective methods of furnishing fire protection to reduce loss of life and property by fire. Together, goals and objectives establish the level of service to be provided in the community by the Cary Fire Department.

### GENERAL GOALS:

- 1) **AWARENESS** - Develop broad and continuous public and private sector awareness of fire danger and consequence.
- 2) **COMMUNITY INVOLVEMENT** - Foster active and continuous government, industry, and citizen involvement in all aspects of fire prevention and control.
- 3) **COORDINATED MANAGEMENT** - Enable and maintain coordinated management of all public aspects of fire prevention and control.
- 4) **COST EFFECTIVENESS** - Achieve regular and measurable improvements in the cost effectiveness of public fire protection.
- 5) **OPERATIONAL EFFICIENCY** - Achieve regular and measurable improvements in the operational efficiency of public fire suppression activities.
- 6) **RISK REDUCTION** - Plan for measurable and continuous reduction in community life hazard, combustibility, and spread potential through land use, architectural, and materials control.
- 7) **RESPONSIBILITY TRANSFER** - Accomplish significant and continuing transfer of fire prevention and control responsibility from the public to the private sector.
- 8) **ARSON REDUCTION** - Produce measurable and continuous reduction in the incidence of arson.
- 9) **POLITICAL COMMITMENT** - Establish continuing commitment of the elected governing body to the reduction of life loss from fire incidence in that unwanted fire can be reduced to a negligible level of public and private cost.
- 10) **MONITORING** - Provide for continuous assessment of fire protection needs and the degree to which the fire protection system satisfies them.

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### SPECIFIC GOALS:

1. Reduce fire loss through an effective fire prevention, public education and training program.
2. Reduce the number of fires in Cary.
3. Maintain a fire suppression force capable of extinguishing fires that might be anticipated in Cary.
4. Establish and annually review an activity schedule to assure maximum utilization of manpower and coverage for all necessary activities.
5. Develop good physical fitness of all personnel through programs and equipment which will motivate them towards this end.
6. Annually review reports and record keeping to assure adequate statistics are maintained to assist in planning and evaluation.
7. Provide adequate radio communications for dispatching equipment and maintaining contact with all personnel while on emergency alarms or routine calls.
8. Maintain and semi-annually inspect each fire hydrant in the city and secure repairs or raising where needed.
9. Encourage high morale through good internal communications.
10. Review all proposed construction and developments to establish fire flow requirements and coordinate with planning and building departments to assure adequate fire protection is provided as the Town develops.
11. Annually establish and evaluate departmental objectives to assure accomplishments of the above stated goals.

### OBJECTIVES:

1. To minimize the life loss potential and the fire spread factor by maintaining a strong and comprehensive fire prevention, occupancy and building code enforcement program.
2. To reduce fire ignitions by fully investigating the cause of each fire, developing a management information system, and establishing an action program to prevent further ignitions.
3. To prevent conflagrations by controlling large fires with in-depth fire and rescue control forces and an adequate water supply.
4. To achieve regular and measurable improvements in the cost effectiveness of public fire protection by equipping all occupancies with early warning devices.
5. To achieve regular and measurable improvements in the operational efficiency of public fire suppression activities by providing for reduced response time through response route traffic management.
6. Achieve regular and measurable improvements in the cost effectiveness of public fire protection by differentially staffing first-due companies according to anticipated time of day and geographical demand for suppression services.

These goals and objectives are discussed more thoroughly throughout the Plan.

### PLANNING ASSUMPTIONS :

In the preparation of this Plan, a number of assumptions have been made. Right now these assumptions are completely valid, but this may change in the future. If any of these assumptions change, the Plan can be changed accordingly during periodic updates.

1. By 1985, the Crabtree sewer outfall line will have been constructed. This will enable the western and northern portions of Cary to become urbanized and will cause a population increase.
2. The extension of sewer and water to designated Swift Creek watersheds.
3. Future population growth and land use projections provided by the Department of Planning and Development will be reasonably accurate.

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# ESTABLISHING ADEQUATE PROTECTION

The most critical and basic determination that must be considered in the development of the Fire Prevention and Management Plan is the level of public and private fire protection that is to be identified as "adequate" for the Town of Cary. This Section addresses public fire protection.

Determination of Adequacy, considered by the following:

- 1) FIRE PREVENTION (time before the fire)
- ➔ 2) CONTROL OF FIRES: INCIPIENT FIRES & LARGE FIRES (time from detection to extinguishment)
- 3) FIRE DATA SYSTEM (time after the fire)
- 4) FIRE INSURANCE GRADING.

## 1. FIRE PREVENTION

After a very extensive study of today's fire problem, the National Commission on Fire Prevention and Control reported that "95 cents of every dollar spent on the fire services is used to extinguish fires; only about five cents is spent on efforts - mostly fire prevention inspections and public education programs to prevent fires from starting."<sup>2</sup> Much more energy and funds need to be devoted to fire prevention which could yield huge payoffs in lives and property saved. Those fire protection jurisdictions that deliver more prevention services have fewer fires. The concepts revolving around fire prevention will replace the more conventional form of an urban fire safety delivery system that focuses on a service after the fact - a fire suppression force that is committed to doing its best often after a building has become an inferno.

The organization of fire service delivery refers to the set of patterned, public activities performed within a designated area to prevent unwanted ignition and to control and extinguish fires when they occur. This definition assumes that the first division of activities in public fire protection is between fire prevention and fire suppression. Fire prevention is the management option of the future, affecting what happens before the fire starts.

Prevention is the attempt to decrease the chances of unwanted fires and to some extent, to limit the spread of fire by methods which are independent of actions taken after a fire occurs. Fire prevention activities involve those services of the fire department such as public education aimed at improving fire and life safety in the community, in-service inspections, fire cause investigations, and provision of fire and life safety related consulting services to individual citizens and commercial, industrial, institutional enterprises within the community, and many others.

In support of the fire department prevention activities, building department prevention activities include:

- (a) required review of building plans
- (b) construction inspections
- (c) building code maintenance inspections

Fire prevention is a community based activity rather than the service of a specific department or agency. The methods and programs recommended for increasing the emphasis on fire prevention are identified in other sections. The following is a statement of policy about fire prevention.

**RECOMMENDATION** - Place a strong emphasis on fire prevention management activities as a means of reducing the loss of life and property from fire through all divisions of the Fire Department.

## 2. CONTROL OF FIRES

### FIRST STAGE OF FIRE (INCIPIENT)

Through testing and experience, it has been determined that the first five to ten minutes of a fire are of greatest concern. Because of the physical characteristics of fire, the temperature within a building rises extremely rapidly from the fire's beginning to a point when all of the combustible contents within a confined area will ignite in a flashover, the critical point for life safety and fire control. The actual amount of time required for this condition to develop will vary depending on several factors including the building characteristics and contents. If an extinguishing effort is initiated before the fire reaches a flashover point, the difficulty of control and the reduction of life loss is generally greatly reduced. Therefore, one of the primary objectives in establishing adequate fire protection is to develop the capability of attacking structure fires prior to flashover. (Figure 1) Using the standard time versus temperature curve as a base, flashover is estimated to be eight minutes after ignition in standard fuels.

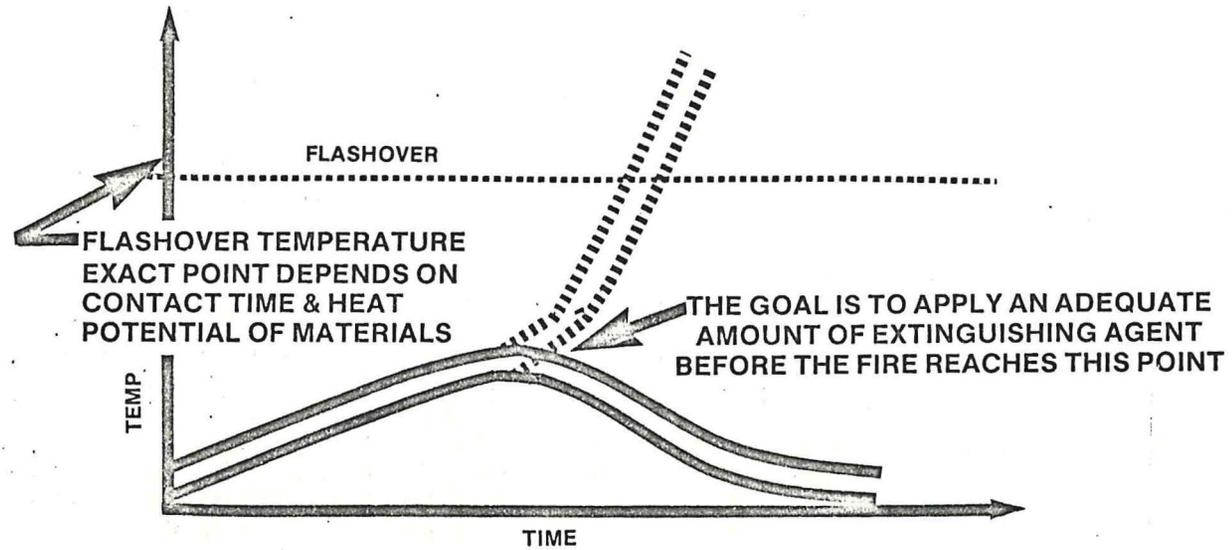
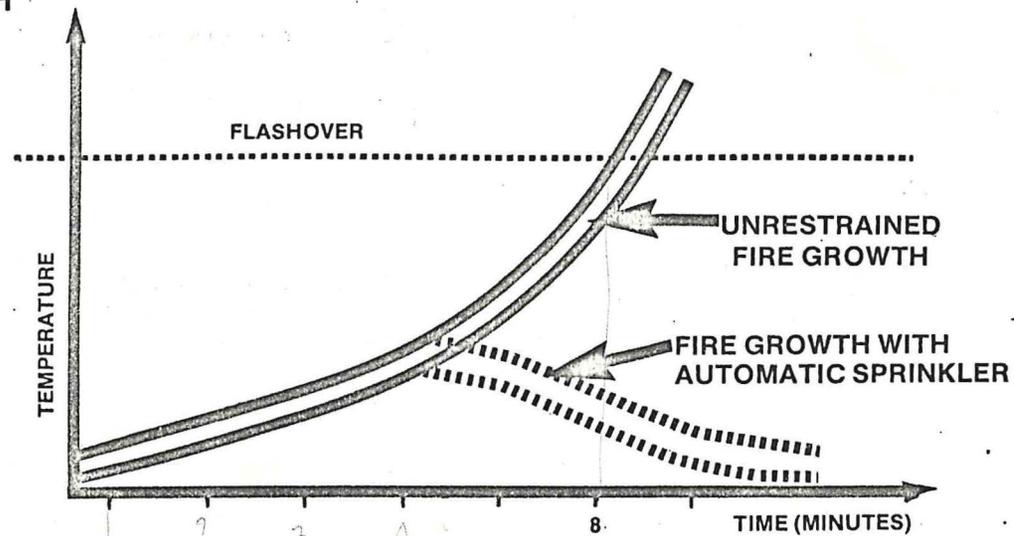


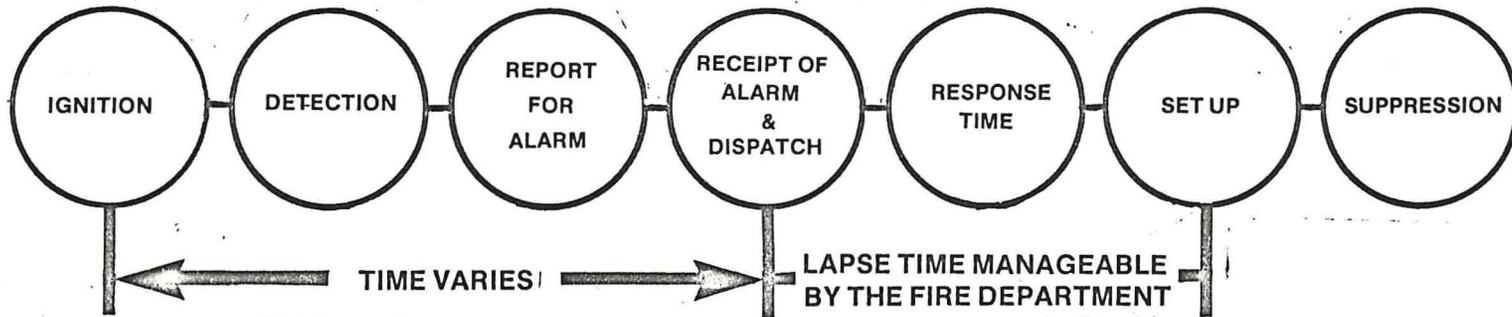
FIG. 1

GENERALIZED FLASHOVER CURVE

FIRE GROWTH



**FIG. 2 REFLEX TIME**



**5 CRITICAL PERIODS ESTABLISHING TIME LAPSE PRIOR TO FLASHOVER.**

- (1) Lapse time between ignition & detection
- (2) Report of emergency
- (3) Receipt of alarm & dispatch of apparatus
- (4) Response time to scene of alarm
- (5) Set-up for equipment & application of extinguishing agent

**REFLEX TIME**

These time periods are also referred to as reflex time. Reflex time is the time span from the time of ignition to the first application of manual suppression by the fire department. The concept of reflex time is useful in understanding the public and private sector responsibilities with respect to fire risks and fire protection. A fire department's overall response time can be established by system design. Historically, the time that elapses between ignition and alarm has been uncontrolled and fire extinguishing commenced only after arrival of firefighting forces. With automatic detection, a speedy alarm can be given and response time of fire fighting forces can be reduced. With automatic suppression, fire danger can be controlled prior to flashover, and frequently prior to the arrival of firefighting forces. Private fire protection is discussed at length in Section II of this Plan.

These time periods provide an evaluation framework in which to evaluate the management options of Cary's fire protection system. 6 intervals can be created between the time periods and correspond to the criteria used to determine adequate fire protection in Cary:

- Interval 1: Fire Prevention: Time Before The Fire
- Interval 2: Lapse Time Between Ignition & Detection
- Interval 3: Report of Emergency
- Interval 4: Response Time to the Scene of the Alarm
- Interval 5: Set Up Time at the Scene of the Emergency
- Interval 6: Fire Data System: Time After The Fire

For example, city managers can ask what management options have the highest payoffs in terms of reducing the time line while remaining economically feasible? What options contain the greatest leverage for reducing fire losses? Do these options derive from improved fire prevention, early detection of fires, sprinklers, or fire department operations?

**• Interval 1: Fire Prevention: Time Before the Fire**

Fire prevention has already been mentioned as an important management option (Interval 1) in establishing an adequate level of public fire protection and in affecting what takes place before the fire starts.

• **Interval 2: Lapse Time Between Ignition & Detection**

The period of time from start of ignition to detection is a critical stage in a structural fire. Very often, major fires have been a result of a long burning time prior to detection. This period of time is the most difficult period for a fire protection agency to control and reduce. This is where private sector participation comes in. Automatic fire extinguishing systems and early detection devices such as fire and smoke detectors are options that would succeed in reducing the detection period and greatly assist in extinguishing fires in their incipiency. These options are discussed in Section II.

• **Interval 3: Report of Emergency**

There are two areas of concern to be considered in minimizing the time required to report an alarm. The first area is educating the members of the community in the proper procedures to follow after detecting an emergency. Programs to provide such education are recommended in Section II.

The second area is the availability and proper use of alarm reporting equipment or devices. The Town of Cary has the 911 emergency number system. The recommendations pertaining to this system, equipment, programs, and procedures for minimizing alarm reporting delay will be included under the Communications Subsection of Section II of this Plan.

**Receipt of Alarm & Dispatch of Apparatus**

The time it takes the Cary Communications Center to determine the appropriate response assignments and dispatch the equipment after receipt of alarm affects the capability of controlling a fire in its incipient stage. In order for a fire to be controlled prior to flashover, fire companies should be dispatched within 60 seconds after receipt of alarm. Programs designed to meet this objective are discussed in Section II.

**RECOMMENDATION** - Maintain the capability of dispatching fire companies within 60 seconds after receipt of alarm.

• **Interval 4: Response Time to the Scene of the Alarm**

RESPONSE TIME TO THE FIRE SCENE IS INFLUENCED BY:

- 1) STATION LOCATION
- 2) STREET PATTERNS
- 3) CONDITIONS OF STREETS
- 4) TRAFFIC CONGESTION
- 5) LOCATION OF COMPANIES
- 6) ACTIVITIES OF COMPANIES

**RESPONSE TIME** The level of public fire service may be defined by the average response time required to reach each scene of a fire with appropriate personnel and equipment. In order for Cary's Fire Department to control fires prior to flashover, maximum response time of first-due engine companies must be four (4) minutes. This response time may vary depending on the hazard severity of a particular building or area.

See section headed **Station Location** for more detail.

**RECOMMENDATIONS**

1) Establish a maximum response time of four (4) minutes for first-due engine companies, with a deviation of ~~± one (1) minute~~ depending on the fire risk category in order to control fires in their incipiency. 2) Determine future fire station locations through studies considering the response time necessary for the required number of fire companies to travel from the station site to the various fire risk categories within Cary's fire service delivery area.

• **Interval 5: Set Up Time at the Scene of the Emergency**

Set up time is that time required for the fire companies to obtain a supply source of water, lay hose lines in place, locate apparatus, select proper equipment and devices, place ladders, gain entry and prepare for the application of an extinguishing agent. The time required for fire companies to accomplish the set up on the emergency scene and apply an extinguishing agent to the fire is directly related to the manning levels, access to the structure involved in fire, water supply and hydrant distribution, built-in fire protection, the magnitude of involvement, number of companies required and training of personnel. The above considerations and options will be discussed in other portions of this Comprehensive Plan. However, it is recommended that operational procedures and standards be established which will limit set up time for the first-due companies to within four (4) minutes.

**RECOMMENDATION** - Maintain the capability of setting up the first-due level of fire suppression capability within four (4) minutes of the time of arrival at the fire scene.

• **Interval 6: Fire Data System: Time After the Fire**

See section head **FIRE DATA SYSTEM** for more detail.

Station

## STATION LOCATION:

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Since fire companies in Cary spend over 50% of their time in the station, it is evident that station location must become the point of focus in calculating the anticipated lapse time between the fire companies' receipt of alarm and their arrival at the fire scene. The determination of fire station locations is a very critical aspect of public fire protection because of the great impact on the level of fire protection and the operating budget. Fire stations that are properly located can reduce response time and loss of life and property. The operating budget is affected by station location. The fewer fire stations required, the less cost to the taxpayer. Therefore, the objective in locating fire stations is to meet the established criteria for response time with the minimum number of stations.

To assist in the determination of fire station locations and the desired level of public fire protection, Cary was divided into 14 areas referred to as Fire Management Areas (FMA). An FMA is an area in which to specifically manage fire prevention and control. Each FMA was studied to determine Cary's fire protection needs.

**A) FIRE STATION LOCATION STUDY** was undertaken to determine which existing and/or potential fire station location sites provide the best distribution of fire companies given established response time criteria. In determining the most appropriate sites, the following factors were considered:

- A) Establishment Of Fire Management Areas (FMA)
- B) Present & Projected Land Uses
- C) Growth Patterns
- D) Annexations
- E) Examination By FMA's
- F) Fire Risks
- G) Fire Risk Categories & Their Response Times
- H) Transportation Network
  - I) Topographical & Man-Made Barriers
  - J) Existing Station Locations

### A) ESTABLISHMENT OF FIRE MANAGEMENT AREAS (FMA)

Cary is located in Wake County with a total population of approximately 20,000 within the corporate limits (December 1978). 4,000 people live in the two (2) mile extraterritorial planning jurisdiction. The geographic area for this station location study is comprised of the Town limits of Cary and an area approximately two (2) miles beyond the corporate limits. At the present time, the Cary Fire Department only provides fire protection to people and property within its corporate limits.

In order to study Cary's fire situation, it was necessary to establish geographical boundaries within the Town. Since all of Cary's comprehensive planning efforts have centered around the watershed as its planning unit, watersheds will be applied to this report also. For the purposes of this study, each watershed will serve as a Fire Management Area, FMA. The FMA is an area in which to specifically manage fire prevention and control. The FMA's for Cary will provide manageable units in which to define the fire situation, to take action to provide fire protection, and to measure the results. Map 1 shows the FMA's (watersheds) of Cary and the study area of this report.

### B) PRESENT AND PROJECTED LAND USES. (Map 2 shows present and projected land uses for all the FMA's)

Present and projected land uses help fire departments to determine what they need to protect from fire. Present land uses determine what there is to protect now. Projected land uses may signal a change in a fire risk category, thus making it necessary to make adjustments to response times.

**FMA 1:** Crabtree Creek Tributary 6 is totally outside of Cary's Town limits but within its two-mile extraterritorial zoning jurisdiction (ETJ). The western boundary is the mutually agreed upon jurisdiction line between Morrisville and Cary. In 1975, the population was approximately 183. The primary land use is residential (single-family). There is one church located in this FMA. Much of this watershed is undeveloped. When development does occur, it will remain primarily single-family residential, with a smaller area for multi-family residential development.

**FMA 2:** Black Creek is partially within the Town limits, the remainder being within the two-mile ETJ. Its estimated population for 1975 was 912. One of the Town's water towers is located in this FMA. Land uses in this watershed are varied. Three schools and two churches are located within its boundaries. There is a small subdivision with smaller than usual lots just to the north of Highway 54 at the Academy Street intersection. There are several business and industrial areas, along with an apartment complex, Northwoods. A large portion of this FMA is still undeveloped. Proposed land uses include some industrial and business uses, with the primary proposed land use being residential, both single and multi-family. The non-residential uses are clustered around existing and proposed intersections.

**FMA 3:** Reedy Creek is completely outside of Cary's Town limits. The eastern boundary is contiguous with Raleigh's jurisdiction. The population as of 1975 was approximately 1,080. The predominant present and future land use is single-family residential. Much of this FMA is still undeveloped. There is also an office and institutional use at the intersection of I-40 and North Harrison Avenue. Public Service Gas, an industrial use, is located in this area. Other industrial uses, existing and proposed, are located between Highway 54 and the railroad tracks. Within this FMA are two churches, a tract of state owned property, and a mobile home park.

*Is Coles too far to right?*

**FMA 4:** Coles Branch is partially within Cary's Town limits. The northwest boundary of this FMA is contiguous with Morrisville's extraterritorial zoning jurisdiction. The population as of 1975 was 1,208. Presently there is one church in this area. A portion of this FMA has existing and proposed industrial uses. The industrial uses are adjacent to the railroad tracks, which partially border this FMA. The Department of Planning and Development is projecting industrial development to occur in the northwestern portion of this area, adjacent to the railroad tracks. The Public Works Department is also located in this FMA. The other areas of Coles Branch, both present and future, are made up of single and multi-family uses.

**FMA 5:** Upper Crabtree Creek had approximately 589 people as of 1975. Except for a couple of areas, all of this FMA falls outside of Cary's Town limits. The northern boundary is contiguous with Morrisville's jurisdiction and the southern boundary is partially contiguous with Apex's jurisdiction. At the present time, most of this area is undeveloped. Hi-House Mobile Home Park and scattered residential developments are in this FMA. Major industrial land uses are projected for the land west of the proposed Cary Parkway. Residential land uses are proposed for the land east of the Cary Parkway. An area for business uses is proposed at the intersection of Hi-House Road and the proposed Maynard extension. Future office and institutional uses are also scattered throughout this FMA.

**FMA 6:** Johnson Creek is another FMA with mixed land uses. Almost all of it is within Cary's Town limits, except for a large tract of state owned property. As of 1975, approximately 5,069 people lived in this FMA. The eastern border is contiguous with Raleigh's jurisdiction. Five schools and two churches are located in this FMA. There are scattered business and office uses. Part of Cary's central business district is located within this FMA, which

includes a portion of the first fire district. One of Cary's water towers, along with the Town's existing fire stations, are in this FMA. Specific non-residential uses include: U.S. Post Office, Cary Village Square, Cary Village Mall, and South Hills Shopping Center. There are also several industrial uses, one being Fairmont Foods. The other land uses in this FMA are single-family and multi-family. Multi-family uses include Williamsburg Manor, Village Green, and Oxford Square. There are also several mobile home parks. The majority of this FMA is developed. What land is left is proposed for single-family, multi-family and office and institutional uses.

**FMA 7:** Swift Creek Tributary 7 had a population of 6,063 as of 1975. Most of this FMA is within Cary's Town limits and developed. Land uses are mixed. Two schools and ten churches are located here. The remainder of the Town's central business district and primary fire district is located in this FMA. There are scattered existing business and industrial uses, primarily located at intersections or adjacent to the railroad tracks. Some office and institutional uses are also in this area both existing and proposed. The major land use in this FMA is single-family. There is also a fairly large portion of multi-family uses. These multi-family uses include Bowling Arms and Briarcliff Apartments. Other undeveloped land is proposed for multi-family use. When this FMA is developed to its capacity, the primary land use will be single-family residential.

**FMA 8:** Swift Creek Tributary 5 had a population of approximately 2,805 as of 1975. There are two schools, five churches and a Town water tower in this FMA. Scattered business and office uses are located here, but the primary land use is single-family residential. The land to the north of U.S. 1 and 64 is to a large extent developed, while the land south of U.S. 1 and 64 is primarily undeveloped. Proposed land uses include business and office and institutional uses at the intersection of the proposed Cary Parkway and Apex-Macedonia Road. There are also several areas projected for multi-family uses. The predominant future land use is single-family residential.

**FMA 9:** Swift Creek Tributary 6 is almost entirely outside of Cary's Town limits. Most of this FMA is undeveloped. The primary land use now and in the future is single-family residential. There are no schools and churches in this FMA. The population was 245 as of 1975. A shopping center is presently under construction, and there is a small area of office uses.

**FMA 10:** Upper Swift Creek is primarily outside of Cary's Town limits. The western boundary of this FMA is contiguous with Apex's

jurisdiction. As of 1975, the population was 66. Most of the land in this area is undeveloped. The major land use north of U.S. 64 now and in the future is single-family residential. There is presently an industrial area at the intersection of the Cary Parkway and Old U.S. 1 and 64. The land south of U.S. 64 is presently undeveloped. Proposed land uses for this area include single and multi-family, business and industrial uses.

**FMA 11:** Swift Creek had a population of 120 as of 1975. This FMA is totally outside of Cary's Town limits, and except for scattered residential development, is undeveloped. Industrial, office and institutional, and residential uses are proposed for the undeveloped land in this FMA. A state park is also located in this area.

**FMA 12:** Swift Creek Tributary 4 is outside of Cary's Town limits. As of 1975, the population was 109. There is one church in this FMA. The major land use is single-family residential. Except for scattered dwellings, this FMA is undeveloped. The predominant land uses projected for this area are single and multi-family uses. There is also a small area designated for business uses.

**FMA 13:** Swift Creek Tributary 3 is primarily undeveloped, except for scattered dwellings. 24 people lived in this FMA in 1975. The predominant land use is projected to be single-family. There is presently a small pocket of business uses at the intersection of Apex-Macedonia Road and Cary-Macedonia Road.

**FMA 14:** This FMA is part of a watershed that drains into Raleigh's watershed system. It is undeveloped except for scattered dwellings. As of 1975, this area had zero population. The proposed land use for this area is office and institutional.

Growth patterns and population projections have been established by the Department of Planning and Development (Map 3). These projections may change from year to year. Therefore, periodic updates of Cary's growth patterns will be necessary in order to determine if any changes have taken place.

Presently, Cary's major growth areas are located in FMA 6, FMA 7, FMA 8, north of US 1 and 64, and part of FMA 10. By 1980, 80% of this area should be developed out.

Between 1980 and 1995, growth areas will be located in southern, northern, and western FMA's of Cary. Development will first occur in the southern FMA's: FMA 7, south of US 1 and 64, FMA 9, north of US 1 and 64, the remainder of FMA 10, part of FMA 11, and FMA 14. In 1985, with the completion of Crabtree Sewer Outfall, development will begin occurring in the northern and western FMA's: part of FMA 2, FMA 3, FMA 4, and part of FMA 5. The Crabtree Sewer Outfall will cause the growth pattern to begin shifting to northern and western Cary. The outfall line will open up this whole area of Cary for development and will add two times the land mass being considered in the Swift Creek tributaries, FMA's 7-13. The major portion of the development occurring in all of the above FMA's should be completed by 1995.

In 1990, development will begin occurring in the remaining FMA's: FMA 1, the rest of FMA 2, the remainder of FMA 5, FMA 8, south of US 1 and 64, FMA 9, south of US 1 and 64, the rest of FMA 11, FMA 12, and FMA 13. Development will continue to occur throughout the 1990's in these FMA's.

Between 1990 and 1995, growth and development will be well under way in the northern and western portions of Cary. The growth pattern will have shifted more toward the northern and western FMA's, 1-5. Between 1995 and 2000, the Swift Creek tributaries, FMA's 7-13, will experience a slowdown in development and maintain a development rate of 6% per year. The peak of Cary's development trend, assuming Cary will develop as anticipated, will occur in the year 2000. From this point, Cary will grow at a constant rate and will not experience any high degree of growth.

**(C) GROWTH PATTERNS**

The direction(s), rate and type of development which are occurring both within and adjacent to a city, are factors which may indicate priorities if a fire station is to be constructed. Such an analysis may indicate that a fire station be built outside the corporate limits, in a presently undeveloped area which will likely become a part of the city in the future. Planning of this nature will prevent overlapping of first-due companies and will result in the most efficient use of the Town's fire defense resources.

*This C) is not the same as A) and B) on pg. 10.*

BETWEEN 1970-1978 CARY'S POPULATION GREW FROM 7,339 TO 20,000, AN INCREASE OF 172.5%.

**POPULATION PROJECTIONS FOR FMA'S**

	1980	1985	1990	1995	2000
FMA 1	210	250	1,600	2,300	3,000
FMA 2	1,158	1,470	6,900	9,700	13,000
FMA 3	1,665	2,561	6,000	8,350	10,700
FMA 4	1,461	1,500	2,100	2,925	3,850
FMA 5	631	675	6,300	9,800	13,400
FMA 6	6,080	7,211	7,718	8,218	8,718
FMA 7	9,171	11,148	12,327	12,552	12,702
FMA 8	4,650	5,364	5,745	6,045	6,795
FMA 9	950	1,493	2,603	2,903	3,083
FMA 10	741	1,302	2,202	2,502	2,616
FMA 11	138	2,019	4,245	5,145	5,745
FMA 12	136	232	532	832	1,627
FMA 13	75	126	177	231	306
FMA 14					

**POPULATION PROJECTIONS  
FOR  
CARY TOWN LIMITS & EXTRATERRITORIAL  
PLANNING JURISDICTION**

	Inside City Limits	Extraterritorial Planning Jurisdiction	Total Population
December 1978	20,000	4,000	24,000
1980	22,382	4,159	26,541
1985	30,366	5,000	35,366
1990	39,543	5,000	44,543
1995	48,923	5,200	54,123
2000	56,087	5,200	61,287

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**D) ANNEXATIONS**

Annexations will follow the projected growth patterns of Cary. Annexations will continue to occur throughout Cary in areas adjacent to existing corporate limits. As existing developments expand and new ones begin, they will be annexed as services are extended.

**E) EXAMINATION BY FMA'S**

The Cary Fire Department collected fire data for three years, 1970, 1974, and 1978. These three years, at four (4) year intervals, clearly show the growth of Cary's fire situation. A questionnaire formulated by the Department of Planning and Development was used to gather the needed information.

In 1970, there were a total of 90 calls to the Fire Department. Out of these 90 calls, 32 were actually fires or 44%.

**TOTAL CALLS & FIRES - 1970**

	Total Calls	Total Fires
FMA 1	0	0
FMA 2	12	6
FMA 3	0	0
FMA 4	9	6
FMA 5	0	0
FMA 6	21	8
FMA 7	37	10
FMA 8	11	2
FMA 9	0	0
FMA 10	0	0
FMA 11	0	0
FMA 12	0	0
FMA 13	0	0
FMA 14	0	0

The location of the calls and fires reflect the corporate limits of Cary since Cary's Fire Department provides fire service to only those people and places inside its Town limits, except where there are mutual aid agreements with other jurisdictions.

By 1974, Cary had begun to experience rapid growth. This is reflected in the total number of calls and fires for 1974.

**TOTAL CALLS & FIRES - 1974**

	Total Calls	Total Fires
FMA 1	0	0
FMA 2	14	13
FMA 3	2	2
FMA 4	8	8
FMA 5	2	2
FMA 6	59	54
FMA 7	77	69
FMA 8	17	16
FMA 9	1	0
FMA 10	1	1
FMA 11	0	0
FMA 12	0	0
FMA 13	0	0
FMA 14	0	0

As Cary's population increased and land was annexed into Cary, the number of calls and fires increased. In 1970, fires occurred in only four (4) FMA's whereas in 1974 they occurred in eight (8).

**COMPARISON 1970/1974**

Total Calls		Total Fires	
1970	1974	1970	1974
90	181 (101% Increase)	32	165 (416% Increase)

This represents a 101% increase over the number of total calls in 1970, and a 4.16% increase over the total number of fires in 1970.

**CHANGES IN 1970 & 1974**

	Total Calls		Total Fires	
	1970	1974	1970	1974
FMA 6	21	59 (181% Increase)	8	54 (575% Increase)
FMA 7	37	77 (108% Increase)	10	69 (590% Increase)

Check A) & B) pg. 12  
C) pg. 14.

This line too for call

By the end of 1978, Cary's population had increased by 172.5% over 1970's population figures.

TOTAL CALLS & FIRES - 1978			
	Total Calls		Total Fires
1978	416	(130% Increase over 1974)	277
			(68% Increase over 1974)

	BREAKDOWN	
	Total Calls	Total Fires
FMA 1	0	0
FMA 2	48	39
FMA 3	0	0
FMA 4	23	13
FMA 5	3	1
FMA 6	138	51
FMA 7	149	124
FMA 8	50	45
FMA 9	3	2
FMA 10	2	2
FMA 11	0	0
FMA 12	0	0
FMA 13	0	0
FMA 14	0	0

The increase in calls and fires correspond to population increases and growth patterns. An examination of certain FMA's shows this correlation:

TOTAL CALLS			
	1970	1974	1978
FMA 2	12	14 (17% increase)	48 (243% increase)
FMA 4	9	8 (11% decrease)	23 (188% increase)
FMA 6	21	59 (181% increase)	138 (134% increase)
FMA 7	37	77 (108% increase)	149 (94% increase)
FMA 8	11	17 (55% increase)	50 (194% increase)

TOTAL FIRES			
	1970	1974	1978
FMA 2	6	13 (117% increase)	39 (200% increase)
FMA 4	6	8 (33% increase)	13 (63% increase)
FMA 6	8	54 (575% increase)	51 (6% decrease)
FMA 7	10	69 (590% increase)	124 (80% increase)
FMA 8	2	16 (700% increase)	45 (181% increase)

INCREASES		
	Total Calls	Total Fires
1970	90	32
1974	181 (101% increase)	165 (416% increase)
1978	416 (130% increase)	277 (68% increase)

The number of calls to the Fire Department increased dramatically over this eight (8) year period. A large population is associated with a high number of fire department calls for service. Total calls to the fire department include fire calls, false alarms, and service calls. Actual fires increased, but not as dramatically due to the effective fire prevention measures of the Cary Fire Department. It is important that Cary continues to suppress and eventually reduce the number of its fires by providing effective fire prevention services. The object of a prevention effort is to reduce the number of fires that actually occur. The fewer the number of fires, the more effective the prevention effectiveness.

Information was also gathered for approximate value of each call to the fire department and approximate losses for each fire along with injuries and deaths for each fire. These categories address suppression effectiveness.

	Total Approximate Value for All Calls	Total Approximate Loss for All Calls
1970	\$ 5,939,245.00	\$ 39,041.00
1974	2,323,430.00	175,300.00
1978	64,016,532.00	395,794.00

The value for a call refers to the structure or nonstructure involved in the emergency and reflects what the potential dollar loss could be.

Total approximate dollar values for all calls increased because of the sheer increase in total number of calls to the Fire Department and because of the increase of the value of property and structures due to inflation. Total approximate dollar losses for all fires increased because of the increase in the number of fires and the rising costs of property and structures.

#### INJURIES

	Civilian		Firefighter	
1970	2		1	
1974	3	(50% Increase)	1	
1978	14	(367% Increase)	6	(500% increase)

Deaths have rarely occurred in Cary as shown in the following chart:

#### DEATHS

	Civilian		Firefighter
1970	0		0
1974	4		0
1978	0		0

A fire department that effectively contains, suppresses or controls a fire once it has occurred, will experience a minimum of dollar loss to property and a minimum number of deaths or injuries to both civilian and firefighting personnel. Dollar loss and civilian and firefighter injuries and deaths per fire are measures of suppression effectiveness. Dollar losses and injuries have increased over the eight year study period. Part of this increase is attributed to the natural increase in fires due to the large increase in population and growth in Cary. But part of this increase is also due to Cary's difficulty in suppressing and controlling fires prior to flashover, that critical stage in a fire's development that controls dollar loss and life loss. This can be seen in an examination of response times for the three study years.

#### AVERAGE RESPONSE TIME TO THE SCENE OF THE ALARM

1970	1974	1978
5 minutes	4 minutes, 31 sec.	4 minutes, 11 sec.

Average response time slightly decreased in 1978 despite increases in population and in the number of calls for assistance. But a closer look at particular FMA's shows runs longer than the established response times of this document and runs longer than the average response time for a study year. This is seen in the following chart:

#### RESPONSE TIMES BY SPECIFIC FMA'S

	1974		1978
FMA 5	5.5 minutes	FMA 5	5.3 minutes
FMA 9	7 minutes	FMA 10	7 minutes
FMA 10	7 minutes		

Individual response times are increasing as development moves further away from existing fire stations. This automatically reduces the suppression effectiveness of Cary's Fire Department by increasing response time. Increased response time makes it more difficult to control fires prior to flashover, thus increasing the likelihood of dollar (property) loss and life loss. Unless special provisions are made, these losses will continue to rise as Cary grows and develops further away from existing fire station sites.

#### SUMMARY

In summary, Cary's fire situation has grown since 1970. Calls, fires, dollar losses from fire, injuries, and several individual FMA response times have all increased. The distribution of demand for fire services has increased in relationship to where annexations have occurred between 1970 and 1978. Service demands tend to cluster by population and land use type. There has been a gradual but distinct shift in the distribution of fire department calls to southern Cary. This corresponds to Cary's present growth patterns and is of interest because of the implications for fire planning. A thorough understanding of Cary's fire situation will enable Cary to provide a higher level of effective fire prevention and suppression services.

Check  
 A) P. 10  
 B) P. 14  
 C) P. 17 to  
 D) + E) make consistent

**F) FIRE RISKS**

There are two types:

**(1) LIFE LOSS-RISK:**

Schools, hospitals, public assembly places, nursing homes, large apartment complexes, high rise apartments for elderly, congested areas of substandard housing.

All these represent a high Life Loss-Risk, therefore Fire Companies need to be located in proximity in order to prevent or control panic and thus reduce the Life Loss-Risk.

**(2) PROPERTY LOSS-RISK**

Commercial, industrial & institutional properties in large areas & congested areas.

These require large volumes of water (fire flow) to extinguish a fire. Fire companies need to be located in proximity in order to provide initial attack and thus reduce Property Loss-Risk.

Both people and property need to be protected from fire and need to be examined when determining station locations. Maximizing life safety should be the major concern with protection of properties at risk a secondary although important concern. "In 1977 residential occupancies accounted for some 7,800 fatalities, or 78% of the 9,950 fatalities estimated to have occurred throughout the United States." In 1978 in Cary, 34% of the total number of calls to the Cary Fire Department originated from dwellings.

Fire incidence in residential areas is rising throughout the United States. Since public funds are used for providing public fire defenses, it is most essential to provide an acceptable level of fire service to all properties on a basis which first gives recognition to the severity of life loss-risks. Municipalities are responsible for providing an acceptable level of fire service for all of its citizens regardless of the monetary value of such properties. This approach does not preclude a concern for the monetary loss-risk of property. To do so would not be realistic. However, to ignore the fact that fire companies should be in or near areas of the city in which most fires occur would be foolish. Therefore, a major assumption underlying the identification of appropriate fire station sites in this study is that of maximizing life safety with protection of properties at risk a secondary although important concern.

**LIFE LOSS & PROPERTY LOSS-RISK**

FMA	Risk	Fire Flow (water)
6	South Hills (non-sprinklered section) (monetary loss-risk)	4,000 gpm
6	Methodist Church (life loss-risk)	4,000 gpm
7	Baptist Church (Academy) (life loss-risk)	4,000 gpm
7	Bowling Arms (life loss-risk)	4,000 gpm
6	Williamsburg Manor (life loss-risk)	3,500 gpm
7	Cary Elementary School (life loss-risk)	3,500 gpm
6	Village Square Office Building (life and monetary loss-risk)	3,000 gpm
7	Foodtown (monetary loss-risk)	2,000 gpm
6	Pete's Hardware/Goodyear (monetary loss-risk)	3,000 gpm
2	Town Hall (monetary loss-risk)	2,500 gpm
7	Greenwood Forest Baptist Church (life loss-risk)	2,000 gpm
7	Ashworth's (monetary loss-risk)	1,500 gpm
8	Cary Senior High School Gym (life loss-risk)	2,000 gpm
6	Cary Village Square (Winn-Dixie, Kerr, giving sprinkler credit) (monetary loss-risk)	2,000 gpm
6	South Hills (sprinklered section) (monetary loss-risk)	3,000 gpm

This is just a partial list of fire risks in Cary. All structures in Cary fall into a fire risk category. Cary presently has predominately life loss-risks with scattered monetary loss-risks. These categories will be defined shortly.

This list also mentions fire flow. Fire flow relates to how many gallons of water per minute must be applied to a fire through hand held hose lines and heavy stream appliances to effect control. The higher the fire flow requirement, the more fire apparatus and manpower required to handle the volume. Fire flow figures help to determine fire risks, manning levels and apparatus needs.

For 1970 and 1974, dwellings, woods and vehicles elicited the highest number of calls to the fire department. In 1970, out of 90 calls, 36% came from dwellings, 26% from woods, and 26% came from vehicles. In 1974, out of 181 calls, 33% came from dwellings, 22% from woods, and 10% from vehicles. In 1978, this changed slightly. Out of 416 calls to the fire department, 34% came from dwellings, 18% from vehicles, 13% of the calls came from commercial uses, and 12% of the calls were from woods. Out of the 277 fires in 1978, 38% came from dwellings, 16% came from woods or field fires, 16% came from vehicles, and 12% came from commercial uses. Over the eight (8) year period, calls from commercial uses rose:

**CALLS FROM COMMERCIAL USES**

1970	1974	1978
3 or 3% out of 90 calls	17 or 9% out of 181 calls	56 or 13% out of 416 calls

margin not even

Jack  
A) 10:10  
B) 10:15  
C) 10:20  
D) 10:25  
E) 10:30  
F) 10:35

As Cary develops, there will be additional commercial and industrial uses, thus increasing the chance of fire calls from these uses which are usually monetary loss-risks. There will also be an increase in life loss-risks due to more people moving into Cary. This growth will add fire risks and cause Cary's fire situation to change. New risks will need to be identified so they can be properly protected and minimized. It will be important that internal fire protection be provided for these new uses so that potential fire risks can be reduced, thus reducing the fire flow, number of apparatus, manpower, and stations. Because the Fire Department cannot prevent all fire losses, formal obligations fall on owners of certain kinds of buildings to have built-in fire protection. It becomes very clear that fire safety is a responsibility shared by the public and private sectors. In this way, Cary will be better able to manage its fire risks. This shift to private fire protection will be discussed in Section II.

**G) FIRE RISK CATEGORIES AND THEIR RESPONSE TIMES**

The common thread which runs through all fire station site study criteria is that of response time of fire companies in relation to the type of properties to be protected. The maximum response time of first-due engine companies chosen by the Cary Fire Department is four (4) minutes, with a deviation of + or - one minute depending on the fire risk category the structure falls under. As mentioned earlier, this response time was established based on certain known characteristics regarding the progressive growth of fires in a given time period. The chosen response time will allow the fire department to provide initial fire protection prior to a fire reaching the flashover point. With the emphasis on built-in fire protection systems and early warning devices, this flashover time should increase. Automatic detection and suppression is intended to limit the scope of the anticipated problem by adding additional response time.

**FIRE DEPARTMENT RESPONSE TIME** varies depending on the magnitude of the fire risk. There are three risk categories: 1) major risks or high hazards, 2) key risks or medium hazards, 3) typical risks or low hazards.

1) A Major Risk is one which requires the largest quantity of fire protection resources or one which would result in the greatest life loss or property loss if destroyed. The easiest measure of the resources required is fire flow, and the best measure of potential property loss is assessed value. Potential life loss can be estimated by examining demographic data, geographic data, fire history data, resource data (water supply) and occupancy data. Examples of major risks are: Institutional buildings,

Stratton A

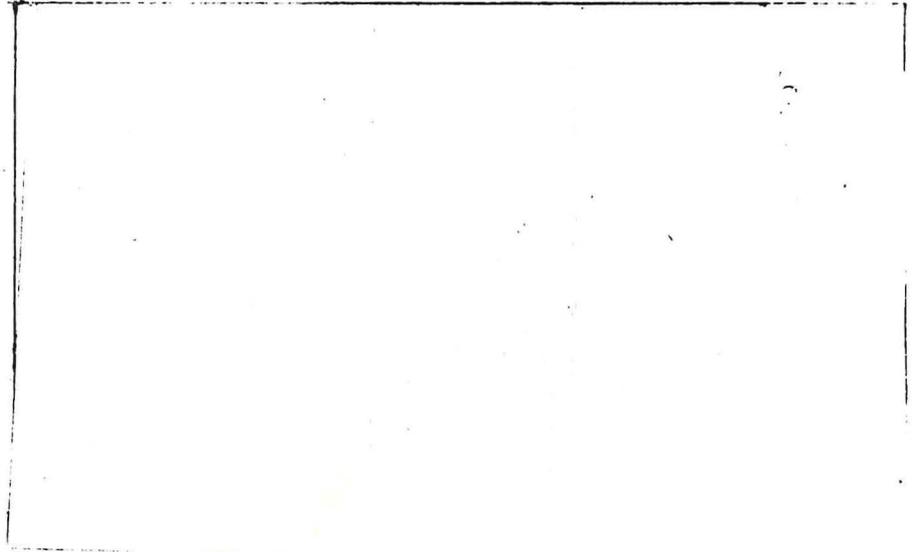
remove

auditoriums, chemical storage plants, liquified flammable gas storage plants, lumber yards, warehouses, heavy manufacturing, commercial and office buildings that are unsprinklered or of combustible or non-fire resistant construction, convalescent homes, residential highrises (5 stories or more), and hotels. Structures that have fire flows 3,500 gpm and over should be classified as major risks. A major risk has a response time of three (3) minutes.

2) Key Risks include commercial and office buildings that are sprinklered or of noncombustible or fire resistive construction, churches, libraries, museums, service stations and apartments. These are risks that do not present as high a hazard as major risks. Certain major risks become key risks if they are sprinklered because this reduces the fire flow and risk potential. ISO gives up to a 50% reduction to fire flow requirements for structures that have complete automatic sprinkler protection. The response time for key risks is four (4) minutes.

3) A Typical Risk is the risk you would expect to find. These risks are low hazard risks and include single-family dwellings, duplexes, and triplexes. Also, if certain key risks are sprinklered, they can be classified as typical or low risks if their required fire flow is low and if the structures are isolated, thereby making it more difficult for the fire to spread. The response time for a typical risk is five (5) minutes.

All structures and nonstructures (woods) in Cary need to be placed into a risk category. The form for doing this is located in Appendix B. For the purposes of this document, only certain designated areas will be examined from each FMA.



## H) TRANSPORTATION NETWORK

Cary's long-range thoroughfare plan calls for completion of the Cary Parkway and Maynard Road. The Cary Parkway would serve as an outer loop and Maynard Road would serve as an inner loop. Other collector and residential streets are planned as development occurs. The phasing of street extensions and additions will correspond to Cary's growth patterns. Map 4 shows Cary's present and proposed thoroughfare system.

A town's thoroughfare system influences response times, and it needs to be considered when locating future fire stations. How Cary's thoroughfare system affects response times and station locations in Cary will be discussed when examining specific proposed fire station sites. At that time, particular streets and thoroughfares will be identified and comments made as to how they affect particular station locations.

## I) TOPOGRAPHICAL & MAN-MADE BARRIERS

(1) Topographical - There are no major natural boundaries or topographical features in Cary that will affect the location of fire stations or established response times. (2) Man-made barrier - There is one man-made barrier that will affect response times and station locations: THE RAILROAD. Southern, Seaboard Coastline, and Amtrack pass through Cary at the Academy Street railroad crossing. Trains pass through this point eighteen (18) times in a 24-hour period. Out of the eighteen (18) runs, only two are passenger trains. The other trains are freight. Freight trains have schedules but the times can vary depending on availability of the tracks. (Map 4 also shows where the railroad tracks and crossings are located in Cary.)

Railroad tracks basically cut off northern and western sections of Cary from the rest of the Town. With the completion of Crabtree Sewer Outfall, major growth and development will begin occurring in these two sections of Cary, dramatically increasing the present population and fire risk potential. These people and properties will need to be protected adequately by the Cary Fire Department when they are annexed. In order to do this effectively, the location of the railroad tracks will need to be considered because of the potential impact they might have on meeting established response times. If a train is passing through Town, a fire company has to take an alternate route. In many cases, this alternate route will increase the response time. As more people move into the area, the chances of a fire call occurring when a train is passing will increase, thus having a negative impact on fire protection.

## J) EXISTING STATION LOCATIONS

Before future station locations are recommended, it is important to examine existing fire station locations to see if they are providing adequate fire protection to Cary.

Stations 1 and 2 are both located in FMA 6. The present fire service delivery area for each first-due engine company can be seen in Map 5. Response times were estimated by using an average speed of 30.2 mph for first-due engine companies. This figure was obtained from the N.C. League of Municipalities. Distances were obtained by driving from existing station sites to designated points throughout Cary. These points correspond to fire risk categories.

### RESPONSE TIMES FOR STATION 1 & 2:

#### Station 1 to:

- 1 - Intersection of N. Harrison Avenue and Reedy Creek Road: 4 min. 22 sec. Proposed commercial, single-family.
- 2 - Intersection of N. Harrison Avenue and Maynard Road: 2 min. 11 sec. Proposed commercial, office and institutional.
- 3 - Intersection of Maynard Road and Highway 54: 2 min. 35 sec. Multi-family, single-family, school.
- 4 - Intersection of Maynard Road and S/R 1011 (Old 1 and 64) (western intersection): 2 min. 47 sec. Industrial, office and institutional.
- 5 - Intersection of S/R 1011 and Cary Parkway: 5 min. 58 sec. Proposed industrial, multi-family.
- 6 - Intersection of Lake Pine Road and Cary Parkway: 5 min. 58 sec. Proposed industrial, multi-family.
- 7 - Intersection of Maynard Road and Plantation Drive: 3 min. 58 sec. Single-family.
- 8 - Intersection of Maynard Road and Kildaire Farm Road: 2 min. 23 sec. Commercial, office and institutional.
- 9 - Intersection of Walnut Street and Kildaire Farm Road: 50 sec. School.
- 10 - Hi-House Mobile Home Park: 3 min. 35 sec. Multi-family, proposed commercial.
- 11 - Intersection of Old Apex Road and S/R 1011 (northern intersection): 59 sec. Commercial, industrial.
- 12 - Intersection of Old Apex Road and S/R 1011 (southern intersection): 3 min. 46 sec. Multi-family, single-family.
- 13 - Intersection of Old Apex Road and Hi-House Road: 2 min. 23 sec. Industrial, multi-family, single-family.
- 14 - Intersection of Madison Avenue and Crest Drive: 1 min. 35 sec. Single-family, multi-family.

**Station 2 to:**

- 1 - Intersection of Maynard Road and Old 1 & 64: 1 min. 59 sec. Multi-family, commercial, proposed office and Institutional.
- 2 - Intersection of Manchester Drive and Sturdivant Drive: 3 min. 13 sec. Residential.
- 3 - Intersection of Kildaire Farm Road and proposed Cary Parkway: 5 min. 10 sec. Single-family, commercial, proposed office and Institutional.
- 4 - Intersection of Buck Jones Road and Cary-Macedonia Road: 2 min. 59 sec. Commercial, office and Institutional, multi-family.
- 5 - Intersection of Kildaire Farm Road and Apex-Macedonia Road: 7 min. 21 sec. Residential.
- 6 - Intersection of Seabrook Avenue and Dirkson Court: 3 min. 6 sec. Residential.
- 7 - Intersection of Hampton Valley and Cary Parkway: 3 min. 46 sec. Residential.
- 8 - Intersection of Maynard Road and Ellynn Drive: 1 min. 59 sec. Residential.
- 9 - Intersection of 64 and Edinburgh Drive: 9 min. 32 sec. Residential, proposed commercial, office and Institutional.
- 10 - Intersection of Farmington Woods Drive and Kildaire Farm Road: 4 min. 10 sec. Commercial, office and Institutional, multi-family.
- 11 - Intersection of Glasgow Road and Kildaire Farm Road: 6 min. 40 sec. Residential.
- 12 - Intersection of Seabrook Avenue and Maynard Road: 1 min. 23 sec. Residential.
- 13 - Station 2 is within 1 minute of major commercial uses, schools, office and institutional, multi-family.

After reviewing these charts, it becomes clear that there are areas presently in Cary's fire service delivery area that are not receiving an adequate level of fire protection from Stations 1 and 2 as defined in this document. Engine companies are not meeting response time criteria. Response times are greater than those established in this Plan. These areas are predominately located in southern Cary. As development occurred, Cary's corporate limits moved further south. This caused response times to increase since these new areas were further away from existing station locations. Response times for specific FMA's point this out. In 1974 and 1978, FMA 10 had a 7-minute response time for a fire department call. As development continues to occur throughout Cary, it will become increasingly difficult for the engine and truck companies located at Stations 1 and 2 to meet Cary's present and future fire needs. Additional stations will have to be built in order for Cary to provide adequate fire protection in the future.

## COMPREHENSIVE STATION LOCATION PLAN:

The Station Location Plan designates 4 fire station sites to adequately protect Cary for the next 20 years, depending on the rate of annexation.

### Comprehensive Station Location Plan:

#### PHASE I (1980-1985)

- (1) Addition of 3rd Station
- (2) Carry out portions of Thoroughfare Plan
- (3) Acquisition of sites - Station 4 and relocation of Station 1

#### PHASE II (1985-1990)

- (1) Addition of 4th Station
- (2) Continuation of Thoroughfare Improvements

#### PHASE III (1990-2000)

- (1) Relocation of Station 1
- (2) Continuation of Thoroughfare Improvements

### Locations that meet established response time criteria with the minimum number of stations:

- (1) Intersection of North Harrison Avenue and Maynard Road. (Relocation site for Station 1)
- (2) Intersection of Maynard Road and Walnut Street. (Station 2)
- (3) Intersection of Kildaire Farm Road (S/R 1300) and Apex-Macedonia Road (S/R 1009). (New site)
- (4) Intersection of Old Apex Road (S/R 1616) and Old 1 and 64 (S/R 1011). (New site)

An optimal program for phasing station locations is necessary if the Plan is to be effective. The phasing relates back to projected growth patterns, rate of development, annexations, and other factors already mentioned that help determine station locations. Stations will be built when the need arises as growth occurs in Cary. The overall station location plan should enable the Town of Cary to provide an adequate level of fire protection for the next twenty (20) years, depending on the rate of annexation. During this 20-year period, there will be temporary inequities in certain sections of Cary's fire service delivery area. However, no area will have less than an acceptable level of fire protection during the phasing periods. All of Cary's fire service delivery areas will be receiving the recommended level of adequate fire protection when the total plan is implemented. During the 20-

*add ( )*  
year planning period, it is imperative that the phasing in of fire stations follow the recommendations of this Subsection. If individual fire station location decisions are made without reference to these recommendations, it is almost a certainty that these new sites will become inefficient and obsolete within a few short years due to Cary's growth rate.

The Comprehensive Station Location Plan is divided into three phases. If any of the assumptions change, time periods may change and designated locations may become ineffective. Therefore, it will be necessary to periodically review the station location plan and recommend changes where necessary.

#### PHASE I (1980-1985)

*check this with other phases and tables*  
1) Addition of 3rd station is recommended for FMA 9 at the Kildaire Farm Road and Apex-Macedonia Road intersection. This location enables companies to respond in more than two directions. There are no topographical barriers or necessary detours to hinder rapid coverage of service area. Stations 1 and 2 will remain where they are. This southern location is in an outlying area. When locating an outlying station, future annexations and growth patterns need to be considered. The information presented earlier in this document shows that this area will likely develop and become a part of the Town in the future, thus justifying the placement of the fire station outside the corporate limits in an area that is presently undeveloped. Planning of this nature will prevent overlapping of first-due companies and will result in the most efficient use of the Town's fire defense resources. On the other hand, a station too close to a town's corporate limits reduces its response area, thereby decreasing efficiency. Because of rapid growth in southern Cary, the existing site for Station 3 is too close to Stations 1 and 2 and is no longer the most efficient site.

Station 3 can adequately protect parts of Cary now and in the future. This location makes maximum use of Station 3's present and future fire service delivery area. It also takes into account Apex's jurisdiction line and Cary's Thoroughfare Plan. The efficiency of Station 3 increases with the completion of each phase of this station location plan. Map 6 shows the entire fire service area for first-due engine companies for Stations 1, 2 and 3 during Phase 1 with existing thoroughfares. The total fire service area, or response area, for each station includes Cary's present Town limits and an area approximately two (2) miles beyond the corporate limits. The actual fire service delivery area for each fire station will increase as annexation occurs. The potential is there for each station to have to provide fire protection to its entire service area. This station location pattern will enable Cary's Fire Department to better protect certain areas that are presently

receiving less than the adequate level of fire protection defined in this document by providing improved response times.

During Phase I, Station 2 will concentrate its fire protection services over portions of eastern and central Cary. The change in Station 2's service area can be seen by comparing maps 5 and 6. Station 2 will now be able to adequately protect its response area in Phase I. Station 1 still has to provide less than the established level of fire protection to portions of southwestern Cary in Phase I. This will change to some degree with the implementation of portions of Cary's Thoroughfare Plan, but the major improvements will occur in Phase II with the addition of a fourth station.

### RESPONSE TIMES

#### Station 1 to:

- 1 - Intersection of N. Harrison Avenue and Reedy Creek Road: 4 min. 22 sec. Single-family, proposed commercial.
- 2 - Intersection of N. Harrison Avenue and Maynard Road: 2 min. 11 sec. Proposed commercial, office and institutional, single-family.
- 3 - Intersection of Reedy Creek Road and Maynard Road: 3 min. 32 sec. Proposed single-family.
- 4 - Intersection of Reedy Creek Road and Highway 54: 2 min. 18 sec. Multi-family, single-family, industrial.
- 5 - Intersection of Maynard Road and Highway 54 (northwestern): 2 min. 35 sec. Single-family, multi-family.
- 6 - Intersection of Walnut Street and Kildaire Farm Road: 50 sec. School.
- 7 - Intersection of Old Apex Road and S/R 1011 (northern intersection): 59 sec. Commercial, industrial.
- 8 - Intersection of Old Apex Road and HI-House Road: 2 min. 23 sec. Industrial, multi-family, single-family.
- 9 - HI-house Mobile Home Park: 3 min. 34 sec. Multi-family, proposed commercial.
- 10 - Intersection of HI-House Road and Cary Parkway: 5 min. 56 sec. Single-family, proposed office and institutional, industrial.
- 11 - Intersection of Old Apex Road and S/R 1011 (southern intersection) 3 min. 46 sec. Multi-family, single-family.
- 12 - Intersection of Maynard Road and S/R 1011 (western section): 2 min. 47 sec. Industrial, office and institutional.
- 13 - Intersection of Maynard Road and Plantation Drive: 3 min. 35 sec. Single-family.
- 14 - Intersection of Maynard Road and Kildaire Farm Road: 2 min. 23 sec. Commercial, office and institutional.
- 15 - Intersection of S/R 1011 and Cary Parkway: 5 min. 58 sec. Proposed industrial, multi-family.
- 16 - Intersection of Lake Pine Road and Cary Parkway: 5 min. 58 sec. Single-family, proposed commercial.

#### STATION 2 to:

- 1 - Intersection of Maynard Road and S/R 1011 (northern intersection): 1 min. 59 sec. Multi-family, commercial, proposed office and institutional.
- 2 - Intersection of Manchester Drive and Sturdivant Drive: 3 min. 13 sec. Single-family.
- 3 - Intersection of Greenwood Circle and Cary-Macedonia Road: 2 min. 3 sec. Single-family.
- 4 - Intersection of Buck Jones Road and Cary-Macedonia Road: 2 min. 59 sec. Single-family.
- 5 - Intersection of Maynard Road and Ellynn Drive: 1 min. 59 sec. Single-family.
- 6 - Intersection of Seabrook Avenue and Maynard Road: 1 min. 19 sec. Single-family, multi-family.
- 7 - Intersection of Seabrook Avenue and Dirkson Court: 3 min. 6 sec. Single-family.

#### STATION 3 TO:

- 1 - Intersection of Kildaire Farm Road and proposed Cary Parkway: 2 min. 11 sec. Commercial, proposed office and institutional.
- 2 - Intersection of Farmington Woods and Kildaire Farm Road: 3 min. 11 sec. Multi-family, commercial, office and institutional.
- 3 - Intersection of Hampton Valley and Cary Parkway: 5 min. 9 sec. School, single-family.
- 4 - Intersection of Bruce Drive and Queensferry Road: 2 min. 59 sec. Single-family.
- 5 - Intersection of Edinburgh Drive and U.S. 64: 2 min. 11 sec. Single-family, office and institutional, commercial.
- 6 - Intersection of U.S. 64 and Lake Pine Drive: 4 min. 56 sec. Single-family, proposed office and institutional.
- 7 - Intersection of S/R 1379 and S/R 1300: 3 min. 58 sec. Single-family.
- 8 - S/R 1385 at S.W. 2-mile ETJ: 3 min. 37 sec. Single-family.
- 9 - Intersection of Piney Plains Road. (S/R 1315) and Apex-Macedonia Road (S/R 1009): 2 min. 58 sec. Proposed office and institutional, commercial.
- 10 - Intersection of S/R 1313 and Apex-Macedonia Road (S/R 1009) at ETJ: 4 min. 52 sec. Single-family, commercial.

Because of the rapid growth in southern Cary, the need for a third station is already present. This is seen in the increased response times for Stations 1 and 2. Therefore, it is recommended that this third station be operating no later than 1981. With the addition of this third station, the Fire Department will be able to provide better protection to its entire fire service delivery area.

2) Carrying out portions of the Thoroughfare Plan will improve the level of fire protection offered in Phase I. By extending the Cary Parkway from Old 1 and 64 (S/R 1001) to Seabrook Avenue, Station 1 is no longer responsible for portions of southwest Cary. Stations 1 and 3 can better protect their present and future fire service delivery areas. Response times are reduced and the capability of providing excellent assistance to first-

due companies is increased. By completing the Cary Parkway only to Old 1 and 64, Station 1 can also offer better protection to portions of its present fire service delivery area. (Map 6 (overlay) shows the total service area for the first-due engine companies for Stations 1, 2 and 3 with the southern section of the Cary Parkway completed.)

### IMPROVEMENTS IN RESPONSE TIMES FROM NEW STATION 3

#### NEW STATION 3 TO:

- 1 - Intersection of Lake Pine Road and Cary Parkway: 5 min. 12 sec. versus 5 min. 58 sec. from Station 1.
- 2 - Intersection of Two Creeks and Cary Parkway: 3 min. 19 sec.
- 3 - Intersection of Hampton Valley and Cary Parkway: 2 min. 56 sec. versus 5 min. 9 sec. without Cary Parkway.

The completion of this portion of the Thoroughfare Plan should correspond as closely as possible with the completion and opening of Station 3. This would enable Cary to achieve a higher level of fire protection during Phase I.

During Phase I, the Town should also look into improving the response capability of Station 2. By extending Kingston Ridge Road to Seabrook Avenue and by completing Greenwood Circle to Seabrook Avenue, Station 2 can offer better fire protection to these areas. These improvements would not only improve the delivery of fire services, but they would also help in the delivery of other Town services, such as police and sanitation.

**3) Acquisition of the site for Station 4 and the relocation of Station 1 need to be done.** Beginning the process of establishing these stations now will enable Cary to adequately protect the future urbanized areas north and west of the present corporate limits thus guaranteeing the Town's ability to initiate annexation. These stations will offer better protection to Cary's present and future fire service area.

### ADVANCE SITE ACQUISITIONS - REASONS BEING:

1. By the time a station is needed, considerable urbanization will have taken place. Increased development results in rising property values. An appropriate fire station site may be expected to rise in cost by at least 1-1½% per month.
2. Availability of suitable sites will constantly diminish as urbanization progresses. Desirable fire station sites are also desirable commercial sites.

3. Advance acquisition is financially safe. Small tracts of land are highly liquid, and the Town has the option of selling the site if unforeseen events prevent its utilization as planned.

4. At the lower prices prevailing before urbanization, a site may be acquired which is large enough to provide the possibility of having multiple use sites. An example of this would be a site that could be partially developed as park area for both the surrounding neighborhood and for use by the firemen living at the station.

With the land already purchased for Station 4 and the relocation of Station 1, the Town will be ready for future station construction when it is needed.

### RECOMMENDATIONS - Phase I

- 1) A southern station located at the intersection of Kildaire Farm Road (S/R 1300) and Apex-Macedonia Road (S/R 1009) to be operational no later than 1981.
- 2) Completion of the southern portion of the Cary Parkway from Old U.S. to Seabrook Avenue. Completion of Greenwood Circle to Seabrook Avenue and extension of Kingston Ridge Road to Seabrook Avenue.
- 3) Acquisition of sites for Station 4 and the relocation of Station 1.

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**PHASE II (1985-1990)**

1) Addition of the 4th Station is recommended at the southern intersection of Old Apex Road (S/R 1616) and Old 1 and 64 (S/R 1001). This location borders FMA 5 and FMA 7 and permits a response in more than two directions. There is easy access to arterial streets with no topographical or man-made barriers or necessary detours to hinder rapid coverage of service area. This is made possible by a railroad overpass.

By 1985, certain portions of southern FMA's 7, 8, 9, 10 and 11, will be well under development. Their population will have grown. Land will be annexed, thus enlarging the area that Cary's Fire Department must provide fire protection. At approximately the same time, Crabtree Sewer Outfall is projected to be completed (1985). This will enable northern and western Cary to experience accelerated growth, adding two times the landmass being considered in the Swift Creek tributaries, FMA's 7-13. The FMA's affected by the outfall are FMA's 1-5. By 1985, Cary's population inside its corporate limits is estimated to be 30,366 compared to 20,000 in December of 1978 and 22,383 projected for 1980. It will become increasingly difficult for Stations 1, 2 and 3 to adequately protect Cary's fire service delivery area at that time.

For these reasons, this fourth station needs to be operational no later than 1986. This date corresponds to 1985's projected population of 30,366 for Cary's Town limits. This population will warrant a fourth station. If studies show that this population will not be reached by 1985, the building of this fourth station may need to be delayed. Periodic reviews and updates of Cary's growth patterns and fire service needs will be necessary in order to determine if the station should be built on schedule or delayed until the need for it arises.

With the land already purchased, the Town will be in an excellent position to construct the station by this date. Station 4 will enable Cary to adequately protect southwestern Cary. With this fourth station in place, Station 1 can begin focusing its attention to northern development that is beginning to occur. Station 3 will be able to focus its entire attention on protecting southern and southwestern Cary. Station 2 will continue to provide adequate fire protection to its fire service delivery area. Stations 1 and 2 will also be primarily responsible for protecting central Cary. Map 7 shows the total service area for the first-due engine companies of Stations 1, 2, 3 and 4.

The station locations in Phase II provide excellent protection to the entire study area of this Comprehensive Fire Protection Plan. Response times meet established criteria. Using existing roads and thoroughfares, the response times for Stations 1, 2 and 3 are the same as they were in Phase I. The only difference is that the service area for Stations 1 and 3 are smaller. Station 4 takes part of Station 1 and Station 3's service area.

**STATION 4 TO: RESPONSE TIMES**

- 1 - Intersection of Old Apex Road and HI-House Road: 1 min. 59 sec. Single-family, multi-family, Industrial.
- 2 - HI-House Mobile Home Park: 3 min. 11 sec. Multi-family, proposed commercial.
- 3 - Intersection of Cary Parkway and HI-House Road: 5 min. 32 sec. Single-family, proposed office and Institutional, Industrial.
- 4 - Intersection of Pond Street and Maynard Road: 2 min. 40 sec. Single-family.
- 5 - Intersection of Plantation Drive and Maynard Road: 1 min. 47 sec. Single-family.
- 6 - Intersection of Maynard Road and Old 1 & 64: 59 sec. Industrial, multi-family, proposed office and institutional.
- 7 - Intersection of Cary Parkway and Old 1 & 64: 2 min. 11 sec. Industrial, multi-family.
- 8 - Intersection of Lake Pine Road and Cary Parkway: 4 min. 10 sec. Single-family, office and institutional, proposed commercial.
- 9 - Intersection of Brookgreen Drive and Balmoral Drive: 2 min. 52 sec. Single-family.

2) Continuation of the Thoroughfare Plan will offer an even higher level of service and protection. This includes the completion of each new segment of Cary Parkway and Maynard Road. These road improvements will enable Stations 1, 2, 3 and 4 to adequately protect a larger portion of their total service area since the fire service delivery area of each station will have increased due to annexations. As the Town grows, these stations will be able to handle the additional need for fire protection. Cary's thoroughfare system will also enable these stations to provide excellent assistance when and where needed.

**IMPROVED RESPONSE TIMES FOR NEW STATION 4**

**NEW STATION 4 TO:**

- 1 - HI-House Mobile Home Park: 1 min. 50 sec. with Maynard Road, versus 3 min. 11 sec. without Maynard Road.
- 2 - Intersection of HI-House Road and Cary Parkway: 4 min. 11 sec. with Maynard Road, versus 5 min. 32 sec. without Maynard Road.
- 3 - Intersection of Lake Pine Road and Cary Parkway: 4 min. 4 sec. with Cary Parkway, versus Station 1: 5 min. 58 sec. with existing thoroughfares and Station 3: 5 min. 12 sec. with Cary Parkway.

**RECOMMENDATIONS - PHASE II**

1) A western station located at the southern section of Old Apex Road (S/R 1616) and Old 1 and 64 (S/R 1001).

2) Continuation of thoroughfare improvements. LOOK at p. 201

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Station 1

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Phase 1 p. 20  
Phase 1 p. 30

**PHASE III - (1990-2000)**

1) **Relocation of Station** will enable each station to adequately protect their area. The existing location for Station 1 is at an intersection, but it is one that is heavily traveled and often times congested. It is located next to a barrier, railroad tracks, that hinders rapid coverage of its service area by causing detours in response routes thus increasing response times.

The existing Station 1 is responsible for portions of northern, western and central Cary.

**POPULATION PROJECTIONS FOR FMA'S 1 THRU 5  
(North & West Cary)**

1980	1985	1990	1995	2000
10,731	13,731	16,731	23,931	28,431

Future northern development will be primarily residential. This means both daytime and nighttime population increases. Since a large population is associated with a high number of fire calls for service, the number of calls to Station 1 will dramatically increase when northern Cary develops.

Its Company crosses the tracks at Academy Street to answer a fire department call in northern Cary. If a train is passing, an alternate route is taken. As mentioned earlier, trains pass through this point approximately 18 times in a 24-hour period. With the increase in population and the accompanying increase in number of calls to the fire department, the number of times an engine or truck company at Station 1 will have to take an alternate route to reach the scene of the fire alarm because of a train passing will increase. This will cost the Cary Fire Department valuable response time thus reducing the level of effective fire protection and increasing both life and property loss-risks.

As Cary continues to develop, it will become increasingly difficult for the existing Station 1 to adequately protect its fire service delivery area for the above reasons. Therefore, it is recommended that Station 1 be relocated and operational no later than 1990. This date corresponds to 1990's projected population of approximately 40,000 for Cary's Town limits and approximately 17,000 for northern and western Cary. The specific time for relocation will vary depending on the rate of growth and annexation in Cary, particularly northern Cary. If population projections are not met, this date may have to be postponed. Periodic reviews of this Plan will determine if a delay is necessary.

map 8

map 5 8a 1 b

The proposed location is at an excellent intersection, allowing for response in four directions. There are no barriers at this new location. With the site already purchased, the relocation can take place when needed. (Map 7 shows the first-due service area for the relocated Station 1, in addition to Stations 2, 3 and 4.

Station 1's new service area is primarily north of the railroad tracks. This can be seen by comparing Maps 7 and 8. Station 1 will provide adequate fire protection to downtown Cary and portions of central Cary, with excellent assistance from Stations 2 and 4. With the completion of the Cary Parkway and Maynard Road extension, Station 1 will have excellent access to all parts of its entire fire service delivery area. This new location will be able to handle all of Cary's northern development, since its annexation potential is limited due to I-40, State owned property, and Morrisville's and Raleigh's jurisdiction. These factors will limit the expansion of Station 1's service area. Maximum coverage of northern Cary will be achieved. Without the relocation of Station 1, another station to adequately protect this area would be necessary.

**RESPONSE TIMES FOR NEW STATION 1**

**NEW STATION 1 TO:**

- 1 - Intersection of North Harrison Avenue and Reedy Creek Road: 2 min. 11 sec. Single-family, commercial.
- 2 - Intersection of North Harrison Avenue and Cary Parkway: 2 min. 35 sec. Single-family, commercial.
- 3 - Intersection of North Harrison and I-40: 4 min. 29 sec. Office and Institutional, proposed commercial.
- 4 - Intersection of Reedy Creek Road and 54: 2 min. 58 sec. Single-family, multi-family, industrial.
- 5 - Maynard Road and 54 (west): 1 min. 23 sec. Single-family, multi-family, school, proposed industrial.
- 6 - Intersection of 54 and 2-mile Extraterritorial Jurisdiction (west): 3 min. 13 sec. Industrial, single-family.
- 7 - Academy Street and Dry Avenue: 2 min. 55 sec. School, multi-family, single-family, office and institutional.
- 8 - Chatham Street and Academy Street: 2 min. 11 sec. Commercial, industrial, proposed office and institutional.
- 9 - South Harrison Avenue and Heater Drive: 3 min. 57 sec. Single-family.
- 10 - Old 1 & 64 and Urban Drive: 2 min. 49 sec. Commercial.

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Maps 7 and 8.

Station 2's first-due service area changes very little with the relocation of Station 1. Station 2 is satisfactorily located for the present and future fire needs of eastern Cary. Its service area will change very little because here, as in northern Cary, annexation is limited due to Raleigh's jurisdiction. With the completion of Maynard Road, Station 2 will be able to adequately protect its service area and offer excellent assistance to Station 1.

Station 3 keeps the same first-due service area as in Phase II. Depending on the rate of annexation in southern and southeastern Cary, there may be the need for another southern station since its service area can increase. If the service area for Station 3 increases to the point where response times are well over those established in this document, a new station will be needed. A constant review of Cary's fire situation will determine if and when this station will be necessary. The addition of portions of Cary's Thoroughfare Plan, such as the Cary Parkway, will off-set this need by increasing the size of the service area that Station 3 can protect adequately.

Station 4's service area changes in Phase III. This can be seen by also comparing Maps 7 and 8 (May). Station 4 is no longer responsible for land north of the railroad tracks. This will enable Station 4 to concentrate on western development. With the completion of the Cary Parkway, Maynard Road and other roads in its service area, Station 4 will be able to adequately protect its service area as defined in this Subsection. Since Cary has the potential to grow west, it is possible that Station 4's service area will extend beyond the area established in this Plan. If this happens, there may be the need for another station west of the proposed Station 4, since response times should increase above those established in this document. Analyzing Cary's fire situation will determine if and when another western station is needed.

RECOMMENDATIONS - PHASE III (check) Phase III

- 1) The relocation of Station 1 to a site at the intersection of North Harrison Ave and Maynard Road to be operational no later than 1990. (cut off)
- 2) Continuation of thoroughfare improvements.

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**SUMMARY OF COMPREHENSIVE STATION LOCATION PLAN:**

Cary will achieve maximum use of its fire service resources with this fire station location plan. The plan enables Cary to meet its objective in locating fire stations: to meet established criteria for response times with the minimum number of stations, thus reducing the cost of public fire protection. This station location plan will enable Cary's Fire Department to keep up with Cary's growth rate and the increased demand for fire protection. Cary should be able to provide adequate fire protection to its fire service delivery area for the next twenty (20) years with this comprehensive station location plan, the shift to private sector fire protection and the Town's Thoroughfare System. The actual time period may vary depending on the rate of annexation. Periodic reviews and updates to the station location plan will determine when new stations are needed.

**CONCLUSION**

The ability to control fires in their incipency is directly related to early detection and application of an adequate extinguishing agent. The use of automatic detection and suppression systems is the most effective and efficient method of controlling fires in the incipient stage. Their use involves private sector participation in fire protection. Recommendations for automatic fire protection and early detection systems are included in Section II.

RECOMMENDATIONS - Controlling Fires in their Incipency.

The Cary Fire Department will maintain the capability of applying an extinguishing agent to a fire in any area of the Town within nine (9) minutes from receipt of the alarm in order to control a fire prior to flashover. This objective will allow one (1) minute for dispatch, four (4) minutes for response time of the first-due companies and four (4) minutes for set up of the first-due fire suppression equipment at the fire scene. These time periods will vary  $\pm$  one (1) minute, depending on the fire hazard category.

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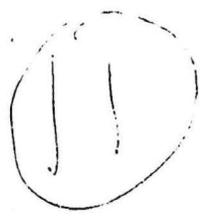
### LARGE FIRES

Another consideration in determining adequate fire protection is the control of fires that are not stopped in their early stage and progress to a point where they threaten not only the consumption of the building on fire but the neighboring structures as well. If this happens, Cary's Fire Department must be prepared. The Fire Department will need adequate manpower, equipment, and mutual aid agreements if necessary.

Attacking such a fire requires large volumes of water through hose streams with sufficient manpower to apply these streams. The 2½" hose line is the major hand held line used for attacking large fires and is difficult to maneuver. The amount of water that would be required to handle a large fire in a particular building and protect the exposures, along with the hose line size, affects manpower and apparatus requirements. The required amount of water can be calculated through the use of the "Guide for Determination of Required Fire Flow" published by the Insurance Services Office. This volume of water, referred to earlier as the fire flow requirement, relates to how many gallons of water per minute must be applied to a fire through hand held hose lines and heavy stream appliances to effect control. The higher the fire flow and the larger the hose line, the more fire apparatus and manpower required to handle the volume of water in the event of a fire.

In 1976, the North Carolina Fire Insurance Rating Bureau established the basic fire flow for the Town of Cary at 3,500 gpm. This basic fire flow is indicative of the quantities of water needed for handling fires in important districts of Cary. It is anticipated that a fire in certain areas of Cary could be of such magnitude that 3,500 gallons of water per minute would be required to effect control. Several structures in Cary registered a 4,000 gpm fire flow requirement, but they were not numerous enough to warrant a 4,000 gpm basic fire flow for the Town. With the recent general acceptance of sprinkler systems coupled with the rate structure of private insurance companies, it is anticipated that no future individual fire flow requirement will exceed 4,000 gpm.

In addition to the fire flow requirement, other considerations must be evaluated in order to determine the required amount of fire apparatus and manpower necessary to furnish the desired level of fire protection. These factors include: 1) high life hazards, 2) difficult access of fire suppression apparatus and equipment; 3) structure types, 4) occupancies whose closure could have significant negative economic impact on the community, 5) lack of barriers to fire spread, and 6) structures built prior to code requirements.



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Keeping it at 3500 - basic fire would not exceed 3500. A 4000 gpm might - if there are too many.

531 Walnut Street  
Cary, N. C. - 27511  
467-1993

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## FIRE COMPANY REQUIREMENTS

In determining the number of fire companies needed to adequately protect Cary, consideration must be given to:

- 1) distribution of fire companies needed to provide adequate coverage of Cary
- 2) present and potential fire situation
- 3) required fire flows
- 4) Cary's population and total area served
- 5) any other factors which may have an effect on protection requirements.

The station location plan examined Cary's present and potential fire situation, population and growth projections, thoroughfares, and topographical and man-made barriers to determine the number and location of fire stations needed to adequately protect Cary. The Station Location Plan identified the need for four (4) fire station sites to adequately protect Cary given response time criteria for the next twenty (20) years.

Given Cary's basic fire flow of 3,500 gpm and the average pumping capacity of engines (1,000 gpm), a minimum of four (4) engine companies is required to control a fire of maximum severity within a structure, complex, or block of related occupancies. Only one (1) truck company is needed to adequately protect Cary given Cary's basic fire flow, structure types, and projected fire situation.

**RECOMMENDATIONS** 1) Four engine companies are needed to adequately protect Cary for the next twenty (20) years, depending on the rate of annexation. 2) Locate one (1) engine company at each present and proposed fire station. 3) One truck company is needed to adequately protect Cary for the next twenty (20) years. Its location will be discussed under truck company manning requirements.

## MANNING REQUIREMENTS Engine Company

The engine company is the basic fire fighting unit in the Department. The fire engine carries water, hoses, a pump, and miscellaneous equipment, such as nozzles and breathing apparatus. The responsibility of the personnel assigned to the engine company is to size-up the fire scene upon arrival, place hose streams in operation, and apply an extinguishing agent to the fire.

add - after RECOMMENDATION

add star after hose

1978 FIRES		
DWELLINGS 38%	VEHICLES 16%	WOODS & FIELDS 16%

NEEDED: • 1" to 1½" hose  
• 3 member engine company

\*1" to 1½" hose used 132 times or 86% of total time. This reflects the types of structures and size of fires that are presently occurring, therefore Cary has low fire flow requiring less equipment and manpower.

As Cary grows, its fire situation will change. A look at types of fires points this out. The number of commercial fires in Cary rose from 17 in 1974 to 33 in 1978. This was a 94% increase over commercial fires in 1974.

Projected future land uses show additional commercial, industrial, office and multi-family uses planned for Cary. Along with these increases in uses will come an increase in structure size. This has already taken place in some of Cary's newest development projects such as the shopping mall and multi-story office buildings. Proposed land development plans show high-rise motels, office buildings and condominiums. With this increase in multi-story, multi-family and nonresidential uses, the potential for fires to occur in these types of uses will increase.

This change in type of structural fires in Cary will alter the level of manning required on an engine company because the size of the hose lines will change. The need for using a 2½" hose line will increase. Four member companies are adequate for fires requiring 2½" hose lines and are capable of efficiently performing many standard firefighting tactics without depending upon supplemental manpower. This enables other engine companies to be available for simultaneous emergencies. The 2½" hose line is the major hand held line used for attacking large fires and is difficult to maneuver because it discharges one ton of water per minute. In 1978, a 2½" hose line or greater was used only 21 times or 14% of the time. This reflects the smaller, single-story buildings that are presently in Cary. At least two men are required to hold the 2½" line in place, however, a third member is necessary if the hose line must be advanced. Difficult access, such as is experienced in large commercial and industrial occupancies and particularly in multi-story buildings, greatly compounds the difficulty of advancing a 2½" line to the seat of the fire.

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The responsibility of the driver at a fire is to hook up the pump to the water supply line and operate the pump. On a three member company, this leaves only two members, the captain (company officer) and the firefighter available for advancing hose lines on the fire. These two people are under a great strain if they need to place a 2½" line in operation. If access to the fire is difficult, they will have to obtain assistance from another fire company. It should also be noted that the captain on a three member company must be on the line going into the structure. If this company is the first company to arrive at the scene, the captain is unable to give the needed direction to arriving support companies.

**RECOMMENDATIONS** - Because of Cary's changing fire situation, manning levels will vary from engine company to engine company. These levels will reflect the type of structural fire and fire flow requirements in an engine company's response area since these factors affect hose line sizes. In addition to these factors, consideration must also be given to the absenteeism in fire companies. 1) No engine company shall be assigned less than a three member company. 2) It is recommended that the engine company that is first-due in the central business district of Cary continue to be assigned a four member company. This is the engine company at Station 1. In this area, the buildings are older, fire flows are higher, access and containment is a problem, and many buildings lack built-in fire protection. The primary fire district is also located in this area. Present and proposed commercial, office and industrial uses will warrant the use of 2½" hose lines, thus continuing the need for a four member company. 3) The total response area for Engine 2, located at Station 2, is primarily comprised of single-story residences. There are sections of the response area that have large commercial, industrial and office structures with high fire flow requirements requiring large hose line sizes. Because of this mixture of structure types, it is recommended that Engine 2 operate with a three member company. In order to maintain this three member level, one additional member is needed to rotate to all three shifts to fill vacancies created by members taking vacation time, holidays, sick leave or compensatory time. Then, as new development occurs in Engine 2's response area, structure types will need to be examined to determine if changes in manning levels are needed. If structure types warrant the use of 2½" hose lines, additional manpower will be necessary. The close monitoring of the increase in types of structures that require 2½" hose lines

will help to determine when to expand the manning levels of Engine 2. 4) The total response area for Engine 3 presently has predominately single-story residences with two-story residences scattered throughout. Engine 3 will be located at Station 3. Much of its response area is undeveloped. Proposed structures include multi-story office buildings and condominiums, large commercial structures and some industrial occupancies. Given the type of structures proposed for the response area of Engine 3, a four member company is recommended. This four member company will not be needed until the proposed structure types requiring 2½" hose lines are built. Therefore, when Engine 3 is activated, it is recommended that Engine 3 operate with a three member company with one additional member to rotate to all three shifts to fill vacancies created by members taking vacation leave, holidays, sick leave, or compensatory time. This additional person will enable the engine company to handle the demand for fire protection in its response area and maintain the minimum three member level. As new structures are built requiring 2½" hose lines, manning levels will need to be increased until the four member company is achieved. The time frame for this expansion to a four member company will depend on when these new structure types are built. Here, as with Engine 2, the close monitoring of structure types requiring 2½" hose lines to fight a fire will be necessary in order to determine when the engine company needs to be enlarged. 5) Engine 4 will be located at the proposed Station 4. The total response area for Engine 4 presently has single-story residences. The remainder of its response area is predominately undeveloped. If Station 4 was opening now, a three member company with one additional member would be required. Engine 4's response area is proposed to get most of Cary's industrial development. These structures will be large, requiring 2½" hose lines to extinguish a fire because of larger fire flow requirements. Therefore, if Engine 4's response area develops as proposed, a four member company will be required. At the time Station 4 is ready for construction, an examination of existing structure types will be necessary to determine the actual manning level for Engine 4. 6) In order for Cary to provide an adequate level of fire protection to its entire fire service delivery area, maximum utilization of existing personnel is necessary. It is recommended that all fire department personnel who are not assigned to a particular engine company and are trained firefighters, respond to fire calls and provide assistance. They can help in many ways such as operating the pump, thus enabling engine company members to advance hose lines on the fire. This additional manpower will increase manning levels and will increase Cary's capability to extinguish all types of fires until the recommended manning levels are achieved.

*straighten out.*

### ENGINE COMPANY MANNING LEVELS

Shifts	Present		1981 Proposed		
	Engine 1	Engine 2	Engine 1	Engine 2	Engine 3
A	4 member	3 member	4 member	3 member	3 member
B	4 member	3 member	4 member	3 member	3 member
C	4 member	3 member	4 member	3 member	3 member
Totals	12	9	12	10	10
Total Engine Company Members (1979) = 21			Total Engine Company Members (1981) = 32		

#### Proposed 1986

Shifts	Engine 1	Engine 2	Engine 3	Engine 4
	A	4 member	3 member	3 member
B	4 member	3 member	3 member	3 member
C	4 member	3 member	3 member	3 member
		plus 1 additional member	plus 1 additional member	plus 1 additional member
Totals	12	10	10	10

\*The need for additional members will be determined prior to activation of Engine 4.  
Total Engine Company Members (1986) = 42

#### Maximum Proposed Levels

Shifts	Engine 1	Engine 2 <sup>1</sup>	Engine 3 <sup>2</sup>	Engine 4 <sup>3</sup>
	A	4 member	3 member	4 member
B	4 member	3 member	4 member	4 member
C	4 member	3 member	4 member	4 member
		plus 1 additional member (1995)	(approximately 1990)	(approximately 1995)
Totals	12	10	12	12

Total Engine Company Members = 46

Notes:

1. The need for additional members must be studied annually.
2. Cary's growth projections and fire situation must be reviewed annually in order to determine exactly when this four member company will be needed.
3. Same as 2 above.



### Truck Company

The truck company in Cary carries ladders of various lengths and rescue and salvage equipment. A truck company has various functions. The members of a truck company are responsible for rescue, laddering the building, affecting entry, ventilating and thereby making it possible for the engine company members to enter a structure and attack the base of the fire. Another function of the truck company is salvage operations. This function is the prevention of damage to property from smoke, water, and firefighting operations. Often, effective salvage operation is the most significant factor in minimizing fire loss.

Because of the critical nature of the services performed by the truck company and the difficulty of handling certain equipment, a four member company is needed in order to operate efficiently. Reducing the manning level of a truck company below four members is very unsatisfactory because the company's ability to perform the operations for which it is responsible is greatly reduced and simultaneous operations cannot be performed, thus increasing the time requirement.

As mentioned earlier, Cary's basic fire flow level requires only one truck company. At the present time, the Fire Department's truck company is considered to be a service company. Its service truck carries ladders of various lengths and rescue and salvage equipment. It has only one member. When the service truck arrives at the scene of the fire, it is up to engine company members, along with the one member of the truck company, to set up the equipment they need to fight the fire or rescue people. Salvage operations primarily have to take place after the fire is extinguished due to the lack of manpower. This understaffing of the service company greatly reduces the company's ability to perform its operations effectively and efficiently.

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**RECOMMENDATIONS** It is recommended that the service truck company manning level be ultimately expanded to a minimum four member company. The types of structures projected for Cary warrant this manning level. Population projections and growth patterns point to a time frame of around 1990 when this four member company will be needed. A year-by-year update of Cary's fire situation will help determine when to put the four member company into operation. This four member company will enable the service truck company to perform its operations rapidly and efficiently, without depending on engine company members for assistance. 2) The structure types presently in Cary do not warrant a four member company. Until the four member company is needed, it is recommended that the present service truck company be expanded to a two member company by the time Station 3 is activated. According to population projections, growth patterns, and fire protection needs, the two member company should be expanded to a three member company, at the time Station 4 is activated. These interim measures will enable the service truck company to perform its duties, though somewhat less efficiently. Manning levels are shown in the following charts:

**TRUCK COMPANY MANNING LEVELS**

	<i>Lineup</i>		<i>line up with other dates.</i>
	<b>Present</b>		<b>1981</b>
Shifts	Truck	Shifts	Truck
A	1 member	A	2 member
B	1 member	B	2 member
C	1 member	C	2 member
			(when Station 3 is activated)
	<b>1986</b>		<b>1990</b>
Shifts	Truck	Shifts	Truck
A	3 member	A	4 member
B	3 member	B	4 member
C	3 member	C	4 member
	(when Station 4 is activated)		(when Station 1 is relocated)

TOTAL TRUCK COMPANY MEMBERS = 12

3) Given Cary's present structure types and their distribution, Cary's service truck company is properly located at Station 2. It is centrally located to respond to fire calls requesting the assistance of a truck company. As Cary grows, the truck company may need to be relocated. Constant monitoring of structure types and their location will enable the Cary Fire Department to determine if the truck company needs to be relocated.

**CONCLUSION - LARGE FIRES**

The ability to control large fires is directly related to the type of construction, size of building, internal fire protection, and exposures to the building or structure involved, and to the availability of fire apparatus and manpower. Hopefully, with an increased emphasis on fire prevention, private sector protection, and controlling fires in their incipency, fires, especially large ones, will not occur.

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**RECOMMENDATION For control of Large Fires**

Locate apparatus with sufficient personnel to meet the standards identified in this Section.

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### 3. FIRE DATA SYSTEM

Good data is essential to managing a modern fire department of any size and establishing an adequate level of fire protection. A fire data system is used in developing a fire management program. Adequate data will explain a fire department's needs and will help them to use their resources efficiently. A good fire data system can better describe and track down the local fire problem. Data includes: 1) information on the fire problem-what, where, who, why and when questions about the fires, casualties and losses in the community; 2) information on apparatus maintenance schedules; and 3) what mixes of equipment and company sizes have been needed in the past and on what types of fires.

#### USES:

1. The provision of information for planning both prevention and suppression policies. For example, it can tell whether under existing prevention policies, the fire rate in the community is going up or down and, if it is changing, whether this is being caused by the fire rates for single-family dwellings, apartment, or businesses, or by some combination of occupancies. For suppression, the data system can show how well the loss per fire is being held down.

2. DEPARTMENT MANAGEMENT. The system will need to provide information on who are the personnel in the department, what units they are assigned to, and whether they are on duty. The system will need to keep track of which apparatus are available, which apparatus are in maintenance, what the back-ups are, and which are deployed. This is the basic information needed to know what is available for various calls and what is being used for calls in progress. The data may also provide information for managing prevention activities. The data can point out what type of inspections are needed and when and where to make these inspections. The types of public education programs needed can also be determined from the data. The data may be kept in a way that makes it easy to match the causes of fires with the conditions discovered during inspections, so that the effectiveness of inspections can be assessed.

3. OPERATIONAL DECISIONS. The system can furnish information that can aid suppression operations while they are underway. It can provide information from pre-fire plans on the following: how to fight fires in particular places, special hazards that may exist, types of built-in suppression systems, etc. The data can also be used for post-fire training sessions.

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4. BUDGET REQUESTS. The system can support budget requests by providing information on work loads, numbers of calls by type of call, and if they are showing an upward or a downward trend. The data system may also show that new types of hazards are appearing that require new equipment that needs to be added to the budget, or information may be needed to estimate effects of potential budget reductions.

5. PROGRAM EVALUATION. The system can aid in assessing the effectiveness of both newly instituted and long-standing fire protection programs.

6. DEMONSTRATION OF ACHIEVEMENTS. Effectiveness and productivity measures, and information on the nature of the local fire problem can be used to show both local decision makers and the public that the Fire Department is successfully handling the public trust and doing its job.

7. FIRE CODE DEVELOPMENT. The system can provide information about structural configurations assessed with the greatest fire spread and can identify problems requiring stronger codes or stronger code enforcement.

8. ALARM FREQUENCY can be affectively monitored by a fire data system. Alarm frequency should be reviewed annually to determine the ability of the Fire Department to meet the standards established by this Plan. It is essential that sufficient fire companies be maintained in service to handle the anticipated magnitude and frequency of fires. When it becomes evident that the standards are not being met due to an unreasonably high frequency of alarms, different options will need to be analyzed. With appropriate data on response times, manning levels, types of fires, etc., the fire department should be able to choose the most appropriate option to correct the problem.

**RECOMMENDATIONS** 1) Place a strong emphasis on an effective fire data system as a means of reducing the loss of life and property from fire and as a means of establishing an effective and efficient fire department. 2) Review the data periodically to evaluate the ability of the fire department to meet the standards established in this document. When it becomes evident that standards are not being met, data should be analyzed to determine the reasons why. Recommendations should then be presented for consideration.

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#### 4. FIRE INSURANCE GRADING

Another aspect that may be given consideration in determining adequate fire protection is the Insurance Services Office (ISO) grading of a town's fire defense system. This organization grades a city's fire defenses against the possibility of a fire spreading out of control and resulting in great financial loss. ISO establishes ten (10) classes of fire defense systems. A Class 1 town would have the greatest capacity to prevent a conflagration, while Class 10 would have the least capacity. On January 1, 1977, Cary received a Class 6 rating. ← add a

A town's grade affects its fire insurance rates. Towns with lower grades should have lower insurance rates.

For reasons mentioned earlier, the ISO grading schedule should not be the sole or predominant basis for a local government's decision on how to improve its fire protection system. Although the grading schedule provides adequate guidelines for conflagration control, it is not intended to meet the total fire protection needs of cities since individual community goals and capabilities are not considered. A Comprehensive Fire Prevention and Management Plan addresses specific community goals and objectives. The Plan should automatically lower a town's classification in the most cost effective and efficient way. The Plan addresses all areas of fire protection raised by ISO. ISO grading standards should be used as a data source and management option when determining an adequate level of fire protection. These standards will serve as a tool for evaluating fire department efficiency and effectiveness.

**RECOMMENDATION** - Use ISO grading standards as a guideline in determining and evaluating adequate fire protection for Cary. After the Town is regraded by ISO, review the grading report to determine the practicality of the recommendations included therein.

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section

222

community

fire

protection

*Straighten out. add A.*

## A. THE FIRE DEPARTMENT PUBLIC SECTOR

This Subsection provides goals, recommendations, and guidelines for the management and operation of the Fire Department based upon the standards recommended in Section I.

Fire Department's three primary responsibilities:

- Prevention of the loss of life and property
- Suppression of fire
- Provision of extrication rescue services involving fire crisis

To accomplish these responsibilities, the Fire Department carries out 4 basic activities:

- 1) FIRE PREVENTION
- 2) EMERGENCY OPERATIONS
- 3) SUPPORT SERVICES
- 4) ADMINISTRATION AND ORGANIZATION

## COMMUNITY FIRE PROTECTION

Community fire protection is a combination of two factors - public sector protection and private sector protection. Public sector fire protection consists of the manpower and facilities supplied by a town. In addition to the job of fire suppression, public protection, to be most effective, must include structural design review, fire code enforcement, continuing inspections, and coordination of building, planning, and public works activities as they relate to fire protection. Private sector fire protection consists of fire resistive design of structures and materials, as well as fire extinguishing, warning, and detection systems. Fire resistive structural elements limit the size of the fire problem by dividing a structure into manageable fire areas and lowering the required fire flow. Through automatic detection and suppression, built-in protection is intended to limit the scope of the anticipated problem to that which is manageable. Both public and private sector fire protection are discussed in this Section.

### 1. FIRE PREVENTION

FIRE PREVENTION IS THE MOST IMPORTANT ACTIVITY AND NUMBER ONE GOAL OF THE CARY FIRE DEPARTMENT. As mentioned earlier, the major criteria in determining adequate fire protection for Cary is to place an emphasis on fire prevention or the time before the fire. It has been shown that towns which invest more time and money in prevention activities have a relatively lower rate of fire incidence. Fire prevention should be a community based activity since the lives and property of everyone in a community can be threatened by fire. The greatest benefit to be derived from prevention activities is to create an environment in which it is difficult for fires to erupt.

Fire prevention activities include inspection services, fire code enforcement, public education services aimed at improving fire and life safety in the community, and provision of fire and life safety related consulting services to individual citizens and commercial, industrial and institutional enterprises within the community, and fire cause investigations. Each prevention activity will be discussed with recommendations made for each.

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### INSPECTION & CODE ENFORCEMENT

In Cary, the Fire Prevention Bureau and fire company personnel carry out fire prevention activities. The Fire Marshal is in charge of the Bureau and code enforcement and supervises inspection activities. The Fire Marshal is in charge of the Bureau and code enforcement and supervises inspection activities. The Fire Marshal and fire company personnel are responsible for carrying out the inspections. During inspections, suppression personnel contact the Fire Marshal for assistance when problems are encountered.

Due to the size of the Cary Fire Department, code enforcement and inspection activities must be carried out by both the Fire Prevention Bureau and fire company personnel if these activities are to be truly effective. This requires coordination between the two. Good organization and management of the code enforcement and inspection program are necessary if the program is to run effectively and efficiently. If these programs are effective, the incidence of fires should decline. The following recommendations address the inspection and code enforcement program.

**RECOMMENDATIONS** - 1) It is recommended that the Fire Marshal be in charge of the code enforcement and inspection program. The Fire Marshal will supervise and coordinate the activities of this program between the Fire Prevention Bureau and fire company personnel. Presently, the Fire Marshal makes major inspections required by the fire code. This includes occupancies with hazardous processes and/or high life hazards in major commercial, industrial, and office occupancies. As Cary continues to grow, it will become increasingly difficult for the Fire Prevention Bureau (Fire Marshal) to handle its workload. The workload will increase due to the rapid rate of commercial and industrial development requiring special attention and inspections, the large number of inspections required to maintain fire safe conditions in the numerous residential, commercial, and industrial occupancies in Cary and the number of plan checks. It is recommended that by 1983, another member be added to the Fire Prevention Bureau whose primary job will be to make inspections and enforce the Fire Prevention Code. This person should also be a trained firefighter in order to maintain maximum utilization of manpower. 2) It is also recommended that fire company personnel continue to handle some of the required inspections. The Bureau will continue to carry out most of the specialized inspections, while fire company personnel make routine inspections on the average building within their geographic area of response. Each fire company shift will be responsible for one-third of its response area, since there are three shifts. Suppression personnel will be responsible for identifying common fire hazards and causes as found primarily in dwellings.

Suppression personnel will contact the Fire Marshal when problems are encountered. The increased utilization of fire companies for fire prevention activities in their geographic areas of response is one of the most promising concepts in fire management. It contributes to the overall effectiveness and efficiency of fire department personnel and fire prevention activities. 3) In order for the Bureau and fire company personnel to effectively carry out the code enforcement and inspection program, training and education courses in fire prevention will have to be made available to all fire department personnel. It is recommended that the Cary Fire Department provide training in fire prevention at the recruit level for all trainees. Recruits will be shown that fire prevention is a major function of the fire department. This training will also contribute to the overall effectiveness and efficiency of fire department personnel. 4) The effectiveness of the code enforcement and the inspection programs are directly related to the fire code provisions adopted by a town. A fire code should follow nationally recognized practices and standards. Cary presently enforces the 1976 edition of the FIRE PREVENTION CODE as recommended by the American Insurance Association. It is recommended that the Town of Cary adopt the National Fire Protection Association's NATIONAL FIRE CODES. This code is revised and updated each year. The North Carolina Building Code requires the enforcement of certain sections of this NATIONAL FIRE CODE. The adoption of the entire NATIONAL FIRE CODES, a compilation of all NFPA standards, might not be practical for Cary, although it may be desirable from the standpoint of covering all possible conditions which might arise. A committee, comprised of the Fire Chief, Fire Marshal and Chief Building Inspector, should be formed to decide which volumes of the Code need to be adopted by Cary. Each year this Code needs to be reviewed to determine its effectiveness and if certain sections need to be added or deleted. This new Code will enable the Cary Fire Department to offer a higher level of fire protection. 5) Record Code enforcement and inspection findings. Review this fire department data to identify what type of inspections need to be made and where and when they need to be made. An inspection program aimed at a specific problem in a specific area will be more effective than just a general inspection program. 6) Concentrate inspections during times when fire alarms are significantly lower since suppression personnel are involved in fire prevention activities. Fire department data for Cary shows that alarms are lower in spring and summer. Therefore, inspections should be heavier during this time of year. The data will also be useful in evaluating the code enforcement and inspection program.

## **PUBLIC FIRE EDUCATION I**

Public education in fire prevention and fire reaction has already become a major component of the Cary Fire Department services. Citizen participation in fire prevention education is a valid and cost effective method of reducing the incidence of fire and the severity of damage and injury when fire does occur. The Cary Fire Department acknowledges the importance of public fire education by providing a public fire education program that is effectively reaching the community. The Department has an Education Specialist/Firefighter who is responsible for developing fire safety programs and making presentations to schools, business organizations, industries, places of public assemblage, and civic and neighborhood groups and developing and presenting a program to members of the community which emphasizes the need for smoke detectors, emergency exit drills, and general fire prevention in the home. The report of the National Commission on Fire Prevention Control, AMERICA BURNING, gave recognition to the importance of fire safety education, stating the following:

"Among the many measures that can be taken to reduce fire losses, perhaps none is more important than educating people about fire. Americans must be made aware of the magnitude of fire's toll and its threat to them personally. They must know how to minimize the risk of fire in their daily surroundings. They must know how to cope with fire, quickly and effectively, once it has started."<sup>4</sup> Through the implementation of the recommendations presented in this subsection, it is realistic to anticipate that Cary residents will develop a conscious fire safety awareness through fire prevention education and through involvement in fire prevention activities.

**RECOMMENDATIONS** - 1) Continue to emphasize the important role public fire education plays in fire prevention and fire reaction. 2) Stress the need for citizen participation in fire prevention education. 3) In order for Cary's public fire education program to run effectively and efficiently, it must be managed and organized properly. It is recommended that the public fire education program fall under the supervision of the Fire Marshal since public fire education is a fire prevention activity. This organizational structure will improve the overall effectiveness of the program. 4) Develop a record keeping system for public fire education activities. Use this data to identify the types of fire education programs needed in Cary. Evaluate these programs for their effectiveness and recommend changes where necessary.

## **FIRE CAUSE INVESTIGATIONS**

Fire cause investigations are a vital component of fire department services. The information obtained from fire investigations is useful in fire prevention activities. Fire causes can be addressed in fire education programs to help in preventing all types of fires. During investigations, fire hazards can be located. This information helps to identify the types of inspections needed and where they need to be made.

suspicious

**RECOMMENDATIONS** - 1) Since fire cause investigations have a direct affect on fire prevention activities, it is recommended that fire cause investigations fall under the supervision of the Fire Marshal. 2) It is recommended that all fire company personnel be trained in identifying fire causes. This is necessary due to the size of Cary's Fire Department and the costs involved in adding additional staff for the sole purpose of making fire cause investigations. All fire company personnel will be responsible for making routine fire cause investigations. All fire department personnel will receive courses in fire cause determination. This training will be confined primarily to observation. This is necessary for several reasons. Many fires will never be investigated if firefighters do not observe conditions and circumstances which indicate that the fire is suspicious and that an investigation should be requested. The observant firefighter can convey significant information to the investigating officers. Firefighters can also assist in establishing the incendiary origin of the fire by courtroom testimony, not as expert witnesses expressing opinions, but as experienced firefighters testifying on their observations. 3) If fire company personnel determine that the fire is of susicious origin or at least warrants further investigation, it is recommended that a special fire cause investigating unit be called. This unit will consist of the Fire Marshal and three company officers. If deemed necessary this unit will call in a member of the police department trained in fire causes. Together the police department and fire department will make the investigation and file a report if necessary. Cooperation between the police and fire departments is essential. Experience has shown that a combination of fire and police personnel is the most effective approach, as it combines the expertise of fire personnel in the technical aspects of fire with that of police personnel in investigative techniques. 4) The work schedule of the unit should be designed so that at least one investigator is on duty at all times. The seriousness of the problem will dictate when and under what circumstances unit members will be called to the fire scene. 5) For the unit to be effective and efficient, all members must be qualified to conduct a complete investigation. It is recommended that each member of the unit complete a comprehensive fire cause investigation training program. The objective of the training program is to enable all members of the unit to carry out their duties effectively and efficiently. Fire department personnel in the unit should receive basic and advanced training in police procedures and investigative techniques, and police personnel training in the unit should center on subjects such as fire department operations, basic fire ground strategy and tactics, firefighting equipment and its utilization, fire origin and cause, and fire scene investigation. The classes should be conducted primarily in the field at fire scenes. 6) Develop a records system

for fire cause investigations. The records will show the location, type of property, and date and time of suspicious fires. This will point out high frequency arson areas. In addition to identifying these areas, properties subject to arson can be noted, along with the hours during which the majority of these offenses occur. This information enables the unit to concentrate its efforts in these areas at the appropriate times. When information is readily available as to where and when suspicious fires may occur, a significant step has been taken in controlling and preventing suspicious fires.

**ADDITIONAL FIRE PREVENTION RECOMMENDATIONS**

1) It is recommended that accurate records be kept of all fire prevention activities, with the Fire Marshal supervising the record keeping system. Fire prevention records can be used in conjunction with fire experience records to establish and evaluate fire prevention activities. The fire department can identify problem areas from the information showing fire losses and hazards. The fire department can then direct inspection efforts toward demonstrated problems rather than on a random basis. 2) It is recommended that an inspection priority system be established from fire incidence records. This system will identify the specific types of inspections that need to be made and where they are needed. The time they should be made can also be determined from fire data. Since suppression personnel are involved in prevention activities, inspections should be scheduled when the incidence of fire calls is low. Fire company personnel should make these inspections in their designated geographic response area. This will enable suppression personnel to respond to a fire call effectively and efficiently. Public fire education programs should also direct their attention to identified fire problems in Cary. These types of management programs will increase the overall effectiveness of Cary's Fire Department. 3) The General Statutes of North Carolina, 160A-435, gives the city or town council of every incorporated city or town the right to establish and define primary and secondary fire limits. The primary fire limits include the principal business portions of a city or town. A city or town may also establish and define one or more separate areas within the city or town as secondary fire limits.

There are restrictions within the fire limits as to the type of building or structure permitted. Periodic inspections are also required. The establishment of fire limits is a tool used to prevent future fire breeders which can cut down the incidence of large fires. In addition to the principal

map 9

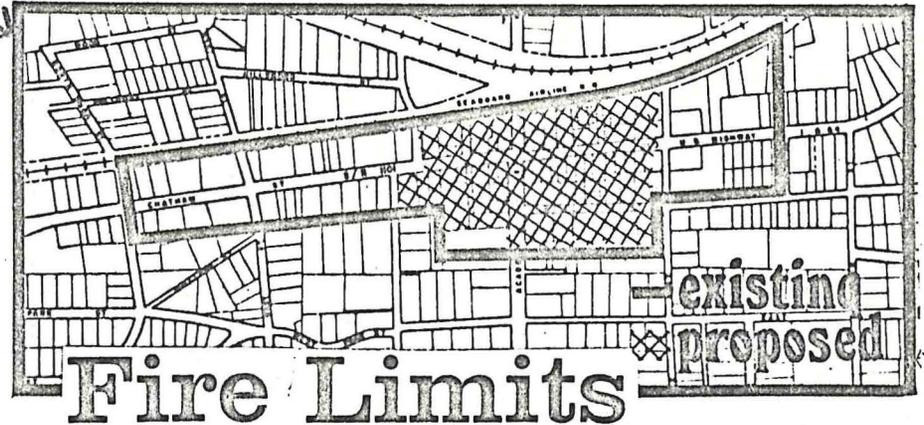
business portions of a city or town that are usually designated as primary fire districts, highly congested areas, other major commercial and office areas, and restoration areas are examples of areas that can be designated as secondary fire districts.

It is recommended that the Town of Cary change its Primary Fire Limits to include only those areas zoned B-1. The B-1 zoning classification corresponds to the Town's Central Business District. The regulations for B-1 zoning are designed to "permit a concentrated development of permitted facilities within the central portion of the Town." This area requires no front, rear, or side setbacks and permits the joining together of structures, thus increasing the risk of fires occurring. This designation should reduce this risk. Map 8 shows the present and proposed Primary Fire Limits.

It is also recommended that a three member committee, comprised of the Fire Marshal, Chief Building Inspector, and Director of Planning and Development, be formed to study the need for establishing secondary fire limits. This committee will also be responsible for reviewing the primary fire limits to see if and when adjustments or changes need to be made.

### SUMMARY OF FIRE PREVENTION RECOMMENDATIONS

1. Continue to emphasize fire prevention (time before the fire) as the most important activity of the fire department.
2. The Fire Marshal will supervise all fire prevention activities. These activities will be carried out jointly by the Fire Prevention Bureau and fire company personnel.
3. Locate the Fire Prevention Bureau, Fire Marshal and Public Fire Educator at a centrally located fire station. The location is important because it has a bearing on the effectiveness of the overall fire prevention program. These people need to be accessible to the public. The physical facilities provided should be suitable for conducting necessary business.
4. Increase the use of fire company personnel in fire prevention activities in their geographic response area. This will assure the most effective and efficient utilization of fire department personnel since personnel costs represent approximately 90% of the public sector's expenditure for fire protection.
5. Implement a priority system for fire inspections based on designated fire hazards and problem areas.



6. Continue to stress public fire education as an important component of fire prevention. The citizens of Cary must be made aware of the important role they play in the overall effectiveness of fire prevention.
7. Develop a fire cause investigative unit to:
  - a. more accurately determine the causes of fires.
  - b. improve the apprehension and conviction rate of persons suspected of arson or unlawful burning.
  - c. improve investigations of false alarms.
8. Emphasize fire prevention activities in the Fire Department's training program. This is necessary because all fire department personnel participate in prevention activities, although in varying degrees.
9. Develop a record keeping system of all fire prevention activities. Record keeping contributes to the overall effectiveness of fire prevention by providing information to develop effective fire prevention programs.
10. Establish a program to measure the effectiveness of fire prevention activities in Cary. This program will look at:
  - a. effectiveness of various prevention activities in terms of loss reduction as well as cost effectiveness,
  - b. analysis of fire losses and the implications for fire prevention activities,
  - c. effectiveness of codes and regulations,
  - d. use of hazard analysis as a basis for prevention effort priority system, and
  - e. public education needs, media effectiveness, type of education most needed, and population group to which education should be directed.

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## 2. EMERGENCY OPERATIONS

This subsection discusses the emergency operations of the Cary Fire Department. These operations include provision of fire suppression and rescue services, provision of services for controlling releases of hazardous materials which could threaten public safety, and provision of less-than-emergency level services which are still very important to the community and its individual citizens. In order for a fire department to effectively and efficiently perform these emergency operations, certain factors need to be considered:

- a. COMMUNICATIONS AND FIRE ALARM
- b. MANPOWER ASSIGNMENTS
- c. UTILIZATION OF FIRE COMPANY PERSONNEL
- d. FACILITIES AND FIRE STATION LOCATIONS
- e. FIRE APPARATUS
- f. FIRE VEHICLES
- g. MUTUAL AID
- h. WATER SUPPLY AND DISTRIBUTION SYSTEM
- i. CORPORATE LIMITS

### a. COMMUNICATIONS AND FIRE ALARM

#### The Communications Center

The Center, located in the Cary Town Hall, is an emergency dispatching system connecting the Center with all fire stations, the police department and rescue squad. One (1) dispatcher is on duty at all times. Dispatchers are responsible for receiving alarms, determining appropriate response assignments, and dispatching the fire companies. Emergency responses are pre-determined, using set procedures to guarantee a uniform operation. The Director of Communications supervises the operations of the Center. The Fire Chief and Police Chief supply the Center with their procedures in case the call is a fire and/or police emergency. The following recommendations will enable the Communications Center to dispatch fire companies within sixty (60) seconds after receipt of alarm.

### RECOMMENDATIONS

- 1) Employ an adequate number of dispatchers to maintain one (1) dispatcher on duty at all times.
- 2) Develop a comprehensive training program for dispatchers. Dispatchers need to be trained in the operation of radios, keeping the status of all companies, and obtaining valid locations and information from people in stress situations. Necessary skills must be gained through training experience and contact with people.
- 3) Retain the Center at its present location with expanding facilities.
- 4) Examine the possibility of utilizing the Town's computer in dispatching operations to improve the overall efficiency of the Center.
- 5) Provide the Center with adequate equipment.
- 6) Develop a radio equipment maintenance program.
- 7) Establish a replacement schedule for all equipment so as to assure a continued acceptable level of emergency and routine radio communication with the cost divided over future budgetary years.
- 8) Provide adequate facilities for conducting necessary business. Minor repairs and improvements should be made to the facility.
- 9) Continuously review and assess the activities of the Communications Center to determine if it is operating effectively and efficiently. At such time the Center is found to be inadequate, conduct a study to identify the problems and the proper course of action to take.

## Fire Alarm Reporting System

There is a need for all citizens to be able to rapidly summon help in an emergency situation. A well designed fire alarm reporting system will reduce the time it takes to report and receive the alarm.

The Town of Cary implemented a new emergency reporting system in October 1979: the 911 concept. This emergency reporting number provides a simple number which is easy to remember and to use. The primary purpose of 911 emergency telephone service is to enable citizens to obtain fire, law enforcement, rescue, medical, and other emergency services as quickly and efficiently as possible by calling this number. This system should also enable public safety agencies (fire, police) to satisfy their operational and communications needs more efficiently. This system simplifies the procedures in reporting and receiving alarms and is readily available to the public, therefore reducing critical fire department response time.

911 also promotes citizen involvement. The ease with which 911 can be remembered and dialed, the potentially quick response by an emergency agency, and the very fact that a community chooses to provide its citizens with such a system appear to have encouraged a less apathetic attitude on the part of the public. 911 thus seems to have very positive benefits to the community in increasing citizen awareness and acceptance of its public safety agencies and in promoting a sense of responsibility toward fellow citizens. 911 benefits new residents and travelers to a community. These people can quickly learn the procedures of the Town's alarm reporting system.

There are additional advantages to the Fire Department and other emergency agencies:

1) Because the time from the detection of an incident to the time an agency is notified is potentially reduced through the use of 911, the Fire Department's response time can be reduced. This reduction can lead to the saving of lives and property.

2) Because calls are received at a central answering point by trained personnel, better coordination between emergency agencies is possible. The 911 system encourages those providing communications services and those providing emergency assistance to coordinate their efforts and facilities, and work together.

3) Priority calls are immediately identified when a 911 call comes into the answering center, the Cary Communications Center.

4) Better record keeping procedures are possible and almost inherent in the initiation and operation of a 911 system.

## RECOMMENDATIONS

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1) Continue to offer public fire education programs in the proper procedures to follow after detecting an emergency. Educating the citizens of Cary in these procedures is essential if fires are to be contained in their incipient stage. 2) Emphasize the benefits of 911. The 911 concept will improve the efficiency and effectiveness of Cary's communications system. Time will be saved in reporting and receiving emergency calls. The completeness of the information received will help in the determination of the appropriate response assignments. 3) Annually review this system to see if it is adequate and cost effective. At such time that the system is found to be inadequate, an extensive study should be conducted to determine the proper course of action.

## b. MANPOWER ASSIGNMENTS

### Paid Suppression Manpower Positions

There are presently 8 suppression positions assigned for manning of the three shifts. These positions are assigned to two engine companies and one truck company. The manning and apparatus assignments are as follows:

Station	Type of Apparatus	Manning
1	Engine	1 Captain 1 Driver/Firefighter 2 Firefighters
2	Engine	1 Captain 1 Driver/Firefighter 1 Firefighter
2	Truck	1 Firefighter

**RECOMMENDATIONS** - Manning level recommendations are included in Section I. These recommendations must be followed if emergency operations are to be effective and efficient. Here is a brief summary of the recommendations:

1) The minimum manning level for all engine companies be established as three (3) members. Manning levels for a particular engine company above this minimum will vary depending upon the type of structures in its response area.

2) The minimum manning level for all truck companies be established as four (4) members. However, this level will be reached in phases.

## Volunteer Firefighters

Adequate manpower is essential if a large fire occurs. Volunteer firefighters can help engine and truck companies to meet manning requirements when fire emergencies require additional manpower over and above the manning levels recommended in this Plan. A company member in good physical condition is generally expected to perform with concentrated effort in a hazardous environment for a maximum of thirty minutes without relief. In tactical terms for engine companies, this would relate to two firefighters advancing a single 1½ or 1¾ inch hose line at ground level and applying 80 to 200 gpm of water. Three firefighters would be required to advance these charged lines up stairways. Three firefighters would be needed to advance a 2½ inch charged hose at ground level and apply 200 to 300 gpm. Four firefighters would be required to advance the same hose lines up a stairway. Fires requiring either three or four firefighters to advance hose lines would require engine companies with manning levels greater than three or four members. A five member company would be needed. In order to reach this manning level, volunteer firefighters can be called in. These volunteer firefighters will enable the engine company to deliver water on the fire quickly and effectively. An important measure of engine company efficiency is the gallons of water per minute it can deliver on the fire ground in the shortest practical time after being given an assignment. A five member company can place a 2½ inch hose line in service on the fire in three minutes whereas a four member company can place it in service in four minutes. Volunteers will increase engine company efficiency. By using volunteer firefighters, other engine companies can remain at their station in case of a simultaneous alarm.

Volunteer firefighters can also be used for emergency fire situations requiring manning levels greater than those recommended for truck companies in this document. The placement of a 50 foot ladder requires six members. At times, two ladders need to be immediately placed on each building that requires laddering. A five member team is capable of performing this operation rapidly. Volunteer firefighters can increase the overall effectiveness and efficiency of truck company operations when necessary.

**RECOMMENDATIONS** - 1) Maintain Cary's volunteer suppression force. These additional firefighters will increase the overall effectiveness of emergency operations. 2) Require volunteer firefighters to meet basically the same qualifications that paid suppression personnel must meet. 3) Require volunteer firefighters to go through a suppression

training program. These requirements will enable volunteer firefighters to perform effectively and efficiently at the emergency scene. 4) Annually review the activities of the volunteer force to determine if it is operating effectively and efficiently and if changes are needed.

## c. UTILIZATION OF SUPPRESSION MANPOWER

Effective and efficient utilization of suppression manpower is important if the emergency operations of the fire department are to be effective. A comprehensive training program is essential for developing the most capable attack force for dollar investment. Also, well trained suppression personnel are more effective and efficient on the fire scene if their apparatus and equipment are designed to take full advantage of the skills and capabilities of a firefighter.

**RECOMMENDATIONS** 1) Utilize fire suppression personnel in fire prevention activities. 2) Schedule inspections made by fire company personnel in their geographic response area. When a fire alarm is received, suppression personnel will be able to respond efficiently. 3) Concentrate inspections made by suppression personnel during months that have fewer fire alarms. In this way, suppression personnel will be at their station when fire alarms are greatest. 4) Develop a comprehensive training program that develops the most capable attack force. 5) Review the use of apparatus and equipment to determine if they are being utilized efficiently and effectively. In some cases, responses to alarms are standardized to the point of being inefficient - a deployment of too many resources for too small a problem. It would be more efficient to have the response fit the problem. If such a response system could be developed, it is felt that fire department efficiency would rise. 6) Constantly evaluate the activities of suppression personnel and their equipment and apparatus to determine if the emergency operations program is taking full advantage of the skills and capabilities of a firefighter. 7) Continue to maintain a program of volunteer firefighters. This will enable additional manpower, trained in firefighting activities, to respond to an emergency situation when necessary. This will increase the overall effectiveness of emergency operations.

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## d. FACILITIES AND FIRE STATION LOCATIONS

### Design of Facilities

One key to successful fire department operations is the functioning of the fire station. Well planned, flexibly designed fire station buildings can provide adequate service for many years to the constantly changing communities in which they are situated. Some modifications, however, may be required during their service lifetime. Primarily, a fire station must provide the fastest possible response to fires. Therefore, floor plans and building egress routes must be designed to efficiently move firefighters and equipment through the station and out to the street without delays.

In planning station designs, specific station functions need to be considered. The four basic functions or kinds of activities in day-to-day operations are: 1) Administrative or management activities; 2) fire prevention activities; 3) operations (fire suppression, rescue); 4) support activities of maintenance and training which ensure adequate response to all functional activity areas. Fire department facilities to support these functions may consist of fire stations, communications centers, administrative offices, repair facilities, and training grounds.

A primary concern for an efficient fire station is the circulation system within the building. During an alarm situation, firefighters must move quickly from other areas to the apparatus room. Circulation must be designed to facilitate this emergency movement. Certain design considerations for station functional areas can improve overall efficiency and facilitate maintenance of stations. The following guidelines apply to dormitories:

1. The dormitory should always be separated from noise producing areas of the station.
2. In all sleeping areas, an exit should be provided for emergency.
3. Private sleeping areas should be provided for officers.

The guidelines below are applicable to the apparatus room:

1. Adequate circulation space should be provided around vehicles.
2. Protected electrical outlets should be mounted well above the floor to permit hosing down of the apparatus room.
3. Apparatus room exit doors should be sized to accommodate all apparatus.

4. Apparatus lanes and exits should allow all vehicles to exit independently of others.
5. Ventilation of the apparatus room should be provided to remove fumes from vehicle testing and warmup.
6. Apparatus doors should be equipped with a timed electric door closer.
7. Apparatus doors, normally electrically operated, should be manually operable if power fails.

The following guidelines apply to public areas:

1. Public areas should be secured from the apparatus room and the private areas of the station.
2. Public restrooms should be provided if public use of meeting rooms is planned.
3. Handicapped needs should be addressed in all public areas.

Energy conserving building systems need to be examined when designing fire stations. Rising costs of energy have had a heavy impact on public construction in recent years. Although initial steps to reduce energy consumption in existing stations are important, energy conservation will best be achieved by rethinking the design of buildings and energy consuming systems.

### RECENT STEPS TAKEN IN FIRE STATIONS

1. Addition of more insulation to improve insulating values of walls, roofs, and floors.
2. In design plans, better building orientation to sunlight and shade and use of adjustable controls for admitting or rejecting natural light.
3. Reduction of northern exposure window areas and use of double glazing throughout.
4. Use of heat exchangers to reduce loss of exhaust heat.
5. Use of automated apparatus room heater shutdown when doors are opened.
6. Use of heat pumps for reduced Heating, Ventilation, Air Conditioning costs.

An energy conservation study should be part of the preliminary design phase of fire station projects to achieve the closest integration possible of the building and its energy system requirements.

Fire department training as the basis for firefighter efficiency at the fire ground should be conducted at properly equipped facilities. Training facilities should be located at a principal local fire station or they may be located at a separate local site if a desirable station site is not available. A training center should be capable of simulating all types of emergency situations that a fire department expects to encounter. Its facilities may consist of classrooms, a simulated fire ground with buildings designed to

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simulate different types of fire situations, simulated hazardous types of outdoor fires, and test and simulation equipment. It should be developed on a site which is large enough to provide full maneuverability to apparatus and personnel and should have hydrants located appropriately. Buildings housing classrooms, assembly space, and administrative functions should be located apart from the fire ground simulation area.

THE DEVELOPMENT OF A FIRE STATION SITE SHOULD SATISFY TWO PRIMARY GOALS. 1) The exitways will need to be designed to allow vehicles to move directly to the street. 2) An adequate exterior area for vehicle maintenance and for employee and guest parking should be maintained. Other principles must be considered if the site is to be adequate for the size of the station planned. These include:

1. The immediate vicinity of a fire station should be free from land uses which make it difficult or dangerous for the Fire Department to be able to respond quickly.
2. A site at an intersection is good as it permits response in more than two directions.
3. Stations should be set well back from the curb line.
4. The site should be level. If possible, stations should be planned so vehicles can drive through from rear to front exits.
5. Good site distance on street or streets where apparatus will enter.
6. A two (2) company station site should be approximately 150 feet by 150 feet, with 25 additional feet for a three (3) company station.

Because the fire protection needs of jurisdictions are always changing, a fire station which is adequate today may require extensive expansion or modification in just a few years. It is necessary for local fire stations to be designed and constructed to accommodate at the very least, anticipated changes to their staff, equipment, and services. Only when they have been designed for flexibility and adaptability to change, can these essential facilities expand and adjust to meet new demands with cost effective alterations.

#### **Capital Budgeting for Fire Stations**

Timing is the single most important factor in the capital budgeting process for several reasons. The amount of funds available to a jurisdiction for capital projects is less easily changed than are project completion schedules. Bond limits, outside grants, and tax rates change over time, but generally they are outside the immediate control of the jurisdiction. Project timing and phasing, on the other hand, can be controlled directly. Other timing concerns need to be dealt with in preparing capital budgets. Fire station budget priorities need to be developed in terms of the impact each station can make on fire department response capabilities. Those stations providing the greatest impact generally will be budgeted first. Community

growth, as described in the location study, shows up again in the budget process as an important timing element in determining when stations must become operational.

Inflation is another timing factor to be considered. Generally, in recent years, increases in construction costs have outpaced inflation in other sectors of the economy. As a result, budget estimates which are realistic in one year may become quite insufficient in later years. The inflationary factor puts a premium on near term completion of projects and requires that cost escalations be considered when station construction schedules are extended or delayed. Inflation should also be continuously monitored when long-range facilities planning goals are being developed and revised.

Costs for the design and construction of a fire station are extremely variable because of differences in interest rates, land acquisition costs, differences in station design and required site improvements, labor rates and material cost variations, and site specific features. Because of these variables, it is generally appropriate to use conservative cost estimating, especially during feasibility and programming studies. The importance of reliability in cost estimates merits significant emphasis.

Public construction has increasingly been criticized for a shortsighted emphasis on minimizing initial costs for new construction projects including fire stations. The criticism focuses on jurisdictions that pass up long-term or life cycle savings that can be gained through high standards of quality in favor of short-term but smaller savings in initial design or construction cost. Provision for station expansion, long-term energy savings, and design for low maintenance are the three most important areas of concern in terms of life cycle costs.

The argument against skimping on initial costs holds especially true in providing low maintenance interior and exterior finishes for the station and in providing amenities for firefighters which make the fire station a more livable place. Low maintenance interior and exterior finishes are important to reduce the amount of required routine cleaning and to avoid situations in the future where maintenance of finishes is put off indefinitely because of tight operating budgets. If preventive maintenance is overlooked during tight budget years, the result could be a shortened service life for a fire station as well as higher maintenance costs and lower station effectiveness

in later years. Also, morale is likely to be much higher if the station finishes remain in good repair. Additional station amenities such as recreational equipment and comfortable lounge space can also help maintain firefighters enthusiasm for their work. Physical fitness equipment can help maintain physical conditioning. Initial costs for such items are insignificant compared to costs which can occur if the station needs to be replaced or if firefighters become dissatisfied with their work, or out of condition physically. If expenditures for such amenities reduce absenteeism and show the firefighter that the jurisdiction takes pride in its fire service, such initial costs will prove to have been a good investment.

Another approach that can be used to hold down new station costs by jurisdictions planning construction of several stations over a span of years involves developing one or more basic fire station designs which can be used repetitively at more than one site. Through the use of standardized designs, the objective is to reduce design and engineering needs and fees for stations built to the same basic designs. This does not eliminate, however, the need for some additional architectural and engineering services on these projects. Plans are almost certain to require modification for a number of reasons. These reasons include: 1) site differences, such as unique site layout and soil conditions; 2) modifications and improvements to the original plans based on experience with earlier station; and 3) modifications of external or internal appearance due to locational differences. Plans will also vary depending on the functions that are to take place in a particular station.

### FIRE STATION FACILITIES PRESENTLY IN CARY

Cary has two fire stations. Station 1 houses the Fire Chief, the Fire Marshal, the Education Specialist, the training office and one four (4) member engine company. Engine's 3 and 4 (back ups) are usually stored at Station 1. Station 2 houses one 3 member engine company and one 1 member truck company.

In addition to the station location study, each station was critically evaluated to determine overall condition and adequacy for the housing required by personnel and apparatus. Following are descriptions, evaluations, and recommendations for each fire station.

#### FIRE STATION NO. 1

100 N. Academy Street

Constructed and occupied in 1966-1967. Additions in 1972. Blocks and brick construction.

Condition: Fair

Inadequacies: Apparatus floor is cracked, lacks ventilation for apparatus exhaust, lacks separate heat system, and is too short. Apparatus doors do not have automatic closers. Front apron is too narrow. Administrative office area is too small. Dormitory is adequate but additional lockers and carpeting are needed. Exterior walls, windows, and doors are poorly insulated. Parking is insufficient. Lot size is too small and poorly situated for rapid coverage of its service area.

**RECOMMENDATIONS** Due to the condition of Station 1 and its proximity to the railroads, it is recommended that Station 1 be relocated. The size of the facility is also too small for modern day ladder trucks. Major renovations would be necessary in order to house a ladder truck. Major repairs should be limited. If they become necessary to enable effective and efficient utilization of the Station before the recommended relocation date, the feasibility of an earlier relocation date should be examined. Monitoring of maintenance requests will help determine if this will be necessary. 2) Install carpeting, additional lockers, repair floor cracks, improve insulation. 3) Relocate administrative offices. The Fire Chief, Fire Prevention Bureau and Education Specialist need to be located at Station 2. Station 2 is more centrally located and accessible to the public given projected growth patterns. 4) Maintain the training office at Station 1 until Station 4 is built. At that time, relocate the training office to Station 4. 5) Purchase property at the intersection of North Harrison Avenue and Maynard Road to built a two (2) company fire station.

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#### **FIRE STATION NO. 2**

875 E. Maynard Road

Constructed and occupied in 1976. Blocks and brick construction.

Condition: Very Good

Inadequacies: Front apron is too narrow.

**Recommendations**- 1) Provide offices for administrative staff at Station 2: Fire Chief, Fire Marshal, and Education Specialist. Additional property will need to be purchased for this expansion. 2) Widen front apron.

#### **FIRE STATION NO. 3**

**RECOMMENDATION** - 1) Purchase property to locate a two (2) company fire station at the intersection of Kildaire Farm Road (S/R 1300) and Apex-Macedonia Road (S/R 1009).

#### **FIRE STATION NO. 4**

**RECOMMENDATION** - Locate a two (2) company fire station with a training facility at the southern intersection of Old Apex Road (S/R 1616) and Old U. S. 1 and 64 (S/R 1001). The training facility will include such items as classrooms, offices, storage space, training and drill facilities, and test facilities. The building housing the training classrooms, assembly space, and administrative offices should be located apart from the fire ground simulation area. The location of Station 4 provides a suitable area where the use of smoke and water will not be restricted.

#### **SUMMARY OF FIRE STATION FACILITIES.**

Well planned, flexibly designed fire stations are a key to successful fire department operations. The cost, the facility, and the site are all important.

**RECOMMENDATIONS** - 1) A minimum of <sup>1</sup> acre needs to be purchased for each proposed fire station site. Size may vary depending on the activities to be performed at the facility and its location. 2) Build cost-effective and efficient fire stations designed for flexibility and adaptability to change. Use DESIGN OF FIRE STATIONS INFORMATION BULLETIN NO. 278, the NATIONAL BOARD OF FIRE UNDERWRITERS SPECIAL INTEREST BULLETIN 175 AND 176, and energy efficient designs as guides to the design of fire station facilities. These bulletins discuss in great detail fire station building space requirements, specific room requirements for each station function, and site requirements. Existing stations need to be evaluated to determine if changes are necessary. 3) Design the building facade to reflect the character of the neighborhood it is located in. 4) Develop a schedule for correcting deficiencies in existing stations so that all stations will provide a good atmosphere in which to work and to be conducive to a high level of morale.

Stations must be maintained to increase their life span. 5) Conduct an update of the station location study annually to keep abreast of Cary's development. This information will be used in determining future fire station needs and locations. 6) The use of these standards is nullified if the selection and acquisition of individual sites is delayed until development has occurred. Increased development reduces the number of available sites and results in rising property values. Development will occur in any event, and sites selected before its occurrence can be acquired at lower prices from a greater choice of sites. Therefore, advance site acquisition is recommended.

**e. FIRE APPARATUS**

Fire apparatus play an important role in the overall effectiveness of a fire department's emergency operations. Fire company personnel are more effective and efficient on the fire scene if their apparatus and equipment are designed to take full advantage of the skills and capabilities of a firefighter.

The Cary Fire Department has two pumping engines, one service ladder truck, and one brush truck on first run assignment. In addition, there are two pumping engines on reserve. The Fire Department has sufficient apparatus to meet the standards established in this Comprehensive Plan and Cary's basic fire flow. A description of present and proposed fire apparatus follows with recommendations:

APPARATUS	DESCRIPTION
<b>Engine 1</b>	1971, 1,000 gallon per minute custom American LeFrance two stage triple combination pumper with 500 gallon booster tank. Diesel engine, air brakes. Assigned currently to Station No. 1 - first run. General condition: Good Recommended replacement: Replace with a 1,000 gpm two stage triple combination pumper in 1990, assuming condition of the pumper is maintained at its present level. Replacement would occur during Phase III of the Station Location Plan. Assign to reserve status in 1991 for five (5) years.
<b>Engine 2</b>	1965, 1,000 gallons per minute custom American LeFrance two state triple combination pumper with 750 gallon booster tank. Gas engine, booster brakes. Assigned currently to Station No. 2 - first run. General Condition: Fair Recommended replacement: Replace with a 1,000 gpm two stage triple combination pumper in 1984, assuming condition of the pumper is maintained at its present level. Replacement of this engine would be during Phase II. Assign to reserve status in 1985 for five (5) years.
<b>Engine 3</b>	1975, 1,250 gallon per minute, short wheel base commercial or conventional cab, American LaFrance/Ford two stage triple combination pumper with 500 gallon booster tank. Gas engine, booster brakes. Assigned currently to Station No. 1 - First back up pumper. General condition - Good Recommended replacement: 1,000 gpm, regular wheel base, two stage triple combination pumper in 1994, assuming condition of the pumper is maintained at its present level. Assign to reserve status in 1995 for five (5) years.

<b>Engine 4</b>	1953, 750 gallons per minute custom Sea Graves two stage triple combination pumper with 500 gallon booster tank. Diesel engine, mechanical brakes. Assigned currently to Station No. 1 - Second back up pumper. 26 years old, replacement parts are scarce. General condition: Poor Recommended replacement: At the time Station 3 is activated (1981).
<b>Truck 6</b>	1976, GMC long wheel base truck. 1-16 foot ladder, 1-20 foot ladder, 2-30 foot ladders, 2-35 foot ladders, 1-45 foot ladder. Assigned currently to Station No. 2-first run ladder truck. General condition: Good Recommended replacement: 1986. Assign to reserve status 1987.
<b>Brush 9</b>	1963, 10 gallon per minute, 4 wheel drive, 1 ton Dodge with winch. Gas engine. Assigned currently to Station No. 2 - first run on grass and brush fires. General condition: Fair Recommended replacement: 1987. Assign to reserve status in 1988.

**RECOMMENDATIONS** - 1) Schedule all fire pumbers and trucks for removal from first run assignment after twenty (20) years of service. Assign pumbers and trucks to reserve status for an additional five (5) years. The schedule for removal from first run assignment and reserve status can vary. Pumpers and trucks should be individually assessed and maintenance records reviewed before they are replaced or put in reserve status. Annual service tests will determine the condition of all fire apparatus. When making the assessment, availability of replacement parts, pumping capacity, protection of the driver, and the way the engine or truck handles need to be examined. If the assessment indicates that the pumper or truck is still adequate, first run service may be continued with periodic reassessments to determine reliability and adequacy. The same holds true for determining the length of reserve status. The schedule of replacement and reserve status for all other fire apparatus will depend on their reliability, adequacy and efficiency. Periodic checks by the Fire Department will determine when replacement or reserve status is necessary. 2) Cary's basic fire flow is 3,500 gallons of water per minute, with some required fire flows at 4,000 gpm. All four (4) engines are needed to pump Cary's basic fire flow level during maximum alarm fires in Cary. If one of Cary's engines goes down for repair, Cary cannot provide its required fire flow without calling for outside assistance. Engine 4 is old and replacement parts are difficult to obtain, thus increasing the chances for down time. When Station 3 opens, Engine 3

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which is presently a back up engine, will be assigned to Station 3 as its first run engine. This will leave Engine 4 as the sole back up pumping engine. Engine 4 is too old and unreliable for this function. Therefore, it is recommended that Engine 4 be replaced at the time Station 3 is activated in 1981. This will enable the Fire Department to have a reliable back up pumper. If the Sea Graves pumper still works, it can also be used as a second back up. When Station 4 is activated, the new Engine 4 will become first run pumper at this new station. If Engine 2 has not been replaced by the time Station 4 is activated, the old Sea Graves will once again become the sole back-up pumper if it is still in service. has been retired, Cary's Fire Department will be without a back up pumper if one goes down. If a maximum alarm fire or a simultaneous fire occurs under these circumstances, outside assistance will be necessary to provide the required fire flow or respond to another fire. Therefore, it is recommended that Engine 2 be replaced on schedule or no later than the activation date of Station 4 (1986). This will enable the Fire Department to have a reliable back up pumper. Reserve back up pumpers, operated by both paid and volunteer firefighters, can also go to a fire scene if needed. Even with a back up pumper and volunteer firefighters, it will still be essential that the existing mutual aid agreements be continued in order for Cary's Fire Department to adequately respond to all emergency situations. 3) Cary's present service truck is adequate given the EXISTING size and type of structures in Cary. As Cary continues to grow, more structures will be built requiring the use of a ladder truck. With this increased growth and development, the effectiveness and efficiency of the existing service truck will decrease. Therefore, it is recommended that the Town of Cary purchase either an aerial ladder or elevated platform truck during Phase II of the Station Location Plan at the time Station 4 is activated, 1986. This replacement schedule corresponds to the proposed structure types and population projections. When the existing service truck is replaced, it should be assigned to reserve status. The type of ladder truck will be determined at the time replacement is deemed necessary and will depend on Cary's fire situation at that time. 4) When purchasing new fire apparatus and evaluating existing fire apparatus, use the NATIONAL FIRE PROTECTION ASSOCIATION NO. 1901 as a guideline. 5) Constantly maintain all fire apparatus in a safe and excellent operating condition. 6) Before purchasing new fire apparatus, it is recommended that both commercial and custom-made fire apparatus be examined. Commercial fire apparatus means that instead of using mass produced vehicles, fire departments use apparatus constructed according to the purchaser's specifications on a vehicle chassis which could also go under a fuel oil tanker or a freight hauler. 7) Examine the need for specialized apparatus and/or changes in existing apparatus to determine if fire department apparatus is designed to take full advantage of the skills and capabilities of a firefighter and to determine if emergency operations are cost effective and

efficient. 8) Rotate fire apparatus to cut down on maintenance costs. 9) Carefully keep records of operation and maintenance costs of apparatus by manufacturer, records of service quality, records of the manner in which salesmen and manufacturers have lived up to promises and warranties, and records of the way fire apparatus have held up under fire ground operating conditions. This will help in determining if repair or replacement is warranted. 10) Review Cary's fire situation, alarm frequency, and the Town's basic fire flow to determine when and if additional fire apparatus will be needed to adequately protect Cary based upon the standards outlined in Section I. 11) The following chart shows the replacement schedule for fire department apparatus. This schedule must be reviewed and updated annually if emergency operations are to be effective and efficient.

Apparatus	Replacement	Reserve Status
Engine 1	1990	1991-1995
Engine 2	1984	1985-1989
Engine 3	1994	1995-1999
Engine 4	1981	1982-1986
Truck 6	1986	1987-1991
Brush Truck 9	1987	1988-1992

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equipment;

### f. VEHICLES

The Cary Fire Department needs vehicles in its day-to-day activities to operate effectively and efficiently. The Fire Department presently has three (3) vehicles. Following is a description and recommendation for each vehicle:

- Department Function**

1. Administration: Car 1  
Assigned currently to the Fire Chief  
General Condition: good  
Uses: a) to answer emergency fire alarms; b) attend to administrative matters of the fire department; and c) to carry needed firefighting clothes, small equipment and fire investigation equipment.  
Recommended replacement: 1980
- Vehicle**

1976 Plymouth Fury, 4 door
- 2. Fire Safety: Car 2  
Assigned currently to Fire Marshal  
General Condition: Good  
Uses: a) to answer emergency fire alarms; b) attend to inspections of all businesses and schools; c) to carry needed firefighting clothes, small equipment and fire investigation equipment; and d) attend to administrative matters.  
Recommended replacement: 1980
- Vehicle**

1977 Plymouth Fury, 4 door
- 3. Operations: Car 3  
General Condition: Good  
Uses: a) to answer emergency fire alarms; b) to provide training programs for all the fire department; c) hauling used hose from the fire to the station for cleaning and drying; d) hauling all materials for training fires; e) hauling water meters and hose for rental purposes; f) hauling station supplies and parts for equipment repair; and g) moving drums of oil.  
Recommended replacement: 1981
- Vehicle**

1972 Ford pick-up, short bed

program by the time Station 3 is operational. 5) Maintain vehicles in a safe and good operating condition at all times. 6) Review the activities of fire vehicles to determine if additional vehicles are needed.

The following chart shows the replacement schedule for fire department vehicles:

Vehicle	Replacement
1	1980
2	1980
3	1981

### g. MUTUAL AID

Mutual aid is used to provide additional manpower and apparatus as may be required for major fires, multi-story buildings, difficult access or salvage and extreme exposures. Mutual aid is also designated to provide stand-by for additional alarms during a major fire.

**RECOMMENDATIONS** - 1) Develop and maintain mutual aid and outside response programs with nearby fire departments in order for Cary to provide adequate fire protection during all emergency situations. 2) Continually evaluate the program to make certain that the total area-wide fire protection resources are most effectively utilized. 3) Conduct quarterly training sessions with the designated mutual aid fire departments to assure that all fire companies operate efficiently as a team.

### RECOMMENDATIONS

- 1) Develop a replacement schedule that will obtain maximum value from the vehicles and spread the costs of acquisition evenly through the coming budget. Analyze maintenance reports and reliability of the vehicles to determine when replacement is necessary. 2) Replace each vehicle with energy efficient compacts where possible. 3) Replace Car 3 with a 1/2 ton long wheel base truck. 4) A fourth vehicle is needed for the education and training program. It is recommended that a vehicle be assigned to the education/training

3/4 ton long wheel base  
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### h. WATER SUPPLY & DISTRIBUTION SYSTEM

An adequate water supply and distribution system is needed to effectively carry out emergency fire operations. The water supply and distribution system is composed of the following elements: raw water supply, treatment facilities, bulk transmission facilities, treated water storage, and distribution piping network.

The Town of Cary purchases all of its water in treated form from the City of Raleigh. Accordingly, the first two elements listed above - raw water

supply and treatment facilities - are embodied in contractual agreement with the City of Raleigh. The Town's bulk transmission facilities consist of two water-pumping stations and the transmission mains from the stations to the elevated storage tanks. Water storage capacity is provided through the use of three elevated storage tanks. The distribution piping network is a system of arterial and looping mains with appurtenant valves, fittings and hydrants.

In evaluating the adequacy of the system, the fire flow requirement of the Town was assumed to be 4000 GPM - as discussed elsewhere in this report. The duration of fire flow for Cary as recommended by I.S.O. is four hours. Essentially, a system is regarded as adequate if the simultaneous demands of anticipated peak day usage and basic fire flow requirements can be met. A cursory examination indicates that although the Town's physical facilities are, for the most part, adequate to provide the required level of service, certain areas of deficiency exist in the distribution piping network. These deficiencies are manifested as less than optimum hydrant location, areas of one-directional (and therefore potentially unreliable) feed, and limited areas of less than desirable water pressure. Identifications of individual, specific deficiencies with recommendations is beyond the scope of this report.

The major point of concern with respect to the water supply is that although the physical facilities are adequate, the present contractual agreement with the City of Raleigh is less than adequate. The contract does have a provision for exceeding the contractual quantities in the event of emergency. However, any such excessive use is subject to factors presently out of the control of Cary.

**RECOMMENDATIONS** - 1) Identify individual deficiencies in distribution piping network, prepare construction plans, and schedule corrective operations. It is anticipated that some degree of engineering study (in the form of a Hardy-Cross system analysis) will be required in order to define the extent of specific areas of inadequate pressure. 2) Procure, through contract revision or development of alternate water sources, a supply of treated water adequate to meet the combined demands of anticipated maximum day usage and basic fire flow requirement. 3) Continually evaluate and upgrade the system to ensure that all elements of the system remain adequate to serve the Town's ever increasing demands.

## I. CORPORATE LIMITS

Being able to quickly locate the emergency scene is essential to effective and efficient emergency operations. A town's corporate limits affects this capability. Corporate limits should be clearly discernable. Having a street which is partially inside the Town's corporate limits will cause confusion not only for the Fire Department, but for the Police Department and Rescue Squad.

**RECOMMENDATIONS** - 1) Make adjustments, where necessary, in the Town's corporate limits to enable fire companies to arrive at the emergency scene quickly.

## 3. SUPPORT SERVICES

Support services are essential if a fire department is to function effectively and efficiently. The support services area of concern includes: provision of the comprehensive personnel recruitment, development, and training program necessary to improve performance and efficiency at every level and in every area of concern of the fire delivery system; provision of performance evaluation services; provision of the record keeping and reporting systems necessary to provide effective and efficient fire protection; provision of a service system to assure proper maintenance and repair of fire department buildings, facilities, apparatus, and equipment; provision of a supply service appropriate to departmental needs; and provision of liaison with other fire-related departments. The area of support services is the area of concern in the American Fire Service which receives less delivered attention than all other fire service activities. Without these services, a fire department cannot provide adequate fire protection services. Support services will be discussed in this subsection with recommendations made for each.

### TRAINING & EDUCATION

A new emphasis on the importance of training and education has arisen in fire departments across the United States. A comprehensive training

and education program is essential if firefighters are to perform effectively and efficiently in emergency and non-emergency situations. This is especially important since personnel costs represent approximately 90% of the public sector's expenditure for fire protection.

There are many varied skills required for a firefighter to perform satisfactorily besides physical strength. Managers and personnel, both inside and outside the Fire Department, recognize that there is a need to upgrade those personnel already within the system as well as to equip new firefighters with the information required to cope with the changing environment. Training and education are necessary if these skills are to be learned. The key to accomplishing these new fire service goals falls to those involved in the field of fire service training and education. Those individuals responsible for developing and implementing the training program are among the most important members of the fire department. They are the basic ingredient to the success of the program. If a fire department is to operate efficiently and effectively, a thorough training and education program is necessary.

#### TRAINING PERSONNEL

A good training and education program is the key to an efficient fire department. The person or persons selected to supervise this program should be well qualified. Because of the varied responsibilities of a training officer, there needs to be an individual in charge of this fire department activity.

**RECOMMENDATIONS** - 1) Establish a position in the Cary Fire Department of Training Officer prior to the time Engine 3 is activated. The primary responsibility of the individual in this position will be development and implementation of the training program. To assure the most efficient

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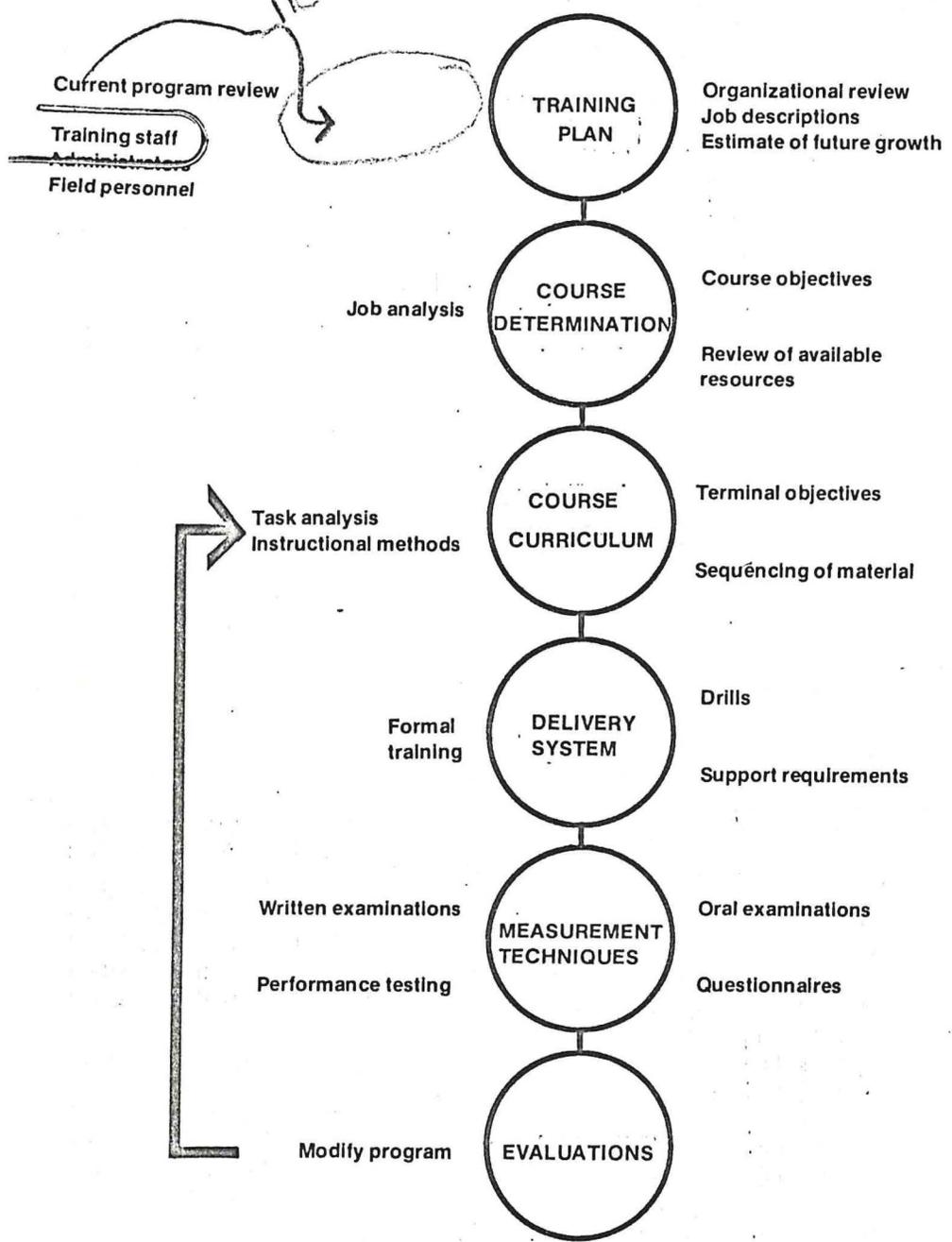
and effective utilization of fire department manpower, it is essential that this individual also be a trained firefighter. The responsibilities of the training officer will include: a) overall direction and coordination of the Fire Department's training program, b) assessment of individual and company training needs; c) development of comprehensive and individualized training programs to satisfy identified needs, d) conduct the training classes, e) development of a program to measure fire department personnel in training techniques; and f) development of a program to evaluate the training program. The work of the training officer will involve developing questionnaires, performing a needs analysis, establishing criteria for program development, creating visual aids, preparing lesson plans, preparing course examinations, schedule classes, and keeping training records. 2) Dispatch the Training Officer to fire emergencies as determined by the Fire Chief. The Officer will be responsible for either suppressing the fire and/or reviewing the techniques used to carry out the operations. This review will serve the following purposes:

- a. To advise the Chief on problem areas and provide staff support on the scene.
- b. To form the basis of a critique with personnel and supervisors.
- c. To provide the opportunity for company officers to acquire the necessary training skills to train their company in recognized areas of need.

#### DEVELOPING A TRAINING AND EDUCATION PROGRAM

The training and education program is a complex operation. It should be based on fire department goals and objectives. The following diagram shows the steps involved in developing the program:

*Needs to be paid*



Fire service personnel receive their training and education in many ways and from many sources. The basic transfer of skills as well as the maintenance of these skills occurs at drills. A drill can be defined as a planned, organized practice session, conducted by the local training officer, covering a single, specific topic. It usually takes place in or near the individual fire station and involves small groups from the station. Some examples of drills would include practice of hose layouts, ladder raises, advancing of attack lines, knot tying, and placement of salvage covers.

Drills can be contrasted with formal training sessions, which are structured, planned classes conducted by the training officer. Training classes are usually conducted at a central location and cover an entire subject area. Subjects which are covered under the heading of training sessions would include recruit firefighting and pump operation.

Finally, there are formal educational classes, conducted by either a two year or four year college.

There are basic differences in drills, training and education. Drills reinforce training which has already occurred. Training provides the specific skills level needed on the job. Education gives the basic knowledge and understanding of both the technical and managerial requisites for administering the fire service.

**RECOMMENDATIONS** - 1) Develop a training and education program based on the diagram on this page for paid and volunteer members of the Fire Department. Department goals and objectives need to be incorporated into the program. Input from field personnel is necessary. 2) In conjunction with the training and education program, adopt NFPA 1001 FIREFIGHTER PROFESSIONAL QUALIFICATIONS. This is a

document that describes the qualifications for fire department personnel and is used for advancement and training. Individuals progressing through the ranks in the fire service will be required to meet NFPA 1001 standards prior to advancement. Each individual is tested on the ability to master certain performance objectives related to a field of specialty. The training officer will know what courses to offer, depending on the classification sought.

#### SCHEDULING OF PROGRAM

**RECOMMENDATIONS** - The training officer is responsible for preparing a training schedule for drills, formal training classes, and outside educational classes.

#### TRAINING & EDUCATION PROGRAM RECORDS

Record keeping is essential if the program is to be effective. Records must be evaluated to see if changes are necessary.

**RECOMMENDATIONS** - 1) Develop a system for recording information on training and education completed. These records should provide basic information on in-service drills, formal drills, education, and special courses completed by all fire department personnel. These records must be kept up-to-date and will be useful in determining promotions. 2) Daily training records also need to be kept. From these records, fire department administrators can determine which areas of the fire service are being practiced and which are being neglected. These daily records provide a measure of a department's efficiency and also indicate the areas where changes are needed.

#### TRAINING FACILITIES

However good the training instructors are, the physical facilities will still play an important role in the success of a training program. They must be adequate for a program to be effective.

**RECOMMENDATIONS** - 1) Develop a training facility. The facility should include such items as classrooms, offices, storage space, training and drill facilities, and test facilities. 2) Build the facility in conjunction with Fire Station 4. Until the facility is completed, examine the possibility of utilizing neighboring facilities. 3) Design classrooms so that a variety of seating arrangements are possible. Classrooms should be separate from the drill facilities. 4) Provide adequate office space for the training officer. 5) Design the training facility with sufficient storage space.

#### SUMMARY OF TRAINING & EDUCATION

In order to assure the most effective and efficient utilization of fire department personnel, a comprehensive training and education program is essential. This is important considering that personnel costs represent approximately 90% of the public sector's expenditure for fire protection. An effective training and education program is the key to an effective and efficient fire department. A fire department can be no stronger than its training program. Training and education is especially important in Cary's Fire Department, since personnel perform both prevention and suppression activities and must be knowledgeable in most areas of the fire service delivery system.

Training and education is a continuous process. They should never cease. Training classes are necessary on a regular basis to reestablish fundamentals and to provide additional skills and knowledge, as well as innovative concepts. This training will enable fire company personnel to perform effectively and efficiently during all types of emergency situations.

#### PHYSICAL FITNESS

The single most important component in fire suppression is still the firefighter. Physically fit firefighters are more efficient and effective at the fire scene. The incidence of injury and life loss is reduced when firefighters are physically fit. The firefighter needs to be in top physical and psychological condition. The design of the total work environment to minimize the stress placed on the firefighter is essential. The anticipated benefits would include: fewer accidents, more efficient operations, lower cost of operations, and more effective use of personnel.

**RECOMMENDATIONS** 1) Study job stresses of the firefighter to improve the work environment. 2) Establish a required fitness program to assist the individual members in developing and maintaining good physical condition. 3) Maintain individual fitness records and assign an officer the responsibility of evaluating these records so as to keep abreast of the progress or decline of each member. A report to the Fire Chief should be provided at least bi-annually so that total department physical fitness can be evaluated.

#### DATA COLLECTION

Good data are essential to managing a modern fire department of any size. Adequate data will help to determine how best to use fire department resources.

#### PURPOSE & USE OF FIRE DATA

The main purpose of a fire data system is to identify and describe the fire problem. The Fire Department needs to answer the what, where, who, why

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those which require the least maintenance. 2) Select paint and finishes which need the least attention to maintain their durability and appearance. 3) Select all wall furnishings and floor coverings to be used in stations on the basis of maintenance time requirements as well as appearance and durability. 4) Keep detailed maintenance records in order to determine whether repair or replacement is needed. 5) Develop a joint repair and maintenance program with the Public Works Department and the Fire Department that would put fire equipment, apparatus, and vehicles on a priority schedule. If a fire engine or truck needs to be repaired or serviced, it will have priority over other town vehicles. This will necessitate having a mechanic at the Public Works Department trained in repairing fire apparatus and equipment. Fire department personnel will still perform minor repairs and routine service checks, but the amount of time fire personnel spend in maintenance activities will be reduced. At the present time, Cary's Fire Department does not need its own mechanic. The close monitoring of fire department apparatus, equipment, and vehicle maintenance records will determine if and when a fire department mechanic is warranted.

**SUPPLY SERVICE**

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Adequate supplies are essential if a fire department is to operate effectively and efficiently. It takes a considerable amount of time to inventory, order and deliver fire department supplies.

**RECOMMENDATIONS**

- Assign the responsibility of maintaining an adequate level of fire department supplies to one member of the Fire Department. This person will coordinate the supply service activity.

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**COORDINATION BETWEEN MUNICIPAL DEPARTMENTS**

**1. INSPECTIONS DIVISION**

The Fire Department and Inspections Division work together to assist developers with their plans to assure the construction of a substantial building, including the installation of adequate fire protection for the type of occupancy involved. When problems or hazards have been found on fire inspections in existing construction and occupancies, joint inspections have helped in the elimination of code violations that were hazardous to life and property.

**RECOMMENDATIONS**

- 1) The existing cooperation and teamwork between the Fire Department and the Inspections Division

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should be continued. 2) When violations to the building code are located by fire personnel on their inspections, these violations should be referred to the Inspections Division for correction. Depending on the nature of the violation, both departments should work together to assist the property and/or business owner in correcting conditions which may be hazardous to their personnel, operation and neighbors. 3) There should be continuous review of building and fire codes and ordinances to establish standards that guide the progress of this Town towards the goal of maintaining as low a fire flow requirement as practical and developing a community safe from major fire and loss of life.

**2. THE DEPARTMENT OF PLANNING AND DEVELOPMENT**

This department is instrumental in planning and managing the development of Cary. Zoning regulations control the extent, amount, and location of hazardous materials and processes and therefore have assisted in controlling the fire flow requirement. Routine referral of zone change requests, site plans, special and conditional use permits, parcel maps, and when appropriate, environmental impact reports, make it possible for the Cary Fire Department to evaluate plans and requests and make recommendations which will enable adequate fire protection to be provided.

**RECOMMENDATIONS** - 1) Continue the present joint activities and cooperation between the Fire and Planning Departments. 2) Consideration of the fire flow requirement should be given to all applications and requests so that adequate fire protection requirements can be established in the very earliest stages of planning.

**3. ENGINEERING DEPARTMENT**

The Engineering Department provides considerable assistance to the Fire Department. This Department is responsible for engineering a water distribution system that provides adequate fire flows in all areas of Cary. Close cooperation between the Engineering Department, Department of Planning Development, and Fire Department assures that adequate mains and hydrants are installed by the developers. The Engineering Department also provides standards for street designs. Street designs affect the movement of fire apparatus, equipment, and vehicles.

**RECOMMENDATIONS** - 1) Continue to design a water supply system that can provide adequate fire flows in all areas of Cary. Every effort should be made to assure that there will be ample water available to satisfy the fire flow requirements established by the Fire Department. 2) Continue the very close working relationship between the Fire Department and Engineering Department. 3) Continue to assist in reviewing plans of new development to determine if main sizes, hydrant locations, and street designs are adequate.

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#### 4. PUBLIC WORKS DEPARTMENT

The Public Works Department also provides assistance to the Fire Department. This department maintains the water supply system, fire apparatus and vehicles, and streets for access. These activities are essential if a fire department is to provide adequate fire protection.

~~RECOMMENDATIONS~~ - 1) Continue the present joint activities and cooperation between the Fire and Public Works Departments.

#### 5. POLICE DEPARTMENT

The Police and Fire Departments have many areas of common interest. Primarily, they have the common interest of public safety. The Police Department provides assistance in many emergency situations such as: 1) traffic control at the scene of fires and rescues; 2) investigation at incendiary fires; 3) record checks; 4) interviewing witnesses and/or suspects; and 5) arrest and incarceration procedures.

~~RECOMMENDATIONS~~ - 1) Continue the close working relationship between the Police and Fire Departments.

#### 6. TOWN ATTORNEY

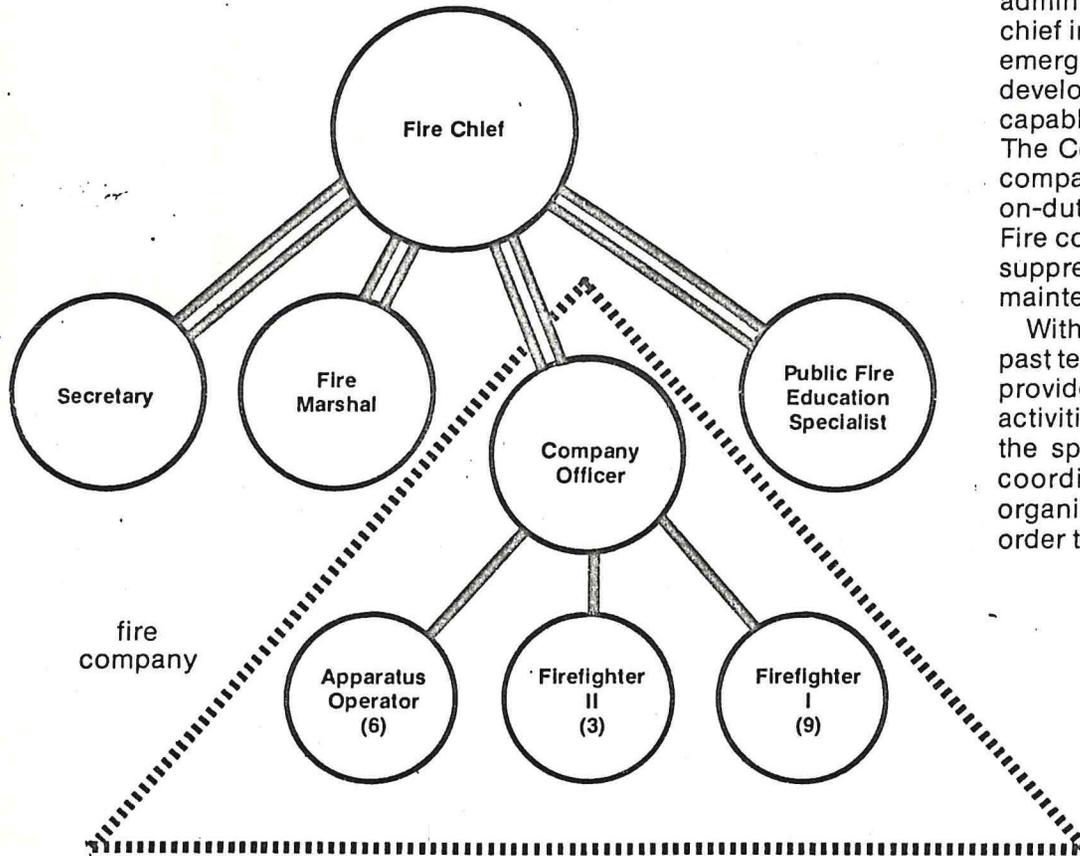
From time to time, the Fire Department needs legal assistance from the Town Attorney. This assistance from the Town Attorney's office includes advisement in recruitment policies, contract writing, interpretation of codes, ordinances, and laws and other miscellaneous legal problems.

~~RECOMMENDATIONS~~ - 1) Maintain a close liaison between the Town Attorney and the Fire Department. The Fire Department should continue to utilize advice and legal services of the Town Attorney's office in future planning and in day-to-day operations, especially as fire department activities increase.

~~RECOMMENDATIONS~~ - 1) The close working relationship between the Fire Department and all other Town departments should be maintained and improved where possible. 2) Improved communications between all departments should be fostered and the service rendered to the citizens of Cary continually evaluated. Through improved communications, methods of improving municipal service while eliminating duplication of services can be developed and implemented.

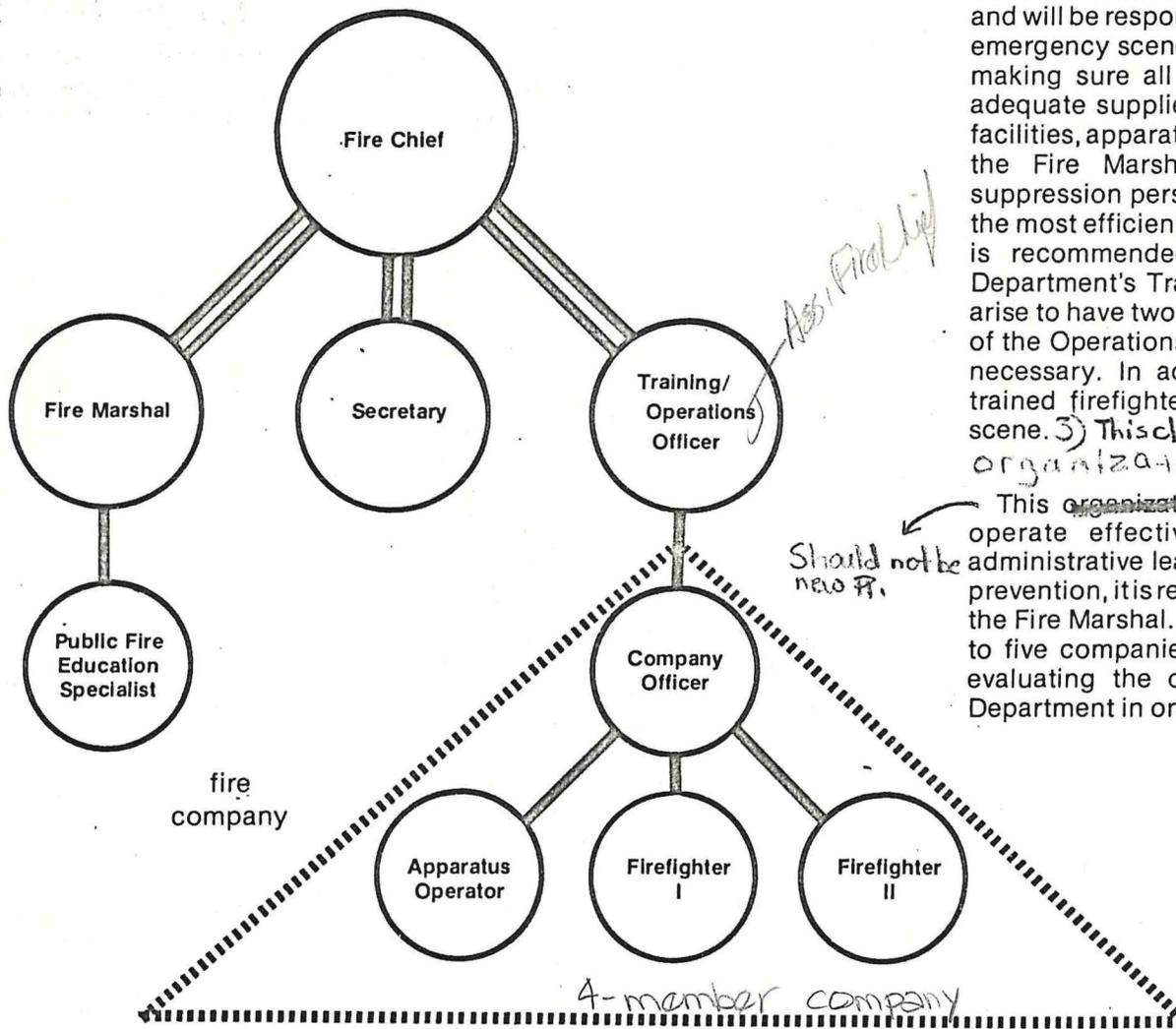
## 4. ADMINISTRATION & ORGANIZATION

In order for a fire department to provide adequate fire protection effectively and efficiently, it must be properly administered and organized. The Cary Fire Department has 28 authorized positions.



This organizational structure reflects a small fire department. The Fire Chief is the department head, serving as ranking administrative and fire combat officer. The Chief provides back up support to suppression forces on the emergency scene. Management responsibilities of the Chief include planning, budgeting, directing fire department personnel toward accomplishment of organizational goals, and evaluating progress. The Fire Marshal provides administrative assistance to the Fire Chief. The Marshal is in charge of the Fire Prevention Bureau and is the chief administrator for prevention activities. The Fire Marshal serves as acting chief in the Fire Chief's absence and also provides back up support on the emergency scene. The Public Fire Education Specialist is responsible for developing and presenting fire safety programs to the community and is capable of providing assistance at the emergency scene when necessary. The Company Officer, usually a captain, is the ranking position in a fire company. The duties of the Company Officer include the command of the on-duty fire company and the fire station to which the Officer is assigned. Fire company members perform a wide range of duties which include: 1) suppression activities, 2) training, 3) facility, apparatus, and equipment maintenance, 4) fire code enforcement, 5) rescue, and 6) salvage.

With the increase in fire department activities that has occurred over the past ten (10) years, it has become increasingly difficult for the Fire Chief to provide the necessary administrative leadership to the suppression activities of the Fire Department. Additional fire companies would exceed the span of control of the Fire Chief. The Chief needs assistance in coordinating emergency operations activities. Changes in the organizational structure of the Cary Fire Department are necessary in order to guarantee the continuation of adequate public fire protection.



**RECOMMENDATIONS**

1) Establish the position of Operations Officer prior to the time Engine 3 is activated. The Operations Officer will administer and coordinate operation activities with the company officers and will be responsible for the proficiency of fire suppression forces on the emergency scene. Other duties of the Operations Officer will include: 1) making sure all shifts have adequate manning levels; 2) maintaining adequate supplies for all stations; and 3) maintenance management of facilities, apparatus, and equipment. The Operations Officer will work with the Fire Marshal in coordinating fire prevention activities since suppression personnel participate in prevention activities. 2) To achieve the most efficient and effective utilization of fire department manpower, it is recommended that the Operations Officer also serves as the Department's Training Officer. As the Department grows, the need may arise to have two separate positions. Periodic evaluations of the activities of the Operations/Training Officer will determine if and when this will be necessary. In addition, the Operations/Training Officer should be a trained firefighter, capable of providing assistance at the emergency scene. 3) This chart (left) shows the recommended organizational structure.

This organizational structure enables the Cary Fire Department to operate effectively and efficiently and provides the necessary administrative leadership. Since public fire education is a function of fire prevention, it is recommended that this activity come under the direction of the Fire Marshal. 4) This fire department organization is suitable for three to five companies. Use this organizational structure as a guideline in evaluating the overall effectiveness and efficiency of the Cary Fire Department in order to determine when changes are needed.

RECOMMENDATION 3) ←  
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## B. PRIVATE & BUILT-IN FIRE PROTECTION

Community fire protection is a combination of public sector and private sector protection. This Subsection addresses private sector protection. The provision of adequate fire protection for the Town of Cary is directly affected by residential, commercial and industrial growth. As Cary develops, there is a corresponding demand for increased public fire protection. If the entire burden of the expenditure for increased public fire protection is placed on all taxpayers, they are in effect, subsidizing the fire protection for the developing areas. Though residential growth may require additional public fire protection, the greatest demands result from commercial and industrial developments. However, when considering the fact that business and industry brings in jobs and revenue, subsidizing the required additional public fire protection may be justified. Nevertheless, the requirement for additional public fire protection could be greatly reduced if the new commercial, industrial, and residential developments were provided with built-in fire protection. The cost of providing such protection is minimal compared to the cost for public fire protection and the intrinsic values, such as insurance savings and protection from business interruption, will often offset the cost to the business owner. In effect this approach utilizes a concept of dual responsibility, that is, adequate fire protection is furnished through contributions from both the public and private sectors.

As an alternative to an ever-increasing fire department, this Subsection of the Fire Protection and Management Plan provides recommendations which will encourage built-in and private fire protection and assure that new residential, commercial, and industrial developments are constructed without excessive fire potential. Such an approach will distribute the proportional cost among those receiving the immediate benefit.

### IMPACT OF COMMERCIAL & INDUSTRIAL FIRE LOSSES

Increased commercial and industrial growth is accompanied by a wide variety of ever increasing fire problems. Fire risks may be more severe due to various processes and product-related hazards. Growth projections for Cary show increased commercial and industrial developments. Attention to the particular fire problems in a given business, commercial, or industrial enterprise should receive consideration from within as well as close control by the public fire protection agency.

Fire losses are generally computed on a valuation of the damaged structure and contents. The total loss-value beyond this is difficult to assess. There are numerous indirect fire losses resulting from factors such as: 1) reduced income due to interruption of normal business flow; 2) cost of temporary housing, processing, or transporting; 3) increased replacement costs; 4) loss of items whose value cannot be monetarily calculated; and 5) work-product losses such as plans and records. These latent fire losses significantly contribute to the entire community fire loss reflected in tax revenues, fire insurance premiums, and the expense of maintaining the fire department. With increased commercial and industrial developments, the risk of these losses occurring will increase. It is essential that fire risks and problems are minimized.

### FIRE FLOW REQUIREMENT

Reiterating the premise introduced in Section 1 of this Comprehensive Plan, an essential component in determining adequate fire protection is establishing the capability of the Fire Department to control fires that develop beyond the incipient stage. A major consideration in making this determination is the fire flow requirement. That is, the amount of water required to control and extinguish a large fire in a particular building while providing adequate protection for the adjacent exposures. In determining the fire flow requirement of a building, consideration is given to the type of building construction, total floor area, hazardous nature of the occupancy, presence of automatic fire sprinkler systems, and exposure to nearby structures.

Cary's basic fire flow is 3,500 gpm. The Fire Department has the suppression capability to effectively apply a total fire flow of 4,000 gpm. If fire flow requirements of individual buildings increase, Cary's basic fire flow will increase. The higher the basic fire flow, the more fire apparatus and manpower required to handle the volume of water. The economic impact of personnel and apparatus increases is great. By controlling Cary's basic fire flow, Cary can limit the increasing costs of public fire protection as the Town continues to develop. The size of the Fire Department would not have to be increased. The exception to this would be if the time standards established in Section 1 of this Plan could not be met due to alarm frequency and the increased demand for fire protection.

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When it becomes evident that the standards are not being met, the need for additional response procedures and/or additional staffing levels and/or additional apparatus should be analyzed.

Limiting the basic fire flow to 4,000 gpm will not hinder town development. North Carolina Building Code requirements automatically keep fire flow requirements low in most new construction. By utilizing the various forms of built-in fire protection, developers will be able to limit the fire flow requirement while satisfying the needs of those who are to occupy the building. Business concerns will find the expenditures necessary to provide built-in protection can be amortized over a period of time through insurance savings. Additionally, the threat of business interruption and loss of life due to fire is almost totally eliminated.

**CONSIDERATIONS IN DETERMINING FIRE FLOW REQUIREMENT CONSTRUCTION**

The type of construction of a particular building, based on the combustible nature of the building fabrication, is significant in establishing the fire flow requirement for that structure. As construction type is upgraded from wood frame to ordinary to non-combustible to fire resistive, there is a corresponding reduction in the fire flow requirement. There is also a reduction in the risk of a fire of any size occurring.

Evaluation from a fire safety point of view requires attention to protection against vertical and horizontal fire spread, exposure fires, and provision of fire protection equipment sufficient to control anticipated fire conditions. Cary's Building Code and Fire Code will help to limit fire hazards, allowable floor areas, and ignition sources, thereby contributing to fire control. However, additional regulations will be necessary to limit the fire flow requirement to the protection capability of the fire department.

Fire resistive building construction alone does not guarantee safety to life and property. It is, however, one of several significant factors which can greatly assist in providing fire safety, and can considerably reduce the amount of water needed, and consequently the number of firefighters required for combating a structural fire.

**FIRELOADING AND OCCUPANCY HAZARD**

The occupancy of a building is an essential consideration in identifying fire protection needs. The fire hazard of a building is determined not only by the fire resistance of the structure, but also by the contents or process contained therein. The combustible contents and materials of construction in a given fire area is referred to as the fireloading, and can be measured by the number of pounds of combustibles per square foot of floor area. Potential fire severity is affected by fireloading, including not only materials of product, but also quantities of accumulated rubbish, dust, and improperly stored combustibles.

In recent years there has been an increasing tendency to upgrade the aesthetic effect and improve the acoustics in commercial and industrial buildings. An economical and practical means of accomplishing this has been through wide-spread use of plastic and foam materials. These materials significantly affect the probable fire spread within a structure. The combustible nature of contents within a structure affect the fire risk. For example, steel furniture has a low probability of contributing to the fireload, whereas wood furniture contributes substantially to the rate of fire build up.

Combustible finish material is also a source of fuel. It is noted that paints or wallpapers in unusual thicknesses have contributed significantly to fire spread during many structural fires. Acoustical materials vary from highly combustible fibrous materials to non-combustible plaster or metal. Also of concern is the use of insulation materials, plywoods, veneers, cemented tiles, carpeting, draperies and other decorative fabrics. In many cases, the combustibility of finish materials can be reduced by the application of a fire-retardant coating.

The fire flow for a given building may be reduced or increased as much as 25 percent depending on the type of fireloading or occupancy. Since a portion of the fire flow requirement is based upon the fireload and the nature of the occupancy, industry and business can play a significant role in reducing the fire flow requirement through good internal fire prevention, safe handling and storage of hazardous materials, and maintaining storage to a minimum operating level.

**SPRINKLERS**

Automatic sprinkler systems are the most effective means of controlling fires in buildings. Their ability to apply relatively small quantities of water promptly and directly to the fire area produces a most effective use of water and accounts for their outstanding record in preventing serious fire damage. In industrial occupancies, a principal factor in both life safety and property protection through control of fire spread has been the use of automatic sprinkler protection. According to the NFPA (National Fire Protection Association), only a very small percentage of the large loss fires have occurred in buildings equipped with sprinkler systems. A properly installed system will generate less water damage than the application of hose streams by firefighters. Also, smoke, toxic gases and reduced visibility do not hamper their operation.

Sprinkler systems provide an efficient means of attacking a fire in its incipient stage. Additionally, the system can be fully supervised, that is, an alarm system may be attached so that operation of any valve or flow of water will immediately and automatically notify an alarm receiving center, or the Fire Department.

Provision of fire sprinklers has the greatest effect on reducing the fire flow requirement. If a building is equipped with a fully supervised sprinkler system, the fire flow requirement can be reduced by 50 percent. This reduction in the fire flow requirement reduces the demand for public fire protection. In addition, the provision of sprinkler systems greatly reduces the frequency of demand for multiple fire company response and the corresponding demand for an ever increasing fire department.

Fire loss in industrial and commercial properties where sprinklers are installed shows a much lower loss value than those properties not so equipped. In addition to the saving in direct fire losses, there is a savings represented by freedom from business interruption. The savings in insurance costs often make the expenditure for automatic sprinklers a wise investment.

Of equal importance are the many building code alternatives allowed when sprinklers are installed. These alternatives allow for an increase in undivided area and less fire resistance in the building construction. Omission of automatic sprinkler systems imposes upon the building designer more stringent rules regarding compartmentalization, use of fire resistive materials, and exterior design requirements.

Automatic sprinkler systems provide a reliable means of providing for life safety as well as property protection. Unnecessary life loss can be prevented by a more extensive use of sprinkler protection.

#### EXPOSURES

Neighboring structures to a building are referred to as exposures. Depending on the distance of separation between other buildings, type of construction and openings in the walls (such as windows and doors), the fire flow requirement of a building may be increased as much as 25 percent per side up to a maximum of 75 percent. To reduce this high fire flow requirement and the potential adverse economic effect of demanding greater public fire protection, the builder could: 1) increase the degree of fire resistive construction; 2) reduce the areas of exposures by compartmentalization with fire resistive walls; 3) eliminate openings in the building adjacent to close exposures; 4) install automatic sprinklers; or 5) locate the proposed new building more distant from the exposures. Such alternatives provide builders with the opportunity to choose the fire protection method or combination of methods which are the most economical and practical for their particular needs. In addition, the Fire Department is not presented a fire spread potential capable of over-taxing the Department's suppression capability.

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**RECOMMENDATIONS** - 1) Adopt an ordinance limiting the computed required fire flow for any single structure to 4,000 gpm. Such an ordinance would require that prior to a building permit being issued, information be submitted that would enable the Department of Planning and Development (Inspections Division) and Fire Department to determine the fire flow requirement of a building using ISO's "Guide for Determination of Required Fire Flow." The ordinance would specify that if the required fire flow of a particular building is determined to be over 4,000 gpm, the fire flow requirement must be reduced as a prerequisite to building permit issuance. A provision for the granting of a variance by the Town Council could be included in the ordinance. Adoption of this ordinance would limit the Town's basic fire flow to 4,000 gpm thereby limiting the rising costs of public fire protection and increasing the overall effectiveness of this Comprehensive Plan. In order for this ordinance to be effective, it is recommended that the Town Council give the Fire Department authority to review plans and make inspections within the Town limits and its two mile extraterritorial jurisdiction. 2) Encourage architects, designers, planners and builders to install fire suppression systems and/or built-in fire protection in all buildings where not required by Cary's Building Code. 3) Strictly enforce the Building and Fire Codes as a way to control fire flow requirements. 4) Provide businesses and industries with educational material which will bring to their attention ways to reduce fire flow requirements.

#### FIRE RISK STRUCTURES IN CARY

There are areas in Cary with buildings that constitute a serious fire potential. An example would be the downtown area of Cary where there are buildings that were built prior to present building code regulations. These buildings or structures, plus others throughout Cary, have high fire flow requirements. They present a serious potential life hazard, especially places of public assemblage. In addition, houses built prior to January 1, 1978, were not required to have warning devices. These houses, if early warning devices have not been installed, also present a greater fire risk. - These areas of Cary must receive strong surveillance by the Fire Department to see that all applicable fire codes are strictly enforced. Fire personnel must individually assess these occupancies to determine the extent of life and fire hazards. From this assessment, building owners and occupants should be provided recommendations and suggested measures that could be taken to improve life safety in their buildings. The advantages of improved life safety conditions should also be brought to the attention of owners and occupants further encouraging their cooperation in providing improvements.

**RECOMMENDATIONS** - 1) Individually assess high fire risk buildings or structures to determine the extent of life hazard. Notices of Fire and Building Code violations, recommendations and measures that could be taken to improve life safety should then be brought to the attention of the owner(s) and their occupants, where applicable.

#### **PROTECTION OF HAZARDOUS PROCESSES**

In addition to providing built-in fire protection, the potential for loss of life and property can be greatly reduced by providing fire suppression systems to protect industrial processes utilizing highly combustible materials, flammable liquids and hazardous chemicals. Furthermore, equipment and appliances, such as paint spray booths and restaurant range hoods, can have suppression systems installed and thereby localize the fire potential and prevent exposure to the remainder of the facility.

Depending on the type of process being protected, fire suppression systems utilize a variety of extinguishing agents, including dry chemical, carbon dioxide, halons and water spray. These systems may be prepackaged to protect a common hazardous process or especially engineered for hazardous processes which are unusual or difficult to protect.

**RECOMMENDATIONS** - 1) Provide business and industry owners with educational material which will bring to their attention the availability and advantage of fire suppression systems. 2) Through education and code requirement, encourage the installation of fire suppression systems to protect processes and equipment that present a serious fire or explosion threat to life and property.

#### **MULTI-STORY & HIGHRISE STRUCTURES**

Highrise buildings present a set of inherent fire problems which are discernible from other structural forms. The fire flow requirement, while establishing the amount of water necessary to control and extinguish a large fire in a given building, does not adequately address equipment and manpower needs essential for rescue and fire suppression in a highrise structure. It is conceivable that a multi-story building may have a fire flow requirement below 3000 gpm because of the required fire resistive construction and automatic fire sprinklers. Calculating the fire flow requirement does not include consideration of life safety hazards, accessibility to all areas within a building, or the ease of difficulty with which firefighting and rescue operations may be conducted. This low fire flow usually requires less manpower and apparatus. In reality, combating a highrise fire can demand many personnel, and because of the excessive and strenuous physical activity, replacement personnel are also needed

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within relatively short periods of time. Volunteer firefighters and mutual-aid agreements are essential in fighting a highrise fire effectively and efficiently.

The primary objective of fire protection is the prevention of injury and loss of life by fire. Of critical concern in highrise buildings, is the ability to rescue or evacuate occupants. Evacuating large numbers requires organization, direction, and control, and an adequate number of fire department personnel and apparatus.

Features of highrise construction demand that a fire be fought from within. Because of the height of these buildings, the use of ladders and aerial equipment is severely limited. Gaining access to the fire is often very difficult. Location of the area of fire origin is not always immediately determinable. In a highrise building, firefighters may have to check several floors and numerous rooms before locating the area of fire origin. Firefighters usually are not able to use elevators for their transport and are required to climb numerous flights of stairs weighted down with heavy equipment. A firefighter who has climbed six flights of stairs while carrying forty pounds of hose plus the additional weight of breathing apparatus and protective clothing, is excessively fatigued before ever beginning actual attack on the fire. Stairways must also be used for occupant evacuation and there is always the possibility of panic-stricken people trying to escape down a stairway in which fire department personnel are carrying hose and equipment to upper floors.

Communication among fire department personnel is much more difficult in a highrise fire. Without the assistance of radio equipment or other mechanical means of communication, considerable delays in firefighting procedures can occur. Even with the use of portable radio equipment, the concrete and steel construction can interfere with communication.

**RECOMMENDATIONS** - 1) Strictly enforce the N. C. Building Code requirements for highrise buildings. 2) Encourage architects, designers, planners and builders to place a strong emphasis on fire safety features in multi-story and highrise buildings. 3) Emphasize highrise firefighting techniques in the Fire Department's training program. 4) Provide fire emergency procedure training for occupants of all multi-story and highrise buildings. 5) In order for the Cary Fire Department to provide adequate manpower and apparatus at the fire scene of a highrise building, it is recommended that the mutual aid program and volunteer firefighters program be maintained.

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### WARNING DEVICES

The installation of fire suppression systems and the provision of built-in fire protection will prevent or limit the spread of fire, however, an even greater degree of safety would be provided building occupants if warning devices are installed to alert them of hazardous conditions.

History has shown that many fires resulting in large life loss were in a stage of buildup for an extended period of time before being detected. Had smoke or heat detectors been appropriately located, occupants could have been warned and safely evacuated.

As stated in Section 1 of this Plan, the early minutes of a fire are most critical because in this incipient stage, control is usually easily gained. Given a few minutes without detection, fires involving even ordinary combustible material may gain sufficient headway to make extinguishment difficult. Furthermore, when crowded conditions prevail, such fires become threatening to the safety of occupants and often result in a panic.

Warning devices can also be utilized to detect many hazardous conditions in addition to sensing heat and smoke. For example, devices can detect improper conditions in processes, malfunctioning of equipment, improper levels or pressures in containers or vessels and the incorrect operation of controls or valves. When tied to central supervised control panels or the fire department alarm center, immediate and appropriate action can be taken. In addition, warning devices can be called as initiators for independent corrective action, such as correcting pressure, shutting down processes or activating fire suppression or sprinkler systems.

As important as warning devices are to the safety of occupants of industrial and commercial establishments and in places of public confluence, in no area are they as essential as in the home. Fire authorities estimate that over 50 percent of the 12,000 lives lost from fire each year

could be saved if smoke detectors were installed in all dwelling units. With the price of such units within the means of most families, every effort should be made to encourage their purchase, where not required by the Town's Building Code.

### RECOMMENDATIONS

1) Develop educational material that will provide business owners with an understanding of the various warning devices that can be utilized and how they can reduce the threat of life and property loss. 2) Encourage all occupancies that are not required to install warning devices to install them. 3) Strictly enforce Town codes requiring the installation of early warning devices. 4) Develop and present educational programs which will motivate all members of the community to install smoke detectors in the homes, where not required.

### FIRE SAFETY THROUGH INDIVIDUAL COMMUNITY MEMBERS

The previous portions of this Plan have focused on setting public fire protection standards, maximizing the effectiveness and efficiency of the Fire Department and establishing regulations which will reduce the potential of fire spread. Of equal or greater importance to these considerations is the effect that the individual members of the community can have on reducing fire loss. Undoubtedly, the greatest impact that can be made on the prevention of fire is to educate those who work or reside in Cary so that they develop a consciousness of fire safety and are able to identify hazardous conditions around their homes and places of employment.

### RECOMMENDATIONS

1) Develop educational programs which will succeed in communicating the message of fire prevention to everyone in Cary. 2) Provide special instruction to occupants of multi-story buildings so that they will know the correct procedures to follow in reporting a fire, appropriate action to take during an emergency and how to egress rapidly and safely from the building.

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costs &  
funding

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# COSTS & FUNDING

## 1. COSTS

A major component of this Comprehensive Fire Prevention and Management Plan is the cost of implementing the recommendations in this Plan. These costs can be divided into four areas; a) acquisition, b) development, c) personnel, and d) capital outlay equipment. An inflation rate of 12% was used in projecting these costs.

### ACQUISITION

Advance site acquisition is desirable for several reasons. Beginning the process of establishing future stations now will enable Cary to adequately protect future urbanized areas. Availability of suitable sites will constantly diminish as urbanization progresses. Increased development will also result in rising property values. In order to guarantee the purchase of the sites recommended in this Plan, advance site acquisition is needed. -

#### Acquisition Costs

1980	Fire Station 3: 1/2 acre	\$ 5,000.00
1980	Fire Station 4: 2 acres	11,000.00
1980	Relocation of Fire Station 1: 1/2 acre	5,000.00
1980	Fire Station 2 (addition):	15,000.00
<b>TOTAL ACQUISITION COSTS</b>		<b>\$ 36,000.00</b>

Note: These costs reflect current prices.

## DEVELOPMENT

With the land already purchased for future fire stations, Cary will be ready for future station construction when it is needed. The following costs are based on the costs to develop similar fire stations today and add-on inflationary figures.

Date	Development	Cost of Facility
1981	Fire Station 3: 5,000 sq. ft. @ \$70/sq. ft. (New, Two Company)	\$ 392,000.00
1986	Fire Station 4: 5,700 sq. ft. @ \$70/sq. ft. (New, Two Company/Training facility)	686,280.00
	Training Tower: 3 stories, 297 sq. ft. @ \$50/sq. ft.	25,800.00
1990	Fire Station 1: 5,000 sq. ft. @ \$70/sq. ft. (Relocate, Two Company)	770,000.00
1990	Fire Station 2: 650 sq. ft. @ \$65/sq. ft. (Addition, Administrative Offices)	88,660.00
<b>TOTAL DEVELOPMENT COSTS</b>		<b>\$1,962,740.00</b>

Note: 1. Per square foot cost includes total project cost.

2. Improvement costs for existing fire stations will come under the annual capital budget for the Fire Department.

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← PERSONNEL

Year	Engine Companies	Cost
1980	Engine 2: Firefighter (1)	\$ 10,920.00
1981	Engine 3: Captain (3)	51,647.23
	Firefighter/Driver (3)	42,422.02
	Firefighter (4)	48,921.60
1986	Engine 4: Captain (3)	79,315.39
	Firefighter/Driver (3)	65,148.10
	Firefighter (4)	75,129.60
1990	Engine 3: Firefighter (2)	48,048.00
1995	Engine 4: Firefighter (2)	58,531.20
<b>Total Cost</b>		<b>\$ 480,083.14</b>

Year	Truck Company	Cost
1981	Truck 6 Firefighter (3)	36,691.20
1986	Firefighter (3)	56,347.20
1990	Firefighter (3)	72,072.00
<b>Total Cost</b>		<b>\$ 165,110.40</b>

Date	Additional Personnel	Cost
1980	Training/Operations Officer (1)	16,140.00
1983	Fire Inspector (1)	14,851.20
<b>Total Cost</b>		<b>\$ 30,991.20</b>

**TOTAL PERSONNEL COSTS \$ 676,184.74**

Note: These costs reflect current prices and take into account inflation during the time period we are dealing with.

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**CAPITAL OUTLAY EQUIPMENT**

Replacement Schedule for Apparatus

Date	Apparatus	Cost
1981	Engine 4	\$ 89,600.00
1984	Engine 2	118,400.00
1986	Truck 6	334,000.00
1987	Truck 9	40,480.00
1990	Engine 1	176,000.00
1994	Engine 3	214,400.00
<b>Total Apparatus Cost</b>		<b>\$ 972,880.00</b>

Replacement Schedule for Vehicles

Date	Vehicle	Cost
1980	Car 1	5,635.00
1980	Car 2	5,635.00
1981	Car 3	5,600.00
<b>Additional Vehicles</b>		
Date	Vehicle	Cost
1981	Car 4	6,311.20
<b>Total Vehicle Cost</b>		<b>23,181.20</b>

**TOTAL CAPITAL OUTLAY EQUIPMENT COSTS \$ 996,061.20**

Note: These costs also reflect current prices and take into account inflation.

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Specific dates may vary for development, personnel and capital outlay equipment costs. Facility development and personnel levels are based on Cary's growth projections and projected fire situation. If these projections are not met, development and personnel increases will be delayed until the need arises. Periodic reviews of Cary's growth patterns and fire situation will determine when facilities will be developed and personnel levels increased.

The replacement schedule for fire apparatus and vehicles can vary. Fire pumpers and trucks should be individually assessed before they are replaced. Annual service tests will determine the condition of all fire apparatus. If the assessment indicates that the pumper or truck is still adequate, service may be continued beyond the replacement date with periodic reassessments to determine reliability and adequacy. The same holds true for fire department vehicles.

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**YEAR BY YEAR TOTAL COSTS**

The total costs for acquisition, development, personnel and capital outlay equipment for the coming twenty years are shown below:

Year	Acquisition Costs	Development Costs	Personnel Costs	Capital Outlay Equipment Costs	Total
1980	\$ 36,000.00 <sup>1</sup>	\$	\$27,060.00 <sup>2</sup>	\$ 11,270.00 <sup>3</sup>	\$ 74,330.00
1981		392,000.00 (bond)	179,682.05 <sup>4</sup>	101,511.20 <sup>5</sup>	673,193.25
1982					
1983			14,851.20		14,851.20
1984				118,400.00	118,400.00
1985					
1986		712,080.00 <sup>6</sup>	275,940.29 <sup>7</sup>	334,000.00	1,322,020.29
1987				40,480.00	40,480.00
1988					
1989					
1990		858,660.00 <sup>8</sup>	120,120.00 <sup>9</sup>	176,000.00	1,154,780.00
1991					
1992					
1993					
1994				214,400.00	214,400.00
1995			58,531.20 <sup>10</sup>		58,531.20
	<u>\$ 36,000.00</u>	<u>\$1,962,740.00</u>	<u>\$676,184.74</u>	<u>\$996,061.20</u>	<u>\$3,670,985.94</u>

**Note:**

1 -	\$ 5,000.00	Site for Station 3	3 -	\$ 5,635.00	Car 1
	11,000.00	Site for Station 4		5,635.00	Car 2
	5,000.00	Site for Relocation of Station 1		\$ 11,270.00	
	<u>15,000.00</u>	Site for Station 2 Addition			
	\$ 36,000.00				
2 -	\$ 10,920.00	Firefighter (1) Engine 2			
	<u>16,140.00</u>	Training/Operations Officer (1)			
	\$ 27,060.00				

4 -	\$ 51,647.23	Captain (3)	}	
	42,422.02	Firefighter/Driver (3)		Engine 3
	48,921.60	Firefighter (4)		
	<u>36,691.20</u>	Firefighter (3)		Truck 6
	\$179,682.05			
5 -	\$ 89,600.00	Engine 4		
	5,600.00	Car 3		
	<u>6,311.20</u>	Car 4		
	\$101,511.20			
6 -	\$686,280.00	Fire Station 4		
	<u>25,800.00</u>	Training Tower		
	\$712,080.00			
7 -	\$ 79,315.39	Captain (3)	}	
	65,148.10	Firefighter/Driver (3)		Engine 4
	75,129.60	Firefighter (4)		
	<u>56,347.20</u>	Firefighter (3)		Truck 6
	\$275,940.29			
8 -	\$770,000.00	Relocation of Fire Station 1		
	<u>88,660.00</u>	Administrative Offices-Station 2		
	\$858,660.00			
9 -	\$ 48,048.00	Firefighter (2)		Engine 3
	<u>72,072.00</u>	Firefighter (3)		Truck 6
	\$120,120.00			
10 -	\$ 58,531.20	Firefighter (2)		Engine 4

**2. FUNDING**

Consideration must be given to the sources of monies to pay for this fire department package. Through good fiscal management and capital improvements budgeting, funds can be escrowed yearly to pay for this package. A bond referendum has already been passed for the development of Fire Station 3. This should be the only bond referendum needed if good fiscal management is practiced.

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section 4  
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Recommendations

Summary of  
Recommendations

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- 2. Maintain the capability of dispatching fire companies within 60 seconds after receipt of alarm. 9
- 3. 1) Establish a maximum response time of four (4) minutes for first-due engine companies with a deviation of  $\pm$  one (1) minute depending on the fire risk category in order to control fires in their incipency. 2) Determine future fire station locations through studies considering the response time necessary for the required number of fire companies to travel from the station site to the various fire risk categories within Cary's fire service delivery areas. 9
- 4. Maintain the capability of setting up the first-due level of fire suppression capability within four (4) minutes of the time of arrival at the fire scene. 9

# SUMMARY OF RECOMMENDATIONS

In essence, the recommendations which follow summarize the material presented in each section. The page numbers of the portions in the main text which support the recommendations are noted.

## ESTABLISHING ADEQUATE PROTECTION SECTION I

- 1. Place a strong emphasis on fire prevention management activities as a means of reducing the loss of life and property from fire through all divisions of the Fire Department. 6
- 2. Maintain the capability of applying an extinguishing agent to a fire in any area of the Town within nine (9) minutes from receipt of the alarm. This objective will allow one (1) minute for dispatch, four (4) minutes for response and four (4) minutes for set up of the first-due fire suppression equipment. The four (4) minute response time will vary  $\pm$  one (1) minute, depending on the fire hazard category. 34
- 3. Determine future fire station locations through studies considering the response time necessary for the required number of fire companies to travel from the station site to the various fire risk categories within Cary's fire service delivery areas. 9
- 4. Using the established criteria for response time, four (4) stations are needed to provide adequate fire protection to Cary for the next twenty

(20) years, depending on the rate of annexation. The phasing schedule for these four (4) stations is:

- 5. PHASE I (1980-1985) a. A southern station located at the intersection of Kildaire Farm Road (S/R 1300) and Apex-Macedonia Road (S/R 1009) to be operational no later than 1981 (Station 3). b. Completion of the southern portion of the Cary Parkway. Completion of Greenwood Circle and extension of Kingston Ridge Road to Seabrook Avenue. c. Acquisition of sites for Station 4 and relocation of Station. 25
- 6. PHASE II (1985-1990) a. A western station located at the southern intersection of Old Apex Road (S/R 1616) and Old U.S. 1 and 64 (S/R 1001) to be operational no later than 1986 (Station 4). b. Continuation of thoroughfare improvements. 31
- 7. PHASE III (1990-2000+) a. The relocation of Station 1 to a site at the intersection of North Harrison Avenue and Maynard Road to be operational no later than 1990 (relocated Station 1). b. Continuation of thoroughfare improvements. Station 2 is the existing station near the intersection of Maynard Road and Walnut Street. 35
- 8. Four (4) engine companies and one (1) truck company are needed to adequately protect Cary for the next twenty (20) years. Locate one (1) engine company at each present and proposed fire station. 36
- 9. Manning levels will reflect the type of structural fire and fire flow requirements in a company's response area. 37
- 10. Establish minimum manning levels for fire companies as follows: 37
  - 1) No engine company shall be assigned less than a three (3) member company. 37
  - 2) Engine 1, Station 1 (includes Central Business District): four (4) members.
  - 3) Engine 2, Station 2: three (3) member company with one (1) additional member needed to rotate to all three shifts to fill vacancies created by members taking vacation time, holidays, sick leave or compensatory time (1981).
  - 4) Engine 3, Station 3: four (4) member company to be reached in stages:
    - 1981 - three (3) member company, plus one (1) additional member needed to rotate to all three shifts to fill vacancies.
    - 1990 - four (4) member company
  - 5) Engine 4, Station 4: four (4) member company to be reached in stages:
    - 1986 - three (3) member company, plus one (1) additional member needed to rotate to all three shifts to fill vacancies.
    - 1995 - four (4) member company

page

## SECTION II COMMUNITY FIRE PROTECTION

### A. ~~Fire Protection by the Public Sector~~ The Fire Department; Public Sector

#### FIRE PREVENTION

1. Inspection and Code Enforcement 43
  - 1) Put the Fire Marshal in charge of the code enforcement and inspection program.
  - 2) Add another member to the Bureau by 1983 whose primary job will be to make inspections and enforce the Fire Prevention Code.
  - 3) Utilize fire company personnel in making fire department inspections.
  - 4) Adopt portions of the National Fire Protection Association's NATIONAL FIRE CODES. Form a committee to decide which volumes of the code to adopt.
  - 5) Keep records of code enforcement and inspection findings.
  - 6) Make inspections during times when fire alarms are lower since suppression personnel are involved in fire prevention activities.
2. Public Fire Education 44
  - 1) Continue to emphasize the important role public fire education plays in fire prevention and fire reaction.
  - 2) Stress the need for citizen participation in fire prevention education.
  - 3) Place the Fire Education Program under the supervision of the Fire Marshal.
  - 4) Develop a record keeping system for public fire education activities.
3. Fire Cause Investigations 45
  - 1) Place fire cause investigations under the supervision of the Fire Marshal.
  - 2) Train all fire company personnel in identifying fire causes.
  - 3) Form a special fire cause investigating unit consisting of the Fire Marshal and three company officers. Design the work schedule of the unit so that one (1) investigator is on duty at all times. Each member will complete a comprehensive fire cause investigation training program.
  - 4) Develop liaison with other investigating, law enforcement and prosecuting agencies.
  - 5) Develop a record keeping system for fire cause investigations. Collect, correlate and disseminate the results of fire investigations.

6) Truck company - a four (4) member company to be reached in stages:

- 1981 - two (2) member company
- 1986 - three (3) member company
- 1990 - four (4) member company

1. Require all fire department personnel who are not assigned to a particular engine or truck company and are trained firefighters to respond to fire calls and provide assistance. 36  
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2. Continue to locate truck company at Station 2. 38 39
3. Locate apparatus with sufficient personnel to meet the standards in Section 1. Specific dates may vary since they are based on Cary's growth projections and projected fire situation. Periodic reviews of Cary's growth patterns and fire situation will determine specific dates. 38 39
4. Place a strong emphasis on an effective fire data system as a means of reducing the loss of life and property from fire and as a means of establishing an effective and efficient fire department. Review the data periodically to evaluate the ability of the Fire Department to meet the standards established in this document. When it becomes evident that standards are not being met, data should be analyzed to determine the reasons why. Recommendations should then be presented for consideration. 40 41
5. Use ISO grading standards as a guideline in determining and evaluating adequate fire protection for Cary. After the Town is regraded by ISO, review the grading report to determine the practicality of the recommendations included therein. 40  
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4. Additional Fire Prevention Recommendations

- 1) Keep accurate records of all fire prevention activities.
- 2) Develop an inspection priority system.
- 3) Change the Primary Fire Limits to include only those areas zoned B-1. Form a committee to study the need for establishing secondary fire limits.
- 4) Establish the Fire Marshal as supervisor of all fire prevention activities.
- 5) Locate the Fire Prevention Bureau, the Fire Marshal and Public Fire Educator at a centrally located fire station.

EMERGENCY OPERATIONS

5. Communications and Fire Alarm

a. The Communications Center

- 1) Employ an adequate number of dispatchers to maintain one (1) dispatcher on duty at all times.
- 2) Develop a comprehensive training program for dispatchers.
- 3) Retain the Center at its present location with expanding facilities.
- 4) Examine the possibility of utilizing the town's computer in dispatching operations to improve the overall efficiency of the Center.
- 5) Provide the Center with adequate equipment.
- 6) Develop a radio equipment maintenance program.
- 7) Continuously review and assess the activities of the Center.

b. Fire Alarm Reporting System

- 1) Continue to offer public fire education programs in the proper procedures to follow after detecting an emergency.
- 2) Emphasize the benefits of 911.
- 3) Annually review this system.

6. ~~Present~~ Suppression Manpower Assignments

a. Paid Suppression Manpower Positions

- 1) Assign sufficient personnel to meet the standards established in Section I of this Plan.

b. Volunteer Firefighters

- 1) Maintain the volunteer suppression force.
- 2) Require volunteer firefighters to meet basically the same qualifications that paid suppression personnel must meet.
- 3) Require volunteers to go through a suppression training program.
- 4) Annually review the activities of the force.

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- 7. ~~Effective and Efficient~~ Utilization of Suppression Manpower
  - 1) Utilize fire suppression personnel in fire prevention activities.
  - 2) Schedule inspections made by fire company personnel in their geographic response area and concentrate them during months that have fewer fire alarms.
  - 3) Annually review the programming of inspections to make certain that occupancies are receiving a frequency of inspection commensurate with the degree of hazard.
  - 4) Develop a comprehensive training program.
  - 5) Constantly study and review apparatus, equipment and innovative fire attack concepts so as to acquire and develop the most capable attack force for dollar investment.
  - 6) Maintain volunteer firefighters.
- 8. Facilities and Fire Station Locations
  - 1) Design and build cost-effective and efficient fire stations designed for flexibility and adaptability to change. Use DESIGN OF FIRE STATIONS INFORMATION BULLETIN NO. 278, THE NATIONAL BOARD OF FIRE UNDERWRITERS SPECIAL INTEREST BULLETIN 175 AND 176, and energy efficient designs as guides to the design of fire station facilities.
  - 2) Design the building facade to reflect the character of the neighborhood it is located in.
  - 3) Stress long-term or life cycle savings.
  - 4) Develop one or more basic fire station designs which can be used repetitively at more than one site. This does not limit, however, the

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need for some additional architectural and engineering services at specific sites.

5) The recommendations for the individual stations are as follows:

Fire Station 1 - a. Relocate. b. Until relocation occurs, install commercial grade carpeting throughout the living areas, add lockers, repair floor cracks and improve insulation. b. Relocate administrative offices when station relocation occurs. c. Purchase property at the intersection of North Harrison Avenue and Maynard Road to build a two (2) company station.

Fire Station 2 - a. Widen front apron. b. When Station 1 is relocated, put administrative offices at Station 2. Additional property will need to be acquired.

Fire Station 3 - a. Purchase property to locate a two (2) company fire station at the intersection of Kildaire Farm Road (S/R 1300) and Apex-Macedonia Road (S/R 1009).

Fire Station 4 - a. Locate a two (2) company fire station with a training facility at the southern intersection of Old Apex Road (S/R 1616) and Old U.S. 1 and 64 (S/R 1001).

6) Purchase a minimum of ½ acre for proposed fire station sites. Size may vary depending on the activities to be performed at the facility and its location.

7) Develop a schedule for correcting deficiencies in existing stations so that all stations will provide a good atmosphere in which to work and to be conducive to a high level of morale.

8) Conduct an update of street additions and improvements in conjunction with a review and update of Cary's fire situation and station location program to keep abreast of town development and to provide data for fire planning.

9) Acquire land for additional fire stations in advance.

#### 9. Fire Apparatus

1) Schedule all fire pumpers and trucks for removal from first run assignment after twenty (20) years of service. Assign pumpers and trucks to reserve status for an additional five (5) years. Even though the fire apparatus is scheduled for replacement, each apparatus should be individually assessed and maintenance records reviewed before it is removed from first run assignment. If the assessment indicates that the apparatus is still adequate, first run service may be continued with an annual reassessment to determine reliability and adequacy. The same holds true for determining the length of reserve status. The schedule of replacement and reserve status for all other fire apparatus will depend on their reliability, adequacy and efficiency. Periodic checks will determine when replacement or reserve status is necessary.

Leave out.

2) A chart showing removal from front line service and reserve status is provided on this proposed Plan. It is recommended that this schedule be reviewed and updated annually since dates may change due to condition of apparatus.

3) Use the NATIONAL FIRE PROTECTION ASSOCIATION STANDARD NO. 1901 as a guideline when purchasing new fire apparatus and evaluating existing fire apparatus.

4) Constantly maintain all fire apparatus in a safe and excellent operating condition.

5) Examine both commercial and custom-made fire apparatus before purchasing new fire apparatus.

6) Examine the need for specialized apparatus and/or changes in existing apparatus.

7) Rotate fire apparatus to cut down on maintenance costs.

8) Keep complete records of operation and maintenance costs by apparatus.

9) Review the Town's fire situation, alarm frequency, and basic fire flow to determine when and if additional fire apparatus will be needed.

#### 10. Vehicles

1) Develop a replacement schedule that will obtain maximum value from the vehicles.

2) Continuously evaluate the vehicle assignments so as to provide the proper type and adequate number of vehicles to maximize the efficiency of the personnel.

3) Replace each vehicle with energy efficient compacts where possible.

4) Add a fourth vehicle for the education/training program by the time Station 3 is operational, 1981.

5) A schedule for vehicle replacement is provided in this proposed document. It is recommended that this schedule be reviewed and updated annually.

#### 11. Mutual Aid

1) Develop and maintain mutual aid and outside response programs with nearby fire departments in order to provide adequate fire protection during all emergency situations.

2) Continually evaluate the program.

3) Conduct quarterly training sessions with the designated mutual aid fire departments to assure that all fire companies operate efficiently as a team.

#### 12. Water Supply and Distribution System

1) Identify individual deficiencies in distribution piping network,

prepare construction plans, and schedule corrective operations.

2) Procure, through contract revision or development of alternative water sources, a supply of treated water adequate to meet the combined demands of anticipated maximum day usage and basic fire flow requirement.

3) Continually evaluate and upgrade the system to ensure that all elements of the system remain adequate to serve the Town's ever increasing demands.

13. Corporate Limits

1) Make adjustments, where necessary, in the Town's corporate limits to enable fire companies to arrive at the emergency scene quickly.

SUPPORT SERVICES

14. Training and Education

a. Training Personnel

1) Establish a position in the Cary Fire Department of Training Officer prior to the time Engine 3 is activated, 1980. Primary responsibility will be development and implementation of the training program.

2) Dispatch the Training Officer to fire emergencies as determined by the Fire Chief.

b. Developing a Training and Education Program

1) Develop a training program based on the diagram on page 68.

2) Adopt NFPA 1001 FIREFIGHTER PROFESSIONAL QUALIFICATIONS.

c. The Scheduling of the Program

1) The Training Officer is responsible for preparing a training schedule for drills, formal training classes, and outside education classes.

d. Training and Education Program Records

1) Develop a system for recording information on training and education completed which will identify the individual member's progress and areas of training need.

2) Keep daily training records.

e. Training Facilities

1) Develop a training facility in conjunction with Station 4.

15. Physical Fitness

1) Study job stresses of the firefighter to improve the work environment.

2) Establish a required fitness program to assist the individual members in developing and maintaining good physical condition.

3) Maintain individual fitness records and assign an officer the

responsibility of evaluating these records so as to keep abreast of the progress or decline of each member.

16. Data Collection

1) Develop, implement, and maintain a data collection system which can be used for future fire planning, continual evaluation of fire department progress and to update the recommendations in this Plan. Utilize the Town's computer if possible.

2) Keep detailed records of all fire department activities.

3) Assign record keeping responsibilities to all fire department personnel.

4) Appoint one member to be in charge of the system.

5) Keep data sources up-to-date.

17. Maintenance of Apparatus, Equipment and Facilities

1) When developing specifications and designs for acquiring new apparatus, equipment, and facilities, specify those which require the least maintenance time.

2) Select paint and finishes which need the least attention to maintain their durability and appearance.

3) Select all wall furnishings and floor coverings to be used in stations on the basis of maintenance time requirements as well as appearance and durability.

4) Keep detailed maintenance records.

5) Develop a joint repair and maintenance program with the Public Works Department and the Fire Department.

18. Supply Service

1) Assign the responsibility of maintaining an adequate level of fire department supplies to one member of the Fire Department.

19. Coordination Between Municipal Departments

a. Inspection Division

1) The existing cooperation and teamwork between the Fire Department and the Inspections Division should be continued.

2) When violations to the building code are located by fire personnel on their inspections, these violations should be referred to the Inspections Division for correction. Depending on the nature of the violation, both departments should work together to assist the property and/or business owner in correcting conditions which may be hazardous to their personnel, operation and neighbors.

3) There should be continuous review of building and fire codes and ordinances to establish standards that guide the progress of this Town towards the goal of maintaining as low a fire flow requirement as practical and developing a community safe from major fire and loss of life.

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extra sentence.

b. Department of Planning and Development

- 1) Continue the present joint activities and cooperation between the Fire Department and Department of Planning and Development.
- 2) Consideration of the fire flow requirement should be given to all applications and requests so that adequate fire protection requirements can be established in the very earliest stages of planning.

c. Engineering Department

- 1) Continue to design a water supply system that can provide adequate fire flows in all areas of Cary. Every effort should be made to assure that there will be ample water available to satisfy the fire flow requirements established by the Fire Department.
- 2) Continue the very close working relationship between the Fire Department and Engineering Department.
- 3) Continue to assist in reviewing plans of new development to determine if main sizes, hydrant locations, and street designs are adequate.

d. Public Works

- 1) Continue the present joint activities and cooperation between the Fire and Public Works Departments.

e. Police Department

- 1) Continue the close working relationship between the Police and Fire Departments.

f. Town Attorney

- 1) Maintain a close liaison between the Town Attorney and the Fire Department. The Fire Department should continue to utilize advice and legal services of the Town Attorney's office in future planning and in day-to-day operations, especially as fire department activities increase.

g. Miscellaneous Municipal Departments

1) The close working relationship between the Fire Department and other Town departments should be maintained and improved where possible.

2) Improved communications between all departments should be fostered and the service rendered to the citizens of Cary continually evaluated. Through improved communications, methods of improving municipal service while eliminating duplication of services can be developed and implemented.

ADMINISTRATION AND ORGANIZATION

- 20. Adopt the organizational structure chart found on page 65 of this document.
- 21. Establish the position of Training/Operations Officer who will administer and coordinate operation activities prior to activation of Engine 3, 1980.
- 22. This organizational structure enables the Cary Fire Department to operate effectively and efficiently and provides the necessary administrative leadership and is suitable for three to five companies.
- 23. Use this structure as a guideline in evaluating the overall effectiveness and efficiency of the Department.

B. Private and Built-In Fire Protection

- 24. Adopt an ordinance limiting the computed fire flow for any single structure to 4,000 gpm. Adoption of this ordinance would limit the Town's basic fire flow to 4,000 gpm thereby limiting the rising costs of public fire protection and increasing the overall effectiveness of this proposed Plan.
- 25. Encourage architects, designers, planners and builders to install fire suppression systems and/or built-in fire protection in all buildings where not required by Cary's Building Code.
- 26. Strictly enforce the Building and Fire Codes as a way to control fire flow requirements.
- 27. Provide businesses and industries with educational material which will bring to their attention ways to reduce fire flow requirements.
- 28. Individually assess high fire risk buildings or structures to determine the extent of life hazard.

- 29. Provide business and industry owners with educational material which will bring to their attention the availability and advantage of fire suppression systems.
- 30. Through education and code requirement, encourage the installation of fire suppression systems to protect processes and equipment that present a serious fire or explosion threat to life and property.
- 31. Strictly enforce the N. C. Building Code requirements for highrise buildings.
- 32. Encourage architects, designers, planners and builders to place a strong emphasis on fire safety features in multi-story buildings.
- 33. Emphasize highrise firefighting techniques in the Fire Department's training program.
- 34. Provide fire emergency procedure training for occupants of all multi-story and highrise buildings.
- 35. Maintain the mutual aid program and volunteer firefighters program.
- 36. Develop educational material that will provide business owners with an understanding of the various warning devices that can be utilized and how they can reduce the threat of life and property loss.
- 37. Encourage all occupancies that are not required to install warning devices to install them.
- 38. Strictly enforce Town codes requiring the installation of early warning devices.
- 39. Develop and present educational programs which will motivate all members of the community to install smoke detectors in the homes, where not required.
- 40. Develop educational programs which will succeed in communicating the message of fire prevention to everyone in Cary.
- 41. Provide special instruction to occupants of multi-story buildings so that they will know the correct procedures to follow in reporting a fire, appropriate action to take during an emergency and how to egress rapidly and safely from the building.

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appendices

# APPENDICES

## APPENDIX A

### Fire Department Questionnaire

The following questionnaire, filled out by the Cary Fire Department, was used to establish Cary's present fire situation and to project Cary's future fire service needs. The information was gathered by FMA's.

### FIRE RUN REPORT BY WATERSHEDS/FMA

RUN NUMBER & ADDRESS/MONTH	CAUSE OF FIRE	FIRE TYPE	APPROX. VALUE	APPROX. LOSS	INJURIES C/FF	NOTIFIED	ARRIVED	TOTAL TIME	ADDITIONAL ASSISTANCE	EQUIPT USED	NO. OF VEHICLE	LINES USED

**FMA/WATERSHED**

**TOTALS**

1. Type of Fire:
  - 01 - Dwelling \_\_\_\_\_
  - 02 - Mobile Home (Dwelling) \_\_\_\_\_
  - 03 - Commercial \_\_\_\_\_
  - 04 - School \_\_\_\_\_
  - 05 - State Property \_\_\_\_\_
  - 06 - Church \_\_\_\_\_
  - 07 - Boat \_\_\_\_\_
  - 08 - Tobacco Warehouse \_\_\_\_\_
  - 09 - Warehouse \_\_\_\_\_
  - 10 - Woods or Field Fire \_\_\_\_\_
  - 11 - Vehicle \_\_\_\_\_
  - 12 - Other \_\_\_\_\_

TOTAL CALLS: \_\_\_\_\_  
 TOTAL FIRES: \_\_\_\_\_

2. Cause of Fire:
  - 1 - Incendiary \_\_\_\_\_
  - 2 - Accidental \_\_\_\_\_
  - 3 - Electrical \_\_\_\_\_
  - 4 - Explosive \_\_\_\_\_
  - 5 - Undetermined \_\_\_\_\_
  - 6 - Other \_\_\_\_\_

3. TOTAL APPROX. VALUES \_\_\_\_\_

4. TOTAL APPROX. LOSS \_\_\_\_\_

5. TOTAL DEATHS:  
 Civillian \_\_\_\_\_  
 Firefighter \_\_\_\_\_  
 TOTAL \_\_\_\_\_

7. TOTAL ASSISTS \_\_\_\_\_

8. AVERAGE RESPONSE TIME: \_\_\_\_\_

9. EQUIPMENT USED/NO. OF VEHICLES \_\_\_\_\_

10. LINES USED \_\_\_\_\_

**APPENDIX B**

**RISK ANALYSIS SHEET**

- A. Fire Management Area: \_\_\_\_\_  
 Jurisdiction Status \_\_\_\_\_
- B. Major or Critical Property In Area: \_\_\_\_\_  
 Other Risks (Key, typical): \_\_\_\_\_
- C. Risk Rating (Circle the appropriate score):

Characteristic	Low Fire Risk	Average Fire Risk	High Fire Risk
Building Conditions	1	2	3
Special Hazards	1	2	3
Internal Fire Protection	1	2	3
Potential Life Loss	2	4	6
Building Height	1	2	3
Building Density	1	2	3
Potential Dollar Loss	1	2	3

Total Score \_\_\_\_\_

The higher the score, the higher the fire risk.

# of Alarms for Selected Period \_\_\_\_\_

- D. Response Time Rating Response Requirements. From the above score, the desired response time should be: (circle response)
  - Above Average (slow) (5 minutes/typical)
  - Average (4 minutes/key)
  - Below Average (fast) (3 minutes/major)

E. Risk Classification \_\_\_\_\_

- F. Response Level Rating (Amount of Equipment)
  - \_\_\_\_\_ Higher than Average
  - \_\_\_\_\_ Average Strength
  - \_\_\_\_\_ Less than Average Strength

G. Comments:

## DEFINITIONS

1. **CONFLAGRATION** - a large fire
2. **FIRE FLOW** - The amount of water required to control and extinguish a large fire in a particular building while providing adequate protection for the adjacent exposures.
3. **FIRE LOAD** - The combustible contents and materials of construction in a given fire area.
4. **FLASHOVER** - When the temperature within a building rises extremely rapidly from the fire's beginning to a point when all of the combustible contents within a confined area will ignite in a FLASHOVER, the critical point for life safety and control.
5. **MERCHANTILE OCCUPANCY** - The use of a building or structure or any portion of it, for the display and sale of merchandise.

### FOOTNOTES

<sup>1</sup>John L. Bryan and Raymond C. Picard, **MANAGING FIRE SERVICES**, (Washington, D.C.: International City Management Association, 1979), p. 62.

<sup>2</sup>Commission on Fire Prevention and Control, **AMERICA BURNING** (Washington, D.C.: Government Printing Office, 1973), p. 7.

<sup>3</sup>**FIRE JOURNAL** (Boston Massachusetts: National Fire Protection Association, May 1979, Vol. 73, No. 3), p. 42.

<sup>4</sup>Commission on Fire Prevention and Control, **AMERICA BURNING** (Washington, D.C.: Government Printing Office, 1973), p. 105.

## SELECTED BIBLIOGRAPHY

- American Insurance Association. *Fire Department Stations and Companies - Location, Distribution and Response*. New York, N.Y.: National Board of Underwriters, Special Interest Bulletin No. 176, 1975.
- American Insurance Association. *Fire Department Stations - Planning the Location*. New York, N.Y.: National Board of Fire Underwriters, Special Interest Bulletin No. 176, 1959.
- Briffett, John R. "The Garden Grove Fire Protection Plan." *Fire Journal*. Boston, Mass.: July 1971.
- Bryan, John L. and Picard, Raymond C., ed. *Managing Fire Services*. Washington, D.C.: International City Management Association, 1979.
- Carrboro Planning Department. *Community Facilities Report 1978 - 2000*. Carrboro, N.C.: 1978.
- Carrboro Planning Department. *Land Use Plan 1977 - 2000*. Carrboro, N.C.: 1977.
- City of Minneapolis. *Public Facilities Profile: Trends and Issues*. Minneapolis, Minn.: 1978.
- City of Santa Ana. *Fire Protection Master Plan*. Santa Ana, Calif.: 1978.
- City of Winston-Salem, North Carolina. *Fire Management Plan*. Winston-Salem, N.C.: 1975.
- City of Winston-Salem, North Carolina. *Fire Station Locator System*. Winston-Salem, N.C.: 1976.
- Eichelberger, Pierce and Farren, Tom. "Miami Uses Station Location Model to prepare 10-Year Master Plan." *Fire Engineering*, June 1977.
- Grant, Robert W. "Planning - The Basis for Future Control." *Fireman*. July 1967.
- Heath, Richard L. *Systematic Planning*. Minneapolis, Minn.: Department of Planning, 1977.
- Insurance Services Office. *Grading Schedule for Municipal Fire Protection*. New York, N.Y.: 1974.
- Lovaas, John P. and Norheim, Gordon L. *Minneapolis Fire Station Location Study*. Minneapolis, Minn.: 1976.
- Mission Research Corporation. *Advanced Guide for Fire Prevention and Control Master Planning*. 1979.
- National Commission on Fire Prevention and Control. *America Burning*. Washington, D.C.: Government Printing Office, 1973.
- National Fire Prevention and Control Administration. *Executive Summary of the Fires in the United States*. Washington, D.C.: National Fire Data Center, U.S. Department of Commerce, 1977.
- National Fire Prevention and Control Administration. *Fire Protection Master Planning: Now to be a Reality*. Washington, D.C.: U.S. Department of Commerce, 1977.
- North Carolina League of Municipalities. *Fire Station Site Study*. Shelby, N.C.: 1973.
- Pickard, Sherman. *Fire Department Survey Report*. Wilmington, N.C.: N.C. League of Municipalities, 1974.
- Plotecia, Sally. *Fire Protection - Performance Measurement for N.C. Communities*. Research Triangle Park, N.C.: Research Triangle Institute, 1977.
- Raleigh Planning Department. *Fire Protection*. Raleigh, N.C.: 1958.
- Raleigh Planning Department. *Fire Protection*. Raleigh, N.C.: 1970.
- Raleigh Planning Department. *The Eighteen Year Fire Protection Program for Raleigh 1977 - 1995*. 1977.
- Research Triangle Institute. *Municipal Fire Service Workbook*. Research Triangle, N.C.: International City Management Association and National Fire Protection Association, 1977.
- Standards Committee Washington Fire Chiefs. *Design of Fire Stations*. Seattle, Wash.: Information Bulletin No. 278, 1965.
- Teague, Paul E., ed. *Fire Journal*. Boston, Mass. National Fire Protection Association, Vol. 73, No. 3, May 1979.
- Teitz, Michael B. "Toward a Theory of Urban Public Facility Location," *Papers of the Regional Science Association*. Volume XXI.
- Thurmond, James. "Computer Helps Pick Station Site." *Fire Engineering*. November 1975.
- Toregas, Constantine; Swain, Ralph; ReVelle, Charles; and Bergman, Lawrence. *The Location of Emergency Service Facilities*, 1970.
- Weitz, Harold. "A Model for the Simulation of the Fire Services of an Urban Community." *Fire Journal*. Boston, Mass.: January 1969.
- "What are your Target Hazards." *Fire Command!*. August 1973.

## CONCLUSION

Fire protection is a major consideration in every American city. The fire service is one of the oldest and most important services municipalities provide their citizens. Learning to bring fire under control and thus to modify our environment has presented us with one of our greatest challenges.

Although great progress has been made in accumulating knowledge and developing skills to control fire, all too frequently fire breaks out of control and assumes its destructive role. In spite of the advancements toward meeting the challenge of the American fire problem, the cost for public fire protection has escalated so rapidly that communities throughout the nation are being forced to reassess the costs and consider alternatives.

A comprehensive fire plan is one major alternative capable of meeting the challenge of today's fire problem. It is designed to meet a community's present and future needs in fire protection, to serve as a basis for program budgeting and to identify and implement the optimum cost-benefit solution in fire protection. Comprehensive planning permits management of the recognized fire situation instead of reacting to an undefined fire problem. By controlling the fire situation, fire protection costs can also be controlled.

The plan represents broad community participation in defining and accepting a level of fire protection with full knowledge of the risks involved. It emphasizes fire prevention and fire safety education through a system based upon a concept of dual responsibility on the part of both the public and private sectors. Increased citizen awareness and participation will most certainly result in increased understanding and acceptance by the community as a whole of the need and the means to reduce life-property loss and cost related to fire. It is possible that such awareness and involvement will contribute to the reduction and control of fire problems in Cary.

An effective and efficient fire service, dedicated to the protection of lives and property from the perils of fire and other emergencies, makes it possible for citizens to sleep at night with a feeling of security. Through a comprehensive fire prevention program, the Town of Cary will be able to reduce the dangers of fire by creating an environment in which it is difficult for fires to erupt.

the  
comprehensive  
fire prevention  
&  
management  
plan

Is part of the total comprehensive planning process of Cary. It is a general and long-range guide to decisions about the future fire protection needs of Cary. It examines both short and long-term programs designed to meet a community's present and future needs in fire protection. The Plan is flexible, changing and developing with the needs of the community. It permits management of the recognized fire situation, instead of reacting to an undefined fire problem. The Plan is a policy guide helping to prevent the loss of life and property due to fire. Through a comprehensive fire prevention program, the Town of Cary will be able to reduce the dangers of fire by creating an environment in which it is difficult for fires to erupt.