

FIRE SPRINKLERS AS A DEPLOYMENT OPTION: AN AFFORDABLE STANDARD OF COVERAGE?

Executive Leadership

BY: Shane Ray
Pleasant View Volunteer Fire Department
Pleasant View, Tennessee

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CERTIFICATION STATEMENT

I hereby certify that this paper constitutes my own product, that where the language of others is set forth, quotation marks so indicate, and that appropriate credit is given where I have used the language, ideas, expressions, or writings of another.

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ABSTRACT

The growth rate in Cheatham County exceeded the ability of the fire departments to provide service. This applied research project intended to evaluate options for fire department deployment and make recommendations for the future. Evaluative research answered the following research questions:

1. What is the current growth rate for Cheatham County and how does it affect the fire department?
2. What funding is generated from new growth and does it reach the fire department?
3. According to national sources, what is the standard of coverage for Cheatham County?
4. What fire protection options exist for the future?
5. Of the fire protection options available, which is affordable?

A literary review, internet search, survey, and data analysis of fire department, building commissioners', property assessors', and county finance office records was the procedure used. The results produced evaluative tools to measure the impact of growth and identified many areas that needed improvements as well as future research work that should be completed. The recommendation resulted that Cheatham County adopt legislation requiring all new construction be protected with automatic fire sprinklers. This recommendation will reduce the burden on fire departments and make fire protection affordable to the citizens of the county by reducing the required funding of fire departments.

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INTRODUCTION

Visible changes to the landscape in Cheatham County are obvious as new homes are constructed and subdivisions replace farmland. According to the U.S. Census Bureau figures, Cheatham County experienced a 31% increase in the number of housing units in the period from 1990 to 2000. While growth in the number of housing units is very visible, growth in the fire departments that provide services to these housing units is not so visible.

The problem is that Cheatham County, Tennessee continues to experience commercial and residential growth and the fire service struggles to provide service. The report *Population Projections for the State of Tennessee* (2003) estimates a population increase for Cheatham County of 65% from 2005 to 2025. This projected increase in the growth rate exceeds the increase in anticipated fire department personnel and funding.

The time is now for fire service leadership to lead the planning for this projected growth. The title of the National Fire Academy class that this applied research project is applicable to is *Executive Leadership* and the fire service must exercise leadership in order for the needs of the fire service to be known.

The purpose of this applied research project is to evaluate the fire protection options available to Cheatham County, Tennessee and make recommendations for the future. The Cheatham County Firefighters Association, which is made up of a representative from each fire department serving the county, is developing a strategic plan for fire protection. This applied research project will assist in planning future services.

Evaluative research methods were utilized to answer the following questions:

1. What is the current growth rate for Cheatham County and how does it affect the fire department?
2. What funding is generated from new growth and does it reach the fire department?
3. According to national sources, what is the standard of coverage for Cheatham County?
4. What fire protection options exist for the future?
5. Of the fire protection options available, which is affordable?

This applied research project collected data from fire departments, the property assessors' office, the building commissioners' office, the county finance office, and state and national sources. The compiled data captures the relevant information in a way that can be used to address the challenges that growth brings to a community.

BACKGROUND AND SIGNIFICANCE

There currently exist no plans for increased fire department funding or methods of future service delivery. Visible safety improvements in fire departments are obvious when reviewing the period from 1994 to 2004, much to the credit of FIRE Act Grant Program funding from the United States Fire Administration (USFA). However, in 1994, there were eight fire departments serving Cheatham County and only seven in 2004, one fire department experienced bankruptcy in 1997 and their district had to be assumed by three other surrounding departments.

Cheatham County, Tennessee is the smallest of 10 counties in the Greater Nashville Region. It adjoins Metropolitan Nashville Davidson County on the Northwest and Clarksville/Montgomery County on the Southeast. Metropolitan Nashville Davidson County is our state's capital, and Clarksville/Montgomery County is the fifth largest city in the state. Therefore, Cheatham County is a small rural county of 303 square miles with a population of 35,912 (U.S. Census Bureau, 2000) that separates the second and fifth largest cities in the state. According to U.S. Census Bureau data, Cheatham County experienced a 31% increase in the number of housing units in the period from 1990 to 2000. The report, *Effective Fire Protection*, (2004) indicates that growth threatens fire protection and how effectively it is delivered in the community.

The Cheatham County Firefighters Association was formed in 1982 for the purpose of uniting the fire departments in the county. This unity was intended to be a voice for the fire service to the county commission. Original funding of \$2,000 was given to be shared between eight fire departments. The eight fire departments that made up the county had only eight fire stations and very limited volunteers. Today, there are seven fire departments that operate 16 stations to provide fire protection to Cheatham County. Today, the county commission allocates \$200,000 for fire protection through the association, who distributes the funding to the member departments. The one constant is that the Cheatham County Firefighters Association remains the unity and the voice.

Funding for fire protection in Cheatham County is predominantly through donations. Ashland City and Kingston Springs have city taxes and fund fire protection from the general fund. All unincorporated portions of the county fire protection funding is provided through fundraising efforts of individual departments with the exception of

the rural areas around Kingston Springs and Pegram, which is a fire tax district. In 2000, the Town of Kingston Springs, who provided fire service outside their municipal limits, threatened to stop responding if the county didn't provide funding. The Kingston Springs fire department had dropped out as an active participant in the Cheatham County Firefighters Association. The results were the passage of a resolution by the county commission that created 11 fire tax districts. Cheatham County created a fire tax district for each of the four cities and the boundaries of the existing fire departments. Therefore, the four cities and seven fire departments that made up the county fire protection service, each had its own fire tax district. Only two departments chose to request the county commission impose the fire tax, Kingston Springs and Pegram. The county commission set the fire tax rate in the rural area around Kingston Springs and Pegram at .26 cents, as well as within the city of Pegram at the request of the city council. The fire tax rate of the remaining eight fire tax districts was set at zero. The author recalls this period and the predominate reason for a zero fire tax rate in the other eight fire districts was that the \$200,000 donation made by the county would have been redirected away from fire protection, plus some departments were collecting more in fundraisers than the tax would generate. The system exists the same today and the threat of redirecting funding still exists.

Many improvements have been made in the past to fire protection in Cheatham County, but no formal process has occurred that considers the standard of coverage as recommended by the Commission on Fire Accreditation International (CFAI). Most fire departments have also failed to consider standards from the National Fire Protection

Association (NFPA). In an effort to update the last fire protection plan, the deployment of fire service resources and the standards of coverage are being considered.

As a new vision develops for the future of fire protection in Cheatham County, traditional means of providing fire protection are found too costly considering the current tax assessment. Alternative methods of providing fire protection must be considered in order to reduce the burden of growth on the fire service in Cheatham County while limiting the burden on the taxpayer. Pleasant View and Ashland City have adopted legislation that requires fire sprinklers in all new construction in an attempt to reduce the burden on the fire service and citizens.

LITERATURE REVIEW

The report *Population Projections for the State of Tennessee* (2003) estimates the growth rate of Cheatham County at 65%. *Effective Fire Protection* (2004) recognizes that many areas realize the benefits growth brings to local communities while also acknowledging the strains, especially to fire protection. The report continues and acknowledges “even in well protected areas, growth often threatens the abilities of fire departments to keep up with the demand for service” (*Effective Fire Protection*, 2004, p. 1).

NFPA 1720 (2004) is the guiding document establishing minimum standards for volunteer fire departments. *NFPA 1720* (2004) declares its purpose to “specify minimum criteria addressing the effectiveness and efficiency of volunteer fire suppression operations delivery in protecting the citizens of the jurisdiction” (*NFPA 1720*, 2004, p.4).

NFPA 1201 (2004) establishes its scope to set minimum standards on the structure and operations of a fire department. *NFPA 1201* (2004) declares its purpose as being “intended for the use and guidance of persons charged with providing emergency services to protect lives, property, critical infrastructure, and the environment from the effects of hazards.”

While many requirements are set by NFPA and ISO, the CFAI creates a self-assessment program to insure the fire department provides the level of service that coincides with the responsibilities of the fire department and risks of the community. This program defines a standard of response coverage as “written procedures determining the distribution and concentration of fixed and mobile resources” (*Effective Fire Protection*, 2004, p. I). The *Standards of Response Coverage* (2003) uses a systems approach for deployment rather than a set formula whereby the community can match local needs with the cost. Simply put, *Standards of Response Coverage* (2003) says what fire companies must do, if they are to save lives and limit property damage, is arrive within a short period of time with adequate resources to do the job.

While arriving soon with adequate resources sounds easy, Langdon (2005) says volunteer fire departments are hard pressed to meet a six minute response time goal. Langdon (2005) sites extensively the work of Bill Dedman and his report in the *Boston Globe*, which indicated that according to 2002 National Fire Incident Reporting System (NFIRS) data only 14% of volunteer fire departments arrived on scenes in less than six minutes. *Effective Fire Protection* (2004) reported a sample of the 2002 NFPA study *A Needs Assessment of the U.S. Fire Service*, the findings were alarming concerning the areas fire departments lack resources. Therefore, if the volunteer fire service isn't arriving

on time with adequate resources and the needs are greater than the financial resources, how will the standards of response coverage be improved? Johnson (2004) examines how the use of a consulting firm and the mapping software used standard of response coverage data to make improvements to fire protection despite on-going budget reductions.

An internet search produced several fire departments standard of response coverage policies from across the country. The policies identified the challenges of growth as associated with the risks in the community. However, the specifics to local situations did not make them useful for this applied research project.

A review of publications dealing with land-use policy showed the consideration given to the fire service when handling growth and distributing risks. Duany, Plater-Zybeck and Speck (2000) criticize fire departments that usurp town planners and the role they play. Duany et al. (2000) identify the errors made by fire departments which are that more emphasis is placed on fire safety than the bigger picture of life safety. They suggest that auto crashes are a large part of the fire departments role and that street widths being narrow would reduce the impact. They continue by identifying an error that fire departments purchase oversized trucks which force wider streets. This result is caused “by outdated union regulations, but more often they are simply the result of a town’s desire to have the most effective machinery it can afford” (Duany, et al., 2000, p. 67). Despite the bash on the fire department, Duany et al. (2000) conclude the chapter on the physical creation of society by indicating fire chiefs appreciate the use of alleys because it allows an additional access to the building. In another book on land use planning, Kelly and Becker (2000) relate fire and emergency medical facilities to comprehensive planning. They indicate the desire of emergency medical providers desire to be on-scene

in three minutes to revive a cardiac arrest patient. The relation is made to community growth patterns and how it drives the need for facilities and staff. The result of these planning decisions creates a sprawling community that can create a significant cost burden.

Community planning is a public policy issue with land use decisions locally controlled by public policy makers. Along with community planning is the standard of response coverage and national standards. *Standards of Response Coverage* (2003) recognizes that each local government determines the community need and what they can afford. *NFPA 1201* (2004) allows the determination of need and the level of service to be a local determination and requires a master plan that is responsive to the community's changing need for service. *NFPA 1720* (2004) allows the local authority having jurisdiction to determine the applicability of the standard.

Decisions concerning growth, risks, and standards of coverage have been said to be locally determined. The aforementioned publications seem to imply that the decision makers are fire officials, town planners, and public policy officials. Fischel (2001) suggest that the homeowners are the ones with the most influence. He refers to this group as the "homevoter" and says that they are truly the ones most aware of public services and taxes (p. 4). The homevoters largest single asset is their home, they are very concerned about their home values, so homevoters tend to support efficient programs that increase the property value and the fire department was not readily identifiable as such program. Fischel (2001) describes the difference between the tax rate and the tax price, describing the latter as what the average voter has to pay for an increase in public service.

A change in the tax rate in Cheatham County is a public policy decision based on feedback from the homevoter. Alternatives in fire protection must exist that aren't identified in aforementioned publications. Coleman (1985) uses growth in Cobb County, Georgia and Orange County, California as examples that required alternative methods to traditional fire department responses. In both cases, fire sprinklers were used to help combat the fire problem associated with the challenges of growth. In addition to the two counties; two cities, San Clemente, California and Scottsdale, Arizona implemented more aggressive fire sprinkler requirements. The *15-year Scottsdale Report* (2002) identifies the lives saved and property damage reduction of fire sprinklers, however, none identified the reduction in tax rate savings. The cost savings identified by Coleman (1985) was in development costs, which are referred to by Coleman (1985) and Langdon (2005) as trade-offs. Trade-offs were used in all cases to reduce the construction costs.

A more recently identified alternative by *Effective Fire Protection* (2004) is the increase in dependence on mutual and automatic aid. While mutual and automatic aid are not new concepts to the fire service, *Effective Fire Protection* (2004) says the number of mutual aid calls increased by 150% over the period from 1983 to 2002.

The literature review altered the focus on standards of response coverage because of the traditional focus on fire station locations and response times. The publications outside the fire service on land use and the issues associated with growth supported the authors thoughts on the fire departments involvement in local planning commissions. Finally, the literature reviewed showed a lack of fire service focus on events outside of emergency services in the community. The literature review influenced the author to create more involvement of the fire service with the policymakers and the homevoters

because that is where the determination of level of service and standard of response coverage ultimately lies. Therefore, the original focus to have the fire service of Cheatham County determine the standard of response coverage by writing a new fire protection plan was changed. Fire chiefs sitting down with the CFAI, NFPA, and ISO documents will not suffice for the next fire protection plan for Cheatham County.

PROCEDURES

Evaluative research was used to examine how growth in the community affects fire protection. Analyzing how Cheatham County has grown in the past was the beginning point. Consideration of what's projected in the future, how fire protection has changed, and the impacts of the anticipated growth was needed to assist with fire service deployment for the future. The research procedure used for this applied research project included a literary review, data analysis of fire department, building commissioners', property assessors', and county financial administration records, as well as a survey of fire chiefs across the county. Finally, comparison of all information to determine cause and effect lead to the completion of the applied research project.

Internet research was conducted to gather information from ISO, CFAI, and the National Volunteer Fire Council (NVFC) as well as standard of coverage procedures from other fire departments. The internet was also used to obtain information from the U.S. Census Bureau as well as state and local growth projections.

A literature review of information available from the Learning Resource Center at the National Fire Academy (NFA) was the beginning of the applied research project. The on-line card catalog was used to locate other applied research projects, publications, and

articles containing information on fire service deployment and growth. The authors' collection of publications concerning community planning was also utilized for information outside the fire service, particularly those related to planning and zoning.

A collection of data from the fire departments, building commissioners' office, property assessors' office, and the county financial administrator was gathered. Data was collected from fire department NFIRS software, budgets, call volumes, types of response, property use types, and resources available past and present. The data from fire departments was gathered by creating spreadsheets on a disk as a template (Appendix A) for information requested. Meetings of the fire chiefs from across the county was the dissemination and collection point for this information.

The collection of data from the building commissioners' office provided information on the number of and types of building permits as well as the collection of fees as related to the permits. Obtaining information from the county property assessor and the county financial administrator required the scheduling of visits and official request of information. The county property assessor provided information on improved parcels of property and tax assessments by fire tax districts. The county financial administrator provided information on the county budget in general as well as the collection of taxes and expenses related to fire protection. The county financial administrator specifically provided information related to donations made to the Cheatham County Firefighters Association over the past 12 years and the amount of money contracted to the two fire departments protecting the three of the 11 fire tax districts with a fire tax imposed.

A survey was conducted of the fire departments providing fire protection to Cheatham County. Information was sought related to the strategic plan for fire protection in Cheatham County. The survey was conducted orally to the fire chief or representative from each fire department. The conduction of the survey occurred over several meetings to ensure 100% of the fire departments participated. A copy of the survey questions can be found in Appendix B.

The collection of survey information, as well as fire department data, was sent to an individual the author knew personally as an expert in the analysis of data and the creation of usable spreadsheets. David Holmerud assisted in the organization of fire department data as well as provided feedback on the results. The template provided by Mr. Holmerud can be found in Appendix C.

The final part of the applied research project was to assemble the literature to be utilized, create the tables of data to share, and craft the applied research project. All data and documents were organized in three-ring binders and publications and journals were placed in transportable boxes for assembly of the final document, which occurred in multiple locations over the course of the research period.

Assumptions and Limitations

An assumption was made that data collection would involve common formats. However, multiple software programs were in use by the fire departments. Another assumption was made that data would be available over the past 10 years. The assumption that the standard of coverage and the impact of built-in fire protection would be nationally considered was false.

The limitation on this applied research project was the data available, time of the project, which prevented the involvement of citizens and policy makers, and discrepancy in the collection and utilization of data by fire departments and county offices.

DEFINITION OF TERMS

Standards of Response Coverage: A rational and systematic way of looking at the basic services provided by a fire agency.

Sprawl: Haphazard growth as a result of development outside of city service availability.

Trade-offs: A compromise of local requirements for the overall improvement of a building or development.

Improved Parcels: Property lots that has some type of structure or permanent fixture causing taxation of more than just the land.

Built-in fire protection: Fixed fire sprinkler systems installed in a building for the purpose of providing fire suppression.

Fire prevention: The engineering, enforcement, and education methods and resources used to prevent fire or limit the impact.

RESULTS

The results of the procedures performed for this applied research project produced answers to each research question. The literature review produced expected results which was the lack of information on how growth specifically impacts the fire department, while the data analysis produced some new and unexpected results. The final conclusion derived from the results produced the information sought on the impact of growth on the fire department. The results also expressed the need for a comprehensive process in establishing the standards of coverage for Cheatham County. The current process being utilized in Cheatham County to establish a fire protection plan is not comprehensive.

Finally, the intended results that information concerning the impact of fire sprinklers on the standard of coverage was not found in published material, however, local data provided valuable information concerning the impacts of fire sprinklers.

What is the current growth rate in Cheatham County and how does it affect the fire department?

The current growth rate in Cheatham County according to the U.S. Census Bureau based on population was 32.3% and based on the number of housing units was 31%. This growth rate was in accordance with U.S. Census Bureau data from 1990 to 2000. The results from the county property assessors offices based on the number of parcels from 1995 to 2004 showed a 59% increase. 2000 U.S. Census information indicated a total of 13,508 housing units in 2000 and records from the county building commissioners' office showed 1,350 residential building permits form 2000 through 2004, this is a 10% increase over a 5 year period. In addition to the current growth rate, the report *Population Projections for the State of Tennessee* (2003) projects a 65% increase in population for Cheatham County from 2005 to 2025.

The impact of growth on the fire department was not easily measured, however, the benefits of a volunteer fire department was well depicted. The results of an internet search found *Economic Impact of the Volunteer Fire Service* (2004), which is a fill-in the blank spreadsheet that results in the amount of money saved by the community because of volunteers. The results of completing this cost-benefit model (Appendix C) indicated the Pleasant View Volunteer Fire Department saved the community \$3,710,593.00. The cost savings was measured using only data from the Pleasant View Volunteer Fire

Department because the data was not provided from other fire departments in the county in time to complete this applied research project.

The fact the cost savings figure seemed high and when shared with a citizen, the feedback was that they didn't believe it could cost that much, resulted in the creation of a custom model (Appendix D). The spreadsheet developed by David Holmerud (Appendix D) allowed local information and conditions to be applied. The result of the local comparison of volunteer to a career fire department indicated a savings of \$1,656,000.00. The difference in the two models was that apparatus, equipment, etc. cost would be the same regardless of the type of department and that local governments or officials would decide the deployment of fire department resources instead of NFPA.

The real impact of growth on the fire department was discovered when analyzing the increase in the number of responses. The speculation was that the increase in growth, both in dwelling units and population, would increase the call volume. The review of NFIRS data indicated an increase in call volume annually, yet the correlation between the growth of the community and increase in fire department response was not readily available. However, when reviewing the data forecasting could be performed that would identify a relationship. The results of inputting the data in a spreadsheet and seeking the assistance of David Holmerud resulted in a creation of a model (Appendix E) that would show the impact of growth on the fire department.

The following table shows the data used to draw the conclusion on the impact of growth.

Table 1

PLEASANT VIEW GROWTH DATA

PVVFD District Information

Year	Dwellings	Population	Total Calls	Calls per SFD	Calls in SFD	% total in SFD	total calls per person
1995	4340	13454	304	76	0.02	14.80%	0.02
2000	5783	17900	904	401	0.07	12.06%	0.05
2005	6512	20187	1203	481	0.07	10.14%	0.06
2010	7717	23913	1703	736	0.09	9.93%	0.07

The data trends the information from the fire departments' database, in relation to year, population, number of dwelling units, the number of calls to dwelling units and the total number of calls. The results that showed the number of dwelling units was available from the Pleasant View Volunteer Fire Department's database on the donation request mailed out annually, which are separated by residential and commercial because of the amount requested. The population projections were based on state planner formulas that estimate 3.1 persons per household. This was verified by using U.S. Census Bureau information on a given town in the Pleasant View Volunteer Fire Department district and the number of dwelling units in that town. The total calls were derived by reviewing the fire departments NFIRS data. The calls to dwelling units were derived by analyzing the calls by property use type, which in this case were NFIRS code 419, one and two family dwellings because there were no multi-family dwellings in the fire district. The calls per dwelling unit were compiled by dividing the number of calls in single family dwellings by the number of single family dwelling units. The number of calls per person were compiled by dividing the total number of calls by the total population. The results as

expressed in the calls per dwelling unit indicate that for every 100 homes built, it will increase the fire departments call volume by 7 calls to single family dwellings and that every 100 persons would increase the total call volume by 6 calls.

What funding is generated from new growth and does it reach the fire department? Funding from new growth in Cheatham County was found in multiple sources. The most direct indication of revenue from growth was found from data at the building commissioners' office. The results from data analysis at the building commissioners' office was incomplete due to changes in report formatting and software upgrades over the years. The building commissioner's office collects the county assessed building permit fees on buildings built in the county so that data was not utilized for this applied research project. However, the collection of a county imposed adequate facilities tax of \$1.00/sq. ft. of heated space and a \$3,750.00 per dwelling unit development tax, all only on residential property, was collected by the building commissioner regardless if the dwelling was built in a city or in the county. While not conclusive on the development tax, information was available from 2000 through 2004 on the adequate facilities tax. The results showed that \$2,916,958 was generated by the adequate facilities tax, this revenue went into the county general fund.

The increased growth information available from the Cheatham County Property Assessors office indicated an additional 7,670 improved parcels resulting in a \$129,221,478 increase in the total property assessment. This is a period from 1995 to 2005. The 2004 tax assessment information indicated a total of \$498,729,808. Of this total assessment, 83% was residential, 11% commercial, and 6% personal property, which is how property taxes in Cheatham County are assessed, with residential taxed at

25% of the assessment and commercial and personal property at 40%. The data on property assessments for each fire tax district was obtained. The results of the information gathered was unexpected because three of the 11 tax districts had not been coded by the state which meant accurate assessments were not available for Two Rivers Volunteer Fire Department, Henrietta Volunteer Fire Department, and Harpeth Ridge Volunteer Fire Department's District. However, these three could be combined and estimated from the remaining assessed amounts, and the current tax rate as well as the amount generated at the current rate and finally, the average assessment per parcel.

Table 2

CHEATHAM COUNTY FIRE DISTRICTS WITH ASSESSED AMOUNTS

Fire Tax District	Improved Parcels	Assessment	Current Tax Rate	Revenue Resulting from Tax	Average per Parcel Assessment
Kingston Springs Rural	841	\$51,226,394	0.26	\$133,189	\$60,911.29
Ashland City Rural	828	\$29,685,745	0	\$0	\$35,852.35
Pegram Rural	328	\$15,910,609	0.26	\$41,368	\$48,507.95
Pleasant View Rural	2589	\$110,931,760	0	\$0	\$42,847.34
Two Rivers, Henrietta, & Harpeth Ridge	1665	\$37,606,905	0	\$0	\$22,586.73
Kingston Springs City	954	\$49,369,909	0	\$0	\$51,750.43
Ashland City City	1257	\$88,332,249	0	\$0	\$70,272.27
Pegram City	583	\$30,357,335	0.26	\$78,929	\$52,070.90
Pleasant View City	970	\$51,272,820	0	\$0	\$52,858.58

The table shows the three fire tax districts that have a .26 cent tax imposed and the funding generated as well as the eight fire tax districts that have no tax imposed. The eight departments without a fire tax imposed are funded by donations, city taxes, the shared \$200,000 donated by the county to the Cheatham County Firefighters Association, or a combination of the three.

The information available from the building commissioners' office provided information on the number of residential building permits and the amount of revenue generated from the adequate facilities tax. The amount of money generated from the development tax was incomplete for each year except 2002.

Table 3

CHEATHAM COUNTY PERMITS & TAX BY YEAR

Year	Permits	Adequate Facilities Tax	Development Tax
2000	224	\$462,066	
2001	279	\$589,904	
2002	264	\$556,575	\$763,125
2003	295	\$639,481	
2004	288	\$668,932	
Total	1350	\$2,916,958	

The table shows the number of residential permits and the amount of adequate facilities tax collected by year. This revenue is turned over to the county financial administrator. Information obtained from the county finance office could not produce accurate information on the development tax because the county budget combined the adequate facilities tax and the development tax into one line item for the years in review. The county finance office was able to provide information on the amount of funding donated to the Cheatham County Firefighters Association over the past 12 years as well as the amount of money paid to the fire departments providing service to the three fire tax districts with a tax imposed.

The following table shows the amount of funding as related to fire protection in the county budget.

Table 4

CHEATHAM COUNTY FIREFIGHTERS ASSOCIATION DONATIONS

Year	Donation to CCFFA	Fire Tax Collected	Fire Tax Expensed
1992	\$15,000	\$0	\$0
1993	\$18,500	\$0	\$0
1994	\$25,000	\$0	\$0
1995	\$25,000	\$0	\$0
1996	\$50,000	\$0	\$0
1997	\$100,000	\$0	\$0
1998	\$150,000	\$0	\$0
1999	\$150,000	\$0	\$0
2000	\$200,000	\$0	\$0
2001	\$200,000	\$0	\$0
2002	\$200,000	\$206,325	\$196,500
2003	\$200,000	\$206,923	\$196,500
2004	\$200,000	\$166,639	\$203,228
2005	\$200,000	\$227,491	\$210,189
	\$1,733,500	\$807,378	\$806,417

Total spent on fire protection in Cheatham County since
1992

\$2,539,917

The results of this table show that \$1,733,500 has been donated to the Cheatham County Firefighters Association since 1992, which was shared between eight fire departments until one went bankrupt in 1997, then only seven until 2002 when one fire department withdrew from the association. In 2005, the \$200,000 donation is available to seven fire departments because the one that withdrew returned. The result shows a total of \$2,539,917 of county revenue invested in fire protection since 1992 of which 47% of the total amount was generated in the last four years and went to two fire departments.

According to national sources, what is the standard of coverage for Cheatham County?

The results of reviewing the CFAI, NFPA, and ISO provided many guidelines, but the standard of coverage for Cheatham County is a local decision. The local policy maker, the authority having jurisdiction, and the citizen establishes the level of risk that is acceptable. The *Standards of Response Coverage* (2003) guidelines classify Cheatham County as a rural community with a mostly volunteer fire department. The *Standards of Response Coverage* provided a well defined system to determine the standard of coverage, however, the data gathered as a result of this applied research project proves the fire service providers for Cheatham County lack the information to properly fulfill the recommendations. A review of standard of response coverage policies from across the country showed specific local situations, and because of their differences they were not useful for this applied research project.

NFPA 1201 (2004) established a system but all were recommendations to the local government. *NFPA 1720* (2004) like *Standards of Response Coverage* (2003), classified Cheatham County as a rural community and recommends a minimum of six personnel on the scene in 14 minutes or less on 80% of the events. *Standards of Response Coverage* (2003) recommends that even in a moderate risk situation on a residential fire that a minimum of 15 members will be required to perform the essential tasks for life safety and fire control and that this should be performed within six minutes of notification to the dispatch center. ISO utilizes a complicated formula to establish risk levels in a community and unlike CFAI, and NFPA, it is only an evaluation tool that pertains only to fire.

The results of the survey conducted of fire chiefs or a representative from each one of the seven fire departments, indicated that no department had a response time goal

and even if they did it would be greater than 10 minutes. In contrast, they all believed there should be a response time goal established for the county as a whole. Three of the departments said they intend on attempting to comply with *NFPA 1720* (2004), only one planned to seek accreditation, yet all said they wanted to lower their ISO rating. The question was asked if they thought there should be a county fire department formed through the consolidation of some fire departments and six of the seven surveyed answered yes. The final question asked who should determine the level of fire protection in Cheatham County. Three answered fire departments, two answered policy makers and two answered citizens. The result of the Cheatham County Firefighters Association meeting where the survey was conducted orally resulted in an affirmative vote to begin the establishment of a county fire department.

What fire protection options exist for the future?

The results of this research question provided limited answers in the literature review, yet results were unexpected in the analysis of available data when compared to the literature review. Coleman (1985) provided a great history in the evolution of fire sprinklers and their benefit up to that period and the *15-year Scottsdale Report* (2002) measured lives saved and property loss reduction, yet there was no data as to how fire sprinklers impacted the deployment of fire department resources. However, there were great examples given on how fire sprinklers were utilized to deal with life safety issues in growing communities. The *Standards of Response Coverage* (2003) provided a chart in reference to station location decisions; these included maintaining status quo, adding temporary stations with minimal staffing, and adding permanent stations.

The results of reviewing the building permits for the county included a comparison between the county's information and the Town of Pleasant View, a small town within the county and also the town where the authors' fire headquarters for the fire district is located. The spreadsheet provided by the building commissioner from the Town of Pleasant View indicated more information is maintained concerning the permit. Because the Town of Pleasant View has local legislation requiring the installation of fire sprinklers in all new construction and special remodel situations, the building commissioner and fire marshal track if the building is protected with fire sprinklers and which NFPA standard it was installed in accordance with. Also on the spreadsheet was the number of square feet. The results showed that from January 2003 to August 2005, 470,753 square feet of occupancy had been constructed in the Town of Pleasant View that was protected by fire sprinklers. In addition to this, the information obtained that of the 970 improved parcels in the Town of Pleasant View as provided by the county property assessor, 152 residential units were constructed with fire sprinklers, and 10 other occupancies with fire sprinkler protection were constructed. The result is that 808 improved parcels are not protected with fire sprinklers, 166 are protected with fire sprinklers, and according to the Town of Pleasant View's Building Commissioner, another 725 lots are platted and approved to be built upon. These results indicate that when the approved lots are built-upon, over 50% of the buildings in the Town of Pleasant View will be protected with fire sprinklers.

Of the fire protection options available, which is affordable?

This is a decision to be determined by the policy maker, fire department, and/or citizen. However, the data gathered from this applied research project confirms that

information can be obtained to help with the decisions. An attempt to get all fire departments in the county to complete the templates provided was not successful as some indicated they did not have the requested information. The result was an analysis of the authors department considering local policy makers, fire officials, and citizens would determine the transition to a career fire department. Also the option of installing fire sprinklers as an alternative was utilized in consideration that the installation of fire sprinklers in a building was a private investment in fire protection beneficial to the community.

The option of fire sprinklers in relation to the standard of coverage was not given any credit by *NFPA 1720* (2004) and only limited by the *Standards of Response Coverage* (2003), except the fact that the local jurisdiction estimates the risk. A review of the building permit information for the Town of Pleasant View when compared to the fire department template (Appendix A) indicated a public and private investment in the community's fire protection could be derived. The following table shows the total fire protection as related to fire prevention in the Town of Pleasant View.

Table 5

Town of Pleasant View
Private Investment in Fire Protection

Type of Occupancy	Number of Permits	Total Square Feet	Estimated Investment
Commercial	10	32,464	\$129,856
Educational	2	4,320	\$5,400
Mixed	2	9,409	\$11,761
Residential	152	424,560	\$424,560
Total	166	470,753	\$571,577

The table was created by utilizing information from the Town of Pleasant View's building commissioner and estimating based on known bid prices to establish a total private investment in the Town of Pleasant View of \$571,577. The estimated investment used was \$4.00/sq.ft. for commercial, \$1.25/sq.ft. for mixed, and \$1.00/sq.ft. for residential. These are local prices to Pleasant View as derived from fire sprinkler contractors and the fire marshal. Using the Pleasant View Volunteer Fire Department's 2003-2005 budgets to obtain the amount spent on fire prevention efforts and adding the private investment in fire sprinklers, a total fire prevention amount was calculated for the Town of Pleasant View. The total amount invested from the fire department was derived from adding the fire prevention outreach line item and the fire marshal's salary, which for the time period totaled \$265,980. The result was a total investment in fire prevention in the Town of Pleasant View of \$837,557.

The final conclusion of the results was that the options available to provide fire protection in Cheatham County would be a local decision that should use the guidelines of the CFAI, the recommendations of NFPA, while considering the impact on ISO ratings. All decisions pertaining to fire protection should involve many stakeholders and include the total investment of fire protection in the county while evaluating the ability of the citizens to pay through private investment and taxation.

DISCUSSION

Research on growth in Cheatham County and its impact on fire protection uncovered many discrepancies in records and the lack of proactive measures on the part of all agencies involved. The results of the literature reviewed showed the lack of

involvement of the fire department in land-use planning and zoning, as well as the lack of consideration by those responsible for planning and zoning to consider the impact of growth on the fire department. The alternative methods of providing fire protection to a community are not readily available or documented as related to the deployment of fire department resources. The affordability of fire protection is determined by the influence of citizens and fire officials on the policy makers and revenue generated from growth often goes to more visible infrastructure, such as roads, schools, etc. in the community.

The growth rate of Cheatham County can be analyzed in many ways, such as population growth, housing unit growth, and improved parcels growth. The current rate and projected rates are forecasting of historical data. This often fails to consider projected infrastructure changes or lack thereof. The results of data available from *Population Projections for the State of Tennessee* (2003) estimated the growth rate at 65%, this utilized information from beyond the county. However, this is still at best a guess because the data from the county property assessor, building commissioner, U.S. Census Bureau, and fire department are not measured accurately and each tend to collect the data only in relation to their mission. The various ways the data is collected and the fact that almost no data is compared to the other to validate makes it inaccurate and hard to utilize. The figures that result from the data gives credibility to the old saying that liars figure and figures lie. As a result of the data gathering, which involved working with other fire departments and county officials validates the report *Effective Fire Protection* (2004) that states “even in well protected areas, growth often threatens the abilities of fire departments to keep up with the demand for service” (p.5). The fire department can’t

complain to county officials for inaccurate or incomplete data because our own data is the same way, plus it is not shared or utilized properly.

The funding generated from new growth is derived in multiple forms to various agencies and the accurate tracking and usefulness of the information is questionable. Regardless of how the funding is generated and tracked, Fischel (2001) says the “homevoter” has the most influence of government officials. This is obviously not the thinking of fire officials because only two of the seven fire officials surveyed said the citizen should determine the level of fire protection in the county. Fischel (2001) describes the difference between tax rate and tax price as what the average voter has to pay for an increase in public service. Policy makers are the ones responsible for setting the tax rate and in Cheatham County they only do this based on the perception of the reaction of the citizen. This observation is made because the distribution of the adequate facilities tax cannot be specified by a county elected official or the county finance office. That is all understandable since the information on its collection doesn’t exist in a usable format.

The national standards that exist as related to fire protection validate that policy makers, citizens and fire officials determine coverage and acceptable risks. *NFPA 1720* (2004) exists to “specify minimum criteria addressing the effectiveness and efficiency of volunteer fire suppression operations delivery in protecting the citizens of the jurisdiction” (p.4). The need exists to educate fire officials on the minimum standard so that they may inform the citizens and policy makers. *NFPA 1720* (2004) classifies Cheatham County as a rural community. *NFPA 1201* (2004) sets minimum standards on the structure and operations of a fire department and can assist in meeting *NFPA 1720*

(2004). Cheatham County can meet *NFPA 1201* (2004) and *NFPA 1720* (2004) but there must be a commitment of funding generated by growth and the restructuring of current funding practices.

The lack of intent from fire departments to meet national standards and seek accreditation was alarming. Johnson (2004) recommended a consulting firm and mapping software to make improvements to fire protection despite budget reductions. Too often fire department leadership gets bogged down with the daily operations and fails to seek new solutions. This is certainly the case in Cheatham County and if fire chiefs do not know NFPA standards or intend to meet them, it is not likely that they are going to utilize technology in planning alternatives. It is much easier to keep doing what we have done, meeting national standards and planning fire protection takes a lot of work. The part that requires more work is going beyond the minimum standard and seeking accreditation to improve the quality of life in the community, not just respond to fires.

Improving the quality of life in the community seemed to be common in the review of literature from land-use planning. Fire protection was not found to be an issue planners identified as beneficial, but a hinderance. Kelly and Becker (2000) recognize the relation of fire and medical facilities on comprehensive planning. They indicated the desire for medical response to be on-scene within three minutes and how the cost of this would be a significant cost burden on the citizens. The survey of fire departments that found no fire department had a response time goal, yet they all wanted to lower ISO ratings. These facts cause fire stations in the rural county to be planned at five miles apart. Therefore, the community sprawls, the cost increases, and so does response times.

Despite all these considerations, there are still issues yet to be considered. In the mean time, growth occurs.

Duany, Plater-Zybeck and Speck (2000) criticizes fire departments because they use outdated regulations that prevent the town planner from considering alternatives. This is difficult for fire officials to discredit because of the desire for wider streets, which Duany et al. (2000) say only contributes to a reduction in the fire department's overall mission of life safety because auto crashes increase when streets get wider and speeds increase. This may be true because of the circumstances they cite but the wider streets also generally mean more cars. Duany et al. (2000) also identify the fact that fire apparatus get bigger because of local governments desire to have the most they can afford. The part they fail to mention here is the ego and pride of fire chiefs as well as the shift from personnel cost to capital costs. Fire chiefs usually exist in a culture that suggests one get all they can while they can, make it as multi-functional as possible, and get the latest and largest, just like we tend to buy computers. When the focus exist on the fire department deployment with close stations, large fire apparatus, and lots of people, the fire service fails to work with other county officials, planners, and even other fire departments.

Effective Fire Protection (2004) reported a 150% increase in the number of mutual aid calls from 1983 to 2002. This alternative means of fire service deployment is obvious in Cheatham County and working well. The positive to this fact is that it is bringing fire departments together more and improving relationships and information sharing. Without automatic aid in Cheatham County, almost no structure fire would get the recommended response of personnel in the allotted time frame and without mutual aid

some calls would go totally unanswered. The cooperation of fire departments in Cheatham County is a response alternative that is working well, yet more cooperation, even consolidation will be required in the future.

The installation of fire sprinklers in all new growth is an alternative to traditional fire department growth. Coleman (1985) identified the successful use of fire sprinklers in Cobb County, Georgia; Orange County, California; Scottsdale, Arizona and San Clemente, California. The trade-offs used to reduce construction cost increase the private investment in community fire protection as long as the trade-offs aren't other fire protection features. Langdon (2005) addresses the benefits of trade-offs as code flexibility, street widths, and housing density. The reduction of street widths, increase in hydrant spacing, and greater built-upon density result in positive trade-offs and allow the fire sprinkler system to truly be an addition to the communities' fire protection. The reduction of street width and fewer fire hydrants means less cost to the citizen in the future because maintenance and replacement costs are less. Greater built-upon density results in an increase in improved parcels, thus an increase in tax assessment which results in increased tax revenue generated without sprawling and not benefiting the existing citizens whom only have to pay more as sprawl increases infrastructure costs.

The results that indicated 470,753 square feet of building space in the Town of Pleasant View was protected by automatic fire sprinklers was very beneficial and assisted with the recommendation of this applied research project. The installation of fire sprinklers in new construction in Cheatham County will allow the risks of fire to citizens and fire fighters to be reduced, thus the need for fire department staffing will be reduced in the future. If the already approved buildings in the Town of Pleasant View are built

within the next five years, which is possible with the current growth rate, 50% of the buildings in the community will be protected with fire sprinklers. With this rate of growth, 145 building permits a year on average, and using the information from the county property assessors' office that 970 buildings exist in 2005 and 166 of those 970 have automatic fire sprinklers installed; it concludes that in 2025 there will be 3870 buildings in the town. Therefore, in 2025 79% of the buildings in the Town of Pleasant View will be protected with automatic fire sprinklers. Cheatham County should limit sprawl in rural areas and adopt the requirement of automatic fire sprinklers in all new construction. 20 years from now an estimated 80% of buildings could be protected. If an estimated 94% of the Pleasant View Volunteer Fire Departments calls could be handled with 4 personnel because they included medical emergencies, non-entrapment auto accidents, and false alarms the staffing could be reduced because the chances of a building fire going to flashover stage would be very limited in the community.

Community planning is a local issue and fire protection plays a vital role. *Standards of Response Coverage* (2004) indicates how local governments determine the need for an affordable option. The Cheatham County Firefighters Association, the departments that make it up, the county officials and the citizens have a lot to learn about fire protection planning and comprehensive planning. The future cost burden or as Fischel (2001) refers to it as tax price, is dependent on accurate decisions by all stakeholders involved today. A great deal of work will be required to make the information available from multiple sources useful. The Cheatham County Firefighters Association and the fire departments protecting Cheatham County are the leaders to ensure an improved quality of life for the future.

RECOMMENDATIONS

The purpose of this applied research project was to evaluate fire protection options available and make recommendations for the future. Many relationships were established and good experiences occurred while gathering data during this applied research project. More research as well as more data analysis and collection must occur. The relationships established during the applied research project will make those tasks easier.

The following recommendations are attributed to the results and conclusions of this applied research project:

- Complete an applied research project titled The Impacts of Fire Sprinklers in the Town of Pleasant View.
- A fire department representative should attend all planning commission meetings to act as a liaison.
- A county fire marshal should be hired immediately and assigned to the county building commissioners' office.
- A shared information management system should be developed and accessible to all fire departments and county officials.
- Funding distribution from the county to fire departments should require monthly reports of information such as call volumes, budgets, etc. and the county should share information back, such as building permits, tax growth, etc.

- The county should more accurately track the adequate facilities tax and ensure it is spent on items affected by growth.
- The Cheatham County Firefighters Association and the Cheatham County Planning Commission should partner to conduct training classes on community planning.
- The Cheatham County Firefighters Association should conduct training classes on the national standards and send representatives to national conferences.
- A committee of the Cheatham County Firefighters Association should be established to advance departments across the county toward national standards compliance.
- A partnership between the Cheatham County Firefighters Association and the Joint Economic & Community Development Board should be established to ensure GIS data is useful to the county.
- A plan should be developed to educate planning commission members and elected officials on the benefits and need for fire sprinklers in new construction with an adoption of fire sprinkler legislation goal within two years.
- The Cheatham County Firefighters Association should conduct community forums in the county to inform the public on the fire protection available as well as share any needs.

These recommendations can be initiated by December of 2006 if the leadership of the Cheatham County Firefighters Association assumes responsibilities for areas that interest them. A lack of commitment will mean a longer achievement time.

Future applied research projects intended to replicate parts of this study should first focus on the collection of data and expansion of the templates provided in the appendix. Then, the literature review could be used to address specific issues found in the data. Finally, the author recommends seeking formal support from the head government official or governing body prior to beginning research. This may assist in obtaining information without others speculation of your motives.

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APPENDIX A

PLEASANT VIEW FIRE PREVENTION INVESTMENT

An Excel spreadsheet was created with instruction and saved to CD. A CD was given to a representative from each fire department in the county. The general instructions were to complete the information requested in the files on the CD and return to the next month's Fire Association meeting.

The table below is the information received. The spreadsheet requesting that the data be entered into the color cells only.

Pleasant View Volunteer Fire Department				
Sep-05				
Budget Information				
Year	Total Budget	Fire Prevention	Personnel (Fire Prevention Only)	TOTAL
1995	\$147,000.00	\$1,000.00	\$0.00	\$1,000.00
2000	\$393,500.00	\$3,000.00	\$30,000.00	\$33,000.00
2005	\$643,621.00	\$69,100.00	\$35,175.00	\$104,275.00

APPENDIX B

SURVEY QUESTIONS FOR FIRE DEPARTMENTS

1. Does your department have a response time goal?
2. What should the response time goal be for your department?
3. Should the county have a common response time goal?
4. Does your department have a goal of compliance with NFPA? If so, which standard?
5. Does your department intend on seeking accreditation?
6. Does your department intend to lower the ISO rating?
7. Should there be a county fire department?
8. Who should determine the level of fire protection in Cheatham County?
 - a. Citizens
 - b. Policy Makers
 - c. Fire Departments
 - d. Other

APPENDIX C

NATIONAL VOLUNTEER FIRE COUNCIL MODEL

Volunteer Fire Service Cost Savings Project

The model calculates the summary information, based on national standards/averages

Area Protected (square miles)		200
Population Protected	20,187	
Number of Residences		6,512
Current Operating Expenses	\$ 643,000	
Active Volunteers		
Fire Ground Operations		42
Fundraising		6
Administrative		10
Ownership of Assets		-
Number of Stations		4
Number of Apparatus		-
Engines		4
Aerial Trucks		-
Tankers		1
Rescue Trucks		1
Utility Vehicles		-
Brush Trucks		3
Ambulances		-

Starting Salary for career personnel in the vicinity (including benefits)

If there are no salaries paid for any position, use a nearby city costs for these entries.

If there are no cities nearby that can be used, use police salaries for this portion.

	\$
Chief	48,000
	\$
Deputy Chief	44,000
	\$
Assistant Chief	40,000
	\$
Captain	37,000
	\$
Lieutenants	33,000
	\$
Drivers	27,000
	\$
Medics	33,000
	\$
Fire/ Rescue Personnel	24,000
	\$
Administrative	21,000

APPENDIX C, CONTINUED

NATIONAL VOLUNTEER FIRE COUNCIL MODEL

DO NOT ENTER DATA BELOW THIS LINE!

	\$	
Average Salary of Officers in the vicinity	40,400	
Number of Career Personnel Necessary		
Officers		24
Firefighters		44
Drivers		36
Medics		-
Administrative		3
	\$	
Career Fire Fighter Costs	2,997,600	
	\$	
Career Administrative Costs	69,993	
	\$	
Total Career Costs	3,067,593	
	\$	
Personal Protective Clothing Costs	260,000	
	\$	
Apparatus Costs	2,172,000	
	\$	
Capital Equipment Expense	2,432,000	
COST FIGURE ANSWERS ON SAVINGS		
	\$	
Current Company Value	5,499,593	
	\$	
Total Annual Volunteer Savings	3,710,593	
	\$	
Savings per Fire Fighter	35,679	
Savings per Residence	\$	570
Savings per Capita		183.811017

Fire Department
Date Completed
Chief Name
Street Address
City, State, Zip

APPENDIX D

HOLMERUD'S COST MODEL FOR VOLUNTEER FIRE DEPARTMENTS

Volunteer Fire Service Cost Savings Project

Version 2.1

Step 1 - Enter your fire department's data in the yellow boxes.

20,187	Population protected
6,512	Number of residences
\$ 72,000	Current personnel expenses

Your Fire Department Data

Number of Apparatus	
4	Engines
0	Aerial Trucks
1	Tankers
1	Rescue Trucks
0	Utility Vehicles
3	Brush Trucks
0	Ambulances

Total Staffing	Minimum Staffing on Apparatus
3	Engines
0	Aerial Trucks
2	Tankers
3	Rescue Trucks
0	Utility Vehicles
3	Brush Trucks
0	Ambulances

Company Officer	Driver/Operator	Volunteer Firefighter	Medics
1	1	1	0
0	0	0	0
1	1	0	0
1	1	1	0
0	0	0	0
0	1	2	0
0	0	0	0

Step 2 - Go to "Career Costs" tab

Career Cost Spreadsheet

Step 3 - Starting Salary for career personnel in the vicinity (including benefits)

If there are no salaries paid for any position, use a nearby city costs for these entries.

If there are no cities nearby that can be used, use police salaries for this portion.

Chief	\$ 48,000
Deputy Chief	\$ 44,000
Assistant Chief	\$ 40,000
Captain	\$ 37,000
Lieutenants	\$ 33,000
Drivers	\$ 27,000
Medics	\$ 33,000
Fire/ Rescue Personnel	\$ 24,000

Step 4 - Staffing factor (positions needed to staff one full-time position)

For 56 hour week use "3", for 42 hour week use "4"

3

Step 5 - Enter your department staffing for the "Chief" positions only

Number and Cost of Career Personnel Necessary

Chief	1	\$	48,000
Deputy Chief	1	\$	44,000
Assistant Chief	4	\$	160,000
Officers	18	\$	630,000
Drivers	18	\$	486,000
Firefighters	15	\$	360,000
Medics	0	\$	-

Career Chief Officer Costs \$ 252,000

Career Fire Fighter Costs \$ 1,476,000

Total Career Costs \$ 1,728,000

Step 6 - Go to "Summary" tab.

Cost Savings to Your Community

\$ 72,000 Your Annual Personnel Costs

\$ 1,728,000 Full-time Equivalent Fire Department Personnel Costs

\$ 1,656,000 Annual Personnel Cost Savings

\$ 254.30 Savings per Household

\$ 82.03 Savings per Resident

APPENDIX E

PLEASANT VIEW VOLUNTEER FIRE DEPARTMENT
ENTIRE DISTRICT

Pleasant View Fire Department (Entire District) 3 Sets of Data

	Year	Dwellings	Population	Total Calls	Calls in SFD	Calls per SFD	% of Total Calls in SFD	Total calls per person
Enter Your Data	1995	4340	13454	304	76	0.02	25.00%	0.02
	2000	5783	17900	904	401	0.07	44.36%	0.05
	2005	6512	20187	1203	481	0.07	39.98%	0.06
Predicted Value	2010	7717	23913	1703	724	0.09	42.54%	0.07