

STATE OF MINNESOTA
DEPARTMENT OF ADMINISTRATION

In the Matter of the Proposed
Rules of the Department of Administration
Governing Amendments to the State Building
Code entitled Proposed Optional Appendix E
Automatic Fire Suppression Systems

STATEMENT OF NEED AND
REASONABLENESS

The above captioned rules are a proposed optional appendix chapter to the State Building Code which authorizes municipalities to require on-site fire suppression systems in certain occupancies.

The proposed rules are needed to authorize municipalities to adopt fire suppression requirements, established through information obtained from nationally-recognized experts, to a protection level higher than currently authorized. MN Stats. 1980, Section 299F.011, Subd. 4 prohibits municipalities from establishing requirements in excess of the requirements of the Uniform Building Code adopted pursuant to MN Stats. 1980, Section 16.83 to 16.867 (State Building Code). The adoption of rules establishing standards for additional on site fire suppression systems is necessary to permit municipalities to obtain standards of fire suppression capabilities not in conflict with provisions of the State Building Code when it is determined by the municipality that additional provisions are necessary and cost effective.

The agency's authority to promulgate the proposed rules is contained in MN Stats. (1980) §§ 16.85 and 16.86.

The expansion of fire suppression and prevention capabilities is necessary for public safety in buildings located in expanding municipalities. A primary concern of growing municipalities is to establish a balance of public

and private sector financing for fire suppression protection in new buildings where public sector funding limits have been reached.

These rules are a reasonable approach to fire suppression on the local level because resources for municipal fire departments are limited to current or reduced expenditure levels. The level of fire fighting and prevention provided is exclusively a local determination. The economic feasibility and reasonableness of adopting uniform regulations in excess of the State Building Code must be determined by the municipality providing the services and those bearing the expense.

The establishment of optional rules for adoption without change are based on a study of nationwide trends of the fire suppression capabilities of municipal fire departments. This provides municipalities a method to establish reasonable additional standards based on local capabilities.

During the 1981 session of the Minnesota Legislature, a bill was introduced permitting local units of government to enact ordinances requiring on-site fire suppression systems as they deemed appropriate. The legislation passed the House and was considered by the Government Operations Committee of the Senate, where testimony was offered in opposition to the bill. One issue of opposition was that the uniformity provided for in the State Building Code would be destroyed and designers, developers and builders would be subjected to a vast array of requirements. The chairman of the Senate committee recommended that all affected parties attempt to resolve their differences through the rule making process of the Administrative Procedure Act.

The Director of the Building Codes and Standards Division subsequently appointed a committee to review the issues involved and recommend how they

might be best resolved. The listing of committee members is attached to this statement. (Exhibit 1) The committees first meeting was on July 16, 1981 and after a series of 16 meetings the final (4th) draft of the proposal was completed on May 26, 1982. During the committee deliberations input was received from many resource persons, including fire protection engineers, fire department administrative personnel, mechanical engineers, the concrete industry, sprinkler industry, insurance industry, committee members, and others. Several informational meetings were held with architects, building developers, building owners and managers, building officials and others, and draft copies were revised following input from concerned persons.

The consensus of the committee was to propose an optional appendix chapter to the State Building Code that could be adopted, without change, at the discretion of municipal governments, similar to the existing appendix chapter D relating to building security. A measure of uniformity would thus be maintained so that persons affected could quickly ascertain whether or not the appendix chapter had been adopted by any given municipality, so that structures would be designed and constructed accordingly. The committee believes this approach will be a long term solution to existing and future problems.

Although Minnesota Statutes do not mandate that municipalities provide fire protection for their citizens, many municipalities are endeavoring to maintain a proficient level of fire protection in the face of additional construction and restricted budgets due to cutbacks in resources. Municipalities firmly believe that by providing for built-in fire suppression systems in new construction, they can maintain a reasonable degree of protection without building additional fire stations, obtaining new equipment and supplies, and recruiting additional personnel. Additional resources would

also be necessary, to provide ongoing training of personnel; maintenance and operation of equipment, and buildings; as well as additional fire fighter salaries. The cost of providing additional services involves both initial capital outlay plus continuous program maintenance costs. The Fresno California Chronicle attached to this statement (Exhibit #2) supports the effectiveness of this position. In spite of considerable growth in area and population, fire department staffing, equipment and number of stations was not substantially increased.

Recently adopted OSHA regulations impose additional training requirements and safety equipment provisions which places an additional burden on the ability of municipalities to provide fire protection service within reasonable budget levels. The added training requirements may be a deterrent to obtaining volunteer fire fighters due to increased commitments on volunteer fire fighters time. Service of full time paid fire fighters is beyond the budget limitations of most municipalities in Minnesota. OSHA Subpart L. Federal Register Vol. 45, No. 179, Sept. 12, 1980 Sec. 1910.156. A listing of paid and volunteer fire departments in the state is attached to this statement (Exhibit #3).

The Minnesota Fire Chiefs Association has, for years, advocated the extensive use of automatic sprinkler systems in buildings to control or extinguish fires and reduce property damage losses. In addition they are concerned about the life safety of building occupants and fire department personnel who must enter buildings to suppress fires. Statistics show that multiple death losses are very rare in buildings equipped with automatic sprinkler systems throughout. Property losses are greatly reduced in buildings protected throughout by automatic sprinkler systems. Manpower needs are reduced dramatically when buildings are protected with automatic

sprinklers. Comparisons of fires in comparable buildings with and without sprinklers are attached to this statement (Exhibit #4). Edina - Apartment Building fires; Richfield Hub Center; Duluth, Apartment Building.

The installation of sprinkler systems is recognized by the present building code as providing additional fire safety protection, by allowing larger allowable areas, additional stories, and substitution for 1 hour fire resistive construction in some cases. Some cost savings can be realized when the code is researched and applied to a given design.

A Concern has been expressed by multi-family housing developers that increased initial costs will be a deterrent to development of much needed lower and moderate income housing. Experience has shown that there is much less clean up and re-construction after a fire in a sprinklered apartment building, thus allowing re-occupancy of units quickly after a fire. The early reoccupancy results in additional pay-back of initial investment. Tenants are benefitted by the additional safety provided by automatic sprinkler protection. In the proposed rule an exception to 2MCAR Section 1.10020.C.11, was incorporated to allow acceptance of sprinkler systems that would provide protection at minimal cost.

Water supply demands for extinguishment of fires with hose lines are much greater than when automatic sprinklers are used. Fires usually grow rapidly in their early stages, delayed alarms or long response times are serious obstacles to fire extinguishment. On-site extinguishing systems provide an alarm when the sprinkler system is actuated by heat of the fire, thus providing an early alarm as well as containment or extinguishment of the fire.

Small fires are usually fought with 1-1/2" hose lines requiring 2 men per line. Large fires require 2-1/2" hose lines needing 3 or 4 men per hose line. The majority of fires set off a maximum of 2 sprinkler heads with a discharge 15 to 20 GPM. Water and manpower requirements are attached to this statement (Exhibit #5).

Fire resistive construction is required by the code in many instances. Experience by fire and building departments, and investigations after fires has shown that fire resistive assemblies have failed during fires. Some of the factors causing failure are as follows:

1. Many sub-contractors are involved and none of them has total responsibility to assure compliance. These sub-contractors include ceiling installers, electricians, insulators (thermal and acoustical), sheet metal and ventilation installers, plumbers, communications people and others.
2. Frequently, inspectors and plan review personnel are not sufficiently experienced and trained to detect all deficiencies in complex assemblies.
3. Many building departments are understaffed, due to budget constraints.
4. Remodeling of buildings often gives rise to the use of substitute materials and as a result ceilings or walls are no longer fire resistive, and compartmentation is negated.

When fire suppression efforts are underway compartments must be opened to gain access. In many instances this will cause the fire to spread from its original source. Fire fighters advance hoses into stairways and corridors to attack fires. When this occurs, the fire resistive character of such vital life safety areas is defeated. Automatic sprinkler protection tends to offset the hazards which prevail when fire resistive assemblies have been negated.

Minnesota cities are developing a pattern of maintaining a manpower level in their fire departments which is minimally sufficient to extinguish the average size house fire. When the provisions of proposed Appendix E, based on occupancy classification and hazard, are combined with a minimally sufficient fire department an acceptable level of fire extinguishment capability is achieved.

Group A Occupancies (public assembly) accomodating 300 or more persons, normally have large open areas rather than small compartments. Compartments help contain a fire. Fire in a large compartment can readily defeat a small fire fighting force. Sprinkler protection is needed in order to contain an incipient fire. This reduces the chances of panic in a large crowd attempting to flee a growing fire and allows a smaller fire fighting force to extinguish the fire.

The square footage limitation for Group B service stations is restricted due to the nature of the occupancy. Flammable and combustible liquids greatly increase the fire loading in these occupancies. Even in a small square footage occupancy flammable or combustible liquids fire can readily overcome an average fire fighting force.

Group B-1 (parking garages), consisting of large open areas, do not allow storage other than automobiles. The spacing of the automobiles and the fact that fires in an auto are normally contained within the engine or passengers compartment provide some degree of assurance in keeping a fire isolated. Due to this fact the square footage limitations for parking garages was established at 5,000 square feet. This is more liberal than the Group B-1 service stations due to the lesser hazard.

Group B-2 (offices and post-secondary classrooms), were assigned a square footage limitation of 8500 square feet. These occupancies are divided into fairly small compartments which contain a moderate fire loading of normal combustibles. Due to this fact, the committee determined that the square footage limitation could be increased above the more restrictive requirements of the occupancy groups previously listed. The height of a building is a critical factor. Regardless of square footage, the average fire department would still require additional equipment and manpower to gain access to buildings of over two stories.

The Group B-2 (retail, warehouse and manufacturing Occupancies), were assigned a square footage limitation of 2000 square feet. These types of occupancies normally contain a high loading of normal combustibles, densely stored in an open area.


Group E-1 and E-2 Occupancies (K-12 schools) were assigned a square footage limitation of 8500 square feet. The characteristics of these occupancies are similar to Group B-2, offices and post-secondary classrooms. K-12 schools are comprised of smaller compartments which help contain a fire.

Group H-4 Occupancies (repair garages) were assigned a maximum square footage limitation of 3000 square feet. H-4 Occupancies have welding and cutting operations, as well as other open flames used in areas where flammable liquids are stored and dispensed. H-4 Occupancies have a greater probability of fire with such fires being more severe in nature due to the highly flammable and combustible contents.

The Group R-1 Occupancies (apartment houses, hotels and motels) were assigned a maximum square footage limitation of 8500 square feet. The characteristics of these occupancies are similar to Group B-2 offices and post-secondary classrooms as to compartmentation and combustible contents. R-1 Occupancies, where the occupants are sleeping, creates a life loss potential not associated with B-2 Occupancies. Hotel and motel occupancies also present the problem that sleeping occupants are not familiar with their surroundings which also increases the life loss potential. R-1 Occupancies require a high level of fire department manpower for evacuation and rescue purposes.

All testimony received at the hearing will be given due consideration and incorporated into the proposed rule if determined necessary and reasonable.

Date: 11-30-82



JAMES J. HINIKER, JR.
COMMISSIONER

"THE FRESNO CHRONICLE"

An Economically Feasible

Approach to a City's Fire Problem

NATIONAL AUTOMATIC SPRINKLER AND
FIRE CONTROL ASSOCIATION, INC.
4908 TILE LINE ROAD
CRYSTAL LAKE, ILLINOIS 60014

...dedicated to the nation's firefighters who risk
their lives to protect life and property from the
ravages of fire...

March 1, 1978

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PREFACE

This report, "The Fresno Chronicle--An Economically Feasible Approach to a City's Fire Problem", is the result of a massive research effort coordinated by Raymond J. Casey, President of the National Automatic Sprinkler and Fire Control Association, Inc.

During the Spring of 1977, the Association staff was directed to begin updating statistics contained in the original "Project Fresno", published in December of 1966. This initial research compared fire department manpower levels, particularly on duty strength, in 1955 with 1966. It examined the effect of the Dangerous Building Ordinance applicable principally to existing construction and a federally funded urban renewal program calling for automatic fire sprinkler protection in all new construction.

This frontal attack on the fire problem, focusing primarily on Fresno's central business district, resulted in sprinkler protection for numerous buildings.

This effort contributed greatly to the eventual re-grading of Fresno from a Class 3 to a Class 2 city according to the ISO Municipal Grading Schedule.

The research contained in this report examines, over two decades, a variety of factors influencing the fire fighting capacity of the City and the ever increasing strides taken by Fresno officials in seeking out innovative solutions to the fire problem.

We are confident that the research embraced in this report will serve as an impetus for other cities around the country to initiate studies on the fire problem.

It is not the intent of this document to provide all the answers, but rather to focus on the need for continued research and analysis in obtaining viable solutions to the municipal fire problems facing the cities of this nation.

We wish to acknowledge the cooperation of Fresno officials, who greatly aided the Association staff in conducting this research.

Chief Leland Hill, Chief of Department
City of Fresno, California

Fire Marshal Richard Borgardt
City of Fresno, California

Donald Teninty, Deputy Fire Marshal
City of Fresno, California

George Kerber, Director of Planning and Inspections
City of Fresno, California

Pat Smith, Manager--Research Department
Fresno County and City Chamber of Commerce

Without the capable assistance of these officials, this document could not have been published.

We offer the Fresno Chronicle as testimony of how a major metropolitan city responded to the challenge of fire, providing substantial savings to the taxpayer and insuring greater fire protection for its citizenry.

March 1, 1978

THE PROBLEM

The fire problem confronting the American people has become a public menace.

An examination of the statistics for fire losses resulting in property damage to death and injury defy description and stagger the imagination.

The United States, a leader of the nations of the world in technological advancement, has earned the dubious honor of leading "all major industrial countries in per capita deaths and property losses from fire".

The final report of the National Commission on Fire Prevention and Control, "America Burning", issued in 1973, reveals a litany all too familiar.

Here are some facts:

- "Annually, fire claims nearly 12,000 lives in the United States".
- "Only motor vehicle and falls rank higher among the causes of accidental death".
- "300,000 Americans are injured and maimed by fire each year".
- "The price of destructive fire in the United States amounts, by conservative estimate, to at least 11.4 billion dollars per year".
- "Losses from businesses that must close and from jobs that are interrupted or destroyed are incalculable".
- "Estimated annual costs for fire department operations are 2.5 billion dollars".
- "The death rate of fire fighters is 15% greater than the next most dangerous occupation, mining and quarrying".
- "Approximately 85¢ out of every dollar lost is attributal to building fires, considering 2.7 billion dollars in property loss sustained each year".
- "Approximately 2/3 of the 12,000 deaths that occur annually result from building fires".

The National Fire Data Center, an adjunct of the National Fire Prevention and Control Administration, issued in October of 1977, the first in a series of reports entitled "Fires in the United States".

The statistics are startlingly similar to the National Commission's findings.

In the mid-70's, the Nation is experiencing each year approximately:

- "2.6 million fires that were attended by the fire service, and another 30 million fires, mostly minor, that were not reported to the fire service".

- "7,500 fire deaths".

- "110,000 fire injuries and an estimated 200,000 additional injuries from fire not reported to the fire service".

- "4.2 billion in direct property loss from fires".

- "Fire...in the home is the second most frequent cause of accidental death".

Recognizing the importance of national trends, the findings also stress the import of "striking differences from place to place in important aspects of the fire problem".

The report recommends that state and local governments analyze their own fire problems rather than relying on the data of outside groups.

In January of 1978, the National League of Cities issued a policy statement on fire. In their "Policy for Action", the report called for greater cooperation on the part of the federal government and national organizations working with local and state government officials in analyzing evaluative criteria seeking solutions to the fire problem.

With greater public awareness of the fire problem and with greater attention given to fire in the mass media, the need for viable programs in terms of public education is beginning to surface.

The importance of responding to the fire problem is becoming the concern of many municipalities around the country.

A major weapon being utilized more and more in local ordinances and building codes is providing a formidable opponent to fire. The installation of automatic fire sprinkler systems in numerous occupancies is assuming a more prominent role in the thinking of building code writers on both the state and local level.

FRESNO, CALIFORNIA

While many cities have taken up the gauntlet, the City of Fresno, California has built a whole concept of public fire safety around the automatic fire sprinkler.

Located halfway between San Francisco and Los Angeles, in the lush San Joaquin Valley, Fresno is one of the largest agricultural counties in the world.

Between 1956 and 1965, City Fathers were confronted with problems being experienced by many major metropolitan areas around the country. Rapidly rising population, new industry, new construction, higher building costs, and declining sources of tax revenue were putting a squeeze on public fire protection.

It became evident that solutions be sought.

Focusing on Fresno's central business district, City officials enacted a Dangerous Building Ordinance, empowering the building department to require that all unsafe buildings not meeting minimum safety standards be condemned.

Under the provisions of the Dangerous Building Ordinance, a building owner may choose between several alternatives in bringing his building up to standard. In the vast majority of cases, owners elect to install automatic fire sprinklers rather than to enclose stairways, add new stairwells and thus eliminate office space, close transoms, and add costly structural renovations.

In most instances, it was found that the most economical way to comply with these regulations was to install automatic fire sprinklers.

This ordinance, which addresses itself primarily to existing buildings, was coupled with a funding plan with the Federal urban renewal agency.

The City entered into an agreement that "all new construction shall be fire sprinklered to provide fire protection equivalent to the standards listed in a National Board of Fire Underwriters Pamphlet 13--Sprinkler Systems".

Presently, as a direct result of these programs, additional municipal ordinances and strong building and fire codes, 90% of the floor area in Fresno's central business district is afforded sprinkler protection.

Reliable sources within the City of Fresno have stated that the implementation of the requirements contained in the Dangerous Building Ordinance are still not completed.

Waging this war against fire is an on-going process with Fresno's fire officials.

CODE ADOPTIONS

With foresight and planning, the architects of Fresno mapped a strategy to stabilize costs to the taxpayer and improve fire protection for the city's inhabitants, centering on strong codes and ordinances strengthened by requirements calling for the installation of automatic fire sprinkler protection.

Municipal Code--City of Fresno

The Municipal Code for the City of Fresno supplements the provisions of the Uniform Building Code and the California Administrative Code-- Title 19.

Stringent requirements under this code encourage automatic fire sprinkler protection:

- "...ABATEMENT OF DANGEROUS BUILDINGS. All buildings or portions thereof which are determined by the Building Official to be dangerous as defined in this article and hereby declared to be public nuisances and shall be abated by repair, rehabilitation, demolition, or removal in accordance with the procedure specified..."
- "...FIRE ZONE NO. 1. Buildings and structures hereafter erected, constructed, moved within or into Fire Zone No. 1 shall be only a Type I, II, III-H.T., III-one-hour, IV-one-hour, or V-one-hour and shall meet the requirements of this section. All buildings over three thousand square feet in area shall be equipped with an approved automatic fire extinguishing system."
- "...AUTOMATIC FIRE-EXTINGUISHING EQUIPMENT--FIRE ZONE NO. 1. Where an approved automatic fire-extinguishing system is provided in buildings in Fire Zone No. 1, the following substitutions may be approved by the Building Official. These exceptions shall not apply to buildings covered by Title 19 of the California Administrative Code.
 - (a) Occupancy separations may be reduced by one hour.
 - (b) Exterior wall protection due to the proximity of property lines may be reduced by fifty percent.
 - (c) Party walls for adjacent property may be approved by the Building Official subject to the following conditions:
 - (1) Both buildings are equipped with an approved automatic fire-extinguishing system.
 - (2) The party wall is a minimum of a two-hour fire-rated wall.
 - (3) The area of the combined buildings is within the allowable area for a single building.
 - (4) An approved party wall agreement signed by both property owners is recorded in the County Recorder's Office.

- (d) Vertical shaft enclosures may be reduced by one hour but in no case less than one hour in buildings three or more stories in height.
- (e) Corridor protection may be reduced to thirty-minute wood frame construction with twenty-minute labeled assemblies on all openings.
- (f) Fire Protection for exit enclosures and exterior smokeproof enclosures may be reduced by fifty percent but in no case to less than one hour.
- (g) Exit courts and passageways may be constructed with thirty-minute fire protection with twenty-minute labeled assemblies in all openings.
- (h) Fire protection for exterior walls, floors and ceilings may be reduced by fifty percent..."

- "...FIRE RESISTIVE SUBSTITUTION. Where one-hour fire resistive construction throughout is required by this Code, an approved automatic fire extinguishing system, as specified in Chapter 38 of the Uniform Building Code, may not be substituted therefor.

Exception: In no. 2 and No. 3 Fire Zones, an approved automatic fire extinguishing system may be substituted for one-hour fire resistive construction throughout when required by this Code..."

- "...Any historical building having more than three thousand square feet of floor area shall be protected with an installation of approved automatic fire sprinklers..."

Included in the Municipal Code for the City of Fresno are a number of mandatory requirements which call for the installation of automatic fire extinguishing systems.

Here are some examples:

- "In every story, basement or cellar of all buildings except dwellings when floor area exceeds fifteen hundred square feet and there is not provided at least twenty square feet of opening entirely above the adjoining ground level in each fifty lineal feet or fraction thereof of exterior wall in the story, basement or cellar on at least one side of the building. Openings shall have a minimum dimension of not less than thirty inches. Such openings shall be maintained readily accessible to the Fire Department and shall not be obstructed in a manner that fire fighting or rescue cannot be accomplished from the exterior."

- "When openings in a story are provided on only one side and the opposite wall of such story is more than seventy-five feet from such openings, the story shall be provided with an approved automatic fire-extinguishing system, or openings as specified above shall be provided on at least two sides of the exterior walls of the story."

- "If any portion of a basement or cellar is located more than seventy-five feet from openings required in this section, the basement or cellar shall be provided with an approved automatic fire-extinguishing system."

- "Under the roof and gridiron, in the tie and fly galleries and in all places behind the proscenium wall of stages, over enclosed platforms in excess of five hundred square feet in area; and in dressing rooms, workshops and storerooms accessory to such stages or enclosed platforms."

- "In Group E, Division 1 and 2 occupancies which would include storage and handling of hazardous and highly flammable or explosive materials other than flammable liquids for Division 1 classification, and paint stores and paint shops having an area of more than 1,500 square feet, and Division 3 occupancies conducting a woodworking establishment, planing mills and box factories having an area of more than 3,000 square feet; and in repair garages more than one story in height shall be provided with an automatic fire extinguishing system."

- "In Group F, Division 2 occupancies used for retail sales or warehousing having an area of more than 10,000 square feet in a single floor or more than two stories in height."

- "In assembly occupancies having over 12,000 square feet of floor area which can be used for exhibition or display purposes..."

- "Fire extinguishing systems are required in commercial laundry establishments using more than two power driven machines in the laundering process..."

California Administrative Code--Title 19

The City of Fresno is required to enforce the provisions of the California Administrative Code--Title 19--Public Safety.

By establishing minimum standards, Title 19 contains provisions receptive to the automatic fire suppression concept.

Under the provisions of Title 19, nursing homes for ambulatory persons, homes or institutions for the aged, asylums, hospitals and sanitariums, the installation of automatic sprinkler systems are, in most instances, required to provide reasonable fire and panic safety.

Uniform Building Code

The City of Fresno adopts the 1973 edition of the Uniform Building Code. The Code will soon be updated to reflect current changes and technology, and in an effort to reflect these technological changes, the City of Fresno will soon adopt the most recent edition of the code.

The Uniform Building Code provides a number of mandatory requirements for the installation of automatic fire sprinklers and through the use of construction economies, provides the building owner and architect with a number of economic incentives if automatic fire sprinklers are used.

Here are some examples of trade-offs available under this code:

- "Liberal height and area increases."
- "Fireproofing reductions for:
 - a) Exterior bearing walls
 - b) Interior bearing walls
 - c) Structural framing
 - d) Permanent partitions
 - e) Floor
 - f) Roof"
- "Permission to use interior finishes with high flame spread characteristics."
- "Exit distance increases."

The Uniform Building Code was the first of the model codes to allow sprinkler options or "trade-offs" even when sprinklers are mandatory.

Overview

The City of Fresno has developed an entire concept of public fire safety based on automatic fire sprinkler protection.

City officials are not content to rest on the remarkable gains they have made. Constant strides for evaluating present codes and practices will insure the citizens of the City of Fresno, the best available protection from the ravages of fire. The silent sentries are the vanguard...now and in the future.

EXHIBIT A

CITY OF FRESNO
AREA ANALYSIS/POPULATION GROWTH

CITY OF FRESNO
AREA ANALYSIS/POPULATION GROWTH

<u>YEAR</u>	<u>CITY OF FRESNO AREA IN SQUARE MILES</u>	<u>POPULATION</u>
1956	21.45	115,000 (estimated)
1957	23.25	112,944 (special census)
1958	25.05	112,944 (special census)
1959	26.84	132,000 (estimated)
1960	28.64	133,939 (U.S. census)
1961	31.49	141,600 (State Tax Return)
1962	35.59	147,200 (State Spec. Census)
1963	36.29	151,600 (State Dept. of Finance)
1964	37.07	156,000 (State Dept. of Finance)
1965	37.78	158,000 (special census)
1966	38.78	159,300 (State Dept. of Finance)
1967	38.99	161,400 (State Dept. of Finance)
1968	40.70	162,500 (State Calif. Census)
1969	41.78	168,600 (State Calif. Census)
1970	41.80	165,972 (U.S. census)
1971	42.83	169,600 (State Calif. Census)
1972	43.52	173,800 (State Calif. Census)
1973	44.21	176,800 (State Calif. Census)
1974	47.91	176,800 (State Calif. Census)
1975	53.46	177,900 (State Calif. Census)
1976	55.76	179,200 (State Calif. Census)
1977	56.74	186,900 (State Calif. Census)

Notes: From 1960-1974, the area in square miles was as of April 1st.
From 1975-1977, the area in square miles was as of January 1st.

CITY OF FRESNO
AREA ANALYSIS/POPULATION GROWTH

Discussion:

An analysis of the geographical area in square miles for the City of Fresno from 1956-1977 reflects a steady increase over the 22-year period.

A series of annexations has almost tripled the geographical area for Fresno since 1956.

In 1956, the population for the City was an estimated 115,000 people. Federal census polls in 1960 and 1970 reveal a dramatic increase in the City's population.

Presently, a State of California census shows 186,900 people living within the prescribed city limits for the City of Fresno.

The statistics in this exhibit, when compared with exhibits that follow, begin to show some rather interesting trends.

Let us now turn to the number of fire stations and the area in square miles that they protect from 1956-1977.

EXHIBIT B

CITY OF FRESNO

NUMBER OF SQUARE MILES PROTECTED PER FIRE STATION

CITY OF FRESNO
NUMBER OF SQUARE MILES PROTECTED PER FIRE STATION

<u>YEAR</u>	<u>CITY OF FRESNO AREA IN SQUARE MILES</u>	<u>NUMBER OF FIRE STATIONS</u>	<u>SQUARE MILES PROTECTED PER FIRE STATION</u>
1956	21.45	9	2.38
1957	23.25	9	2.58
1958	25.05	9	2.78
1959	26.84	9	2.98
1960	28.64	9	3.18
1961	31.49	9	3.49
1962	35.59	10	3.55
1963	36.29	10	3.62
1964	37.07	10	3.70
1965	37.78	10	3.77
1966	38.78	10	3.87
1967	38.99	10	3.89
1968	40.70	10	4.07
1969	41.78	10	4.17
1970	41.80	10	4.18
1971	42.83	10	4.28
1972	43.52	11	3.96
1973	44.21	11	4.02
1974	47.91	11	4.36
1975	53.46	11	4.86
1976	55.76	10	5.57
1977	56.74	11	5.16

CITY OF FRESNO
NUMBER OF SQUARE MILES PROTECTED PER FIRE STATION

Discussion:

Nine fire stations protected 21.45 square miles of area in 1956. This is approximately one fire station for every 2½ square miles of area.

In 1966, ten fire stations protected an area of 38.78 square miles. This is approximately one fire station serving almost four square miles of area.

In 1976, ten fire stations protected 55.76 square miles, computing to approximately one fire station for every 5½ square miles of area. The addition of one fire station in 1977 reduced this figure slightly.

Dramatic increases in geographical area and population have not required substantial increases in the number of fire stations protecting the City.

Exhibit C analyzes the total on-duty manpower (suppression) from 1955 to 1977. The analysis is startling.

EXHIBIT C
CITY OF FRESNO
FIRE DEPARTMENT MANPOWER LEVELS

CITY OF FRESNO
FIRE DEPARTMENT MANPOWER LEVELS

<u>Fiscal Year</u>	<u>Total On-Duty Manpower (Suppression)</u>
1955	68
1956	68
1957	68
1958	68
1959	66
1960	65
1961	65
1962	68
1963	68
1964	67
1965	67
1966	68
1967	71
1968	73
1969	73
1970	69
1971	69
1972	71
1973	71
1974	70
1975	67
1976	71
1977	68

CITY OF FRESNO
FIRE DEPARTMENT MANPOWER LEVELS

Discussion:

Total on-duty manpower (suppression) for any 24-hour period shows little difference when figures are compared over a 23-year period.

It should be pointed out that in 1955-1956, a 66-hour work-week was in effect. From 1957-1960, the work-week was 60 hours. For both of these periods, a two platoon system was utilized by the Fresno Fire Department.

In 1961, a three platoon system was initiated with a drop of one hour per week per year until, in 1964, a 56-hour work-week was achieved.

These figures begin to take on significance when compared with dramatic increases in population and geographical area for the City of Fresno.

These statistics clearly demonstrate how the manpower levels have been stabilized for the City's fire department.

The savings to the taxpayer in salaries, fringe and pension benefits are substantial. These savings have been accomplished without sacrificing any fire protection for Fresno residents.

We are now beginning to see certain trends emerge which lend support to the contention that the City's fathers have found alternate solutions to the fire problem other than using, as a sole means of defense, the conventional resources of the City's fire department.

With the trend in recent years of protecting wider geographical areas and more people with less manpower, the prominent role of automatic fire sprinklers takes on an even greater significance.

EXHIBIT D

CITY OF FRESNO
FIRE FIGHTERS PER 10,000 POPULATION--1955-1977

CITY OF FRESNO
FIRE FIGHTERS PER 10,000 POPULATION--1955-1977

<u>YEAR</u>	<u>TOTAL ON DUTY MANPOWER (SUPPRESSION)</u>	<u>POPULATION</u>	<u>FIRE FIGHTERS PER 10,000 POPULATION</u>
1955	68	112,650 (estimated)	6.04
1956	68	115,000 (estimated)	5.91
1957	68	112,944 (special census)	6.02
1958	68	112,944 (special census)	6.02
1959	66	132,000 (estimated)	5.00
1960	65	133,939 (U.S. Census)	4.85
1961	65	141,600 (State Tax Return)	4.59
1962	68	147,200 (State Special Census)	4.62
1963	68	151,600 (State Dept. of Finance)	4.49
1964	67	156,000 (State Dept. of Finance)	4.29
1965	67	158,000 (special census)	4.24
1966	68	159,300 (State Dept. of Finance)	4.27
1967	71	161,400 (State Dept. of Finance)	4.40
1968	73	162,500 (State Calif. Census)	4.49
1969	73	168,600 (State Calif. Census)	4.33
1970	69	165,972 (U.S. Census)	4.16
1971	69	169,600 (State Calif. Census)	4.07
1972	71	173,800 (State Calif. Census)	4.09
1973	71	176,800 (State Calif. Census)	4.02
1974	70	176,800 (State Calif. Census)	3.96
1975	67	177,900 (State Calif. Census)	3.77
1976	71	179,200 (State Calif. Census)	3.96
1977	68	186,900 (State Calif. Census)	3.64

CITY OF FRESNO
FIRE FIGHTERS PER 10,000 POPULATION
1955 - 1977

Discussion:

In 1955 an estimated population of 112,650 people was served by a total on-duty manpower (suppression) of 68 fire fighters. Approximately six fire fighters for every 10,000 residents.

In 1965, a special census showed 158,000 people in Fresno. Total on-duty manpower (suppression) was 67 men. Approximately 4 fire fighters for every 10,000 in population.

186,900 people are presently living in the City of Fresno according to a recent State of California census, with a total of 68 on-duty fire fighters, approximately 3½ firemen for every 10,000 inhabitants.

Even with the substantial increases in population and geographical area for the City of Fresno, the fire department was able to reduce its personnel and still effectively protect greater numbers of people and wider geographical regions as the years progressed.

An examination of this exhibit and comparison with Exhibit E clearly shows that more people and wider areas are protected with less manpower.

EXHIBIT E

CITY OF FRESNO
FIRE FIGHTERS PER SQUARE MILES OF AREA

CITY OF FRESNO
FIRE FIGHTERS PER SQUARE MILES OF AREA

<u>YEAR</u>	<u>FIRE DEPT. MANPOWER TOTAL ON-DUTY STRENGTH (SUPPRESSION)</u>	<u>CITY OF FRESNO AREA IN SQUARE MILES</u>	<u>FIRE FIGHTERS PER SQUARE MILES OF AREA</u>
1956	68	21.45	3.2
1957	68	23.25	2.9
1958	68	25.05	2.7
1959	66	26.84	2.5
1960	65	28.64	2.3
1961	65	31.49	2.1
1962	68	35.59	1.9
1963	68	36.29	1.9
1964	67	37.07	1.8
1965	67	37.78	1.8
1966	68	38.78	1.8
1967	71	38.99	1.8
1968	73	40.70	1.8
1969	73	41.78	1.7
1970	69	41.80	1.7
1971	69	42.83	1.6
1972	71	43.52	1.6
1973	71	44.21	1.6
1974	70	47.91	1.5
1975	67	53.46	1.3
1976	71	55.76	1.3
1977	68	56.74	1.2

CITY OF FRESNO
FIRE FIGHTERS PER SQUARE MILE OF AREA

Discussion:

In 1956, there were three fire fighters for slightly in excess of 21 square miles of area.

In 1965, there were approximately two fire fighters for every 38 square miles of area.

In 1977, there is approximately one fire fighter for every 56 square miles of area.

As a result of a series of annexations, the area for the City of Fresno has almost tripled since 1956, but in 1977, requires less fire fighters per square mile to protect its citizens.

EXHIBIT F

CITY OF FRESNO
FIRE DEPARTMENT MANPOWER LEVELS

CITY OF FRESNO
FIRE DEPARTMENT MANPOWER LEVELS

<u>Fiscal Year</u>	<u>Total Sworn/ Uniformed Personnel</u>	<u>Total Nonsworn Uniformed Personnel</u>	<u>Total Uniformed Personnel</u>
1955	218	0	218
1956	218	0	218
1957	238	0	238
1958	237	0	237
1959	232	0	232
1960	232	0	232
1961	236	0	236
1962	245	0	245
1963	249	0	249
1964	249	0	249
1965	250	0	250
1966	254	0	254
1967	264	0	264
1968	271	0	271
1969	271	0	271
1970	258	0	258
1971	259	0	259
1972	264	0	264
1973	265	0	265
1974	263	6	269
1975	262	6	268
1976	275	6	281
1977	276	6	282

CITY OF FRESNO
FIRE DEPARTMENT MANPOWER LEVELS

<u>Fiscal Year</u>	<u>Total Civilian Personnel</u>	<u>Total Full-Time Paid Personnel</u>	<u>Total Prevention Uniformed Personnel including Arson Investigators</u>
1955	9	227	9
1956	9	227	9
1957	10	248	9
1958	10	247	9
1959	6	238	15
1960	5	237	17
1961	5	241	17
1962	5	250	14
1963	5	254	14
1964	8	257	13
1965	8	258	13
1966	8	262	13
1967	9	273	15
1968	9	280	14
1969	5	276	14
1970	5	263	14
1971	5	264	14
1972	8	272	14
1973	8	273	15
1974	7	276	14
1975	14	282	16
1976	14	295	16
1977	24	306	16

CITY OF FRESNO
FIRE DEPARTMENT MANPOWER LEVELS

<u>Fiscal Year</u>	<u>Total Administration Uniformed Personnel including Alarm Dispatchers</u>	<u>Total Operations (Suppression) Uniformed Personnel</u>
1955	12	197
1956	12	197
1957	11	218
1958	10	218
1959	7	210
1960	7	208
1961	8	211
1962	8	223
1963	8	227
1964	8	228
1965	8	229
1966	8	233
1967	8	241
1968	8	249
1969	9	248
1970	10	234
1971	10	235
1972	10	240
1973	10	240
1974	11	238
1975	15	231
1976	15	244
1977	15	245

CITY OF FRESNO
FIRE DEPARTMENT MANPOWER LEVELS

<u>Fiscal Year</u>	<u>Total Operations (Suppression) Uniformed Personnel Excluding Chief Officers</u>	<u>Total Operations (Suppression) Uniformed Personnel Excluding Chief Officers Assigned Per 24-Hour Shift Including Vacation Relief</u>
1955	190	95
1956	190	95
1957	210	105
1958	210	105
1959	202	101
1960	200	100
1961	204	68
1962	216	72
1963	220	73.3
1964	221	73.6
1965	222	74
1966	226	75.3
1967	234	78
1968	242	80.6
1969	241	80.3
1970	227	75.6
1971	228	76
1972	233	77.6
1973	233	77.6
1974	231	77
1975	224	74.6
1976	237	79
1977	237	79

EXHIBIT G

CITY OF FRESNO
FIRE DEPARTMENT APPARATUS

CITY OF FRESNO
FIRE DEPARTMENT APPARATUS

YEAR	IN SERVICE FIRE APPARATUS			RESCUE FIRE APPARATUS					
	ENGINE CO's. (PUMPERS)	TRUCK CO's. (LADDER)	AIR RESCUE	ENGINE CO's. (PUMPERS)	TRUCK CO's. (LADDER)	HOSE WAGONS	WATER TANKS	RESCUE VANS	FUEL SUPPLY TRUCKS
1955	9	4		3		3 in serv.	2		1
1956	9	4		3		3 in serv.	2		1
1957	9	4		4	1	3	2		1
1958	9	4		4	1	3	2		1
1959	9	4		4	1	3	2		1
1960	9	4		4	1	3	2		1
1961	9	4		4	1	3	2		1
1962	10	4	1	3	1	3	2		1
1963	10	4	1	3	1	3	2		1
1964	10	4	1	2	1	3	2		1
1965	10	4	1	3	1	3	2		1
1966	10	4	1	3	1	3	2		1
1967	10	4	1	3	1	3	2		1
1968	10	4	2	3	1	3	2		1
1969	11	4	2	3	1	2	2	1	1
1970	11	4	2	3	1	2	1	1	1
1971	11	4	2	3	1	2	1	1	1

Fire Dept. Apparatus (continued)

YEAR	IN SERVICE FIRE APPARATUS			RESCUE FIRE APPARATUS					
	ENGINE CO's. (PUMPERS)	TRUCK CO's. (LADDER)	AIR RESCUE	ENGINE CO's. (PUMPERS)	TRUCK CO's. (LADDER)	HOSE WAGONS	WATER TANKS	RESCUE VANS	FUEL SUPPLY TRUCKS
1972	11	4	2	3	1	2	1	1	1
1973	11	4	2	2	1	2	1	1	1
1974	11	4	2	2	1	2	1	1	1
1975	10	5	3	3	1	2	1	1	1
1976	10	5	3	2	1	2	1	1	1
1977	11	5	3	2	1	2	1	1	1

CITY OF FRESNO
FIRE DEPARTMENT APPARATUS

Discussion:

Although the fire department for the City of Fresno is protecting larger numbers of people over a wider geographical area, there has not been a dramatic increase in the amount of equipment being used by the fire department when we compared in service fire apparatus from 1955-1977.

Once again, dramatic savings for the taxpayer are evident.

EXHIBIT H

CITY OF FRESNO
21 YEAR PROFILE - FIRE LOSSES PER CAPITA

CITY OF FRESNO
21 YEAR PROFILE - FIRE LOSSES PER CAPITA

<u>YEAR</u>	<u>NO. OF INCIDENTS</u>	<u>LOSS</u>	<u>POPULATION</u>	<u>PER CAPITA LOSS</u>
1956	1026	\$ 415,821	115,000 (estimated)	3.616
1957	1009	449,894	112,944 (special census)	3.98
1958	1291	511,779	112,944 (special census)	4.53
1959	1490	566,363	132,000 (estimated)	4.291
1960	1569	829,528	133,939 (U.S. Census)	6.193
1961	1674	759,779	141,600 (State Tax Return)	5.366
1962	1694	855,145	147,200 (State Special Census)	5.809
1963	1478	397,064	151,600 (State Dept. of Finance)	2.619
1964	1927	638,414	156,000 (State Dept. of Finance)	4.092
1965	2037	596,787	158,000 (special census)	3.777
1966	2396	857,818	159,300 (State Dept. of Finance)	5.385
1967	2893	825,142	161,400 (State Dept. of Finance)	5.112
1968	3341	630,551	162,500 (State Calif. Census)	3.88
1969	3513	871,276	168,600 (State Calif. Census)	5.167
1970*	3455	3,478,897	165,972 (U.S. Census)	20.96
1971	3714	1,286,429	169,600 (State Calif. Census)	7.585
1972	5143	1,211,698	173,800 (State Calif. Census)	6.97
1973	5423	1,214,916	176,800 (State Calif. Census)	6.87
1974	5905	2,008,710	176,800 (State Calif. Census)	11.36
1975	6808	1,788,239	177,900 (State Calif. Census)	10.05
1976	5276	2,167,145	186,900 (State Calif. Census)	11.60

* Fire losses of \$3,478,897 in 1970 was due to one large loss fire which destroyed a retail sales occupancy of 104,000 square feet in area and amounted to a loss of \$2,200,000. The following citation appeared in the May, 1971 issue of Fire Journal:

"Mercantile

Department Store. The GEM Company's department store in Fresno, California, was the scene of a \$2.2 million fire on October 26. The 104,000 square-foot one-story building, constructed of masonry walls and built-up wood roof supported by unprotected steel columns, was 90 per cent stocked in preparation for the store's opening. The installation of three sprinkler systems had just about been completed, but at the time of the fire the valves had not been opened on the risers to two of the systems. The operative system protected one end of the building, including an office and machinery area that was separated from the rest of the building by a one-hour partition. The fire originated during the night in the concealed space between the wood roof deck and the noncombustible suspended ceiling. The point of origin was in that part of the building where sprinkler protection had not yet been turned on. Between 20,000 and 24,000 square feet of concealed area was involved when fire fighters responded to the alarm given by a passer-by at approximately 6 a.m. The fire burned off most of the roof of the building and destroyed all the contents except some machinery in the partitioned-off area. This fire illustrates the folly of occupying new sprinklered buildings before the sprinkler protection has been placed in operation."

EXHIBIT I

CITY OF FRESNO
PERCENT OF TOTAL FIRE LOSS BY OCCUPANCY

PERCENT OF TOTAL FIRE LOSS BY OCCUPANCY
1958 - 1976

Year	Residential	Non Residential	Mercantile	Manufacturing	Miscellaneous	Exposures with Loss	Totals
1958	31.41%	29.04%	36.90%	.99%	.11%	1.55%	100%
1959	41.92%	18.04%	36.16%	3.86%	.02%	--	100%
1960	40.39%	4.00%	52.56%	3.05%	--	--	100%
1961	38.16%	8.80%	31.04%	19.53%	.13%	2.34%	100%
1962	31.94%	.73%	63.96%	2.57%	.11%	.69%	100%
1963	60.61%	.62%	34.23%	2.99%	.08%	1.47%	100%
1964	55.49%	7.56%	35.11%	.06%	--	1.78%	100%
1965	55.49%	5.77%	33.72%	4.67%	.01%	.34%	100%
1966	42.17%	.59%	52.73%	2.89%	.08%	1.54%	100%
1967	48.82%	.08%	23.07%	25.95%	.05%	2.03%	100%
1968	70.14%	3.88%	11.33%	9.26%	.01%	5.38%	100%

Percent of Total Fire Loss By Occupancy (continued)

Year	Residential	Non Residential	Mercantile	Manufacturing	Miscellaneous	Exposures with Loss	Totals
1969	55.82%	3.08%	37.38%	.02%	--	3.70%	100%
1970	17.01%	1.40%	80.08%	.01%	--	1.50%	100%
1971	43.02%	12.20%	31.29%	.65%	--	12.84%	100%

PERCENT OF TOTAL FIRE LOSS BY OCCUPANCY
1972 - 1976

Year	Residential	Schools & Hospitals	Storage & Warehousing	Vehicles	Stores & Offices	Public Assembly	Manu. & Indus.	Spec. Prop.	Totals
1972	54.37%	1.07%	8.62%	10.89%	7.35%	2.22%	9.46%	6.03%	100%
1973	53.10%	1.10%	5.50%	10.10%	15.30%	3.40%	2.60%	8.90%	100%
1974	44.43%	.32%	13.49%	8.65%	15.63%	6.12%	7.09%	4.27%	100%
1975	54.20%	13.31%	10.25%	7.49%	6.03%	4.77%	.30%	3.18%	100%
1976	56.50%	4.16%	4.00%	6.64%	10.82%	5.87%	8.69%	3.32%	100%

CITY OF FRESNO
PERCENT OF TOTAL FIRE LOSS BY OCCUPANCY

Discussion:

An analysis of this exhibit shows some rather significant trends.

In 1958, approximately 31% of the fire losses in the City were in residential buildings. In 1967, almost 49% of the losses reported were in residential buildings.

With the exception of 1970, the statistics show a steady increase in fires occurring in residential occupancies.

In 1972, Fresno began utilizing the Uniform Fire Incident Reporting System (UFIRS) in an effort to collect, classify, and report fire incident data more effectively.

The Special Property category includes fires occurring in utilities and outdoor properties. In 1974 and 1975, residential garages used as storage were considered in the Storage and Warehousing category.

Exhibit J shows the relationship between residential fires and fires occurring in all other occupancies and vividly shows the shift of the greater dollar loss fires in the middle 60's occurring in residential construction.

Exhibit K compares a three-year average of fire losses in residential and other occupancies.

EXHIBIT J

CITY OF FRESNO
PERCENT OF FIRE LOSSES--RESIDENTIAL VS. OTHER

CITY OF FRESNO
PERCENT OF FIRE LOSSES--RESIDENTIAL VS. OTHER

<u>YEAR</u>	<u>RESIDENTIAL</u>	<u>OTHER</u>	<u>TOTAL</u>
1958	31.41%	68.59%	100%
1959	41.92%	58.08%	100%
1960	40.39%	59.61%	100%
1961	38.16%	61.84%	100%
1962	31.94%	68.06%	100%
1963	60.61%	39.39%	100%
1964	55.49%	44.51%	100%
1965	55.48%	44.52%	100%
1966	42.17%	57.83%	100%
1967	48.82%	51.18%	100%
1968	70.14%	29.86%	100%
1969	55.82%	44.18%	100%
1970	17.01%	82.99%	100%
1971	43.02%	56.98%	100%
1972	54.37%	45.63%	100%
1973	53.10%	46.90%	100%
1974	44.43%	55.57%	100%
1975	54.20%	45.80%	100%
1976	56.50%	43.50%	100%

CITY OF FRESNO
PERCENT OF FIRE LOSSES--RESIDENTIAL VS. OTHER

Discussion:

In analyzing the annual statistical summaries provided by the Fresno Fire Department, we see a substantial shift to residential fire losses when compared with other fire losses from a period of 1958-1976.

In 1958, 31.4% of the fire losses in dollars occurred in residential construction. Almost 69% of the losses reported occurred in mercantile, non-residential, and manufacturing occupancies.

With the exception of 1970, where a \$2½ million large loss fire occurred in a mercantile occupancy (see Exhibit H), the trend for fires in residential buildings steadily increases and in 1956, more than 56% of the fire losses occurred in residential construction.

We have plotted, in Exhibit L, the comparison of fire losses.

EXHIBIT K

CITY OF FRESNO
PERCENT OF FIRE LOSSES - RESIDENTIAL VS. OTHER OCCUPANCIES
THREE-YEAR AVERAGE

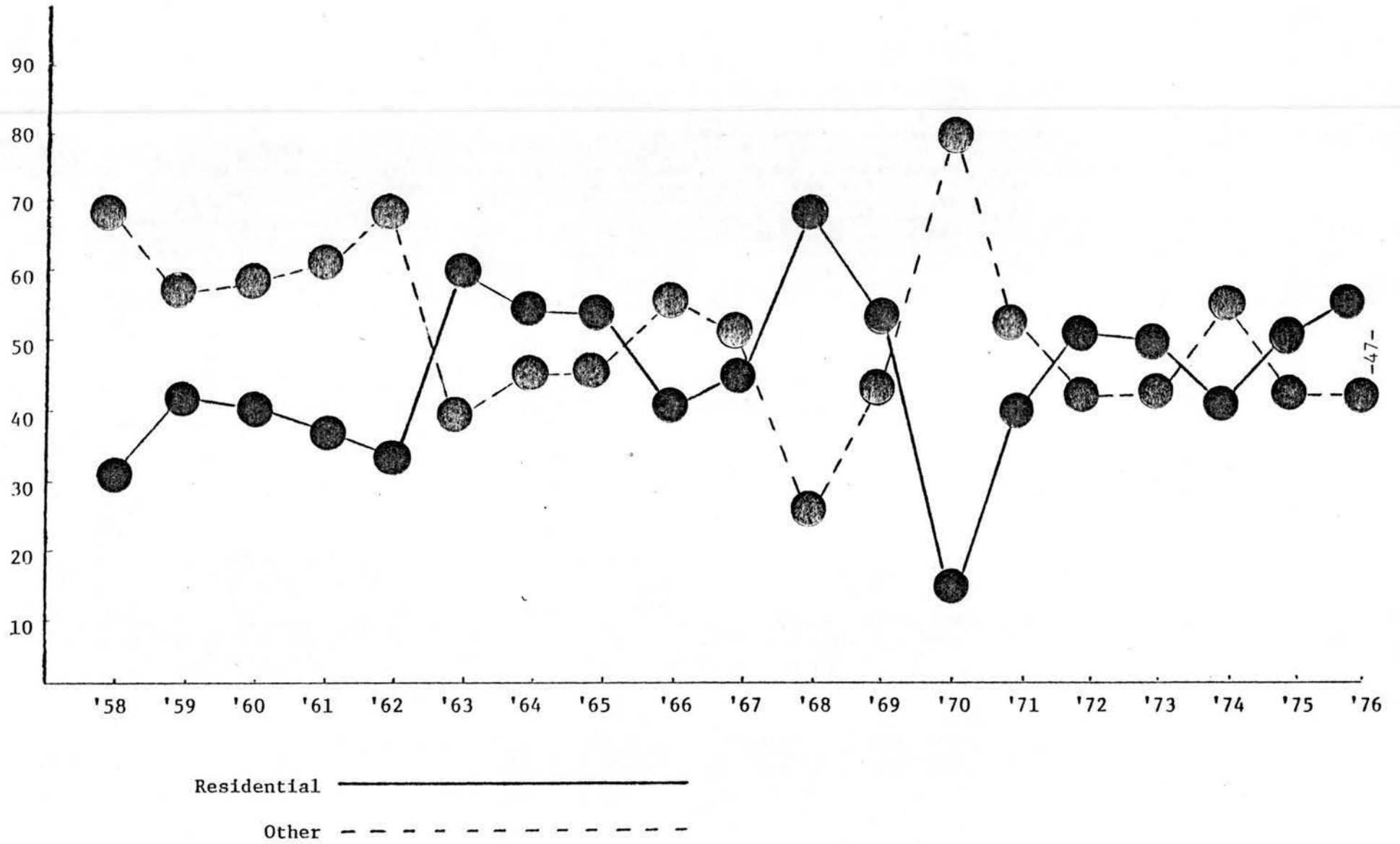
1958 - 1975
PERCENT OF FIRE LOSSES - RESIDENTIAL VS. OTHER OCCUPANCIES
THREE-YEAR AVERAGE

<u>YEAR</u>	<u>RESIDENTIAL</u>	<u>OTHER</u>	<u>TOTAL</u>
1958-1960	37.91%	62.09%	100%
1961-1963	43.57%	56.43%	100%
1964-1966	51.05%	48.95%	100%
1967-1969	58.26%	41.74%	100%
1970-1972	38.13%	61.87%	100%
1973-1975	50.58%	49.42%	100%

EXHIBIT L

CITY OF FRESNO
PERCENT OF FIRE LOSSES IN DOLLARS--GRAPHICAL ANALYSIS
RESIDENTIAL VS. OTHER

CITY OF FRESNO
PERCENT OF FIRE LOSSES IN DOLLARS--GRAPHICAL ANALYSIS
RESIDENTIAL VS. OTHER



-47-

EXHIBIT M

CITY OF FRESNO
1956 - 1976
THREE YEAR AVERAGE

1956 - 1976
THREE YEAR AVERAGE

- Incidents
- Fire Loss
- Population
- Per Capita Loss

Year	Number of Incidents	Average Fire Loss	Average Population	Average Per Capita Loss
1956-1958	1109	\$459,165	113,629	4.04
1959-1961	1578	\$718,557	135,846	5.28
1962-1964	1700	\$630,208	151,600	4.16
1965-1967	2442	\$759,916	159,567	4.76
1968-1970	3436	\$1,660,241	165,691	10.02
1971-1973	4760	\$1,237,681	173,400	7.14
1974-1976	5996	\$1,988,031	180,533	11.11

EXHIBIT N

CITY OF FRESNO
FISCAL ANALYSIS

CITY OF FRESNO
FISCAL ANALYSIS

<u>YEAR</u>	<u>TOTAL FIRE DEPT. BUDGET</u>	<u>TOTAL CITY BUDGET</u>	<u>PERCENT</u>
1956	\$1,860,848	\$14,089,270	13.2%
1957	\$2,029,699	\$15,482,074	13.1%
1958	\$2,158,138	\$16,859,996	12.8%
1959	\$2,143,806	\$15,775,458	13.6%
1960	\$2,304,693	\$17,376,977	13.3%
1961	\$2,508,471	\$19,337,514	12.9%
1962	\$2,655,075	\$20,685,516	12.8%
1963	\$2,817,151	\$22,287,019	12.6%
1964	\$3,156,069	\$22,627,120	13.9%
1965	\$2,681,084	\$24,087,346	11.1%
1966	\$2,643,063	\$25,492,644	10.4%
1967	\$2,728,789	\$27,365,970	9.9%
1968	\$2,980,496	\$29,909,463	9.9%
1969	\$3,150,238	\$37,964,047	8.3%
1970	\$3,347,537	\$41,541,987	8.1%
1971	\$3,654,037	\$44,579,447	8.2%
1972	\$4,142,834	\$43,064,391	9.6%
1973	\$6,114,116*	\$48,091,359	12.7%
1974	\$6,712,890*	\$54,054,730	12.4%
1975	\$7,536,310*	\$61,240,857	12.3%
1976	\$8,768,700*	\$72,481,400	12.1%
1977	\$9,004,600*	\$112,595,800**	7.9%

* Vehicle rental and fringe benefits are paid out of individual departmental appropriations. Prior to 1973-74, they were not paid out of departmental budgets, but were paid out of General Expenses and Fixed Charges Dept.

**Grant funded activities are now included as part of the budget, they were not included prior to the 1977-78 year - these are projected figures.

CITY OF FRESNO
FISCAL ANALYSIS

Discussion:

The City of Fresno has effectively stabilized their fire department costs when we compare allocations with the total city budget from 1956-1977.

Exhibit N compares the total fire department budget with the total city budget in current dollars. Exhibits O, P, and Q compare these same statistics considering inflationary factors, thus making a comparison between current and constant dollars.

Stabilizing fire department costs has provided substantial savings to the taxpayer of the City of Fresno.

In 1956, there was little more than 13% of the monies being allocated for fire department use. In 1977, the fire department budget is a little less than 8% of the total city budget.

This in itself is somewhat remarkable considering the shrinking dollar and the forces of inflation which has affected the budgets of city administrations and departments throughout the country.

Again, these figures take on even greater significance when recognizing that the fire department for the City is serving wider geographical areas and a substantial increase in its population over the last two decades.

EXHIBIT O

CITY OF FRESNO
FISCAL ANALYSIS

CITY OF FRESNO
FISCAL ANALYSIS

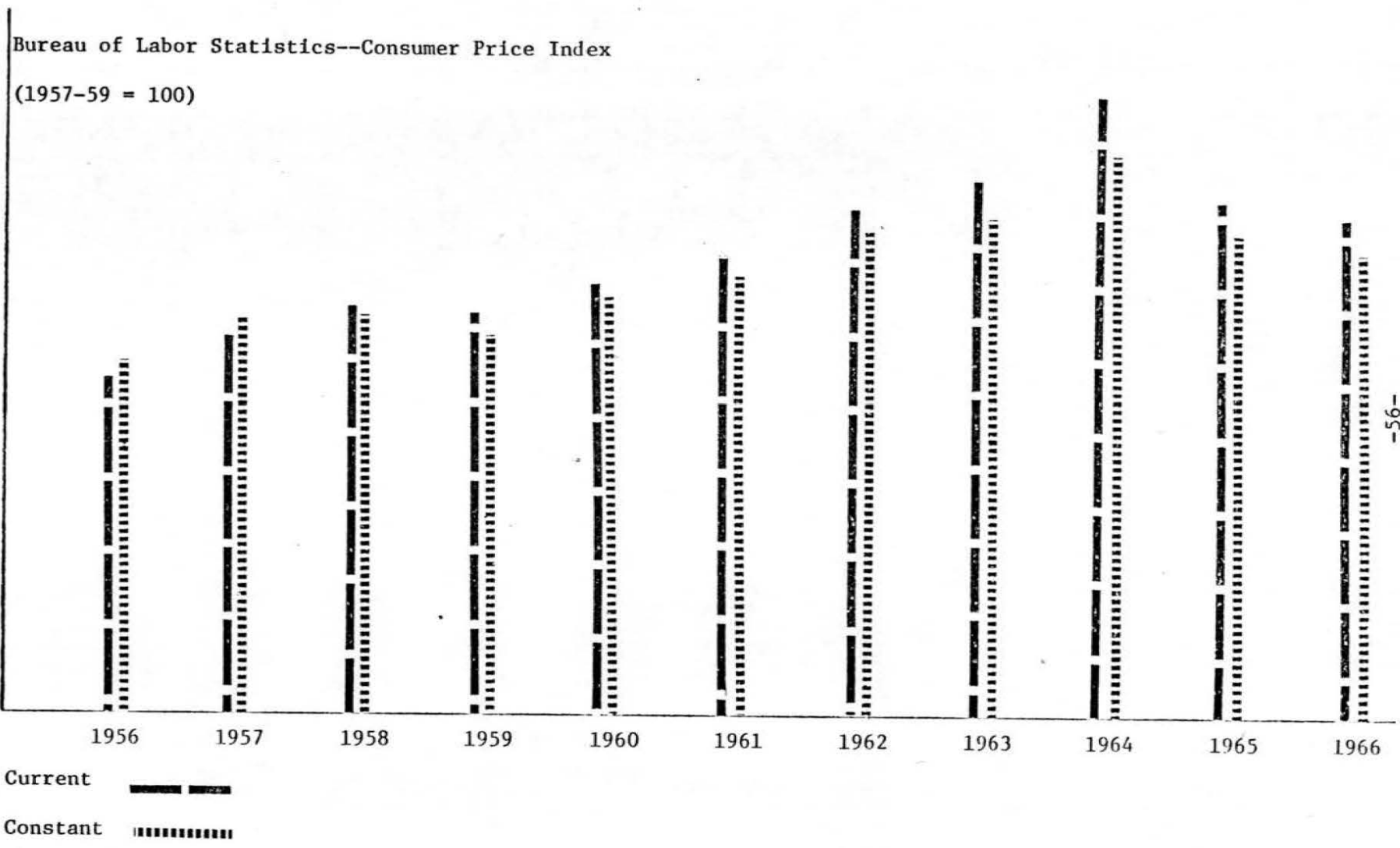
<u>YEAR</u>	<u>TOTAL FIRE DEPARTMENT BUDGET--</u> <u>CURRENT DOLLARS</u>	<u>CONSTANT DOLLARS</u>
1956	\$1,860,848	\$1,964,993
1957	\$2,029,699	\$2,071,121
1958	\$2,158,138	\$2,143,136
1959	\$2,143,806	\$2,112,124
1960	\$2,304,693	\$2,235,396
1961	\$2,508,471	\$2,407,362
1962	\$2,655,075	\$2,519,046
1963	\$2,817,151	\$2,640,254
1964	\$3,156,069	\$2,919,583
1965	\$2,681,084	\$2,439,567
1966	\$2,643,063	\$2,336,926
1967	\$2,728,789	\$2,346,336
1968	\$2,980,496	\$2,459,155
1969	\$3,150,238	\$2,466,905
1970	\$3,347,537	\$2,474,159
1971	\$3,654,037	\$2,591,516
1972	\$4,142,834	\$2,843,400
1973	\$6,114,116	\$3,952,240
1974	\$6,712,890	\$3,907,386
1975	\$7,536,310	\$4,019,365
1976	\$8,768,700	\$4,421,936
1977	\$9,004,600	\$4,265,561

Bureau of Labor Statistics--Consumer Price Index
(1957-59 = 100)

EXHIBIT P

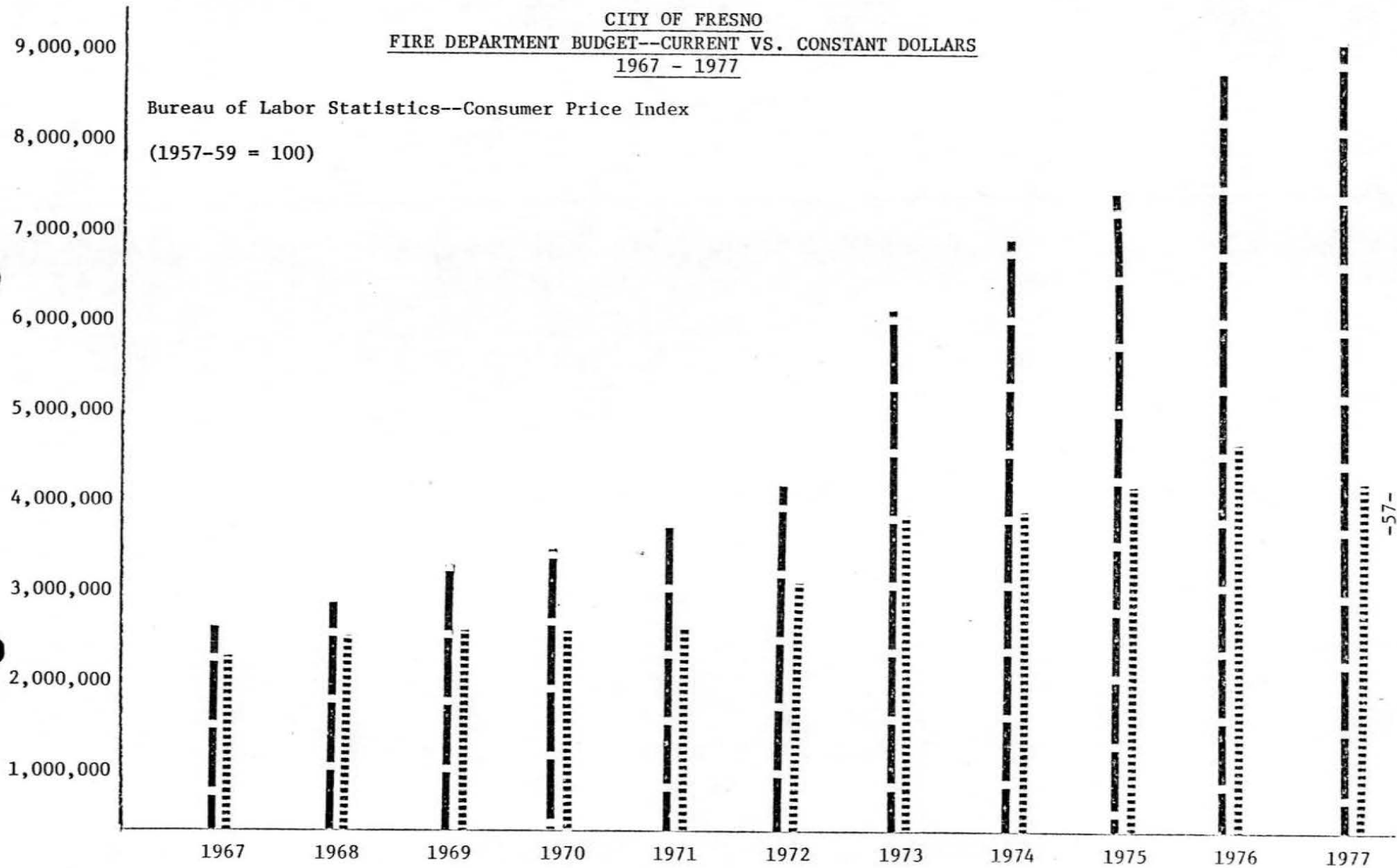
CITY OF FRESNO
FIRE DEPARTMENT BUDGET--CURRENT VS. CONSTANT DOLLARS
1956 - 1977

CITY OF FRESNO
FIRE DEPARTMENT BUDGET--CURRENT VS. CONSTANT DOLLARS
1956 - 1966



CITY OF FRESNO
FIRE DEPARTMENT BUDGET--CURRENT VS. CONSTANT DOLLARS
1967 - 1977

Bureau of Labor Statistics--Consumer Price Index
(1957-59 = 100)





Current 
Constant 

EXHIBIT Q

CITY OF FRESNO
FISCAL ANALYSIS

CITY OF FRESNO
FISCAL ANALYSIS

<u>YEAR</u>	<u>TOTAL CITY BUDGET-- CURRENT DOLLARS</u>	<u>CONSTANT DOLLARS</u>
1956	\$14,089,270	\$14,877,793
1957	\$15,482,074	\$15,798,034
1958	\$16,859,996	\$16,742,796
1959	\$15,775,458	\$15,542,323
1960	\$17,376,977	\$16,854,487
1961	\$19,337,514	\$18,558,074
1962	\$20,685,516	\$19,625,723
1963	\$22,287,019	\$20,887,552
1964	\$22,627,120	\$20,931,655
1965	\$24,087,346	\$21,917,512
1966	\$25,492,644	\$22,539,915
1967	\$27,365,970	\$23,530,498
1968	\$29,909,463	\$24,677,774
1969	\$37,964,047	\$29,729,089
1970	\$41,541,987	\$30,703,611
1971	\$44,579,447	\$31,616,629
1972	\$43,064,391	\$29,556,891
1973	\$48,091,359	\$31,086,851
1974	\$54,054,730	\$31,463,754
1975	\$61,240,857	\$32,661,790
1976	\$72,481,400	\$36,551,386
1977	\$112,595,800	\$53,337,659

Bureau of Labor Statistics--Consumer Price Index
(1957-59 = 100)

EXHIBIT R

CITY OF FRESNO
INSURANCE SERVICES GRADING CLASSIFICATIONS

INSURANCE SERVICES GRADING CLASSIFICATIONS

The American Insurance Association periodically measures a city's capacity to cope with the hazards of fire and other physical property damage.

The "Standard Schedule for Grading Cities and Towns of the United States with References to Their Fire Defenses and Physical Conditions" is commonly known as the "Grading Schedule".

The present version of this standard schedule is developed by the Insurance Services Office and is the modern version for the grading of cities and towns which was first issued in 1916 by the National Board of Underwriters.

The Grading Schedule classifies municipalities, using as a criteria, their fire defense capabilities and related physical conditions.

Within the schedule is a standard which lists 52 items used to analyze the fire protection for any municipality being graded. Deficiency points are assigned for each item which does not meet the standards. The total is determined by adding the deficiency points assigned to all items contained within the standard.

The maximum number of deficiency points is 5,000. These are divided into 10 classes of 500 points each, as shown in Table 1:

RELATIVE CLASS AS DETERMINED BY POINTS OF DEFICIENCY--TABLE 1

<u>Points of Deficiency</u>	<u>Relative Class of Municipality</u>
0 - 500	First
501 - 1,000	Second
1,001 - 1,500	Third
1,501 - 2,000	Fourth
2,001 - 2,500	Fifth
2,501 - 3,000	Sixth
3,001 - 3,500	Seventh
3,501 - 4,000	Eighth
4,001 - 4,500	Ninth
More than 4,500	Tenth

From an examination of the Table, it can be determined that a municipality with 1,548 points would be in Class 4, and a municipality with 4,371 points would be in Class 9.

Each of the 52 items in the schedule are grouped under four factors:

- Water Supply
- Fire Department
- Fire Service Communications
- Fire Safety Control

14 of the 52 items are allocated to Water Supply, 17 to the Fire Department, 10 to Fire Service Communications, 8 to Fire Safety Control, and 3 to Additional Deficiencies.

Once the fire protection classification has been determined as a result of a survey and grading, the question of the relationship between this classification, insurance rates, and the resulting insurance premiums needs to be answered.

The determination of insurance rates for individual properties considers one of two methods:

a) Specific rating used generally for commercial properties

or

b) Class rating used generally for individual properties such as dwellings, apartment houses, and motels.

Factors considered in specific rating are: (see Table 2)

- Construction
- Occupancy
- Hazards
- Exposures
- Internal Fire Protection
- Public Fire Protection Class
- Statistical Loss Experience

There are four factors generally considered in class rating: (see Table 3)

- Construction
- Occupancy
- Public Fire Protection Class
- Statistical Loss Experience

Changes in public fire protection class generally result in changes in the insurance rates on specifically rated properties. However, such changes do not always result in a change of rates on class rated properties. The primary reason for this is because the public fire protection classes are considered in groups when being applied to class rated properties. (see Table 4)

Considering the groupings as shown in Table 4, the public fire protection class of a municipality should improve from Class 5 to Class 4, the rates on both specifically rated and class rated properties. If however, the class improved from Class 4 to Class 3, the rates on the specifically rated properties would be reduced but the rates on the class rated properties would remain the same.

Though most dwellings are insured under a homeowners policy, the "fire rate" is only a portion of the total rate for that policy. Public fire protection class is one of the factors considered in this rate but the classes are generally grouped as in the case of other class rated properties.

The following illustrations exemplify the typical effect of improvements in public fire protection class on insurance rates:

- "An advance in class from 7 to 6 would result in a reduction in rates on specifically rated properties of about 3 percent for frame construction, 5 percent for brick construction, and 2 percent for fire resistive construction; reductions for regular fire policies on frame dwellings would be about 15 percent and for homeowners policies on frame dwellings 5 percent.
- "An advance in class from 6 to 5 would result in a reduction in rates on specifically rated properties of about 5 percent for frame and brick construction, and 2 percent for fire resistive construction; since classes 5 and 6 are often grouped for use with class rated properties, rates for regular fire policies on dwellings and for homeowners policies would remain the same."
- "An advance in class from 3 to 2 would result in a reduction in rates on specifically rated properties of approximately 4 percent for frame construction, 5 percent for brick construction, and 2 percent for fire resistive construction; here again since classes 1 through 4 are frequently grouped for use with class rated properties, rates for regular fire policies on dwellings and for homeowners policies would remain unchanged."
- "City officials frequently ask if the savings in insurance premiums that would result from an advance from one fire protection class to the next better one would be sufficient to justify the cost of the improvements necessary to produce the change in class. If this were the case, the fire protection improvements could be justified on an economic basis. However, as previously observed, the public fire protection class is only one of a number of factors that affect insurance rates. Further, in most cases the other factors generally have a greater effect on insurance rates than the public fire protection class. If these observations are considered together with the fact that the rates on the class rated properties, which include the dwellings, do not always change with every change in public fire protection class, the conclusion can be reached that it generally is not possible to justify the cost necessary to produce an improvement in public fire protection class by the resulting savings in insurance premiums."¹

The incentive to reduce insurance premium costs as a result of reclassification of the city's fire defenses is but a small part of the benefits of using automatic fire sprinklers as a supplement to a large city's conventional resources--the fire services.

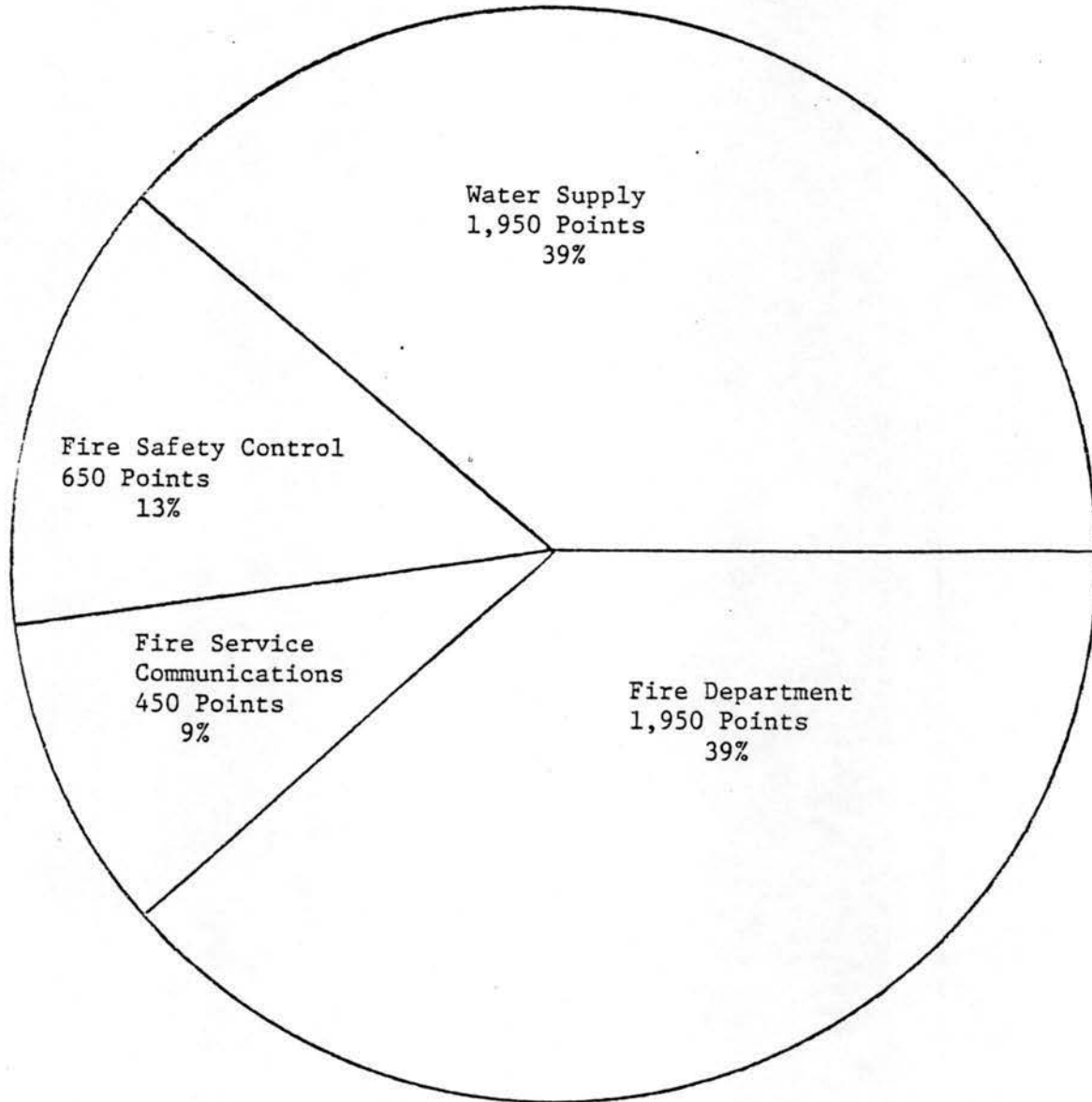
The Fresno Chronicle exemplifies the benefits in reducing men, equipment, and overall cost in conducting the activities of the fire services for a major metropolitan area.

These savings, by themselves, justify the adoption of a master plan calling for a strengthening of building codes for both new and existing construction and using, to its greatest advantage, automatic fire sprinkler protection.

The City of Fresno, California can well serve as a model to other cities in the United States which are attempting to find reasonable answers and solutions to the fire problem.

¹ Carl, Kenneth J., P.E., Director, Public Protection Grading, Insurance Services Office; A Paper Presented at the 96th Annual Conference of the American Water Works Association, June 24, 1976, New Orleans, Louisiana, "Relationship Between Insurance Services Grading Classifications of Municipalities and Fire Insurance Premiums".

INSURANCE SERVICES GRADING CLASSIFICATIONS
RELATIVE VALUES AND MAXIMUM DEFICIENCY POINTS



FACTORS CONSIDERED IN
SPECIFIC RATING FOR FIRE INSURANCE

CONSTRUCTION

OCCUPANCY

HAZARDS

EXPOSURES

INTERNAL FIRE PROTECTION

PUBLIC FIRE PROTECTION CLASS

STATISTICAL LOSS EXPERIENCE

GRADING SCHEDULE FOR
MUNICIPAL FIRE PROTECTION

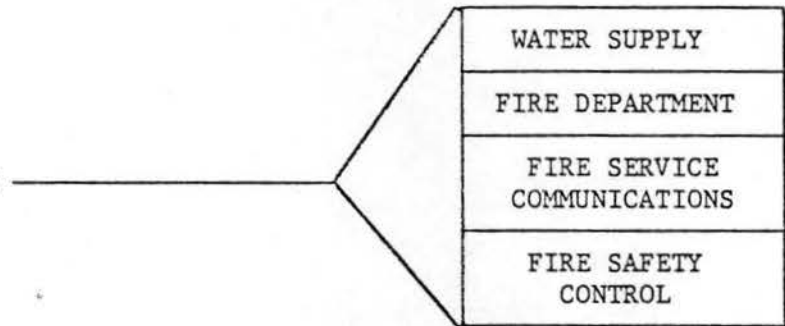


TABLE 2

FACTORS CONSIDERED IN
CLASS RATING FOR FIRE INSURANCE

CONSTRUCTION

OCCUPANCY

PUBLIC FIRE PROTECTION CLASS

STATISTICAL LOSS EXPERIENCE

GRADING SCHEDULE FOR
MUNICIPAL FIRE PROTECTION

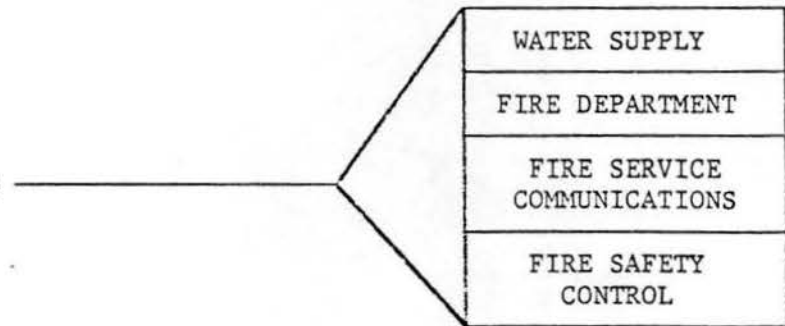


TABLE 3

RELATIVE VALUES AND MAXIMUM DEFICIENCY POINTS

<u>Feature</u>	<u>Per Cent</u>	<u>Points</u>
Water Supply	39	1,950
Fire Department	39	1,950
Fire Service Communications	9	450
Fire Safety Control	13	650
	<hr/>	<hr/>
	100	5,000

USE OF PUBLIC FIRE PROTECTION CLASSES
IN FIRE INSURANCE RATING

COMMERCIAL PROPERTIES

Classes Generally
Considered Separately

1
2
3
4
5
6
7
8
9
10

HABITATIONAL PROPERTIES
(Apartments, Motels, etc.)

Classes Generally
Considered in Groups

1
2
3
4
5
6
7
8
9
10

DWELLING PROPERTIES
(Homeowners policies)

Classes Generally
Considered in Groups

1
2
3
4
5
6
7
8
9
10

TABLE 4

EXHIBIT S

CITY OF FRESNO
NUMBER OF SPRINKLERED BUILDINGS--FIRE INSURANCE RATINGS

CITY OF FRESNO

NUMBER OF SPRINKLERED BUILDINGS--FIRE INSURANCE RATINGS

<u>YEAR</u>	<u>FIRE INSURANCE RATING</u>	<u>NUMBER OF SPRINKLERED BUILDINGS</u>
1956	Class 3	
1957	Class 3	
1958	Class 3	
1959	Class 3	
1960	Class 3	
1961	Class 3	
1962	Class 3	
1963	Class 3	
1964	Class 3	
1965	Class 3	
1966	Class 3	420--Approximate
1967	Class 3	
1968	Class 3	
1969	Class 2	
1970	Class 2	
1971	Class 2	
1972	Class 2	
1973	Class 2	
1974	Class 2	
1975	Class 2	
1976	Class 2	
1977	Class 2	700--Approximate

RECEIVED

SEP - 8 1981

DEPT. OF ADMINISTRATION
BUILDING CODE DIVISION

EXHIBIT # 3

PAID AND VOLUNTEER FIRE DEPARTMENTS

STATE OF MINNESOTA - 1982

14 Departments - All Paid Personnel - (Larger Departments)

22 Departments - 5 or More Paid Personnel

10 Departments - Less Than 5 Paid Personnel

750 Departments - Manned Entirely by Volunteer Personnel

796 Total Departments

(State Fire Marshal Division)

EXHIBIT #4

COMPARISON

TWO EDINA APARTMENT FIRES

6730 VERDON AVENUE

4 stories
Approx. 10 years old
Heat Detectors Throughout

Type I Fire Resistive

Apartment

Within Dwelling Unit

Living Room/Hallway
(Room Unoccupied)

Clothes Basket
(Ignition Source Unknown)

Occupant Entering

To contents, Hall Closet

To Carpet/Interior Hall

Door to Corridor Open

To Public Corridor
Interior Finish
(Rated Less than 25)

To Adjoining Apartment
(Open Door)

2 Dead

\$70,000.00

6 Engines 24 Men

2 Ladders 5 Men

3 Ambulances 7 Men

CONSTRUCTION

OCCUPANCY

FIRE LOCATION

FIRE AREA

FIRE START

ALERT

FIRE GROWTH

LOSS

- Life

- Property

RESOURCES

7151 YORK AVENUE SOUTH

13 stories
10 years old

Type I Fire Resistive

Apartment - Elderly

Within Dwelling Unit

Living Room
(Room Unoccupied)

Plastic Decorative Wreath
(Candle)

Sprinkler/Alarm

To Television Set Cabinet

To Wall Hangings, Picture
Frames

SPREAD OF FIRE CHECKED
Sprinkler

\$1,000.00

1 Engine 8 men

COMPARISON

Two Richfield Shopping Center Fires

26 W. 66th St.

68 W. 66th St.

Type 3, Unprotected

--CONSTRUCTION--

Type 3, Unprotected

Retail Store in Strip
Shopping Center

--OCCUPANCY--

Retail Store in Strip
Shopping Center

1:53 P.M., Monday

--TIME & DAY--

2:53 P.M., Sunday

Storeroom

--FIRE LOCATION--

Storeroom

Electric Water Heater

--FIRE START--

Incinerator

Clerks Heard Sounds
of Fire

--ALERT--

Sprinkler Alarm

To Retail Area, To
Roof, To Next Store,
Stopped by Firefighters
Hose Streams

--FIRE GROWTH--

To Material Next to
Incinerator, Fire Checked
By Two Sprinkler Heads.

\$750,000

--LOSS--

\$800.00

5 Engines,
2 Ladders,
41 Firefighters

--RESOURCES--

2 Engines, 6 Firefighters

Customers Evacuated From
Seven Stores. Only One
Store Reopened the Next
Day. One Store Never
Reopened, and The Rest
Were Reopened From One to
Six Months Afterward.

--COMMENTS--

Customers Evacuated
From One Store. Store
Reopened 45 Minutes Later.

COMPARISON

Two Duluth Building Fires

222 East Second Street
Senior Citizen Apartments

West Junior High
3 Stories

Type 1	Fire Resistive	-- CONSTRUCTION --	Type 1	Fire Resistive
Senior Apartments		-- OCCUPANCY --	School	
Within Dwelling Unit		-- FIRE LOCATION --	School Office	
Living Room (Occupied)		-- FIRE AREA --	Office	
Papers (Pipe)		-- FIRE START --	Wooden Desk	
Smoke Alarm		-- ALERT --	Custodian arriving for work	
Smokers, Pipe to newspaper		-- FIRE GROWTH --	Desk	
To Magazine rack			To Office furniture	
To Overstuffed chair			Office gutted	
Spread of Fire checked			Fire checked by closed office door	
Sprinkler			Smoke spread through school by way of vent system.	
\$3,000.00		-- LOSS --	\$110,000	

EXHIBIT # 5

WATER AND MANPOWER REQUIREMENTS

Theoretically, one gallon of water per minute applied in a fog pattern should have enough cooling power to extinguish 100 cubic feet of fire involving ordinary combustibles. Thus, to be able to extinguish a fire in two floors of a 1500 square foot home (8 foot ceilings) would require:

$$\begin{aligned} 1500 \times 2 &= 3000 \\ 3000 \times 8 &= 2400 \\ 2400 - 100 &= 240 \text{ GPM required} \end{aligned}$$

Fire suppression experts recommend 3 or 4 gallons per minute per 100 cubic feet for fire extinguishment under practical conditions, which allows for such things as openings which aid fire spread, the difficulty in applying water directly on the seat of the fire, as required by the theoretical formula to be valid.

The number of fire fighters required to maneuver the hoses is related to the size of the hose streams. The following are minimum fire fighter requirements on hose streams.

$$\begin{aligned} 100 \text{ GPM} &- 2-3 \\ 250 \text{ GPM} &- 3-5 \end{aligned}$$

"A typical sprinkler head delivers an average of 15 gallons of water per minute, and the data of various national organizations indicates that about three fourths of all fires in sprinklered buildings are extinguished with one or two sprinkler heads going off."

Kimball, Warren, Fire Attack 1, Command Decisions and Company Operations, 1973, National Fire Protection Association, 60 Battery March Street, Boston, Mass., 02110, pg. 81 f.

International Fire Service Training Association, Fire Stream Practices, 1980, Fire Protection Publications, Oklahoma State University, Stillwater, Oklahoma, 74078, pg. 158.

EXHIBIT #1

ADVISORY COMMITTEE FOR PROPOSED SBC APPENDIX E
AUTOMATIC FIRE DETECTION AND SUPPRESSION SYSTEMS

Floyd Erickson, Asst. Director
School Facilities, Dept. of Education
505 Capitol Square Bldg.
St. Paul, MN 55101
296-2288

Omar McGary, Retired Fire Chief
5901 Cambridge
St. Louis Park, MN 55416
929-9625

William Gary
Assoc. General Contractors
Kellogg Square, 111 Kellogg Blvd.
St. Paul, Minnesota 55101
291-1102

Calvin M. Niemeyer, AIA
Hammel, Green, Abrahamson
1201 Harmon Place
Minneapolis, Minnesota 55403
332-3944

Jan Gasterland, Building Official
North Star Chapter, ICBO
2215 W. Old Shakopee Road
Bloomington, MN 55431
887-9630

Russell Smith, Building Official
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100 Church Street S.E.
Minneapolis, Minnesota 55455
373-4558

G. Clinton Hedsten, P.E.
Director of Engineering
Oxford Properties
400 Baker Building
Minneapolis, MN 55402
372-1518

Pat Coughlin, MN Fire Chiefs Assn.
Richfield Fire Dept.
6700 Portland Ave.
Richfield, MN 55423
866-5061

James Heim, CHAIRMAN
Duluth Fire Dept. Deputy Chief
Duluth, MN 55801
218-723-3203

Wes Werner
State Fire Marshal
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St. Paul, Minnesota 55104
296-7641

Jack Horner, General Counsel
Minnesota Multi Housing Assn.
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Minneapolis, MN 55416
927-8602

Norman R. Osterby
Director, Bldg. Codes & Stds. Div.
408 Metro Square Bldg.
St. Paul, MN 55101
296-4627

Richard A. Brooks
Asst. Director
Building Codes & Stds. Division
296-2932

Sivert Hendrickson
Past Supervisor, Code Consultants
Building Codes & Stds. Division
Present Building Official
City of Richfield
866-5061