The Alarm Has Sounded: A Descriptive Study of Performance Measures of Fire Department ESDs in Travis County

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Applied Research Project

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Abstract

Purpose: The purpose of this research is to describe how the thirteen Emergency Service Districts (ESDs) in Travis County meet critical performance measures taken from national ISO, NFPA, CFAI and municipal benchmark standards. These recognized performance measures ensure effectiveness in protecting and preserving the life and property of citizens. Professional, scholarly and empirical literature was reviewed in order to determine "best practices" for the fire service. Fire service measures were divided into three descriptive categories: Fire (suppression) performance, staffing and training, and fire prevention. Thirteen ESDs in Travis County with varying budgets and sizes were evaluated.

Methods: This study uses survey research, interviews and content analysis. A survey instrument was developed and distributed to all 13 ESDs in Travis County. A total of 10 surveys were completed followed by interviews with 15 ESD Chiefs, Commissioners, and various other emergency service administrators. Descriptive statistics were used to analyze the results of the survey.

Findings: The majority of ESDs in Travis County are facing critical financial challenges and threats to their viability. The findings suggest that the fragmentation of ESDs in Travis County has played a significant role in the failure of the majority of ESDs to meet nationally recognized standards.

About the author

The author, Damon Fogley, is a native Californian who moved to Texas during 2006 as part of his military career. He now resides in Kyle, Texas. He served as an officer in the US Army in the rank of Captain up until 2013 when he received an honorable discharge. He has 15 years in public safety, which includes 8 years of employment as a National Registry Paramedic for Austin-Travis County EMS, serving the residents of the City of Austin and Travis County communities. One of the stations he is currently assigned to is the Kennedy Station in Lago Vista, TX, which is within the jurisdiction of Travis County ESD #1 (North Lake Travis Fire Rescue). This research interest stems from his career as a paramedic in Travis County, during which time, he observed firsthand widely varying levels of performance amongst ESDs in Travis County (as compared to the Austin Fire Department, and furthermore, wanted to explore this discovery).

Damon holds a bachelor's degree in sociology and a minor in Spanish from California State University, Long Beach. Upon the successful completion of this project he will have earned a masters degree in public administration from Texas State University.

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  - Assisted with the compilation of ESD response time data and literature pertaining to national response time standards
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Chapter 1: Introduction

Imagine one day you are enjoying a quiet afternoon with your mother and father. Immediately, without notice, one of them collapses and suffers from sudden cardiac arrest. You pick up the phone to dial 911 hoping first responders will arrive quickly. As your loved one lies lifeless on the floor, you recall from your basic CPR course that the earliest possible delivery of defibrillation is critical and almost by itself sufficient enough for many victims of sudden cardiac death (Cummins, 1991). Seconds seem like hours. Minutes seem like days as you wait desperately for trained personnel to arrive at your side. You become shaken and upset. Unfortunately, your local fire department is underfunded and has an extended response time. They also bring with them outdated supplies because they have not been able to afford the newest and most innovative medical equipment due to lack of community tax base. Additionally, they have not been retrained to handle this type of medical emergency in over two years. The inability of ESDs to meet the most minimum standards often times occurs due to a lack of adequate resources. Inadequate tax base, geographic variability, broken relationships, and population growth all contribute to the lack of resources.

This research project is divided into seven phases. During phase one, an extensive literature review of data pertaining to fire department performance measures was conducted. Literature included a review of ESD background data, legislation, and municipal benchmark standards for public safety organizations and NFPA/ISO standards and ratings for fire service organizations. Although the State of Texas does not recognize NFPA as a blanket standard (Anchondo et al, 2011, pg. 27), it is a well-respected national firefighter safety organization that most fire departments would like to model themselves after. The NFPA is also reported to be

one of the most non-partisan and least biased industry organizations in the nation (Anchondo et al, 2011, pg. 6). The NFPA holds a higher standard to achieve than many other publications such as CFAI.

Phase two consisted of creating a conceptual framework directly related to the literature review. A systematic and organized approach to gathering data was constructed using the conceptual framework. Phase three consisted of creating an operationalization table based on the conceptual framework. This included the creation of specific survey questions that aimed to gather specific answers to performance measures, threats and financial hardships faced by all ESDs. Phase four consisted of the distribution of surveys to fire administrative officials. Phase five consisted of gathering survey data and conducting follow-up interviews. The results of survey data and interviews were compiled in phase six. Phase seven was the final phase of the project consisting of conclusions and the application of solutions to these problems. This included describing recommendations and "lessons learned" for other ESDs across the state to follow.

History and Setting

ESDs were established by an amendment to the Texas Constitution in 1987 in order to address local independent geographical management of emergency services (anchondo et al, 2011, pg. 8). ESDs are political subdivisions that provide fire protection and Emergency Medical Services (EMS) to independent geographical regions of each county they serve. Depending on the ESD's creation documents, an ESD can provide fire protection, EMS, or both (SAFE-D, 2013). ESDs function in ways that are similar to school districts, health districts and municipal utility districts. ESDs have a wide range of budgetary diversity due to the varying population groups they serve. The original ESD funding structure was created in order to assist

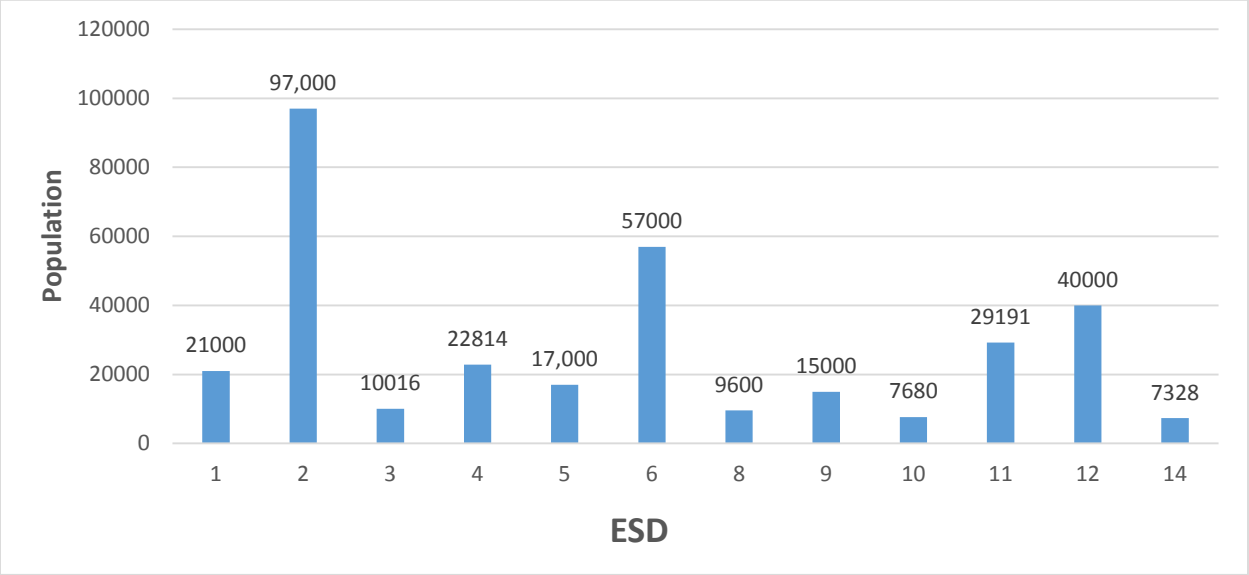
rural volunteer fire departments with funding that was otherwise challenging to overcome with only fundraisers and donations.

ESDs are governed by commissioners serving on ESD boards that are appointed by their respective county commissioners' court, except in the case of an ESD located in more than one county or an ESD in a county with a population of more than 3 million (TX Rural Affairs, 2013, pg. 18). These boards function similar in design to public safety committees operated by municipalities. ESD boards hold monthly meetings that are open to public speculation and comment. While ESDs are established by Article 48e of the Texas constitution, chapter 775 of the Texas Health and Safety Code is the enabling statute for all ESDs (SAFE-D, 2013). ESDs are required by law to file an annual report with the Texas Department of Agriculture by January 1st of each year (TX Rural Affairs, 2013, pg. 20). This legislation, which was originally enacted to govern how ESDs were funded, now jeopardizes their ability to effectively serve their residents.

ESD Population

Given the fact that Travis County (including Austin, TX) consists of 1,095,584 people (Census, 2010), it is important to consider the number of people served amongst each ESD. The total population served by all ESDs within Travis County is 252,922 (Census, 2010). This is calculated by subtracting the population of Austin (served by the Austin Fire Department) from the total population of Travis County. The Austin Fire Department is a municipal fire agency that is funded by the city of Austin. Population served is important when calculating such things as firefighter to citizen ratios in a community. Although some ESDs may be geographically smaller than larger ESDs, they may have a higher call volume due to increased population rates.

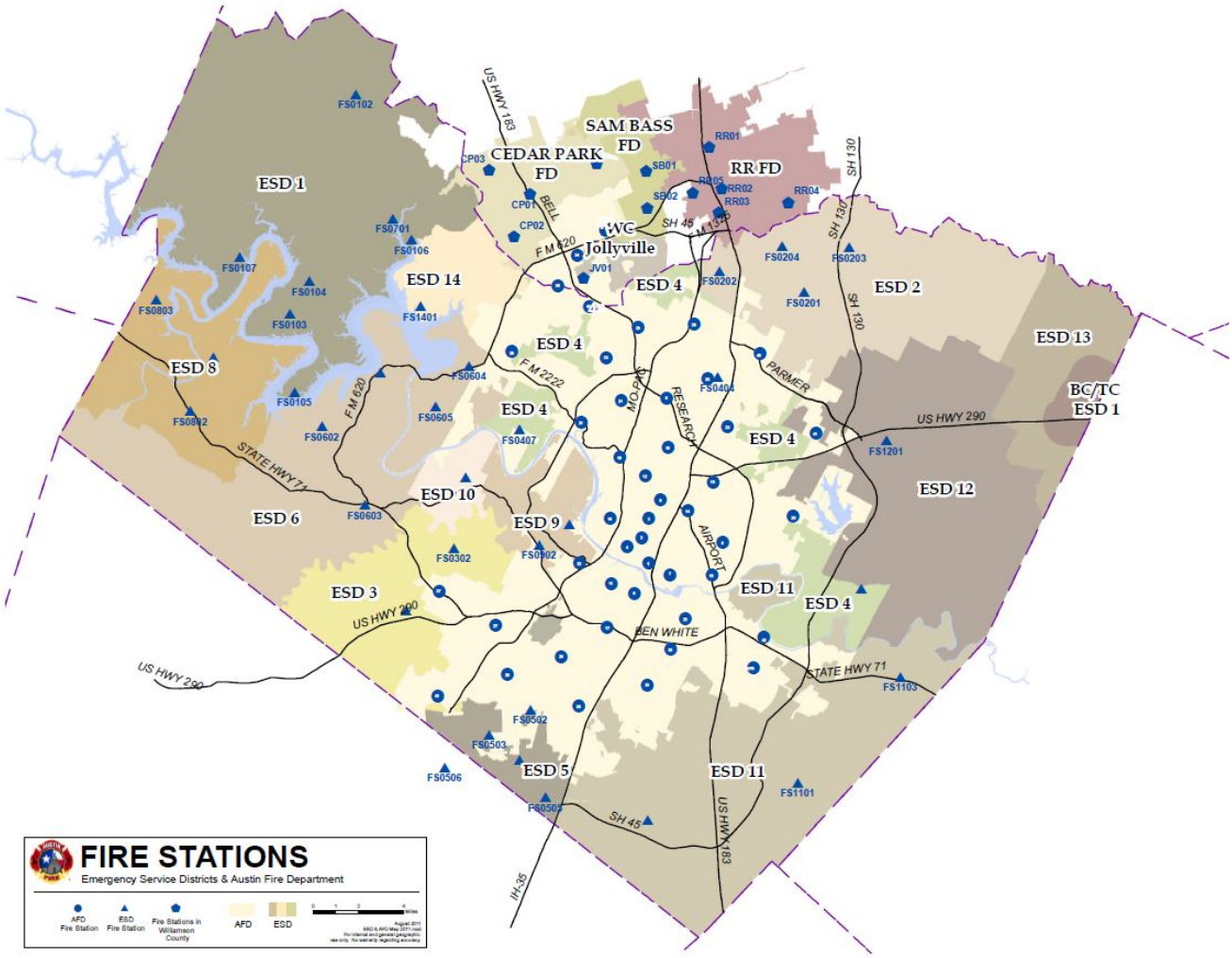
Figure 1.1 Illustrates population served by each ESD in Travis County



Source: Travis County Emergency Services

Travis County's diverse population varies with respect to race, per capita income, and concentration. The 13 ESDs being evaluated stretch across 1022 square miles. However, the actual geographic area they serve is approximately 750 square miles. This figure is produced by subtracting the square miles incorporated by the city of Austin (297.1 square miles), (Census, 2010), from that of Travis County (1022), (Census, 2010).

Figure 1.2 Map of ESDs and their respective fire stations within Travis County including areas serviced by the Austin Fire Department (vanilla) and neighboring Williamson County Fire Departments.



Source: http://www.co.travis.tx.us/maps/misc/ESD_map.pdf

Table 1.1 ESD organization district numbers with respective titles and jurisdictions that are served including unincorporated areas within Travis County.

ESDs in Travis County with Associated Names and jurisdictions		
ESD #	**ESD Name**	**Jurisdiction**
1	North Lake Travis Fire Rescue	Jonestown, Lago Vista, Point Venture, unincorporated Northwest Travis County
2	Pflugerville Fire Department	Pflugerville, Unincorporated Northeast Travis County
3	Oak Hill Fire Department	Oak Hill (unincorporated)
4	Travis County Fire Control	Unincorporated Travis County, Webberville
5	Manchaca Volunteer Fire Department	San Leanna, Manchaca (unincorporated)
6	Lake Travis Fire and Rescue	Lakeway, Bee Caves, Village of The Hills, Unincorporated Southwest Travis County
8	Pedernales Fire Department	Briarcliff, Spicewood (unincorporated)
9	Westlake Fire Department	Rollingwood, West Lake Hills, Lost Creek (Unincorporated)
10	CE-Bar Fire Department	Barton Creek (Unincorporated)
11	Travis County Fire Rescue	Mustang Ridge, Creedmoor (Unincorporated)
12	Manor Fire Department	Manor and surrounding unincorporated areas
13	Elgin First Responders	Elgin (within northeast Travis county)
14	Volente Fire Department	Village of Volente

Source: ESD Survey/Interviews

Note: ESD #7 no longer exists. Bastrop county ESD #1 operates within Travis County as ESD #13 (BN. 1)

ESDs within Travis County offer fire, rescue and EMS services that are normally expected from a fully staffed municipal fire department. These services include, but are not

limited to, structure fire suppression, emergency medical responses, vehicle rescue and extrication, water rescue, rope rescue, and hazardous materials (hazmat).

ESD #11 (TCFR) Training facility located on Elroy Rd. in southeast Travis County

Photograph by Author

Although there is a considerable amount of research being conducted on fire suppression and prevention, minimal research has evaluated ESD performance, especially in light of financial disparities across Texas. This is especially true within counties that have an unequal proportion of wealth distributed amongst their populations. Among the small group of such studies, one recent study evaluated the underfunding of ESDs in high growth areas. This study evaluated two ESDs in Travis County: ESD #2 in Pflugerville and ESD #6 in Lakeway among various other ESDs across Texas. This study assessed the financial and human resources used to provide fire services but did not compare the quantity or quality of service across the departments within Travis County.

ESD Funding

According to the Texas Comptroller, there are approximately 312 ESDs across the state of Texas eligible to collect property tax, sales tax, or both in 2013. ESDs receive a majority of their funding from ad valorem tax which constitutionally has a maximum tax rate of ten cents per one hundred dollars of valuation on appraised property value (TX Dept. of Rural Affairs, 2013, pg. 15). For example, a homeowner would theoretically pay $100 annually for a home valued at $100,000. This tax ceiling creates a serious financial challenge for ESDs that generally have low property tax base.

The ad valorem tax ceiling also creates a problem for ESDs with soaring population rates and increased demands for service. Areas that have high tax base usually do not reach the maximum allowable ad valorem tax rate. ESD #9, which includes the cities of Westlake Hills and Rollingwood levies 8.5 cents per every $100 of valuation which yields an annual $4.5 million (Travis County Taxation Summary, 2013). ESD #1, whose geographical area is at least sixteen times the size of ESD #10 (and has almost three times the population); only has $2.2 million in annual ad valorem tax revenues .

Although many ESDs across the state of Texas are facing budget shortfalls, ESDs in Travis County face exceptional financial setbacks due to a recent population boom which has increased the demand for service without addressing sustainable sources of revenue. Travis County, Texas, has experienced some of the most explosive growth in the country. As of 2012, the population of Travis County reached just over one million residents (Census, 2010).

The Austin Fire Department (AFD), which serves areas located in central Travis County, does not have an ad valorem tax ceiling. AFD, similar to other public safety organizations

within the City of Austin, operates from a general fund that is negotiated annually based on a continuous needs assessment. The cost of service improvement for increased demands for service within the City of Austin that occurs with a population increase can be defrayed with tax increase levied upon City of Austin taxpayers. Travis County residents on the other hand, served by ESDs, cannot incur a property tax increase at the ten cent ceiling despite population growth. Almost all ESDs within Travis County have reached their ad valorem tax ceiling. (ESDs that are within fractions of a cent of their tax ceiling do not put forth efforts to increase this tax due to anticipated election administrative costs that would outweigh financial benefits of the tax increase). Results from the study indicate that although ESD #9 has not reached their ad valorem tax ceiling, they anticipate an increase upon taxpayers within their district soon.

Table 1.2 Most recent ESD ad valorem tax rates as of 2014.

Travis County ESD ad valorem tax assessment rates	
ESD	**2014 Ad Valorem Tax**
1	0.1000
2	0.1000
3	0.0980
4	0.0990
5	0.0980
6	0.1000
8	0.1000
9	0.0845
10	0.1000
11	0.1000
12	0.1000
13	0.1000
14	0.1000

Source: Travis Central Appraisal District

The "inter-local" agreement between Travis County and the Austin-Travis County EMS system allows for the reimbursement of transport fees back to the County. Recent changes in Medicaid and Medicare reimbursement schedules have made it difficult for the County to recoup these fees. There is a huge gap between the amount of money the federal government and each of the states feel necessary for reimbursement and the actual cost of the ambulance transport to the medical provider. These reimbursements are imperative to revenue streams for municipalities that provide EMS and Fire based EMS service. Medicaid and Medicare reimbursements account for as much as 64% of providers' patient mix (Hatley and Patterson, 2007, pg. 259). In fiscal year 2014, Travis County received only $5,032,271 through EMS patient billing (Travis County Emergency Services).

Alternative funding measures (other than EMS billing practices) are available to ESDs. Such measures include sales and use tax increases, fundraisers, donations, overlapping ESD ad valorem tax assessments, grant funding, and the implementation or increase of user fees. Although some innovative ideas have served to address the growing financial problems that ESDs face across the state, most of the local and regional solutions appear to be short-term solutions that do not adequately solve long-term problems.

While some attempts have been made to address ESD sustainability and long-term funding, some of these efforts have proven to be unsuccessful. A bill during the 81st Texas legislature was considered that involved increasing the ad valorem tax rate .05 cents on top of the already .10 cent ad valorem tax cap, but only included funding for infrastructure or capital acquisitions (Anchondo et al, 2011, pg. 4). These politically charged financial challenges, coupled with the rival imperialistic agenda that adjacent cities have had during their attempts at annexation have created the perfect storm for debilitated performance. One clear example of this

is Austin's ongoing attempt to annex the highly valued land surrounding the Circuit of the Americas Formula One racetrack in southeast Travis County's ESD #11.

Given the complicated history and complex structure issues described above, the underlying goal of my project is for a lay reader with no fire service background or experience to be able to comprehend ESD performance. Most appointed or elected boards, commissions and councils who oversee the management of emergency services consist of members who may not have any fire service or emergency medical service background. Technical jargon is difficult to digest. In order to streamline the comprehension of fire service performance data, technical fire service data is minimized, and instead a concentration on the most important basic fire service performance measures is emphasized throughout the project.

This study evaluates fire suppression measures, staffing and training measures, and fire prevention activities. Challenges that ESDs encounter can be categorized based on the type of activity in which they are engaged. In order to describe the service delivery of each ESD, various key performance measures were evaluated. It is important to measure these performance ratings accurately. Utilizing these measures to improve performance is imperative to effective fire service delivery. According to Robert Behn, "abstract measures are worthless." (Behn, 2003, pg. 598). To use a performance measure – to extract information from it – a manager needs a specific, comparative gauge, plus an understanding of the relevant context (Behn, 2003 pg. 13). Critical Fire Department performance measures include the following; Response times, equipment readiness, Insurance Services Office (ISO) fire suppression rating schedule (FSRS) public protection (PPC) ratings, water availability and percentage of fires contained to room of origin (fire extension). Staffing and training measures include staffing, emergency medical service certification and training measures and proficiency training. Fire prevention is further

categorized into fire prevention education, fire code enforcement (inspections), and fire investigation activities. Additionally, annual financial audits obtained from Travis County Emergency Services will be compared against performance measurements for each ESD.

Research Purpose

The purpose of this research is to describe the various performance measures of the thirteen ESDs in Travis County with respect to their ability to be compliant with national ISO and NFPA benchmark standards and to effectively protect and preserve life and property.

Chapter 2: Literature Review

Chapter Purpose

This chapter reviews nationally recognized public safety benchmarking standard publications and technical manuals. Some of these organizations include the National Firefighter Protection Association (NFPA), the Commission on Fire Accreditation International (CFAI), the Occupational Safety and Health Association (OSHA), the United States Fire Administration (USFA) and the Insurance Services Office (ISO). These authoritative sources make recommendations for best practices in firefighting and firefighter safety. It is important to note that best practices for public safety organizations constantly change. Committees consisting of nationally renowned fire service experts may decide certain standards need to be modified. Such changes could be based on the release of innovative firefighting products, or other published and proven research studies which change the dynamic of fire service delivery.

Performance Measures

Performance measurements are used in both the private and public sectors and help legitimize an organization's spending and even its purpose. For example, the banking industry uses performance measurements to decide which branches will stay open and which ones will close. Hospital administrators measure the performance of medical providers through quality assurance and improvement programs that mitigate liability. Regardless of the organization, performance measurements involve the evaluation of achieved outcomes, compared to desired outcome (Flynn, 2009, pg. 6). The act of measuring performance is only useful when someone uses these measures to accomplish something (Behn, 2003 pg. 586). Performance measures are

used for: (1) evaluating, (2) controlling, (3) budgeting, (4) motivating, (5) promoting, (6) celebrating, (7) learning and (8) improving (Behn, 2003, pg. 588).

Conceptual Framework

This project organizes both dynamic and passive fire service functions of ESDs through a descriptive framework that is divided into three distinct categories. In order to have a thorough and organized understanding of how these ESDs function, descriptive categories are an important tool that narrows performance benchmarks for each fire service measure. "Benchmarking denotes the search for best practices" (Flynn, 2009, pg. 9). By organizing performance measurements into separate, distinct categories and comparing the results across each organization brings to light the shortfalls each of these organizations faces. These categories are illustrated below in table 2.1.

Table 2.1 Conceptual Framework tied to Literature

Descriptive Categories	Literature
Fire Suppression Measures	
Response Times	Ammons 2001, Anchondo, Jorge; Jarrett, James, Blackwell 2011, Challands 2009, CFAI 2009, ISO 2007, Myers et al., 2008, NFPA 1710 2013, NFPA 1720 2013, Pell et al., 2001, Thomas 2011, TDI, 2004, USFA 2006
Equipment Readiness	Ammons 2001, ISO 1996, ISO 2007, NFPA 1145, NFPA 1901, USFA 2006
Overall ISO Fire Suppression Rating	Ammons 2001, Behn 2003, Berger 2007, Fire Apparatus 1998, ISO 1996, ISO 2007
Water Availability	Ammons 2001, Anchondo; James 2011, Darden 2007, ISO 1996
Fire Extension	Schaenman 1971, NFPA 1710 (2014), NFIRS 5.0.,2004, fcgov 2014, Flynn 2009
Staffing and Training Measures	
Staffing	Ammons 2001, Anchondo; James 2011, Bavendam Research 2000, Behn, 2003, Cochran 2010, Crawford 2005, Firefighter Nation 2012, NFPA 1720, Rich 1982, USFA 2006, Wilson 2009
Emergency Medical Services (Training)	Cummins 1991, Hatry 2006, Hinchey 2014, Johnson et al 2014, Myers et al., NFPA 1710, 2013, NREMT, Nebraska health and human services 1996, US DOT 2014, Wright 1998
Proficiency Training	Anchondo; James 2011, Bradley 1989, Hatry 2006, ISO 1996, NFPA 1001, 2013, NFPA 1710, 2013, OSHA (2013), Travis County Fire Marshalls Action Guide 2010, Wright 1998, USFA 2006
Fire Prevention	
Education Activities	Anchondo; James 2011, Cline 2008, ISO 1996, ISO 2005, NFPA 1720, National Strategies 2009, Prestemon et al 2009, Ray 1998, Schaenmann 1997, Wildlandfire.org 2014
Inspection Activities	Anchondo; James 2011, Cline 2008, ISO 1996, ISO 2005, NFPA 1710, NFPA 1971, NFPA 1031, Smith 2013, USFA 2006
Investigation Activities	Anchondo; James 2011, Cline 2008, Hatry 2006, ISO 1996, NFPA 1033, NFPA 2006, Schaenmann 1997

Fire Suppression Measures

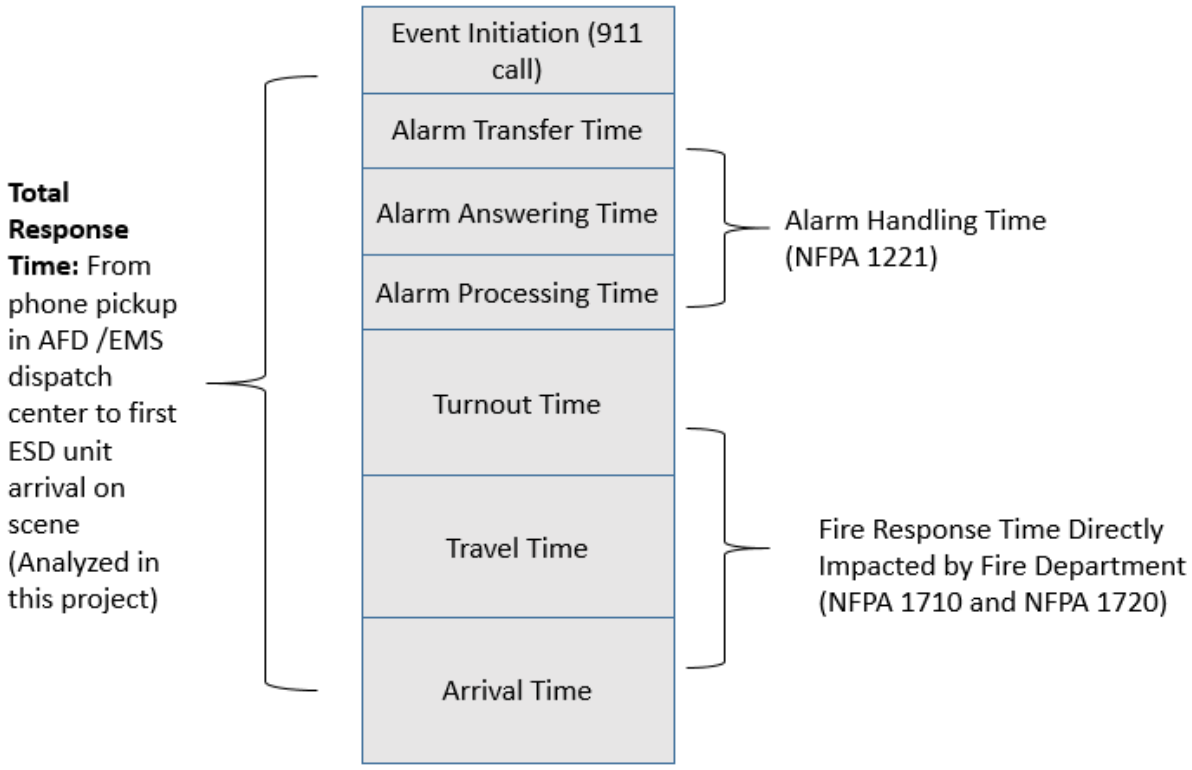
This category measures each ESD's ability to respond to incidents effectively, fight fires, and provide emergency medical care to its citizens. This is the "bread and butter" of the fire service. "Performance measures are represented by inputs, throughputs, and outputs; a direct measure of the services that are being provided, not a measure of the resources committed to providing the service. Outcome indicators have assumed increasing importance." (Rich, 1982, pg. 8).

Response Times

Having highly trained personnel and high quality equipment does a department no good if they cannot reach an emergency within a reasonable amount of time. Response time is one of the most critical fire performance measures scrutinized by agencies who manage public safety organizations. Studies have shown a positive correlation between quicker response times and lower loss of life and property (Ammons, 2001, pg. 156). Response time of fire services has a clear correlation with the amount of structural damage (Challands, 2009, pg. 675). Delayed response times can mean the difference between $2,000 worth of damage and $200,000 worth of damage. During a medical emergency, response times can literally mean the difference between life and death. Reducing ambulance response times to 5 minutes almost doubles the survival rate for cardiac arrests (not witnessed by ambulance crews) (Pell et al., 2001, pg. 1385).

According to NFPA 1710, the response to a request for emergency service begins with the receipt of the alarm (or call), and ends when the first responding unit begins to initiate action to control the event (NFPA 1710, 2010, pg. 7).

Figure 2.1 The response time cascade depicted below shows elements of total response time. Standards per element are referenced, along with elements that are directly controlled by the Fire Department.



Source: CFAI Fire and Emergency Service Self-Assessment Manual

Response times can depend on traffic congestion, weather, distance, firefighter preparation ("turnout time"), dispatch time, and caller accuracy. Fire departments have direct control over certain variables of response time. For example, response times during inclement weather can be longer and difficult to mitigate. "Turnout time", on the other hand, can be mitigated. "Turnout time" is defined as the time interval that begins when there is an audible alarm or visual annunciation of a call and ends at the beginning point of travel time. NFPA guidelines specify an objective of 80 seconds for "Turnout" time for fire and special operations

response and 60 seconds turnout time for EMS response (NFPA 1710, 2010, pg. 7). Fire departments can lower their turnout times by evaluating ways they prepare for responses to emergencies. Practicing the donning of equipment and/or strategically placing gear at or near the location of a fire apparatus can save seconds which can in turn save lives.

Not all elements of response time will have the same potential for improvement. The focus on improving response times must emphasize those elements where safety is not compromised. The safe operation of emergency vehicles must be carefully monitored when attempting to improve response-time intervals. "Overemphasis on response-time interval metrics may lead to unintended, but harmful consequences (e.g., emergency vehicle crashes) and an undeserved confidence in quality and performance" (Myers et al, 2008, pg. 142).

Communities with sparsely distributed fire stations suffer from lengthy response times which can lead to excessive fire damage that would normally be suppressed by fire departments located within shorter distances. Lengthy response times can also be problematic during medical emergencies especially if someone is experiencing serious trauma or cardiac arrest. The NFPA outlines service delivery deployment response times for EMS related calls. Those who suffer from medical emergencies (especially cardiac arrest and serious trauma) have a short span of survival. In the first five minutes, survival rates can be improved if response times were less than five minutes, but after five minutes the curve flattens. Thus, decreasing response times from 10:59 minutes to 9:59 minutes, 9:59 minutes to 8:59 minutes and so forth down to five minutes does not improve the potential for survival on medical calls (Blackwell, Thomas, 2011, pg.23). The national standard for travel time of first responder or higher level trained EMS provider to medical emergencies is four minutes or less 90% of the time (NFPA 1710, 2010, pg. 7). An objective of eight minutes or less travel time for the arrival of an advanced life support

(ALS) unit at an emergency medical incident is outlined where this service is provided by the fire department with a cardiac defibrillator, or BLS unit arriving within 4 minutes or less travel time (NFPA 1710, 2010, pg. 6). The overall 90th percentile, a level often cited in the industry, is less than eleven minutes (USFA, 2006 pg.6). The national standard for fire engine travel time to fires is four minutes or less 90% of the time for urban municipal fire departments (NFPA 1710, 2010, pg. 7). The national standard for first alarm assignment "deployment" travel time to fires is eight minutes or less 90% of the time (NFPA 1710, 2010, pg. 7), 2010, pg. 11.

NFPA 1720 specifies response times for rural and suburban departments that have a combination of both paid firefighters and volunteers based on population per square mile as illustrated below in figure 2.2.

Table 2.2 NFPA Staffing and Response Time recommendations

Staffing and Response Time				
Demand Zone	Demographics	Minimum Staff to Respond	Response Time	Meets Objective (%)
Urban	>1000 people/ sq. mile	15	9	90
Suburban Area	500-1000 people/ sq. mile	10	10	80
Rural Area	< 500 people / sq. mile	6	14	80
Remote Area	Travel distance ≥ 8 miles	4	Directly dependent on travel distance	90
Special Risks	Determined by AHJ	Determined by AHJ based on risk	Determined by AHJ	90

Source: NFPA 1720, 2014, pg. 7

Organizations can improve response times at the level of the 911 call taker also. Certain organizations assume dual roles as both responders and call takers. For example in the City of Austin and Travis County, EMS paramedics and EMTs are responsible for responding to the scene of medical emergencies and also handling 911 medical calls at the combined transportation, emergency and communications center (CTECC). Medics make patient contact

over the phone and are able to give first aid and/or CPR instructions until first responders arrive at the scene. This manner of dispatching is important, especially in rural areas where response times are the longest.

Pre-planning can reduce response times. These pre-plans may include familiarity with best response routes within the district and mapping. Integrated mapping systems should not only include locations of hydrants, but also commercial and industrial buildings that may require special responses.

Another strategy that public safety organizations employ to mitigate lengthy response times is the implementation of global positioning system (GPS) enabled traffic preemption equipment, also known as opticom devices. These sensors can detect when an emergency vehicle is approaching an intersection while in emergency mode. According Advanced Traffic Products Inc., opticom infrared systems control intersections preemptively which help emergency responders conduct a much faster and safer emergency response while at the same time improving safety by eliminating right of way conflicts at intersections. This company claims their devices can potentially decrease response times by up to 20%.

An example of an opticom device used at a controlled intersection

Source: http://archive.wired.com/news/images/full/ir-sensor_f.jpg

ESDs should continuously conduct self-assessments in order to improve response times. The NFPA provides very specific guidelines for annual evaluation of response time objectives in order to address necessary improvements. "The fire department shall evaluate its level of service and deployment delivery and alarm handling time, turnout time, and travel time objectives on an annual basis" (NFPA 1710, 2010, pg. 7). The standard also requests that evaluation shall be based on emergency incident data relating to level of service, deployment, and the achievement of each time objective in each geographic area within the jurisdiction of the fire department.

Equipment Readiness

Response times are meaningless if those who arrive are ill equipped. This category evaluates the equipment responders depend on at the scene of an emergency. Fire departments across the country struggle with aging fleets, especially departments that are staffed by volunteers and are underfunded. Nationally, approximately 14,000 fire engines (pumpers) (17%

of all engines) are 15 to 19 years old, another 15,700 (19%) are 20 to 29 years old, and 10,900 (13%) are at least 30 years old. Therefore, roughly half (49%) of all engines are at least 15 years old (USFA Needs Assessment, 2006 pg.vi). In smaller communities, with less certain sources of revenue, are more likely to obtain their apparatus either used or converted from a non-fire-department design and use (USFA 2006, pg. 9). The national average for fire engines is approximately one pumper per 3,800 population, one aerial apparatus per 41,700 population and one fire station per 5,400 population (Ammons, 2001, pg. 147).

One of the critical performance measures specified by the ISO to determine equipment readiness is pump capacity. The ISO compares the pump capacity of the in-service and reserve pumpers (and pumps on other apparatus) with the basic fire flow. The ISO considers a maximum basic fire flow of 3,500 gallons per minute. NFPA manual 1901 specifies the requirements of a service capable fire apparatus. "The apparatus shall be equipped with a fire pump that has a minimum rated capacity of 750 gpm (3,000 lpm). The pumper shall be equipped with a water tank that meets the requirements of chapter 18 and has a minimum certified capacity of 300 gallons (1100 liters)" (NFPA 1901, 2014, pg. 22).

Hose bed areas, compartments or reels that comply with section 15.10 shall be provided to accommodate the following: minimum hose storage area of 30 square feet for 2.5 inches or larger fire hose. Two areas each, a minimum of 3.5 square feet, to accommodate 1.5 inches or larger pre-connected fire hose lines (NFPA 1901, 2014, pg. 22).

ISO recognizes the response of CAFS (compressed air foam systems) equipped apparatus to all structure fire alarms. CAFS is a systems used by certain fire departments to deliver compressed air foam to materials that have not burned in order to mitigate damage to a structure. The foam and water mixture is environmentally friendly. CAFS systems are especially useful

for jurisdictions that have limited water supplies, or limited staffing levels. CAFS can be used on both structure and wildland operations. The application of CAFS is accomplished by the utilization of a centrifugal pump, water source, foam concentrate tanks, rotary air compressor, direct injection foam proportioning system, mixing chamber and control systems which monitor the correct mixture of all additives (festfiresecurity.co, 2014). The apparatus and CAFS systems must meet or exceed the following requirements designated by the ISO: 300 gallon tank capacity, 500 gallons per minute (gpm) pump capacity, 120 Standard Cubic Feet Per Minute (SCFM) compressor capacity, 20 gallon Class A foam tank capacity and 2.5 GPM Class A foam concentrate pump capacity (ISO, 2005, pg. 26).

The Texas legislature has recognized the need to not only take overall ISO ratings into consideration for homeowners' insurance premium discounts, but also to recognize fire departments that utilize CAFS systems. Legislation pertaining to the Texas Department of Insurance and ISO was drafted in 2004, which gave CAFS systems credit for fire service ISO PPC ratings (TDI, 2004). When CAFS systems are carried and used in the extinguishment of all structures fires, they can potentially carry up to 30 points of Texas Addendum Credit. One of the TDI requirements mandates that CAFS capable fire engines must be able to be assigned to first alarm structure fires, wherever that fire may arise throughout the response area of the AHJ.

Overall ISO PPC Fire Suppression Rating

ISO scores are the golden standard that fire departments around the country aim to achieve. The ISO is a private company that provides information to the insurance industry regarding property and casualty risk. ISO is the principal provider of insurance underwriting, rating, and statistical information to the insurance industry in the United States. The Fire Suppression Rating Schedule (FSRS) is a manual containing the criteria ISO uses in reviewing

the fire prevention and fire suppression capabilities of individual communities or fire protection areas (ISO, 2007). The ISO serves to designate all fire departments across the nation with a comprehensive performance based rating on a scale of 1-10. THE FSRS evaluates three main categories of criteria; water supply (40%), communication abilities (10%), and Fire Department quality (50%), (Ammons, 2001, pg. 152). ISO ratings are heavily influenced by a structure's distance from a fire station and hydrant (Berger, 2007 pg. 3). For purposes of definition, the ISO defines any property within 1,000 feet of a fire hydrant as "city" and any property further than 1,000 feet of a hydrant as "rural." The ISO may sometimes issue dual ratings (ISO 2013 revision), such as 5/9 which designates the first number (5) as a city protection rating and the second number (9) as the rural protection rating. The first number refers to the classification of properties within 5 road miles of a fire station and within 1,000 feet of a creditable water supply. The second number, with either the X or Y designation applies to properties within 5 road miles of a fire station but beyond 1,000 feet of a creditable water supply. ISO generally assigns class 10 to properties situated beyond 5 road miles (isomitigation online, 2014).

The ISO evaluation uses an inverse scale where one is the highest quality rating and ten is the lowest quality rating. Although this measure is an important aspect of firefighting abilities, it is not done on a regular basis. Most fire departments undergo a rating review every ten years (ISO, 2007). Some fire departments have never participated in the ISO program. Before conducting this study, it was unknown which ESDs in Travis County participated in the ISO program.

The ISO evaluates features of fire prevention enforcement, fire investigations, public fire safety education, construction code enforcement, compressed air foam system usage and specific Texas Fire Department training programs are part of ISO's PPC program in Texas (ISO, 2004).

Communities benefit from an improved rating by having not only improved fire protection status but also reduced property insurance premiums. Because a community's investment in fire mitigation is a proven and reliable predictor of future fire losses, insurance companies rely upon ISO's PPC program to help establish fair premiums for fire insurance – generally offering lower premiums in communities with better fire protection (ISO, 2004 preface material). For instance the Norwood-Redvale Fire District in Colorado dropped from a class nine to a class seven and saved homeowners an average of $960 annually (Fire Apparatus, 1998, pg.1). However, cities often are reluctant to increase the property tax rate to fund needed improvements in relation to the fire service even though it can lead to savings in homeowners' insurance policy premiums. The savings in homeowners' insurance premiums usually offsets the costs of improvements to the fire service. It is important to note that not all insurance companies utilize the ISO as a means to assess fire risk. Some insurance agencies utilize their own fire damage rates by zip code to assess risk. Some skeptics of the ISO believe that the ISO does not properly evaluate districts that lack vast amounts of structures (e.g. wild land urban interface).

Water Availability

An inadequate supply of water for the fire service can result in high fire insurance premiums, low ISO rating, inefficient and ineffective fire service, a detriment to local businesses and economic development, high property loss and greater potential for loss of life (Darden 2007, pg.3). The difference in commercial fire insurance premiums between a community with adequate water for fire service and a community that does not have adequate water is significant and in many instances may prevent industry from locating to the community (Darden, 2007, pg.6). A reliable and readily available water supply is paramount both to the success of fire performance measures and to the health of the local economy.

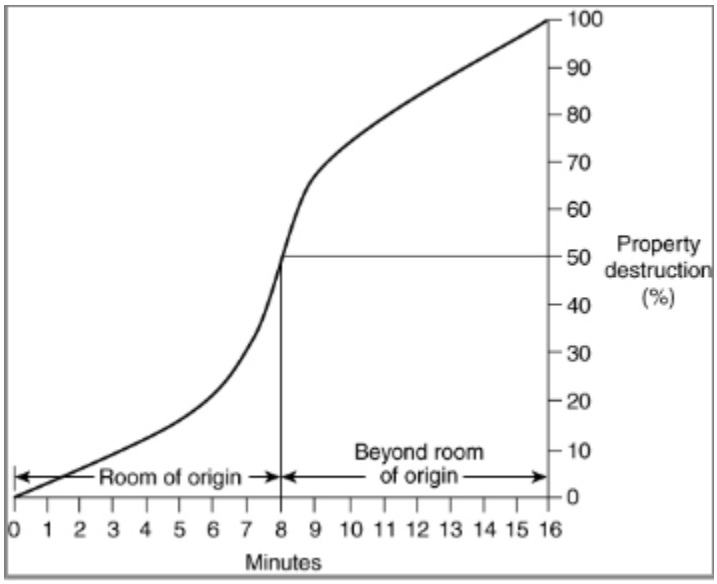
The ISO compares the available water supply at representative community locations with the needed fire flows for those locations. The supply works, the water main capacity, or fire-hydrant distribution may limit the available supply. ISO water supply considerations focus on hydrant availability, hydrant condition, and the availability of adequate supplies of water at sufficient pressure (Ammons, 2001, p. 152). Most municipal subdivision regulations require hydrants to be installed 1,000 feet apart or 500 feet from residential structures (Darden, 2007, pg. 4). The minimum technical requirements for the fire service are 500 gallons of water (gpm) per minute and water flows at 20 pounds per square inch (psi) residual pressure. This requires a minimum six inch water main (Darden, 2007, pg. 4). The flow, which is measured in gallons per minute must be established within 15 minutes from the beginning of a fire alarm. The typical residential fire requires approximately 4,500 gallons for extinguishment, cleanup and refilling tanks (Darden, 2007, pg.6). 40% of a community's ISO rating is based on the adequacy of its water supply, something typically beyond the control of the fire department.

Fire Extension

One of the most frequently used fire service benchmarking statistics often used by many fire departments nation-wide is fire extension from the room of origin per 1,000 fires. This measurement takes the size of a structure, along with distance of extension during flashover and compares it to civilian casualties and property losses. Flashover is the stage of a structure fire when it becomes extremely dangerous to occupants, structures and firefighters. During a flashover, temperatures and conditions are intense and an entire room can burst into flames, causing a fire to spread to other parts of the structure. By containing a fire to its room of origin and delaying flashover, firefighters can buy several minutes, which may be critical. Delaying flashover allows more time to complete a search and rescue of the burning room or allow a

firefighter to go above a fire to rescue a trapped victim. Delaying flashover and fire spread can limit fire loss and injuries to occupants and firefighters (Fcgov.com, 2014).

Figure 2.2 The fire propagation curve illustrates the positive correlation between fire spread beyond room of origin and property destruction.



Source: NFPA 1710 (http://www.nfpa.org/assets/files/aboutthecodes/1710/1710_a2015_fac-aaa_fd_ballotfinal.pdf)

Measures of fire spread at arrival and control have proven and demonstrated face validity (Flynn, 2009, pg. 17). Fire officials must decide the minimum amount of fire spread (and fire size) that is significant for a particular type of decision. This point also applies to measures of fire rates, dollar losses, and fire causes (Schaenman, Hall, et.al).

The ability of adequate fire suppression forces to greatly influence the outcome of a structure fire is undeniable and predictable (NFPA 1710, 2010, pg. 17). An early, aggressive, and offensive primary interior attack on a working fire, where feasible, is usually the most effective strategy to reduce loss of lives and property damage (NFPA 1710, 2010, pg. 16). Data generated by the NFPA and used by the committee in developing this standard provide empirical

data that rapid and aggressive interior attack can substantially reduce the human and property losses associated with structure fires (NFPA 1710, 2010, pg. 17). Table 2.3 illustrates the importance of confining fire to room of origin.

Table 2.3 National fire extension data per 1,000 fires

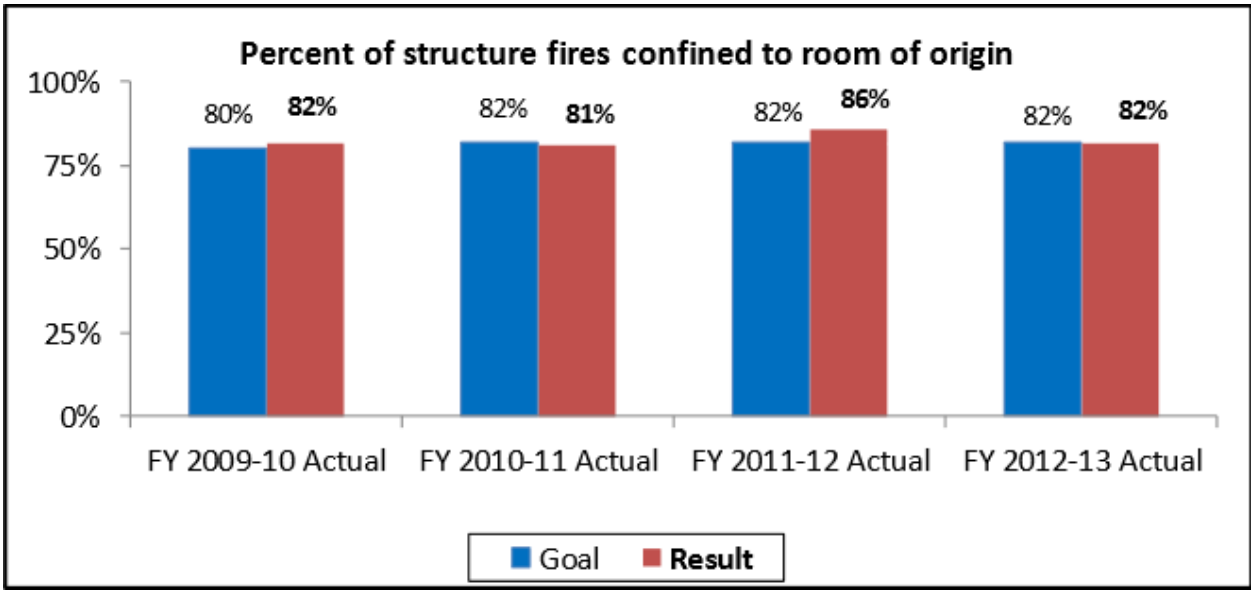
Fire Extension in Residential Structures, 2002-2005			
(Rate per 1000 Fires)			
Extension	Civilian Deaths	Civilian Injuries	Average Dollar Loss per fire
Confined fires (identified by incident type)	0.08	9.25	313
Confined to room of origin	4.99	47	8948
Confined to room of origin, including confined fires by incident type	2.15	25.18	3958
Beyond the room but confined to floor of origin	17.62	80.45	34,011
Beyond floor of origin	27.48	59.38	58,820

Source NFIRS 5.0

Fire extension measurements can have significant variability because a small number of incidents may change the percent of success dramatically. In some cases, fires which have grown significantly before the 911 emergency call is received will be well beyond the control of emergency personnel before they arrive on scene. In the future, policymakers may wish to consider the increased use of the fire code to limit fire spread through the use of building sprinklers (fcgov.com, analysis of performance, 2014).

The Austin Fire Department (AFD) consistently aims to achieve an 82% fire containment to room of origin within their response area. As shown in figure 2.3 below, AFD almost always meets or exceeds this standard.

Figure 2.3 Austin Fire Department key performance indicator- Fire Extension



Source: Austin Public Safety Commission Fire Department Budget Presentation, May 2014

Staffing and Training

Personnel administrative measures enable officials to hold organizations accountable and to introduce consequences for underperformance. It helps citizens and customers judge the value that government creates for them and provides managers with the data they need to improve performance (Behn, 2003, pg. 587). The following descriptive category measures staffing and retention, EMS training measures, and proficiency training.

Staffing

Response times, quality of equipment and other various performance measurements are meaningless when a fire service is understaffed. This category measures each ESD's ability to staff firefighters appropriately. By far, the largest expense that fire departments undertake is personnel cost. With continuously shrinking budgets, many ESDs are unable to properly staff

engine companies. Some stations that should staff at least four firefighters per apparatus can only staff three. The NFPA mandates that initial firefighting operations shall be organized to ensure that at least four members are assembled before interior fire suppression operations are initiated in a hazardous area (NFPA 1720, 2014, pg. 8). Some ESDs in Travis County have previously had only two firefighters per apparatus.

The NFPA and the National Institute for Occupational Safety and Health (NIOSH) have reported that fire departments across the nation lack adequate staffing, which has contributed to millions of dollars in time lost injuries, thousands of on the job injuries, and dozens of line of duty deaths each year (Wilson, 2009).

For many understaffed departments, the first arriving complement of firefighters often falls short of the minimum of four firefighters needed to initiate an interior attack on a structure fire, thereby requiring the first-arriving firefighters to wait until the rest of the first-alarm responders arrive (USFA 2006, pg. iv). "The only exception to this rule is when initial attack personnel find an imminent life-threatening situation where immediate action could prevent the loss of life or serious injury" (NFPA 1720, 2014, pg. 8.) "Fire companies whose primary functions are to pump and deliver water and perform basic firefighting at fires, including search and rescue shall be staffed with a minimum of four on-duty personnel. These requirements shall be based on minimum levels necessary for safe, effective, and efficient emergency operations" (NFPA 1710, 2010, pg. 9). "In the initial stages of an incident where only one crew is operating in the hazardous area at a working structure fire, a minimum of four individuals shall be required, consisting of two individuals working as a crew in the hazardous area and two individuals present outside this hazardous area available for assistance or rescue at emergency operations where entry into the danger area is required" (NFPA 1500, 2014, pg. 24). This

standard is based on a typical two story single family dwelling. The more complex the structure becomes, the more firefighters it will take to deploy a line. The standard acknowledges this fact and recommends five to six personnel for high tactical hazards (high-rises, large commercial occupancies, industrial complexes, large multi-dwellings, geographical restrictions etc.) or increased incident frequency (Firefighter Nation, 2012, pg. 4).

Firefighter Michele Rabel next to an ESD #5 apparatus dons her turnout gear and tests her SCBA during a structure firefighting training exercise.

Source: Michele Rabel

The incident safety officer is imperative to ensuring that the safety and health system is established as required. The NFPA recommends that an incident safety officer shall be deployed to all incidents that escalate beyond a full alarm assignment or when firefighters face significant risk (NFPA 1710, 2010, pg. 11).

The NFPA makes recommendations for staffing levels for various geographical regions across the United States based on demand zone and demographics. For urban areas with less than 1000 population per square mile, it is recommended that 15 personnel be staffed to respond to emergencies with a response time of ten minutes 90% of the time. In suburban areas with population size between 500-1000 people per square mile, it is recommended to staff ten firefighters with a response time of less than ten minutes at least 80% of the time. In rural settings, defined by less than 500 people per square mile, it is recommended there be at least six firefighters available to respond within a 14 minute time frame 80% of the time. In remote areas where travel distance is greater than eight miles, it is recommended that there be at least four firefighters able to respond at least 90% of the time (NFPA 1720, 2010).

The NFPA 1710 standard contains minimum requirements relating to the organization and deployment of fire suppression operations, emergency medical operations, and special operations to the public by substantially all career fire departments. The purpose of this staffing standard is to specify the minimum criteria addressing fire service effectiveness and efficiency in protecting the citizens of the jurisdiction and the occupational safety and health of fire department employees (NFPA 1710, 2010, pg. 4).

Volunteer firefighters are a vital supplement to rural fire districts paid workforce. This is especially critical during times of crisis and disaster where resources are stretched thin. During the Bastrop complex fire in 2011, volunteer firefighters played an invaluable role in being able to mitigate the amount of damage that was sustained to properties in the area. With the increase in population that many ESDs in Travis County have undergone, volunteer firefighters do not participate as often. Volunteers who would normally dedicate time in a rural ESD no longer play a significant role in faster growing districts (Anchondo; James 2011 pg. 54).

In ESDs across the state of Texas, staffing levels are not being increased despite increased service demands (Anchondo; James 2011). Residents who move to areas that are served by ESDs from areas that were served by municipal Fire Departments maintain the demand for the same level of service or higher they once received before moving. Municipalities that are rapidly annexing new areas and experiencing explosive population growth rates should understand the need to constantly reevaluate their necessity for additional staff.

More and more, ESDs struggle to effectively continue to attract and keep quality personnel. ESDs are in direct competition with municipal Fire Departments that offer more attractive employment packages than rural districts that cannot afford to offer such comparable salaries. Younger firefighters, who frequently do not live within their ESD, are more susceptible to the attraction of higher salaries and benefits that are provided by larger municipal fire departments (Anchondo; James 2011 pg. 54). Often times, the ESDs will train new firefighters just to have them leave. When the most experienced veteran firefighters leave for departments that pay more, the ESD suffers and the municipal fire departments win.

Fire Chiefs are faced with the dilemma of leaving positions vacant until they can properly train successors to promote, or promote inexperienced, untrained successors (Cochran, 2010, pg. 66). Additionally, increased vacancies equal to an even larger amount of forced overtime. Burnout rates due to increased workload soar which in turn affects firefighter safety and patient outcomes.

Job satisfaction has been linked to opportunities, leadership, and fair rewards (Bavendam Research Institute, 2000). One researcher noted that any employee contemplating changing jobs first compares their current situation with their prospective employer by evaluating certain

factors such as the labor/management relationship, promotional opportunities, and least importantly salary and benefits (Crawford, 2005, pg. 68).

Emergency Medical Services (Training)

The majority of calls for service that Fire Departments in Travis County respond to are for medical assistance. These types of calls include cardiac arrests, diabetic emergencies, falls, and difficulty breathing just to name a few. It is imperative that first responders are trained and proficient in life-saving skills such as CPR, bleeding control and airway maneuvers.

However, defining EMS performance benchmarks is a difficult task. There are few evidence-based measures of EMS system performance. (Myers et al., 2008, pg. 141). Some EMS agencies typically rely strictly on customer service surveys, response times and cardiac arrest "saves" to determine how well they are serving their citizens. A study recently evaluated the number of emergency dispatches per cardiac arrest which ended up being 555 out of a total of 101,642 (Johnson et al, 2011). This turned out to be less than 1% of all call volume. This means that cardiac arrest saves in and of themselves were an even smaller number.

In the absence of a distinct body of literature evaluating the full spectrum of medical interventions provided in the prehospital setting, EMS performance measures have been limited to the relatively few benchmarks that have been established scientifically such as survival from out-of-hospital cardiac arrest (Myers et al., 2008, pg. 141). The term "return of spontaneous circulation" is used by the EMS industry to define return of pulses secondary to an event that has caused them to become pulseless and apneic. The issue of cardiac arrest "saves" can be further broken down into several other defining criteria. Out of hospital cardiac arrest with spontaneous circulation upon arrival to an Emergency Department is one EMS benchmark. However, an even

more worthwhile benchmark to strive for is patient discharge from hospital neurologically intact. Although cardiac arrest is one of the most important medical emergencies that EMS systems can train for, it is also important to recognize that cardiac arrest only constitutes a small fraction (1-2%) of all EMS responses (Myers et al., 2008, pg. 141).

The 2007 US Metropolitan Municipalities' EMS medical directors' consortium has developed a model that encompasses a broader range of clinical situations, including myocardial infarction, pulmonary edema, bronchospasm, status epilepticus, and trauma.

The National Registry of Emergency Medical Technicians (NREMT) has designated four levels of first responder medical certifications listed in order from lowest to highest trained; Emergency Care Attendant (ECA), Emergency Medical Technician-Basic (EMT-B), Emergency Medical Technician-Intermediate (EMT-I), and Emergency Medical Technician-Paramedic (EMT-P)(NREMT, 2014).

Initial EMT training is defined by the DOT 110 hour curriculum (Wright, 1998, pg. 7). Ongoing EMS training consists of 30 hours of continuing education of skills, knowledge, or clinical experience which is the subject matter of the 110 hour US DOT EMT course obtained during the preceding 3 years (Nebraska health and human services system, 1996, pg. 44).

The ultimate positive outcome for EMS is the survival rate of patients (Hatry, 2006, pg. 95). Call volume may include assaults, psychiatric emergencies, chest pain and respiratory distress problems. With such a variety of calls for medical emergencies, it is difficult to measure performance for every distinct illness or injury. During a cardiac arrest, however, first responders' life-saving skills are truly put to the test. The best measure of outcome for cardiac arrest patients is the survival rate. If very few patients leave the hospital alive, the effectiveness

of the service may be questioned (Hatry, 2006, pg. 95). The following two measures are the best way to examine the effectiveness of Emergency Medical Services: The percentage of cardiac patients who reach the hospital alive and the percentage of cardiac patients who leave the hospital alive (Hatry, 2006, pg. 95).

In Travis County, ESDs contract with the city of Austin's EMS service (Austin-Travis County EMS) to provide advanced life support (ALS) through an inter-local agreement. ALS is defined as emergency medical treatment beyond basic life support that provides for advanced airway management including intubation, advanced cardiac monitoring, defibrillation, establishment and maintenance of intravenous access, and drug therapy (NFPA 1710, 2010, pg. 6). The ESDs provide Basic Life Support (BLS) medical care until ALS arrives for transport to the hospital. BLS is defined as a specific level of pre-hospital medical care provided by trained responders, focused on rapidly evaluating a patient's condition; maintaining a patient's airway, breathing, and circulation; controlling external bleeding, preventing shock; and preventing further injury or disability by immobilizing potential spinal or other bone fractures (NFPA 1710, pg. 6). Due to the fact that there are more firefighters than EMS resources, ESDs are first to arrive on scene the majority of the time and must be proficient in the ability to assess and treat patients with illnesses and injuries. Clinical operating guidelines (COGs) are outlined in the Austin-Travis County Office of the Medical Director's responder handbook (Hinchey, 2014).

Proficiency Training

Although firefighting may appear to be a relatively simple task of placing water on fire, in actuality, there are a complex set of skills that are involved. These skills include effective approach, expedient access, strategic application of water, ladder placement, attack line

deployment, backup (rescue) teams, structure ventilation, and discovery of hidden fires just to name a few. Excellent fire service response times and equipment does a community no good without competent and knowledgeable staff. The training program for a modern fire department will be based on federal OSHA guidelines, NFPA standards, state regulations, local policies, procedures and executive orders (Wright, 1998, pg. 11). According to the NFPA, fire training should incorporate hose, ladders, small tools, forcible entry, breathing equipment, knots and ropes, portable fire extinguishers and communications (NFPA 1001, 2014). Proficiency training, is in a sense, continuing education for firefighters. Much like a nurse or paramedic undergoes continuing education to refresh skills or to learn the most innovative and scientifically proven means of treating patients on a revolving basis, a firefighter must continuously learn the newest techniques to perform effectively. Continuing education or training is necessary to ensure that firefighters remain current and update their knowledge and skills in the evolving field of firefighting (NFPA 1001, 2013, pg. 1001-13). Nationally recognized certification is one means of demonstrating proficiency in current practices (NFPA 1001, 2013, pg. 1001-13).

Larger municipalities, such as Austin, Texas, enjoy their own state of the art public safety training centers equipped with large dummy towers and expensive training equipment. It has been reported that some ESDs simply cannot conduct training because they have no funds to purchase land or structures to perform the training. An estimated 50% of fire departments involved in technical rescue service have not provided formal training in those duties to all involved personnel (USFA, 2006 pg. v). However, some fire departments are able to negotiate agreements that allow them to conduct training at schools or airports using parking lots.

Most FTE firefighters, other than volunteers, hold TCFP (Texas Commission on Fire Protection) certification. This is a standard firefighter “license to practice” in Texas. However,

some firefighters hold certifications that address potential hazards that exist within their respective jurisdictions. This includes swift water rescue, rope rescue, technical rescue, cave rescue, wild land firefighting, and hazardous materials response. This training is geographically dependent. NFPA standards such as 1001 provide volumes of paragraphs and interpretations of what training is commensurate with each firefighter in a given location. For example, the wildfire firefighter training needed by a firefighter in California will be different than the training needed by a firefighter in Lincoln, Nebraska.

With the diverse geographical patterns that are present in Travis County, a variety of rescue capabilities are required. From the high peaks of the rocky cliffs of Reimers Ranch attracting thrill seekers in western Travis County, to the underground caves that are present underneath South Lamar Boulevard in the Austin city limits. Almost any recreational hotspot within Travis County attended by recreational visitors will demand a need for EMS, fire and rescue capabilities.

The presence of the Colorado River which runs through Austin, TX, requires the need for fire departments to have marine capabilities. Boat accidents such as propeller injuries, drownings, and other various unpredictable emergencies require the need for watercraft in order for successful access and egress to the patient(s). NFPA guidelines establish marine firefighting standards which require access to special tools, equipment supplies, PPE, and other marine resources that are required to perform operations in their assigned roles and responsibilities (NFPA 1710, 2010, pg. 11). The fire department shall adopt a marine operations response plan and SOPs that specify the roles and responsibilities of the fire department and the authorized functions of members responding to marine emergencies (NFPA 1710, 2010, pg. 11).

The Wild land Urban Interface (WUI) is the fastest growing fire problem in the United States (Travis County Fire Marshall Action Guide, 2012, pg. 2). The catastrophic Bastrop Complex wildfires that ravaged in September of 2011 were a reminder of the powerful threat that Central Texas residents are now forced to face. The situation will only worsen with recent drought conditions, winds, hot weather patterns, and the build-up of dry and dense vegetation. The NFPA addresses wild land fire suppression services for departments that reside within the WUI. Fire Departments performing wild land operations shall have access to special tools, equipment, supplies, PPE, and other wild land resources that are required to perform operations in their assigned roles and responsibilities (NFPA 1710, 2010, pg. 12). Furthermore, wild land fire suppression operations shall be organized to ensure that the fire department's wild land fire suppression capability includes personnel, equipment, and resources to deploy wild land direct operations that can address marginal situations before they get out of control, and wild land indirect fire-fighting operations that can be assembled and placed into operation against major wild land fires.

Firefighting can be a very dangerous occupation. It is imperative that managers have the ability to mitigate this exposure to risk as much as possible not only by equipping firefighters with the latest safety equipment but also by proficiently training firefighters to the most effective safety standards. The following measure collects data about how well risk of injury and death to firefighters is managed: Number of firefighter (a) injuries and (b) deaths per 100 firefighters and number of firefighter (a) injuries and (b) deaths per 100 fires (Hatry, 2006, pg. 85).

Required training is training that must be provided to fire suppression and EMS personnel to complete their duties and responsibilities safely (Wright, 1998, pg. 12). The NFPA standard 1500 (1992) Occupational Health and Safety Standards identifies in section three that

training is to be commensurate with firefighters duties and responsibilities. However, OSHA standards do not provide guidance on how to measure competency of the firefighter after completion of the training (Wright, 1998, pg. 10).

The NFPA is often times considered a superior standard for firefighter training than all other state and federal standards. After comparing OSHA standards with NFPA standards, if a safety standard complies with NFPA 1500, the other standards would be met as well (Bradley, 1989, pg.2).

Fire Prevention

A Fire Department that is strictly reactive will never be able to reach the achievements obtained by a department that is both reactive and proactive. A proactive department is constantly engaged with the community similar to the way community policing works in law enforcement. Law enforcement officers are able to deter and solve crime by capitalizing from neighborhood partnerships. Community engagement in fire prevention operates similarly by actively educating the public about the risks of fires through town hall meetings, local school presentations, and the distribution of fire safety literature. Fire code enforcement programs help make structures safer and less susceptible to catastrophic events. Criminal activity is deterred through careful and articulate fire arson investigation activities. Fire prevention is not simply preventing a fire but is instead the systematic application of codes, standards, engineering principles, and an understanding of human behavior to achieve the objective of limiting the loss of life and property (NFPA 1720, 2014, pg. 15). Some of the greatest value delivered by the US fire services comes in activities that prevent fires and other emergencies from occurring or that moderate their severity when they do occur (USFA 2006 pg. 51).

Generally, the results expected from fire prevention (and related life safety) programs include documenting educational gain (people actually learning something as opposed to just sitting in class); documenting risk reduction where increased safety behaviors or decreased hazard producing behaviors can be documented (e.g. hazards noted and abated during fire code compliance inspections); and finally documented reductions in losses (death, injuries, and both direct and indirect economic losses) (National Strategies, 2009, pg. 1).

Education Activities

One recent study examined the net benefits of wild fire prevention education efforts. Typical fire education efforts include the distribution of brochures, airing public service announcements and making presentations. "The expected reductions in wild life damages with an effective wildfire prevention education program showed that marginal benefits exceed marginal costs statewide by an average of 35 times. The benefits exceeded fire prevention education costs in the fire management regions by 10 to 99 times, depending on assumptions about how wildfire prevention education spending was allocated to these regions" (Prestemon, et al, 2009, pg. 181).

Urban density is pushing a growing number of residents into suburban and rural areas located within the Wildland Urban Interface (WUI). Fire hazard increases as people continue to build their homes within the proximity of dense trees and brush. ESDs have received grant funding to educate residents about understanding the risks of wildland fires and measures that need to be taken to mitigate the risk.

For example, The Austin Fire Department and the Travis County Fire Marshall's office offer the "Ready, Set, Go!" program sponsored by the US Forest Service in collaboration with

the Firewise Communities Program. This program helps residents understand the impact a wild land fire can have on their safety. Recommendations for landscaping patterns are demonstrated. Tips for pre-planned evacuations are illustrated in detail online (wildlandfire.org, 2014). The importance of a defensible space is emphasized in their printed literature and on their website. Defensible spaces provide firefighters with the capabilities to protect homes that may be susceptible to a rapidly spreading wildfire. Buffer zones are created by removing nearby trees, woodpiles, brush, and other dense vegetation in order to prevent the formation of flying embers and to distance the spread of wildfires from the structure itself.

The number of fire service personnel tasked with fire prevention education is important. One way to determine the level of fire prevention education is based on the number of fire service personnel engaged in prevention efforts. Fire departments that have more fire service personnel engaged in fire prevention education are more effective in fire prevention (Schaenmann, 1997, p. 9).

Additionally, the effectiveness of these education activities is related to the training of the educators themselves. Fire safety education personnel must receive up to 10 hours of continuing education in public fire safety education, per year during the past three years to be ISO compliant (ISO, 2005, pg. 16). Some examples of fire safety education topics within this category are branched underneath the JFIP (Juvenile Fire setter Intervention Program). Such topics include the Texas Commission on Fire Protection (TCFP), fire instructor course, skills building workshop, and connecting school emergency management and youth preparedness.

Inspection Activities

Code enforcement is another important fire prevention activity that is crucial to effective fire districts and the prevention of fires. Code enforcement includes the inspection of such things as fire suppression systems, fire alarms, warning signs (such as capacity limits), emergency exits and ventilation systems. A structure designed and constructed to withstand the effects of fire is the most important asset in achieving fire risk management. A structure relying solely on fire rescue response offers the greatest challenge to the occupants and fire department personnel (NFPA 1720, 2014, pg. 15).

Fire Inspectors prepare correspondence and inspection reports, handle complaints, maintain records, as well as participate in legal proceedings and maintenance of an open dialogue with the plan examiner and emergency response personnel (NFPA 1031, 2014 pg. 1031-8). Fire Inspectors are divided into 3 categories. The Fire Inspector I conducts basic fire inspections and applies codes and standards. The Fire Inspector II conducts most types of inspections and interprets applicable codes and standards. The Fire Inspector III performs all types of fire inspections, plans review duties, and resolves complex code-related issues (NFPA 1031, 2014 pg. 1031-7). This duty involves fire safety inspections of new and existing structures and properties for construction, occupancy, fire protection, and exposure.

Across the nation, an estimated 20.3 million people (7%) live in communities where no one conducts fire-code inspections (USFA, 2006 pg. 7). Two-fifths of this population live in rural communities, with less than 2,500 population (USFA, 2006 pg.vi). One of the reasons the West, Texas explosion was so catastrophic was due to lack of zoning and fire code regulation standards and enforcement (Smith, 2013). Per ISO guidelines, fire prevention personnel must

receive up to 40 hours of continuing education in fire prevention per year during the past three years (ISO, 2005 pg. 2). These include such topics as basic environmental law, fire resistance rated construction by code, and annual fire marshals conferences.

As outlined in NFPA 1, "Fire Code", fire prevention includes egress, construction design, building services, fire protection, and occupancy. All of these elements work together to provide the occupants and fire department personnel with a level of fire safety not otherwise available. By ensuring that each of these elements is balanced, the fire department can maintain a reasonable level of risk for the community and the department (NFPA 1710, 2010, pg. 19). Structures that are designed with noncombustible construction, are protected with fire protection systems, and are routinely inspected to ensure appropriate occupant use are most likely to provide the lowest risk levels and therefore are the least difficult to manage (NFPA 1710, 2010, pg. 20). Nationally, an estimated 128.9 million (44%) are protected by departments that do not provide routine testing of active systems (e.g., fire sprinklers) (USFA, 2006 pg. v).

One recent study examined ways to evaluate the effectiveness of Code Compliance activities (National Strategies, 2009, p. 4)

- Total value of property lost in inspectable occupancies to fire in relation to assessed value (factored for inflation)
- Changes in the percentage of total fire losses occurring in inspectable occupancies (factored for inflation)
- Changes in fire deaths/100,000 residents in inspectable occupancies
- Changes in number of structural fires/1,000 residents in inspectable occupancies

Investigation Activities

Fire investigators play a crucial role in determining the cause of fires. Determining the root of origin of a structure fire requires expertise and experience above and beyond what an ordinary firefighter would be able to accomplish. Civil litigators and criminal prosecutors rely heavily on the competence and consistency of fire investigators when legal matters arise. In rural communities, fire arson investigators are the principal resource for determination of intentional fire setting (NFPA, 2006 pg.55). In many municipalities, arson investigators hold comparable certifications to law enforcement officers who are required to register through their respective states. The investigation of fires is basic to good fire department management since it results in bringing to light the factors which can be used to lessen the number and severity of fires in the future (NFPA, 1971 pg.4B-81). It is also important to know that part of the investigation into the causes of fires can point to gaps in code enforcement efforts.

According to the NFPA, investigator duties shall include inspection and evaluation of the fire scene, or evidence of the scene, and/or conducting a comprehensive review of documentation generated during the examination of the scene if the scene is no longer available, so as to determine the area or point of origin, source of ignition, material (s) ignited, and act of activity that brought the ignition source and materials together and to assess the subsequent progression, extinguishment, and containment of the fire (NFPA 1033, 2014, pg. 7).

The investigator shall have and maintain at a minimum an up-to-date basic knowledge of the following topics beyond the high school level: fire science, fire chemistry, thermodynamics, thermometry, fire dynamics, explosion dynamics, computer fire modeling, fire investigation, fire analysis, fire investigation methodology, fire investigation technology, hazardous materials,

failure analysis and analytical tools, fire protections systems, evidence documentation, collection, and preservation, electricity and electrical systems. The fire investigator shall remain current in the topics listed above by attending formal education courses, workshops, and seminars and/or through professional publications and journals.

Investigators are expected to be able to examine and remove fire debris, given standard equipment and tools, so that all debris is checked for fire cause evidence, potential ignition source (s) is identified, and evidence is preserved without investigator-inflicted damage or contamination (NFPA 1033, 2014, pg. 8). Investigators must also have precise investigatory skills and acute attention to detail. Investigators must be able to discriminate the effects of explosions from other types of damage, given standard equipment and tools, so that an explosion is identified and its evidence is preserved (NFPA 1033, 2014, pg. 8).

Investigators also have an obligation to testify during legal proceedings, given investigative findings, contents of reports, and consultation with legal counsel, so that all pertinent investigative information and evidence are presented clearly and accurately (NFPA 1033, 2014, pg. 10).

Chapter 3: Methodology

Chapter Purpose

This chapter discusses the research methodology used to apply the conceptual framework. The unit of analysis and operationalization table will be discussed. Constraints of this study, problems encountered, and other variables will also be explained in this chapter.

An attempt was made to collect data from all 13 ESDs in Travis County. Ten ESDs were able to successfully complete the survey. ESD #2, #4 and #13 did not participate in the survey. Some of the smaller ESDs were unable to complete the survey due to a lack of administrative resources, funding, and low call volume (especially for fire-rescue incidents). ESD #13 mainly consists of volunteers and medical first responders unlike the traditional structure of the larger ESDs in Travis County. ESD #12 only partially completed the survey. Open record requests were initiated with three ESDs.

Survey distribution began in September, 2014. Surveys were gathered until the beginning of November, when data was compiled and analyzed. Surveys gathered attempted to garner a better understanding of the performance metrics, threats faced, financial hardships, and solutions that were being sought by each ESD. Interviews to further gather information pertaining to each question in the survey were successful. Those ESDs who chose not to participate in the project are highlighted in the list below.

After the surveys were completed, a follow up interview was scheduled with administrative officials. A total of 13 surveys were distributed to 13 ESD fire department officers which were followed by a comparable number of interviews. This included Fire Chiefs,

assistant chiefs, battalion chiefs and other upper level fire service officials with an in depth understanding of the performance measures of their respective departments. Interviews were also conducted with other various administrative officials, who although did not represent an ESD, did have extensive knowledge of how ESDs operate.

In addition to the survey and interview methods mentioned above, a content analysis was also conducted in order to obtain a better understanding of the operations of each ESD. Documents reviewed included financial audits, annual reports, TSFMO ISO evaluations, response time and incident data generated by AFD business planning and research.

Operationalization

This study used survey research to obtain performance measures of each ESD. Survey research provides breadth and flexibility by allowing the researcher to ask a variety of questions on one or more topics. Additionally, survey questionnaires are standardized, reducing measurement ambiguity (Babbie 2010, pg. 287).

Each survey question addressed a specific element of the conceptual framework. For instance, response time categories contain CAD (computer aided dispatch) data obtained from AFD which is the organization tasked with dispatching all ESDs in Travis County in addition to the Austin Fire Department itself. For this particular section, it was important to understand what ESDs are doing to mitigate lengthy response times, since response time is a performance measure that fire departments have direct control over and is a critical fire suppression measure.

The operational relationship between the category and the survey questions is illustrated below. All of the questions presented in the survey are intended to inform the lay citizen how well their fire department is performing.

Table 3.1 Operationalization of the conceptual framework

Operationalization Table	
CATEGORY	**SURVEY QUESTIONS**
Fire Suppression Measures	
Response Times	1. What has your department done to mitigate lengthy response times? (e.g. integrated mapping, practicing rapid donning of turnout gear, opticom devices) 2. What is the main reason for lengthy response times in your jurisdiction? (e.g. fire stations spread out, geographical barriers such as unpaved roads, lack of roads) 3. How large of a response area does your jurisdiction cover? 4. How many fire stations do you have?
Equipment Readiness	1. What is the total number of fire dept. response vehicles your department has readily available for use? 1a. Brush Trucks 1b. Pumpers 1c. Ladder Trucks 1d. Brush Trucks 1e. Other (e.g. boats, squads) 2. What is the average gpm rating for each apparatus? 3. What is the minimum rated capacity (gallons) for each apparatus? 4. What is the minimum certified capacity (in gallons) of water tanks? 5. What is the average size of hose bed storage areas? 6. What is the average age of your fleet? 7. Does your department use CAFS? If yes → 7a. What is the CAFS tank capacity (in gallons)? 7b. What is the CAFS pump capacity? 7c. What is the CAFS CFPM compressor capacity? 8. Does your department use Class A Foam? If yes → What is the average class A foam tank capacity?

	What is the average class A foam *concentrate* pump capacity?
Overall ISO Rating	1. Does your department carry an ISO rating? If yes → 1a. What is your department's current ISO rating? 1b. Do you have a split rating? 1c. When was your last ISO evaluation? 1d. Please provide a ten year history of your ISO rating.
Water Availability	1. What is your department's water availability ISO rating? 1a. Please provide a ten year history of this rating 2. For the following, please provide average number of hydrants per square mile in the following demand zones: 2a. Urban 2b. Suburban 2c. Rural 3. Please provide average condition for each zone (excellent, fair, poor) 4. Please provide average hydrant pressure (gpm) for each zone (Excellent >1500)(Good 1000-1500)(Poor<1000) or inoperable 5. How many structures are within your jurisdiction?
Fire Extension	1. How many structure fires did your department respond to during fiscal year 2013? 1a. Of the structure fires that your department responded to during fiscal year 2013, how many of these fires were confined to room of origin? (as a percentage) 1b. Floor of origin? (as a percentage) 1c. Beyond floor of origin? (as a percentage) 2. How many civilian deaths occurred during structure fires in 2013? 2a. Civilian injuries? 3. How does your department define a civilian injury?
Staffing and Training	
Staffing	1. What is your average level of staffing per fire apparatus? 2. How many FTEs do you employ? 2a. Percentage? 2b. Number of front line Supervisors

	3. How many Part Time Employees do you employ? 3a. Percentage? 4. How many volunteers do you employ? 4a. Percentage? 5. How many employee departures did you incur during fiscal year 2013? 6. Does your department have a problem with attrition? 6a. What are some of the reasons for attrition in your department? 7. How competitive are employee salaries amongst firefighters in your department? 8. How competitive are retirement plans offered amongst your department? 9. What has your department done to address attrition? (mentoring, career opportunities, benefit enhancement)
Emergency Medical Service (Training)	1. What is your department's annual budget for medical CE per firefighter? 2. How many hours of medical CE is each firefighter mandated? 3. How many are NREMT certified? 3a. Percentage? 4. How many are basic EMTs? 4a. Percentage? 5. How many are intermediate EMTs? 5a. Percentage? 6. How many are paramedics? 6a. Percentage?
Proficiency Training	1. How does your department define a firefighter injury? 2. In 2013, how many firefighter injuries occurred while in the process of handling an emergency? (e.g. fire ground operations) 3. Has your department experienced a firefighter death in the last ten years? 4. How many hours of specialized training (other than medical) are firefighters in your department mandated annually? 5. How many hours of specialized training (other than medical) is budgeted for firefighters in your department annually?

	6. How many firefighters in your department are trained in specialized skills? (e.g. rope technician, swift water technician, Hazmat) 6a. percentage?
Fire Prevention	
Education Activities	1. How many employees are actively engaged in fire prevention education programs annually? 2. How much does your department spend on fire prevention education annually? 2a. What percentage of your entire budget is dedicated towards fire prevent education? 2b. Who is your target audience? (e.g. rural homeowners, children, low income families) 3. Has your department observed any changes in the incidence of fires due to fire prevention education programs?
Inspection Activities	1. Does your department use internal fire inspectors? 1a. If no, which agency does your department use? (e.g. AFD) 2. How many fire inspectors are employed by your department? a. Full time? b. Part time? 3. How many fire inspections were conducted in fiscal year 2013? 4. How much of your annual budget is dedicated to the activities of fire inspectors? 5. What percentage of code violations were corrected in fiscal year 2013?
Investigation Activities	1. Does your department use internal fire investigators? 1a. If no, which agency does your department use? (e.g. AFD, TCSO) 2. How many fire investigators are employed by your department? c. Full time? d. Part time? 3. How many fire investigations were conducted in fiscal year 2013? 4. How many interviews were conducted in fiscal year 2013? 5. How much of your annual budget is dedicated to the activities of fire investigators?

	6. What was the percentage of fire occurrence where cause was determined in fiscal year 2013? 7. What percentage of reported fires in 2013 were cleared without a determination of cause? 8. What percentage of fire investigations were successfully prosecuted in fiscal year 2013?

In addition to the above survey questions, the following revenue related questions were asked in order to better understand the financial constraints of each department:

Table 3.2 Questions directly related to funding/revenues

Questions directly related to department funding	1. What are some of the biggest problems your department has had to face? 2. What are some alternative methods of revenue generation your department has sought? 3. If your department was given a large unrestricted grant, what would you spend it on? 4. In your opinion, what would solve the problem with the ESD funding structure? 5. Please add any additional comments you would like to provide

The majority of the survey questions are open-ended questions. Although possible example responses are listed next to the various survey questions, these examples were not shared until after the interview was conducted and survey answers were reviewed. Babbie (2010, pg. 260) warns that survey research is ineffective when surveys are biased, or encourage participants to respond to questions in a particular way. For instance, responders who were asked what they have done to mitigate response times were asked without being prompted by examples. If the respondent was unable to produce any answers they were later prompted

with examples from other fire departments. Such examples might be opticom device implementation, turnout drills, and integrated mapping into CAD. ESD officials were also given the opportunity at the end of the survey to share pertinent and important information that may have not been solicited through the questionnaire.

Table 3.3 Definitions of Measurable Survey Data

Variable Definitions and Sources		
Variable	**Definition**	**Source**
ESD Budget	Annual fiscal year budget	Travis county emergency services/ESD Survey
Population	Population of authority having jurisdiction. May be more than one city and may contain unincorporated areas	Census/Travis county emergency services
Response Time (includes dispatch time, turnout time, and travel time)		
Dispatch Time	Begins when call is received. Ends when first unit is assigned	AFD CAD
Turnout Time	Begins when first unit is assigned ends when first unit is en route	AFD CAD
Travel Time	Begins when first unit is en route. Ends when first unit arrives at the scene of the incident.	AFD CAD
Equipment Readiness		
Total number of response vehicles	Total number of vehicles that are fully operational. Includes brush trucks, engines, ladder trucks, boats, squads etc.	ESD survey/Interview
Pump Capacity	Average Pressure of engine pumps (measured in gpm)	ESD survey/Interview
Certified Capacity	Water tank capacity (gallons)	ESD survey/Interview
Hose bed Capacity	Average dimensions in feet of hose bed storage area	ESD survey/Interview
Fleet Age	Average age of all emergency response vehicles in fleet	ESD survey/Interview
CAFS tank capacity	Average Compressed air foam system tank capacity (gallons)	ESD survey/Interview
CAFS pump capacity	Average Compressed air foam system (psi)	ESD survey/Interview
CAFS compressor capacity	Average CAFS compressor capacity (psi)	ESD Survey/Interview
Class A foam tank capacity	Average class A foam tank capacity (gallons)	ESD Survey/Interview

Class A foam concentrate pump capacity	Average class A foam *concentrate* pump capacity (gallons)	ESD Survey/Interview
ISO		
ISO Rating	1-10 whereas 1 = best rating 10 = Poorest rating	ISO/ESD Survey/Interview
ISO split rating	Communities located in excess of 5 miles from a water source (hydrant) but have nearby fire protection.	ISO/ESD Survey/Interview
Water Availability		
Water availability ISO rating	40% of standard ISO rating (scored out of 40 points)	ESD Survey/Interview
Water availability zones	Average number of hydrants per demand zone (urban, suburban, rural) square mile	ESD Survey/Interview
condition of fire hydrants	Average condition (Excellent, fair, poor) based on sedimentation rate, damage, etc.	ESD Survey/Interview
hydrant pressure	Average hydrant gpm for each zone (Excellent>1500psi, Good 1000-1499psi, Poor <1000) or inoperable/not utilized	ESD Survey/Interview
Structures	Total number of structures within the AHJ (ESD)	ESD Survey/Interview
Extension		
Fire Extension (room)	Percentage of fires confined to room of origin (best)	NFIRS/ESD Survey/Interview
Fire Extension (floor)	Percentage of fires confined to floor of origin	NFIRS/ESD Survey/Interview
Fire Extension (Structure)	Percentage of fires advanced beyond floor of origin (worst)	NFIRS/ESD Survey/Interview
Civilian deaths/injuries	Total number of civilian deaths and injuries during fires 2013	NFIRS/ESD Survey/Interview
Staffing		
Apparatus staffing	Average number of personnel assigned to each fire truck daily (e.g. 3 man engine or 4 man engine)	ESD Survey/Interview
District Staffing	Number of staffed fire stations multiplied by average staffing level per fire station plus	ESD Survey/Interview

	additional command responders	
Attrition Rate	Total number of departures/ Total Employees = Attrition rate	ESD Survey/Interview
FTES/Part-Time and Volunteer Staffing	Total number of full time and part time firefighters available to respond to emergencies	ESD Survey/Interview
Supervisory Staffing	Number of Lieutenants or higher (including Battalion Chiefs)	ESD Survey/Interview
EMS		
Out of hospital cardiac arrest survival rates	Percentage of patient who are discharged from the hospital alive	ATCOMD
ROSC Resuscitation rates	Return of spontaneous circulation at the scene or prior to arrival at ED	ATCOMD
EMS certification level	Total employees at each level of certification	ESD Survey/Interview
Medical CE hours mandated	Total number of hours mandated annually for each firefighter for continuing education (medical)	ESD Survey/Interview
Medical CE hours budgeted	Amount of money budgeted per year for the entire department to undergo CE training	ESD Survey/Interview
Proficiency		
Firefighter injuries	Annual number of firefighter injuries sustained during fire ground operations or other emergencies, not including station injuries or during training	ESD Survey/Interview
Fire operations training budget	How much is spent annually for firefighter *fire* based training?	ESD Survey/Interview
Fire operations training hours	How many hours are mandated for fire based training annually?	ESD Survey/Interview
Specialized training hours	How many hours of specialized training is mandated for	ESD Survey/Interview

	firefighter specialty training? (Wilderness rescue, technical rescue, hazmat etc.)	
Specialized training budgeted	How much is budgeted annually for specialized training (wilderness rescue, technical rescue, hazmat etc.)	ESD Survey/Interview
Number certified in specialized training	How many firefighters hold one or more certifications in specialty training (wilderness rescue, cave rescue, technical rescue, hazmat etc.)	ESD Survey/Interview

Unit of Analysis

The unit of analysis for this study is the individual ESD. No sampling methodologies were utilized in this study. Some categories of performance did not pertain to all ESDs. One example of this is the fire investigation category. Smaller ESDs do not have the financial resources to hire their own fire investigators and must contract with other departments such as the Travis County Sheriff's Department or the Austin Fire Department for service.

Procedures: Online Distribution and Interview Process

Each ESD listed below received a survey through email correspondence to complete. Each survey was approximately 14 pages in length in Microsoft Word format. Interviews were scheduled shortly after obtaining each survey. The ESDs participating in the research study listed below include the names of official(s) who participated in the survey and interview process. ESD #2.

Table 3.4 Contains information relating to survey participants, interview participants and the organizations they represent.

Survey Participation		
ESD #	**Organization name**	**ESD Chief/Administrative Official**
1	North Lake Travis	Chief Donnie Norman, Captain Tim Robeson (completed survey, interview conducted)
2	Pflugerville	**(did not participate)**
3	Oak Hill	Chief Jeffrey Wittig (completed survey, no interview conducted)
4	Travis County Fire Control	Asst. Chief Billy Webb (**survey not completed**, partial interview conducted)
5	Manchaca	Chief Chris Barron (completed survey, interview conducted)
6	Lake Travis Fire and Rescue	Chief Robert Abbott, CFO Jim De Witt (completed survey, interview conducted)
8	Pedernales	Chief Gerry Deming (completed survey, interview conducted)
9	Westlake	Chief Mike Elliott (completed survey, interview conducted)
10	CE-Bar	Chief Buddy Crain, Commissioner Ken Campbell (completed survey, interview conducted)
11	Travis County Fire Rescue	Chief Ken Bailey (completed survey, interview conducted)
12	Manor	Asst. Chief Ryan smith (completed survey, no interview conducted)
13	Elgin First Responders	**(did not participate)**
14	Volente	Chief Walter Groman (completed survey, interview conducted)
	Austin-Travis County EMS	Medical Director Paul Hinchey (interview conducted)
	Austin-Travis County EMS	Chief Ernesto Rodriguez (interview conducted)
	Austin Fire Department	Battalion Chief Robert Bredahl (interview conducted)
	Texas State Fire Marshalls Office	Jesse James Williams (interview conducted)
	Travis County Emergency Services	Executive Danny Hobby (interview conducted)
	Travis County Commissioners ESD #4 Board	Commissioner Dan Herman Interview conducted

Human Subjects Protection

This Applied Research Project was submitted for review and declared exempt by the Institutional Review Board at Texas State University (IRB Approval EXP2014U486S). The questions presented in this survey directly relate to official duties being performed by publicly funded fire departments in Travis County. No questions presented in the survey were unethical. No questions were asked pertaining to the interviewees' personal matters and participants were informed that completion of the questionnaire was completely voluntary and they were allowed to stop taking the survey and/or interview at any time.

Data Limitations

Information obtained from each ESD through the course of the interview and survey process was self-reporting in nature. Verification of the accuracy of the data obtained from each ESD was not conducted during the course of this project. Financial Audits from 2013 were also reviewed for each ESD. Answers received from those selected to participate in the survey questionnaire and interview process were voluntary. All answers received were self-reported.

Some of the data obtained through interviews and surveys were dependent on ESD compliance with the National Fire Incident Reporting System (NFIRS). Some examples of this were questions pertaining to fire extension and structure fire frequency. NFIRS is a reporting standard that fire departments use to uniformly report on the full range of their activities. This may include fires, Emergency Medical Services (EMS) and other equipment involved during the response. The NFIRS software is a free web based resource provided by the US Fire

Administration (USFA) to fire departments across the United States (USFA FEMA, 2014). The results of this survey are highly dependent on user compliance with NFIRS.

Chapter 4: Findings

Chapter Purpose

This chapter focuses on the findings of the survey and interviews as they relate to performance measures of ESDs across Travis County. The findings are based on the operationalization of the conceptual framework discussed in Chapter two.

ESD Demographics

ESD response jurisdictions in Travis County vary depending on geographical size, population, and demand zone. The number of fire stations that are readily available to serve each community also varies as illustrated in the table below. Populations served are US Census estimates based on 2010 US Census data.

Table 4.1 This demographic table illustrates coverage area, population served, demand zone and total fire stations per ESD.

ESD Demographics				
ESD	**coverage area (Sq. miles)**	**Population Served (2014)**	**Demand Zone *NFPA***	**Total Fire Stations**
1	165	21000	Rural	7*
2	77	97,000	Urban	4
3	42	10016	Rural	2
4	35	22814	Suburban	3
5	12	17,000	Urban	2
6	110	57000	Suburban	5
8	54	9600	Rural	3
9	15	15000	Suburban	2
10	10	7680	Suburban	1
11	114	29191	Rural	3
12	100	40000	Rural	1
13	unk	unk	Rural	0*
14	18	7328	Rural	1
Total	752	333,629		34

* Although ESD #1 has 7 fire stations, only 2 are currently staffed. ESD #13 responds from fire stations located in Bastrop County

Large jurisdictional response districts create challenges for ESDs that have stations that are spread out. Densely concentrated populations within ESDs create significantly high call volume levels.

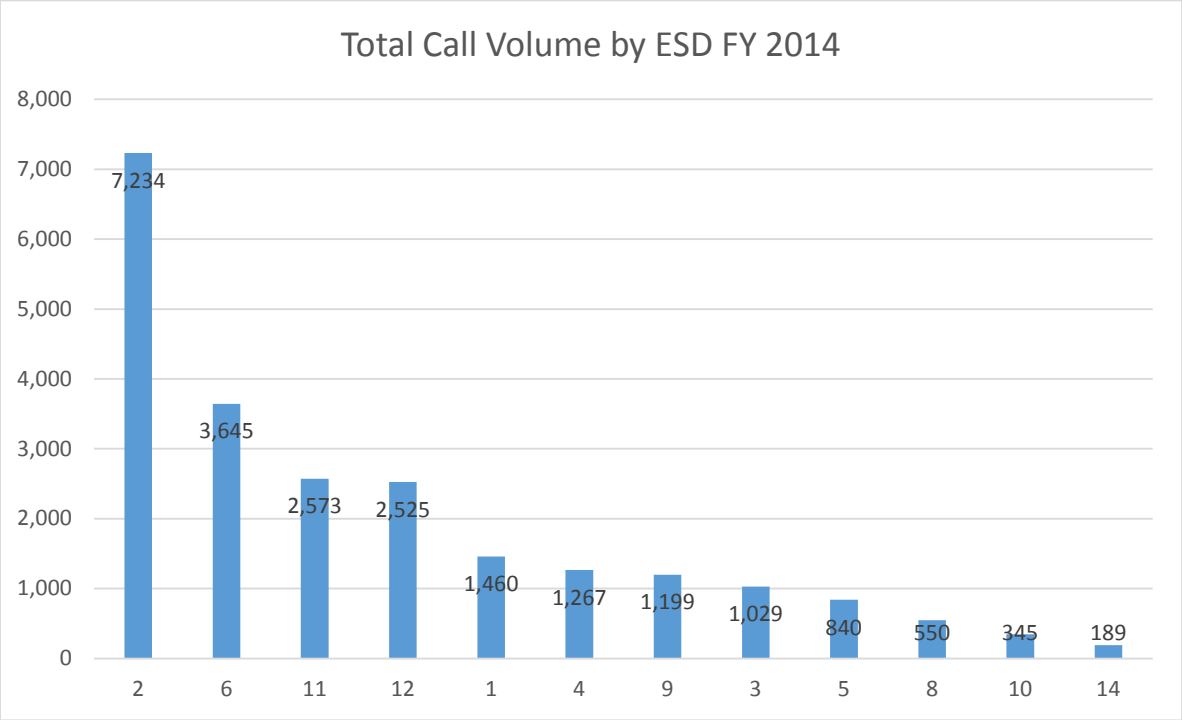
Call Volume

Almost every ESD in Travis County experienced an increase in call volume in 2014 as compared to previous years. This increase in call volume is occurring even after the effects of annexation from neighboring cities that already account for losses in population served. It is also important to note that 2014 was not a wildfire year. Although rainfall levels have not been as high as fire officials would like them to be, the drought has not been nearly as severe as it has

been in previous years. Since wildfire responses for all ESDs across Travis County have been fewer in 2014, a wildfire year would have presented a much larger challenge the ESDs would have had to overcome.

The busiest ESD in the entire county is ESD #2, followed by ESD #6 respectively. The ESDs with the lowest call volume are ESD #10 and ESD #14 as depicted in figure 4.1 below.

Figure 4.1 Total call volume per ESD ranked from most number of incidents to least number of incidents during Fiscal Year 2014

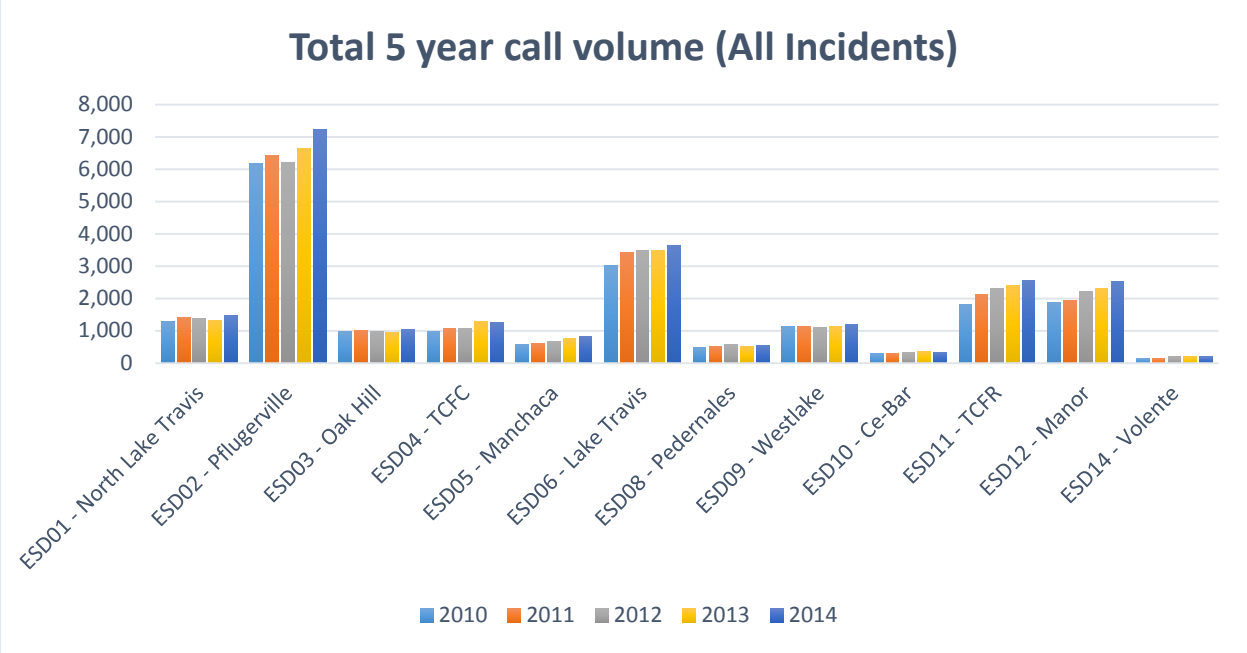


Note: All incidents occurring inside jurisdiction, regardless of which fire department responded. Includes only incidents with frontline units assigned (engines, brush trucks, squads, quints, ladders, rescues, & BC units). Source: Ops-Dispatch For Research.qvw, Austin Fire Department CAD

Source: Austin Fire Department Research and Planning Division

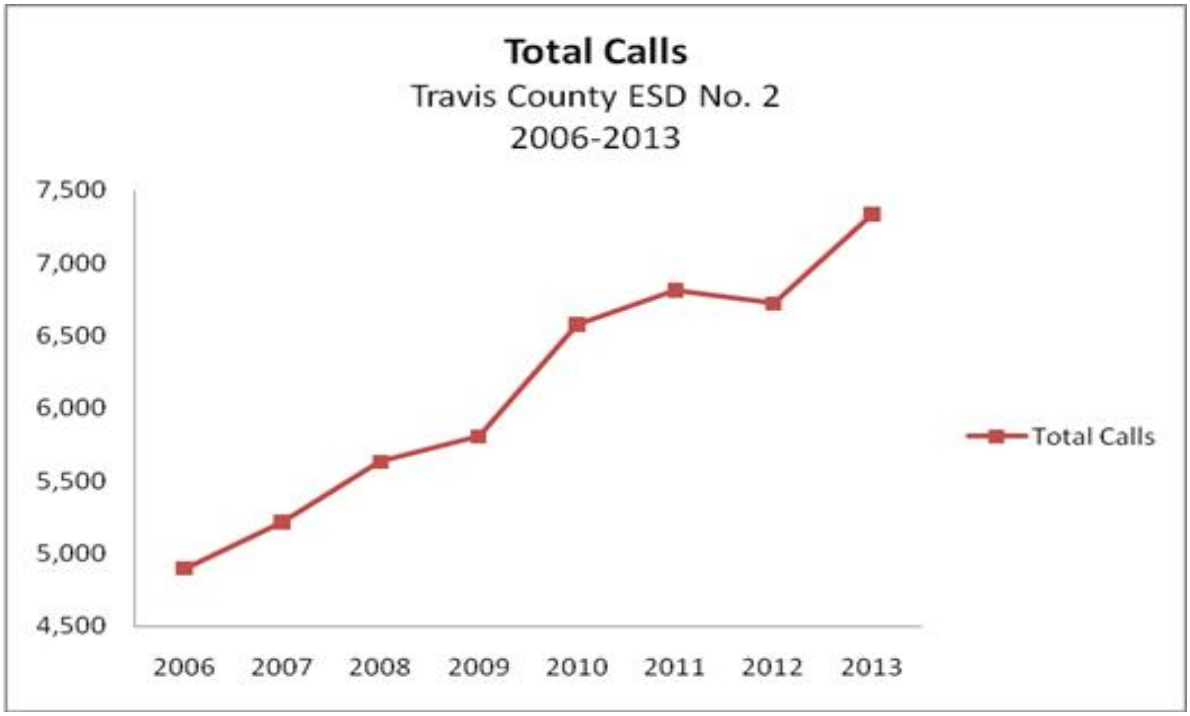
For some ESDs, call volume has remained stagnant. However for some of the larger ESDs such as ESD #2, ESD #6, ESD #11, and ESD #12, call volume has been steadily rising over the last five years as depicted in figure 4.2.

Figure 4.2 Annual call volume per ESD from 2010-2014



ESD #2 in Pflugerville and ESD #6 in Lake Travis have faced the highest surges in population growth throughout all of Travis County. ESD #2 located in Pflugerville has experienced an exponential growth in call volume over the last few years as illustrated in figure 4.3 below.

Figure 4.3 ESD #2 Call volume 2006-2013



Source: ESD #2 (http://www.pflugervillefire.org/index.php/the-department/statistics)

According to the ESD #2 website, they handle the most incidents of all ESDs in Travis County, serve the most citizens, and operate with a budget that is $1 million dollars less than the second largest area District that has half the population

ESD #2, whose main administrative headquarters are physically located in the center of the City of Pflugerville, is not within the organizational structure of the City of Pflugerville. ESD #2 is currently a non-municipal fire department. Some residents may not be aware of this due to the fact that the fire response vehicles of ESD #2 are clearly labeled with the words "Pflugerville Fire Rescue." Not only is this ESD responsible for emergency incidents which occur within the boundaries of the city of Pflugerville, but also outside of the city within Pflugerville's ETJ (unincorporated Travis County).

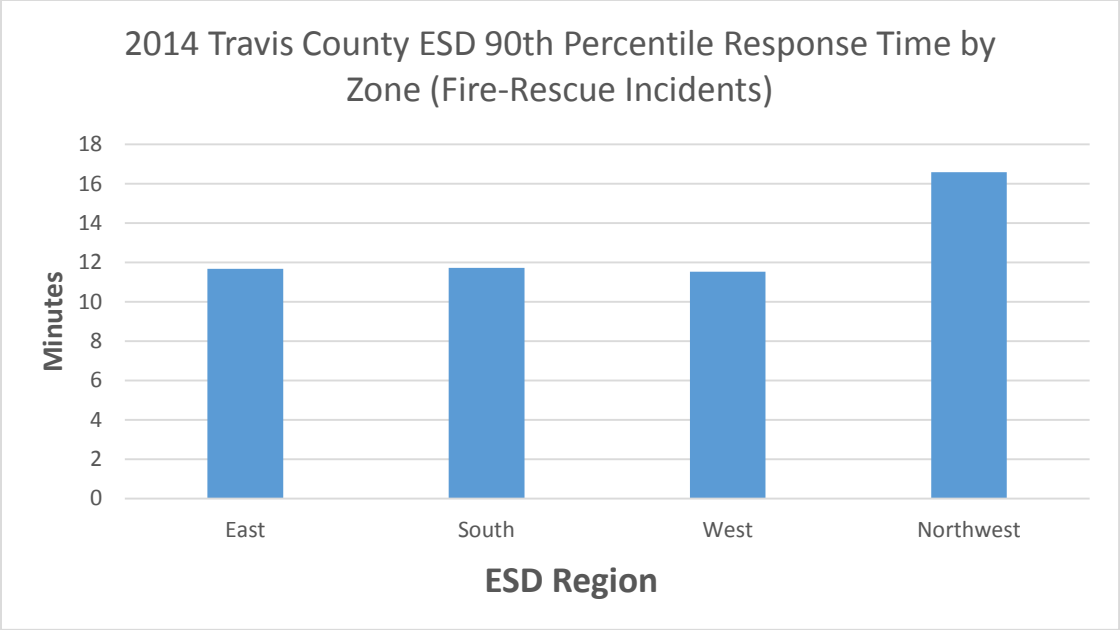
Source: http://kxan.com/2014/03/05/growing-pflugerville-looks-for-fire-department-solutions/

Response Times

Residents of Travis County care about response times more than anything. Nothing is more frightening than having to watch your house burn out of control while standing helpless waiting on your ESD to arrive. Lengthy response times can be indicators of other underlying problems within an ESD. These underlying problems may include apathetic personnel, low morale, improper station placement, poor maintenance/vehicle readiness, subpar communications equipment, and outdated CAD/mapping features.

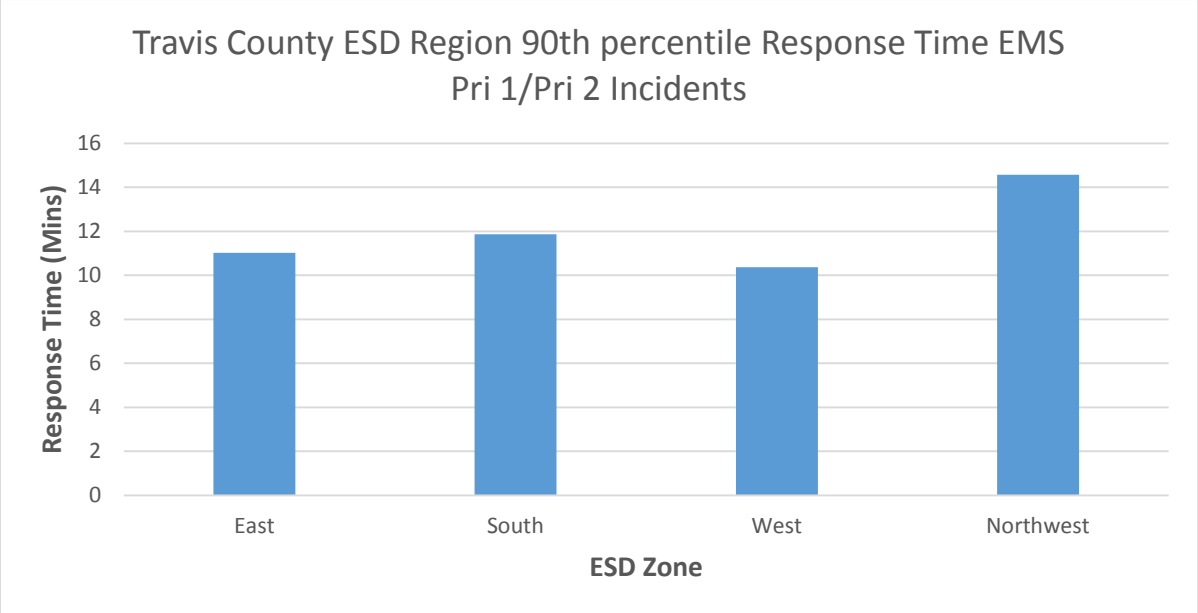
Response times for ESDs in Travis County have significant variability. In Travis County, response times are dependent on station placement, geographic terrain, distance, and the ability to control intersections just to name a few. Although fire departments do have control over some of these variables such as turnout time, intersection control, and vehicle response type, other factors remain out of their control. Figures 4.4 and 4.5 illustrate the differences in 90th percentile response times across four separate regions within Travis County. The northwest region suffers from lengthy response times more than any other region.

Figure 4.4 90th percentile aggregate response times by zone for fire-rescue incidents only



Source: AFD Planning & Research Division

Figure 4.5 90th percentile response times by zone for Priority one and two EMS incidents only

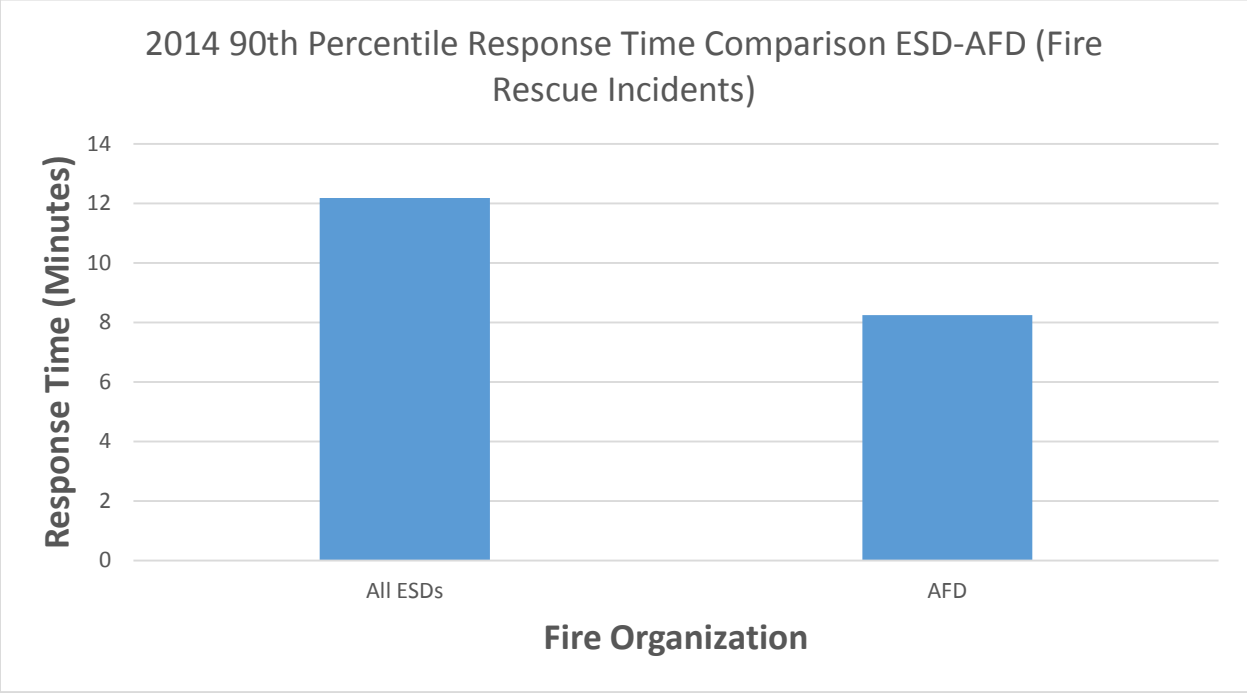


Source: AFD Planning and Research Division

A 5% trimmed average is based on the middle 90% of response times, it excludes the 5% fastest and 5% slowest responses. All other statistics are calculated using the entire case base. The 90th percentile response time subtracts the highest 10% of all response times for any given year. The 90th percentile response time is the measure used throughout this project.

Although AFD responses are mainly urban responses as compared to rural and suburban demand zones serviced by ESDs, it may be helpful to look at a comparison of both organizations for fire-rescue incidents. A comparison of overall response times between all ESDs in Travis County and AFD was also made for fire-rescue incidents. Overall, ESD response times are four minutes longer than AFD response times.

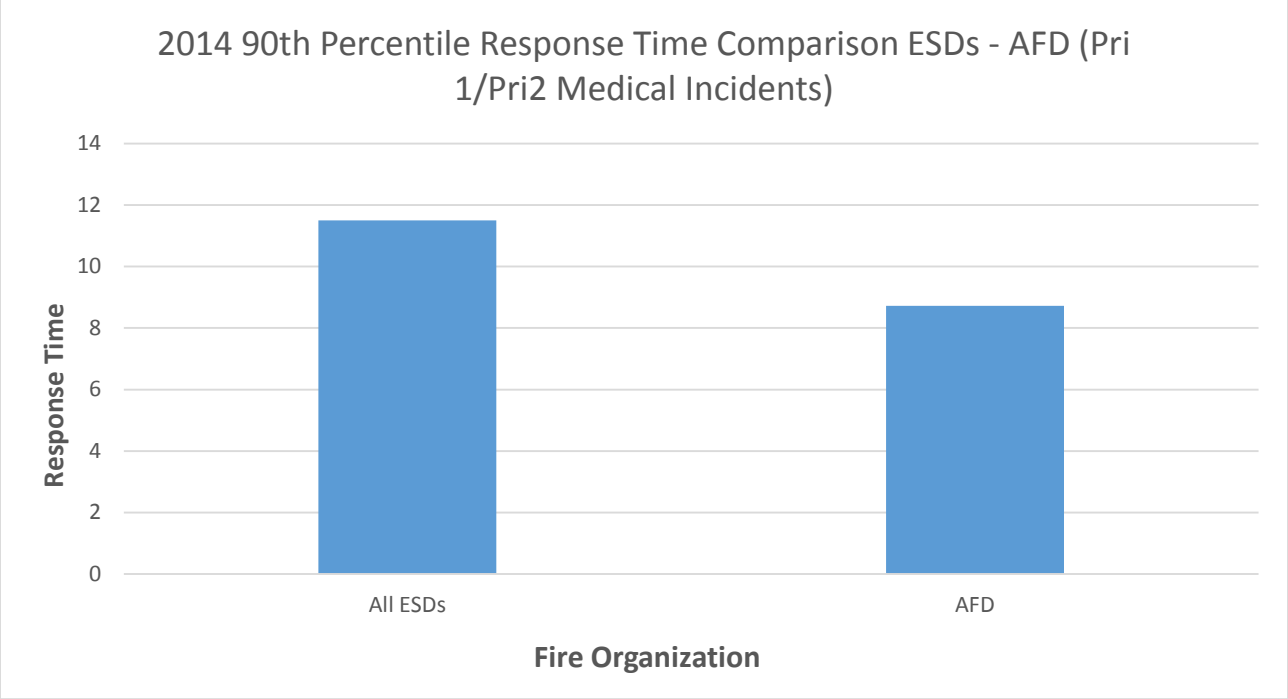
Figure 4.6 2014 aggregate ESD 90th percentile response time compared to AFD (fire-rescue incidents)



Source: AFD Planning & Research Division

The same analysis was conducted for EMS priority one and two incidents. It takes ESDs on average two minutes longer to arrive at these incidents.

Figure 4.7 2014 aggregate ESD 90th percentile response time compared to AFD (priority one and two EMS incidents)



Source: AFD Planning & Research Division

CFAI and NFPA have separate demand zone definitions, therefore response time standards for both NFPA and CFAI were applied to ESD response times for both fire-rescue and EMS priority one and two incidents separately.

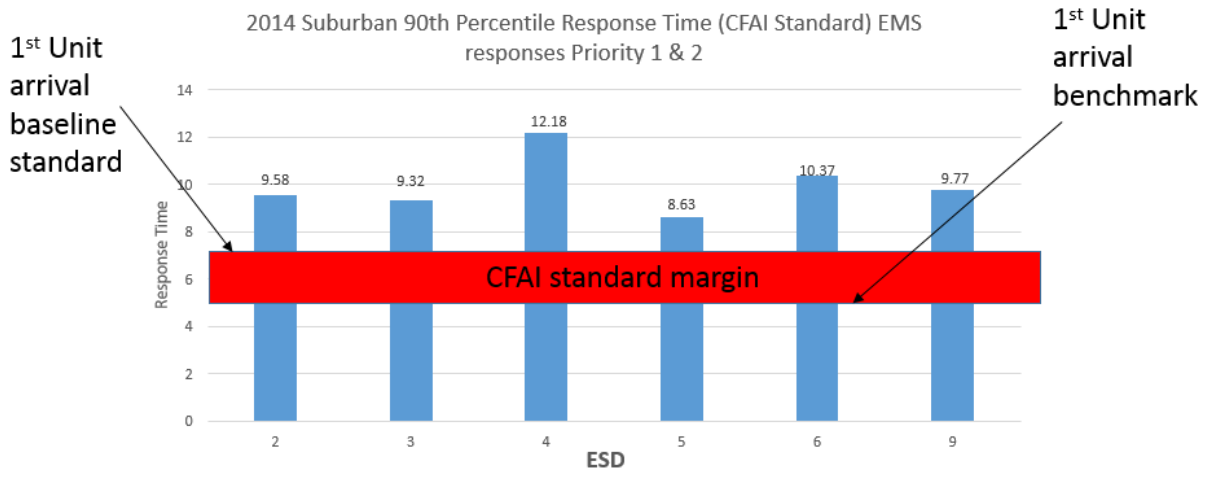
Table 4.2 CFAI response time standards by demand zone. The following table describes in detail response time standards discussed in Chapter two.

CFAI Response Time Benchmark and Baseline Standards						
Demand Zone	**Population**	**Population per Sq. Mile**	**ESDs within category**	**1st Unit Arrival Benchmark (mins)**	**1st Unit Baseline Standard (mins)**	**Meets Objective**
Urban	>30,000	2,000	N/A	4:00	5:12	90%
Suburban	10,000-29,999	1,000-2,000	2, 3, 4, 5, 6, 9	5:00	6:30	90%
Rural	<10,000	1,000	1, 8, 10, 11, 12, 13, 14	10:00	13:00	90%

Source (Standards Only): CFAI Fire & Emergency Service Self-Assessment Manual

In figure 4.8 (below), all six suburban ESDs fail to meet CFAI response time standards for priority one and two EMS incidents (ESD#2, ESD #3, ESD #4, ESD #5, ESD #6 and ESD #9). This is especially concerning, since ESDs respond to more EMS incidents than fire-rescue incidents. This is also alarming because ESDs often times "hold the line" until EMS ground transport units arrive at each incident. Response times in ESD#4 are almost double that of the allotted CFAI standard.

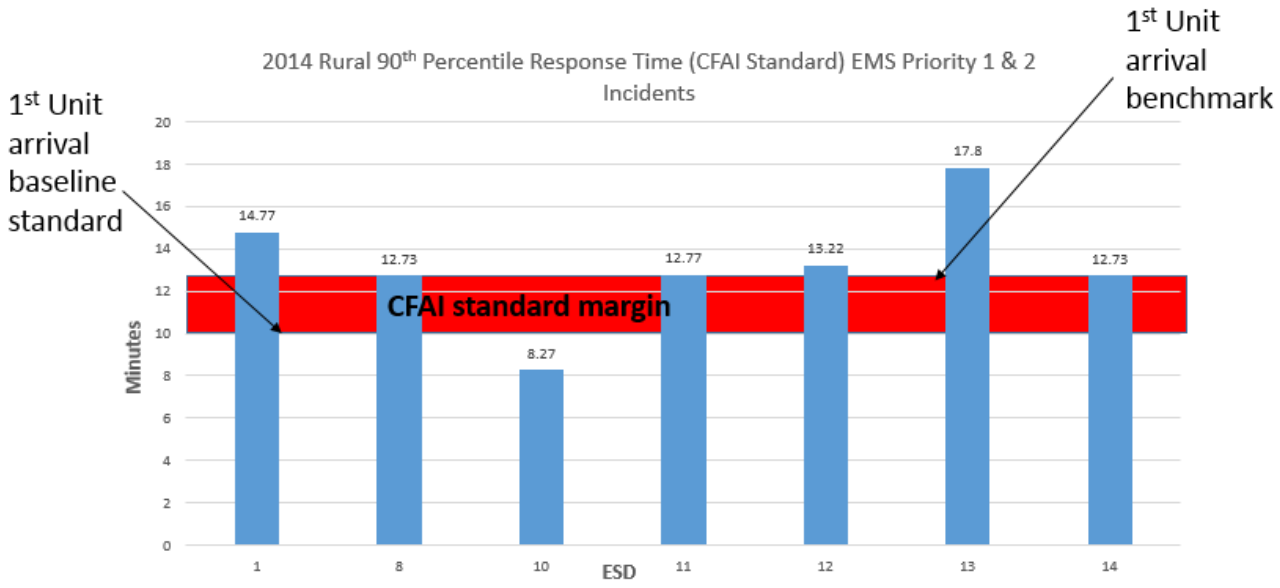
Figure 4.8 (Below) 2014 90th percentile Suburban demand zone response time with CFAI standards



Source: AFD Planning and Research

In figure 4.9 (below), when reviewing priority one and two incidents in rural areas, three out of the seven rural ESDs do not meet CFAI response time standards. This includes ESD #1, ESD #12 and ESD #13. Three out of seven rural ESDs are barely within the response time standard. ESD #10 is well within the standard.

Figure 4.9 (Below) 2014 90th percentile rural demand zone response time standards applied to EMS priority one and two incidents



Source: AFD Planning and Research

As illustrated in figure 4.10, only two rural ESDs do not meet CFAI standards for fire-rescue incidents. Those ESDs are ESD #1, and ESD #14. All other rural ESDs are within the CFAI standard.

Figure 4.10 (Below) 2014 90th percentile response time CFAI standards for fire-rescue incidents in suburban demand zones. None of the six suburban ESDs in Travis County meet CFAI response time standards for fire-rescue incident responses.

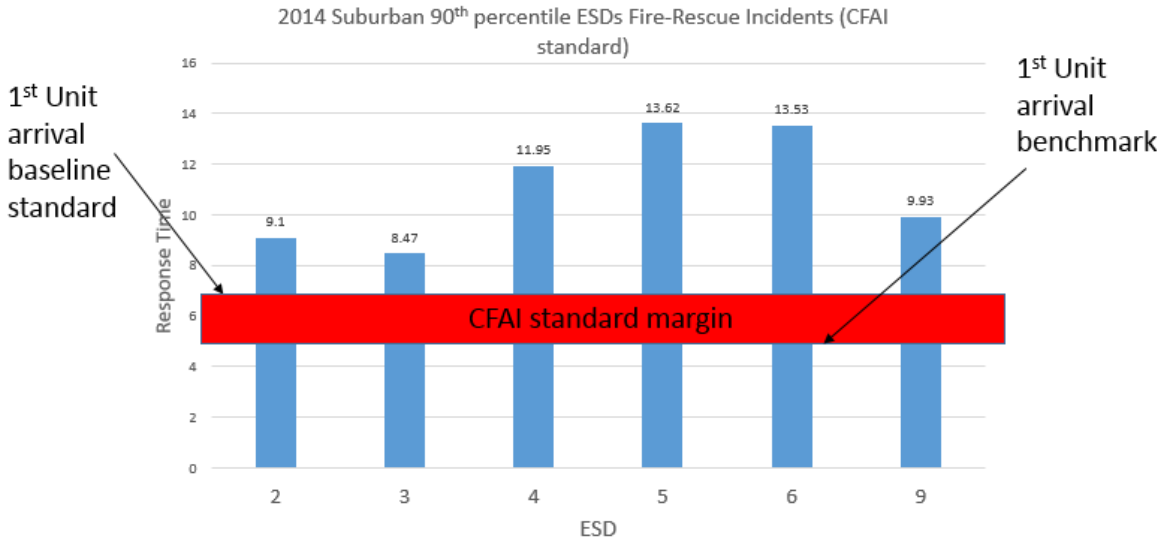
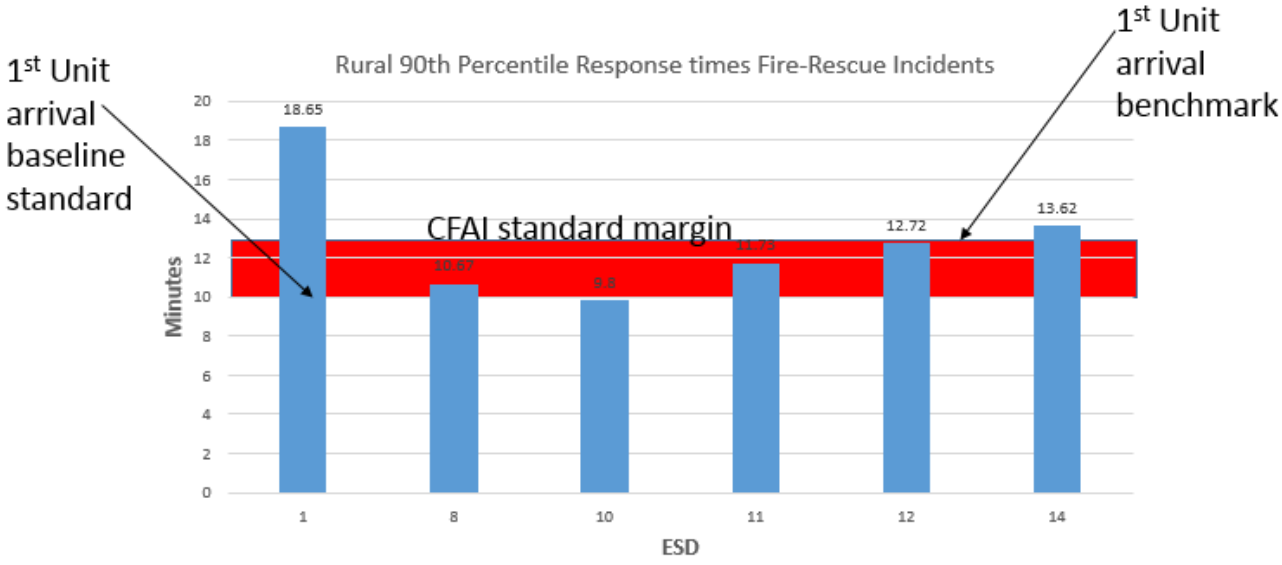


Figure 4.11 (Below) 2014 90th percentile response time CFAI standards for fire-rescue incidents in rural demand zones



Source: AFD Planning and Research

Table 4.3 NFPA response time standard (NFPA 1720)

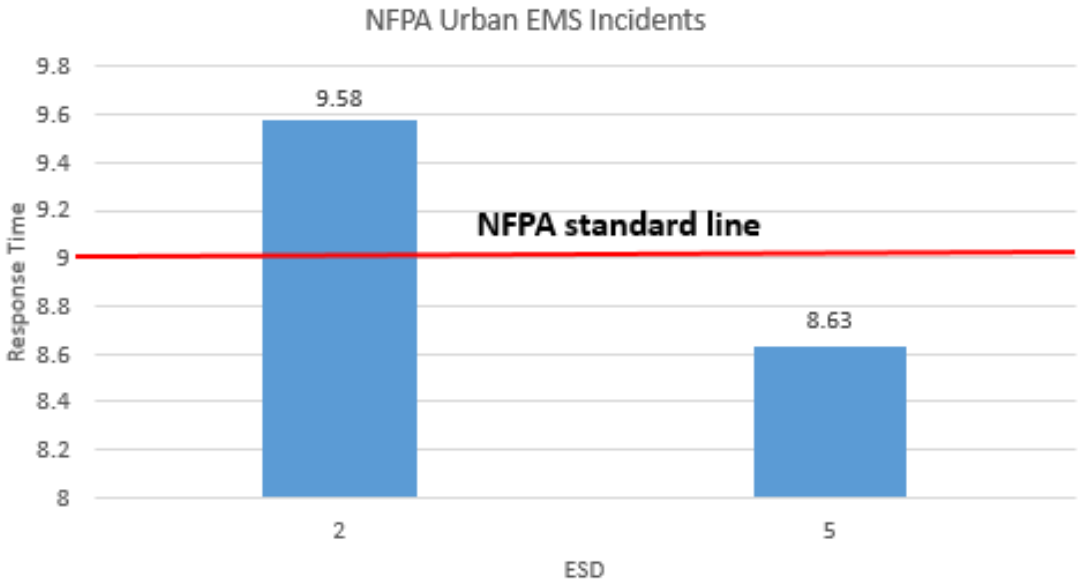
NFPA 1720 Response Time Standards				
Demand Zone	**Population per Sq. Mile**	**ESDs within category**	**Standard**	**Meets Objective**
Urban	>1,000	2,5	9	90%
Suburban	500-1,000	4,6,9,10	10	80%
Rural	<500	1,3,8,11,12,14	14	80%

Source: NFPA 1720

The NFPA defines demand zones slightly differently from CFAI standards. There is also more time allotted to meet NFPA standard for each demand zone category as shown in table 4.3. ESDs in urban districts must meet the objective 90% of the time (90^{th} percentile), whereas suburban and rural ESDs only have to meet the standard 80% of the time.

Not only does ESD #2 fail to meet CFAI response time standards, but the organization also fails to meet NFPA standards. Figure 4.12 (below) illustrates that ESD #2 does not meet urban NFPA response time standards for EMS incidents at the 90^{th} percentile.

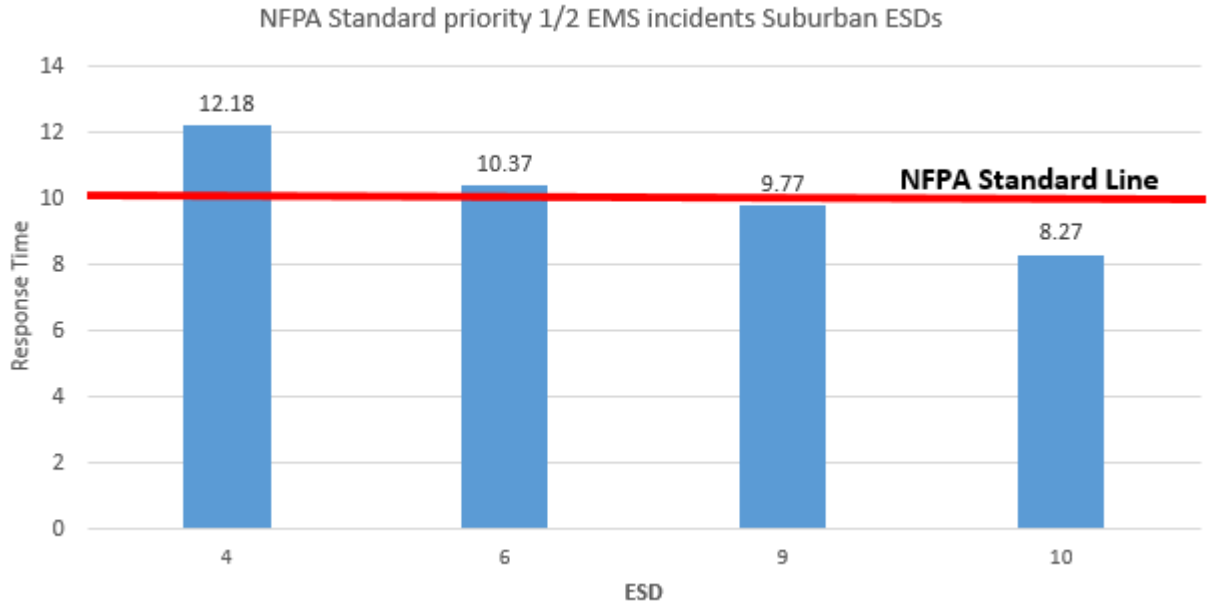
Figure 4.12 2014 90th percentile NFPA urban response time and standard for EMS priority one and two incidents. ESD #2 does not meet this standard, while ESD #5 does.



Source: AFD Planning and Research

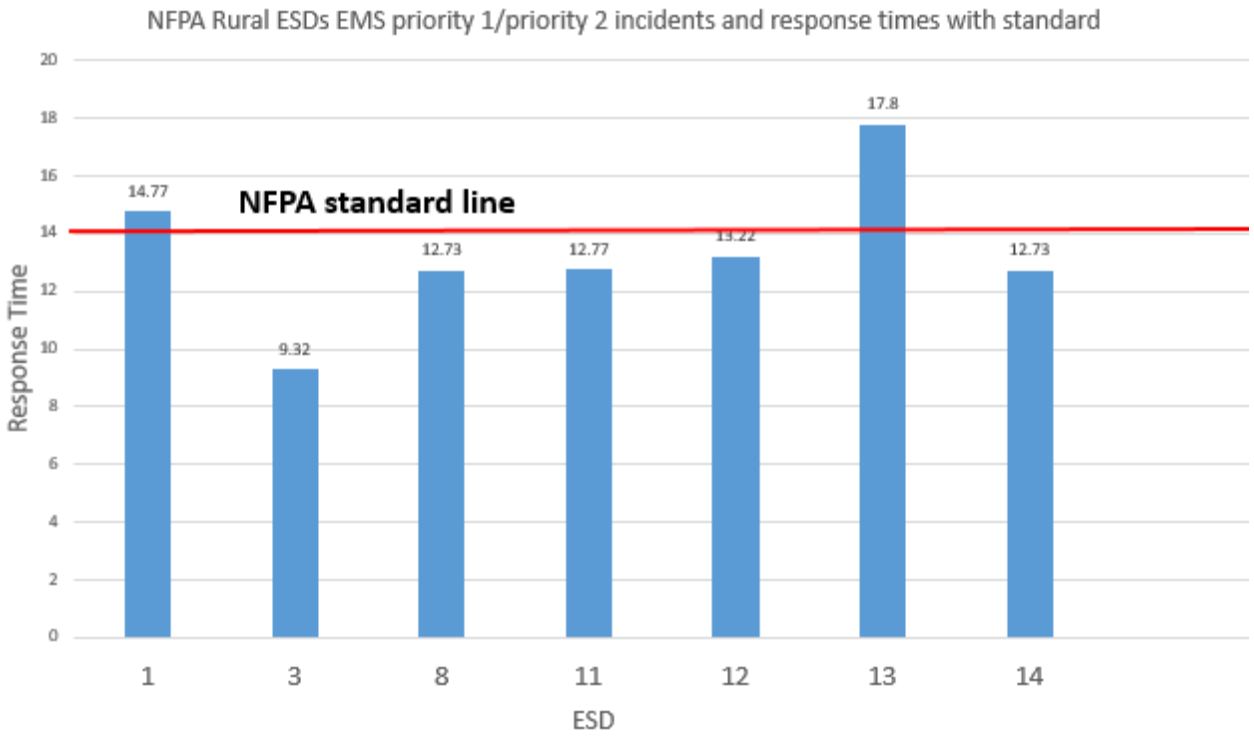
Not only does ESD #4 fail to meet CFAI response time standards, it also fails to meet NFPA standards. Figure 4.13 illustrates those suburban ESDs that do not meet 90th percentile response time NFPA standards. Because the NFPA has an "80%" standard, ESD #6 most likely falls within this standard.

Figure 4.13 (Below) 2014 90th percentile NFPA suburban responses time standards for EMS priority one and two incidents.



Source: AFD Planning and Research

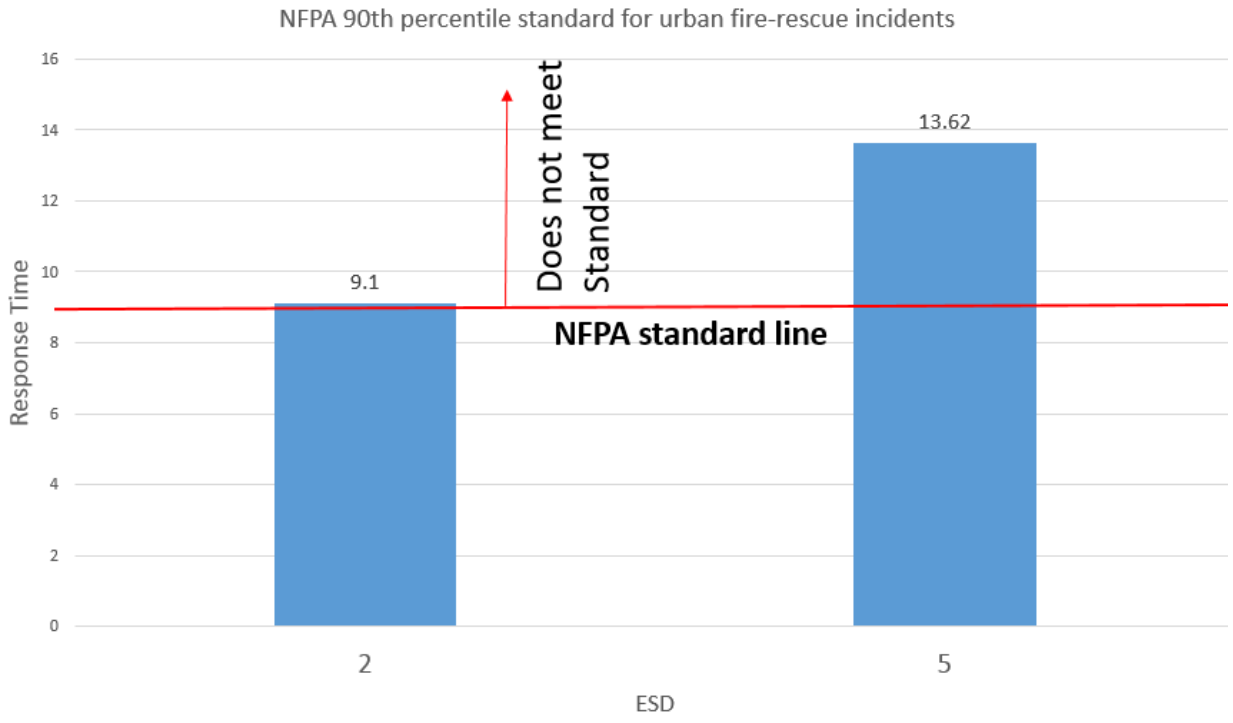
Figure 4.14 (Below) 2014 90th percentile NFPA rural response time standards for EMS priority one and two incidents



Source: AFD Planning and Research

ESD #1 and ESD #13 do not meet NFPA response time guidelines when responding to EMS priority one and two incidents as illustrated in figure 4.14.

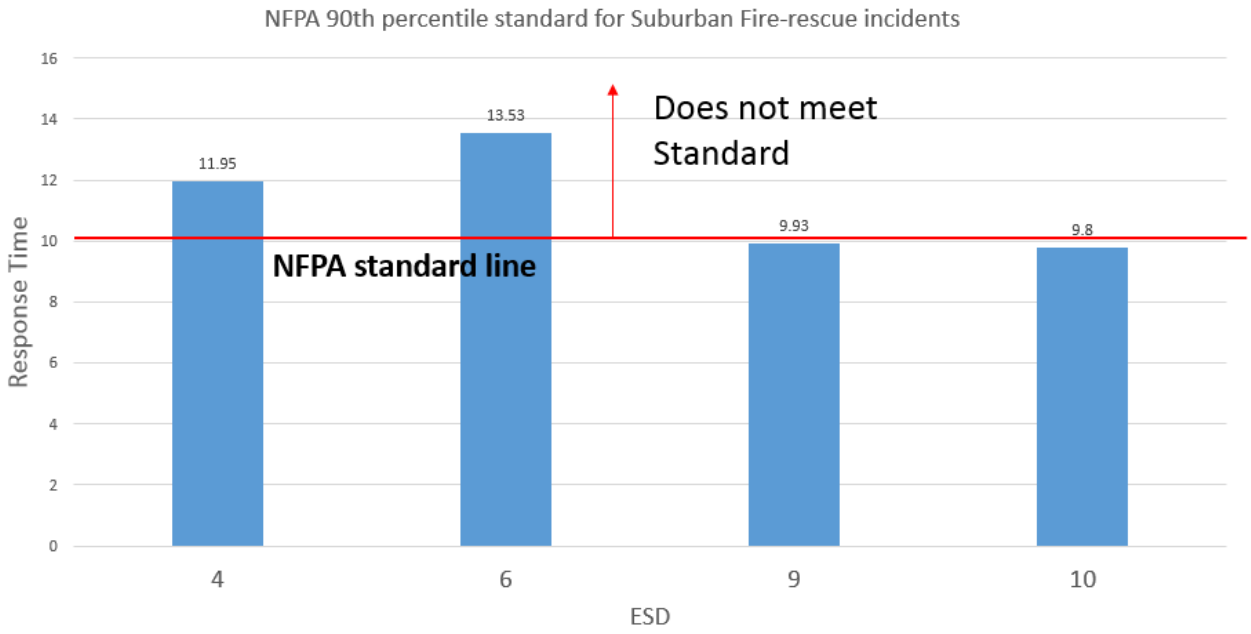
Figure 4.15 (Below) 2014 90th percentile NFPA urban response time standards for fire-rescue incidents



Source: AFD Planning and Research

ESD #2 and ESD #5 do not meet NFPA urban response time standards for fire-rescue incidents. ESD #2 almost meets the standard but is slightly over as shown in figure 4.15.

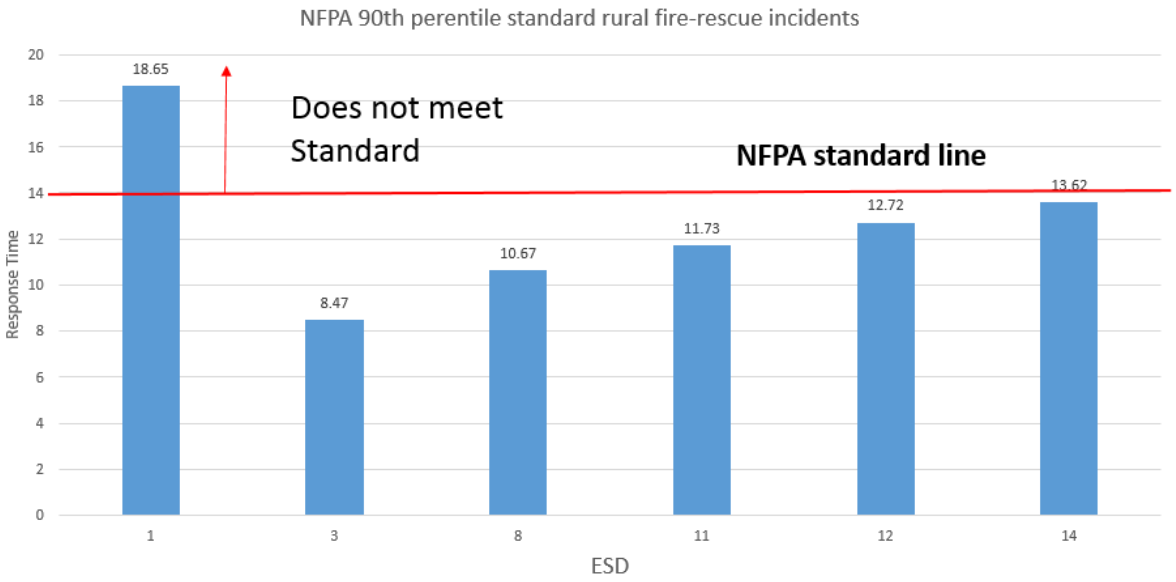
Figure 4.16 (Below) 2014 90th percentile NFPA standard for suburban ESDs responding to fire-rescue incidents



Source: AFD Planning and Research

ESD #4 and ESD #6 failed to meet NFPA response times in 2014 for fire-rescue incidents within their jurisdiction as shown in figure 4.16. Although ESD #9 and ESD #10 meet the standard they are very close to not meeting the standard and should therefore monitor response times closely in the near future.

Figure 4.17 2014 90th percentile NFPA standard for rural ESDs responding to fire-rescue incidents



Source: AFD Planning and Research

ESD #1 not only does not meet CFAI standards for fire-rescue response times but also does not meet NFPA response time standards for fire-rescue incidents as illustrated in figure 4.17. Some ESDs have adjusted their response mechanisms. ESD #4, ESD #1, ESD #6, and ESD #5 all reported to utilize SUV medical squads for EMS incidents. This smaller response vehicle is able to negotiate the terrain much easier, which in turn reduces overall response times. This is a crucial design, especially since ESD #1 is the largest ESD in all of Travis County. ESD #1 covers 165 square miles. Some responses in this district can be as long as 25-30 minutes. These smaller vehicles also consume less fuel, and reduce the frequency of maintenance for each fire pumper truck. This in turn helps reduce recurring departmental costs. ESD #6 is able to staff an ILS/ALS squad unit 12 hours per day, 2-3 times per week. This also helps reduce out of

service time for the larger fire apparatus that normally would be responding to these types of incidents.

Some ESDs also reported to have improved internal policies which include language pertaining to tighter district coverage per unit. This ensures that emergency response vehicles are within the general vicinity of potential emergency incidents within their district.

Other policies have included the establishment of automatic aid agreements. ESD #6 has been able to better manage relationships with surrounding fire departments. Adjacent ESDs and AFD have entered into these automatic aid agreements which allow for ESD #6 units to move around their district in a manner that permits the response of the closest unit regardless of the emblem on the side of each vehicle. A potential incident which occurs on the edge of the ESD #6 jurisdiction may in fact be closer to an emergency vehicle that is situated on the edge of an adjacent district. ESD #6 has been able to negotiate these inter-agency relationships whereas other ESDs have not.

Further studies are recommended to determine reasons for delayed response times within each ESD demand zone. Such delayed response times could be caused by challenging geographic terrain, station placement, insufficient resources or other variables that were mentioned in chapter 2.

Simultaneous Incidents

Simultaneous incidents are emergencies which occur within the same time period. The time period that is dedicated to an emergency begins when the call is dispatched and ends when the incident is over and the emergency no longer exists. The time period of this initial incident may last a short period of time for medical emergencies, but last much longer for structure or

brush fires. If another call is generated during this period of time this can be burdensome for the ESD. Simultaneous calls can cause lengthy response times and put a strain on resources. ESD 8 encountered a total of 36 such simultaneous incidents in 2013 (ESD 8 annual report, 2013).

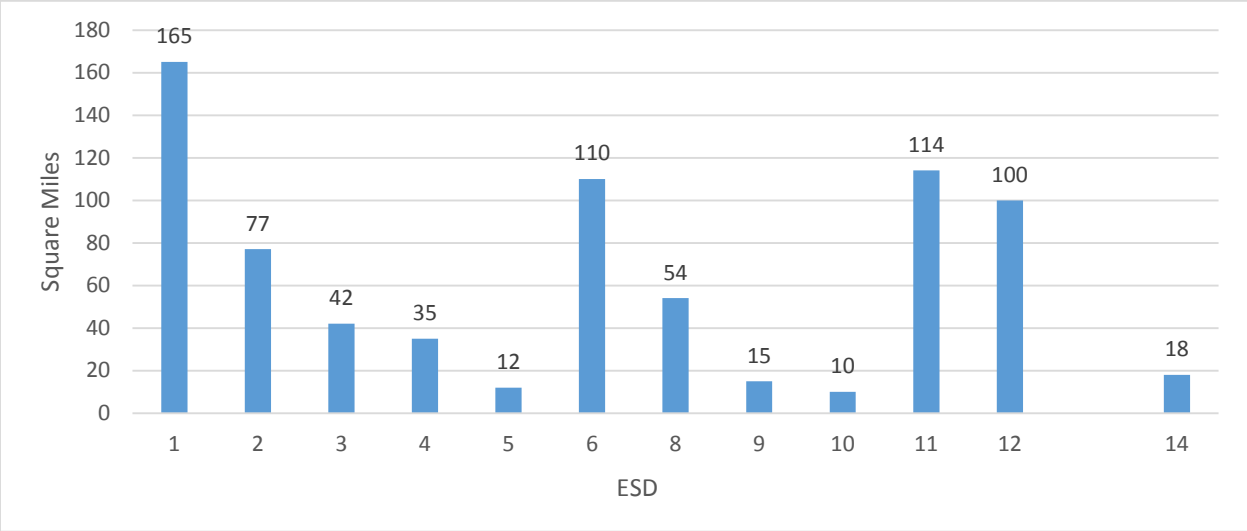
Opticoms, which were discussed in chapter two, are good examples of traffic preemption devices being utilized by ESDs in Travis County. ESD #6 has successfully installed these devices at 22 intersections throughout their district especially on busy thoroughfares that divide their district (RM 620 and SH 71W). Administrative officials report that these devices have allowed emergency vehicles within their district to better navigate heavy traffic and furthermore, reduce response times. However, due to the fact that these devices can cost upwards of $6,000 per intersection to purchase and install, not all ESDs have the luxury and convenience of having these devices within their district. ESD #6 is more of an exception rather than the rule for ESDs with the existence of these devices.

A large proportion of the residents who reside in ESD #6 are those who used to reside in areas of the state and the country where fire services are well funded. Those who move from the Austin area are accustomed to the faster response times that AFD has been able to consistently provide. Residents who move to the ESDs from the Southern California area are also accustomed to fire departments that have better funding structures. These residents typically have a higher demand for service that ESDs struggle to achieve.

ESDs also need to explore station placement configuration. A majority of ESD stations have not been changed despite shifts in population density and fire risk hazards across varying geographical regions. These are the same stations that house many of Travis County's ALS level transport service paramedics (ATCEMS).

Large response areas cause lengthy response times when there aren't sufficient resources to distribute across jurisdictions. ESD #14, for instance, has a large preserve in the middle of their district which causes their engine company to take indirect routes. ESD #1 is geographically the largest ESD, stretching towards the Burnet and Williamson County lines. ESD #1 has only one neighboring Travis County ESD (ESD #14). ESD #1 has minimal automatic aid agreements in place to assist with response time, mainly mutual aid.

Figure 4.18 2014 Travis County ESD Jurisdictional Response Area in square miles



Source: ESD Survey, interview and financial audits

Equipment Readiness

As mentioned in chapter two, poor response times can be indicative of other underlying problems. One of those underlying problems could be substandard equipment readiness. This may include aging fleets or poor vehicle maintenance. There are many emergency vehicles that ESDs utilize to fulfill their mission, however, the most vital to their organizations are fire

engines (pumpers), brush trucks, ladder trucks and water tenders. Some ESDs who may not have ladder trucks may geographically have no use for one. Conversely, some ESDs may have a geographical need for a ladder truck but not a brush truck(s).

Table 4.4 Travis County ESD Mission critical fleet tracking

Fleet Age and Type					
ESD	**Age (Avg)**	**Pumpers**	**Ladders**	**Brush Trucks**	**Water Tender**
1	10	5	0	5	4
2	Unk.	4	1	3	1
3	6	2	1	3	0
4	5	4	0	2	0
5	11	2	0	2	2
6	9.25	6	2	5	0
8	6.7	3	0	4	2
9	4	3	0	3	0
10	12	2	0	2	1
11	3	2	1	4	0
12	3	2	0	2	0
13	unk	unk	unk	unk	unk
14	15	2	0	2	2

Source: ESD Survey (Table includes total number of front line engine and reserves that are readily available for use)

It is no surprise that an aging fleet of fire response vehicles in Travis County directly mirrors national trends described in Chapter two. Table 4.4 illustrates the average age of mission critical fire response vehicles of ESDs in Travis County. Five of eleven ESDs reported that the average age of their most important front line fire response engines are at least nine years old. ESD #14 reported their average fleet age to be fifteen years old. This includes one front line engine that is ten years old, one reserve engine that is twenty years old, one water tender that is six years old, and a brush truck that is seven years old.

Although ESD #1 has an average engine age of ten years, they were able to acquire three brand new brush trucks that are more aligned with their mission as a department. However, all of these brush trucks were purchased through a loan.

ESD #5 has struggled to be able to afford state of the art radio communication equipment. This ESD has used the same radio equipment that was purchased in 2004. One of the goals of ESD #5 is to be able to replace this outdated equipment, but they cannot due to budget constraints.

Command vehicle in ESD #10 CE-BAR

(Photograph by author)

CAFS

Although proven to be effective, especially for fire departments that lack water availability, only 6 ESDs reported having CAFS systems readily available for use on at least one apparatus. ESD #1, ESD #11, and ESD #12 do not currently have CAFS systems, but did not report reasoning for not having CAFS systems. ESDs that do not currently use CAFS should

explore options to add these systems. ESD managers should also discuss the benefits and disadvantages of the use of CAFS systems with neighboring ESDs that possess the resource. This may afford some ESDs the opportunity improve their ISO rating and conserve natural resources.

ESDs that reported the use CAFS systems had very similar technical specifications (tank, pump, compressor capacity) which did not warrant a comparison table. All ESDs that use CAFS either met or exceeded minimum technical requirements for CAFS systems outlined in NFPA 1145 (300 gallon tank capacity, 500 gpm pump capacity, 120 SCFM compressor capacity).

NFPA requirements for the use of Class A foam mandate the need for a foam tank capacity to be at least 20 gallons and have a 2.5 GPM minimum concentrate pump capacity. ESD #8 was the only reporting ESD that does not use Class A foam.

Table 4.5 Class A foam use amongst Travis County ESDs

Class A Foam Use			
ESD	In Place	Tank Capacity	concentrate pump capacity
1	YES	20	unk
2	YES	50	unk
3	YES	20	unk
4	unk	unk	unk
5	YES	50	unk
6	YES	30	.3-1% @95-100 gpm
8	NO	N/A	N/A
9	YES	40	200gpm 6%, 400gpm 3%, 1200 gpm 1%
10	YES	50	unk
11	YES	20	3%
12	YES	25	15 g min max
13	unk	unk	unk
14	YES	30	unk

Source: ESD Survey

ISO Fire Suppression Rating

For many residents in Travis County, as ISO rating not only offers them peace of mind, but can make a huge difference on their homeowners' insurance bill. Some ESDs in Travis County have not been evaluated by ISO in over ten years. A reevaluation should be sought by those ESDs who believe they may be able to improve their ISO ratings, especially when improvement actions have been undertaken.

A complete list of ESD PPC ISO ratings are shown in table 4.6 below. The only fire department in all of Travis County other than AFD that has a near perfect rating is ESD #6 with an ISO rating of 2 within the cities of Lakeway, Bee Cave and The Hills. The rest of the district has a split rating of 3/8b. ESD #12 and #14 have some of the least favorable ratings of any of the other ESDs. ESD #12, unfortunately, has only one engine to respond to a coverage area of approximately 100 square miles and at the same time serves a population of 40,000 as illustrated in table 4.1.

Some ESDs have little to no control over their low ISO rating. An example of this is ESD #8, which has a split rating of 5/10 in all areas within their jurisdiction except the Village of Briarcliff. Water availability is almost completely out of the control of the fire department within this district. Since 40% of the ISO rating is based on water availability, the ISO rating of this district is much lower than it would be if they did not face this problem.

For some residents of Travis County, the fact that they reside within the response area of an ESD means that they will face a higher homeowners' insurance premium than if they lived within the jurisdiction of AFD. One resident of ESD #4 reported that their homeowners'

insurance premium equated to $750 more than what they would have to pay if they were protected by AFD firefighters.

Table 4.6 Current and previous ISO ratings for ESDs in Travis County

Travis County ESD ISO PPC Ratings*			
ESD	**ISO**	**Most Current Year Evaluated**	**Prior Rating**
1	4 (pv), 5 (JT, LV), 8B TC	2011	unk
2	4/8b	2004	N/A
3	2/8b	2009	6/9
4	4/8b	2010	6/9
5	3	2012	5/9
6	2 (LW, BC, TH) 3/8b TC	2008	5/10
8	Briarcliff 3, 5/10 elsewhere	2006	7
9	3	2013	3 RW, 3WLH, 4/8b TC
10	3/8b	2005	6
11	3/8b	2012	7/9
12	7/9	1998	10
13	unk	unk	unk
14	8b	2008	10

Source: ESD Survey and TSFMO

*As mentioned in chapter two, a split rating signifies areas within five miles of a fire station or 1,000 feet of a fully functioning fire hydrant.

Water Availability

Although the survey attempted to assess hydrant and general water availability amongst the various ESDs in the study, only a few could provide this data. After conducting several interviews and reviewing water districts, it was apparent that there was a very confusing mixture of water utility districts (WUDs) and municipal utility districts (MUDs) that stretch across multiple ESDs and municipalities that have their own fire service. However, most ESDs were keen to what their water availability score was during their last water availability ISO

assessment. ISO water availability ratings are shown below in table 4.7. All scores are out of 40 points maximum (40% of total main ISO score). It was important to gather water availability information for ISO ratings due to the fact that a fire department could be performing exceptionally well but have a low water availability rating. An excellent score would be negated due to something out of their control.

Table 4.7 2014 ISO water availability scores

ESD ISO water availability ratings*	
ESD	Water Availability ISO
1	21.24
2	32
3	35.89
4	32.66
5	37
6	BC 34.61, LW 31.38, TH 37.42, TC 36.1
8	23.19
9	36.72 RW, 30.95 WLH, 22.58 TC
10	29.77
11	31.69
12	19.90
13	unk
14	unk

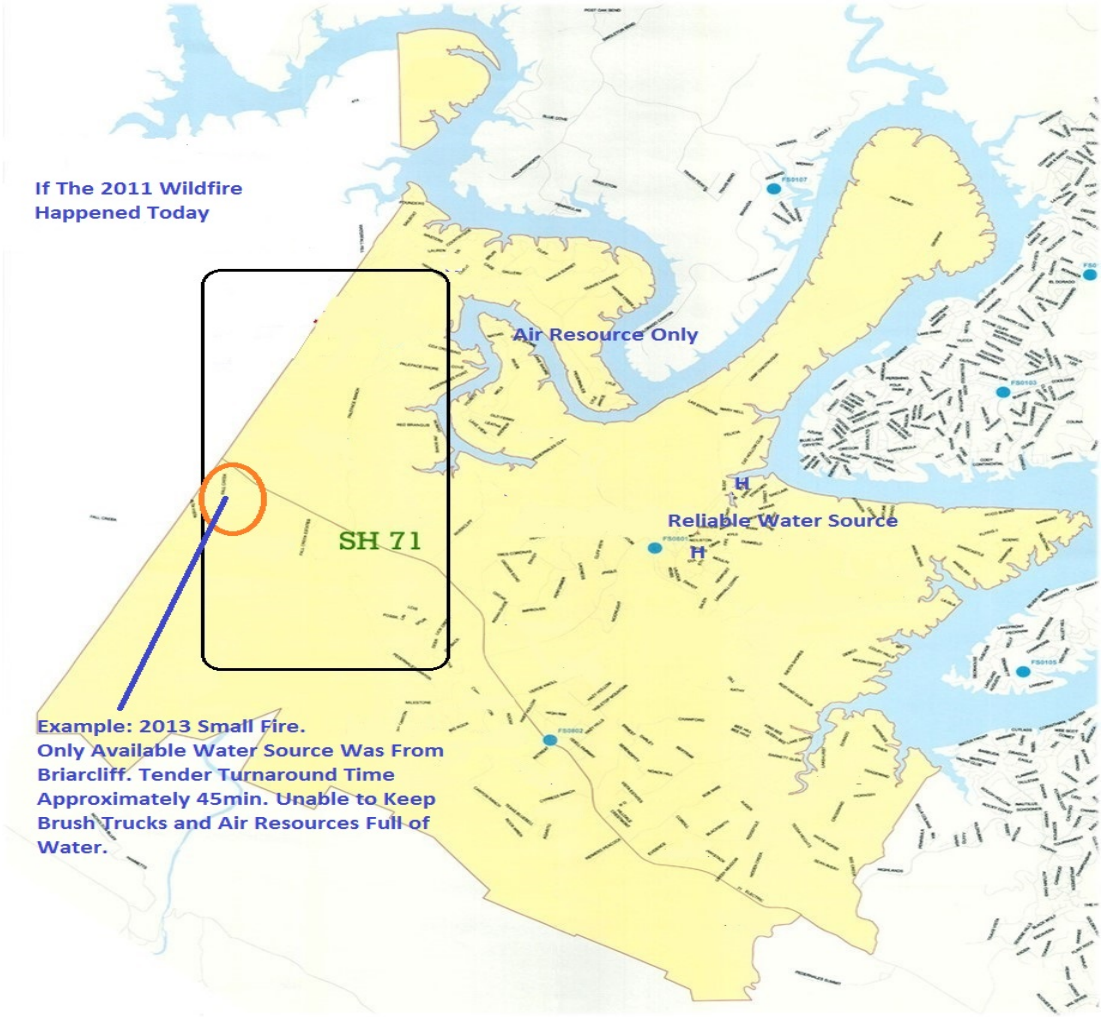
* Category point score out of possible 40 maximum. The 40 point score takes water supply, type of fire hydrant and frequency of inspection into consideration.

Source: ESD Survey and TSFMO

ESD #8 in Pedernales experienced one of the worst fire related disasters in the history of their department. The 2011 Pedernales Bend labor day fires, which occurred during the same time frame as the Bastrop Complex fire, caused the residents in their community to lose 70 structures (ESD #8 2013 annual report). 545 homes lost power, and 6,500 acres were burned (ESD #8 annual report). ESD #8 officials identify water availability as the largest threat to the success of their department. Water hydrants virtually do not exist within the district. Water

sources that used to be available no longer exist due to the receded levels of the Pedernales and Colorado rivers. The number of places for ESD #8 to obtain water resources has diminished from 11 total locations to only one. This department is often times at the mercy of helicopters that have the capability to carry and drop water within the district. However, helicopter water drops are not always available. This is especially true when other fires are occurring in other parts of Central Texas, or if these helicopters are handling medical emergencies.

Figure 4.19 ESD #8 current water availability



Source: ESD #8 Chief Gerry Deming

ESD #8 officials are afraid that one day their department may face the same disaster they faced 2011. As illustrated above in figure 4.19 (above), if the 2011 wildland fires occurred today, ESD #8 would struggle to be able to transport water to the scene of the fire. It is estimated that there would be a 45 minute turnaround time for each brush truck or water tender to be able to leave the scene of the fire, draft water at the source, and then return to the incident. This ESD currently has to rely on only two well sources for water within the district. These wells are very unreliable and inconsistent for use as a water source.

A Pedernales Fire Department (ESD #8) water tender sits ready to be deployed at station 801. These water tenders can carry up to 2000 gallons of water.

Source: (photograph by author)

Fire Extension

An attempt to gather data pertaining to fire extension amongst all ESDs proved to be very difficult and only partially successful. The fire extension table depicted below illustrates the major gaps in data that exist across Travis County. This is despite the fact that NFIRS based

programs are in place at many fire stations across Travis County. ESDs and Travis County should explore the option to consult professionals for centralized data collection directly pertaining to structure fires and fire extension percentages.

Although some ESDs have low fire-rescue incident call volume, other ESDs were unaware of how many structure fire responses were handled in recent years. Of the ESDs that reported fire extension percentages, only two ESDs reported fire contained to room of origin at least 50% or more as depicted below in table 4.8.

Table 4.8 Fire extension amongst ESDs in Travis County

ESD	Room of origin	Floor of origin	Beyond Floor of origin
5	50%	80%	5%
9	0	40%	60%
10	20%	60%	20%
12	85%	90%	10%

Source: ESD Survey

Although ESD #1 was not aware of the number of structure fires encountered over the course of the last five years, they were aware of two civilian deaths during this time frame. ESD #11 reported ten civilian injuries during this same time period. It is also important to note that time constraints for this project prevented fire extension data that was self-reported by ESDs to be validated through NFIRS.

Staffing and Training

ESDs in Travis County are clearly struggling to maintain minimum staffing levels, and retain a sustainable work force. ESD #1 reported to have incurred 21 departures last year. This department only employs 12 part time firefighters. One official who works for this ESD attributes the high number of departures to low morale, non-competitive salaries, low call

volume, and unattractive retirement plans. This coupled with highly competitive salaries offered by AFD, ATCEMS, Williamson County fire departments, and ESD #6 is the driving factor for these departures.

ESD #6 only incurred two departures last year, one of them being a retirement. ESD #6 offers what many would argue to be the most competitive salary and benefits packages of all ESDs in Travis County. ESD #9 reported no employee departures during the last year of operations. The only local departments ESD #9 has to compete with for recruitment are AFD and ESD #6.

Some firefighters amongst ESDs in Travis County are aware of eminent changes that may adversely affect their departments. ESD #14, for instance, faces annexation from the City of Cedar Park sooner rather than later, which will leave their department with no other option but forced layoffs for firefighters that currently work for their department. Because of this anticipated annexation, firefighters are already seeking other departments for employment.

Although better than before, salaries amongst many ESDs are not comparable to neighboring municipalities. The average firefighter in ESD #8, for instance, only earns $11.25 hourly (ESD #8 annual report). This equates to an annual salary of $36, 328. A Battalion Chief for ESD #8 earns only $19.00 hourly. A three year regular firefighter working for AFD earns almost $63,311 annually (http://www.austintexas.gov/department/afd-pay-and-benefits).

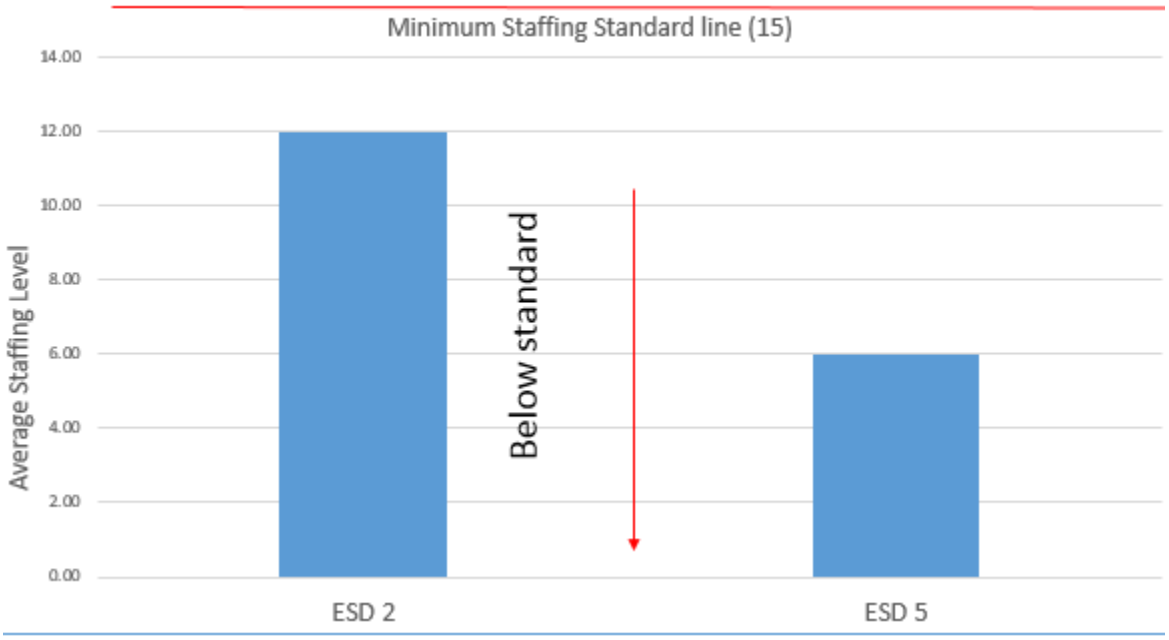
Not only are the majority of ESDs struggling to offer competitive salaries, they are also experiencing difficulties offering competitive retirement benefits. The majority of ESDs in Travis County do not have pension plans, only 457 accounts (the public sector's equivalent of a 401(k) option).

Table 4.9 NFPA 1720 Minimum staffing standards

NFPA 1720 Minimum Staffing Requirements				
Demand Zone	**Population per Sq. Mile**	**ESDs within category**	**Minimum Staff to Respond**	**Meets Objective**
Urban	>1,000	2,5	15	90%
Suburban	500-1,000	4,6,9,10	10	80%
Rural	<500	1,3,8,11,12,14	6	80%

Source: NFPA 1720

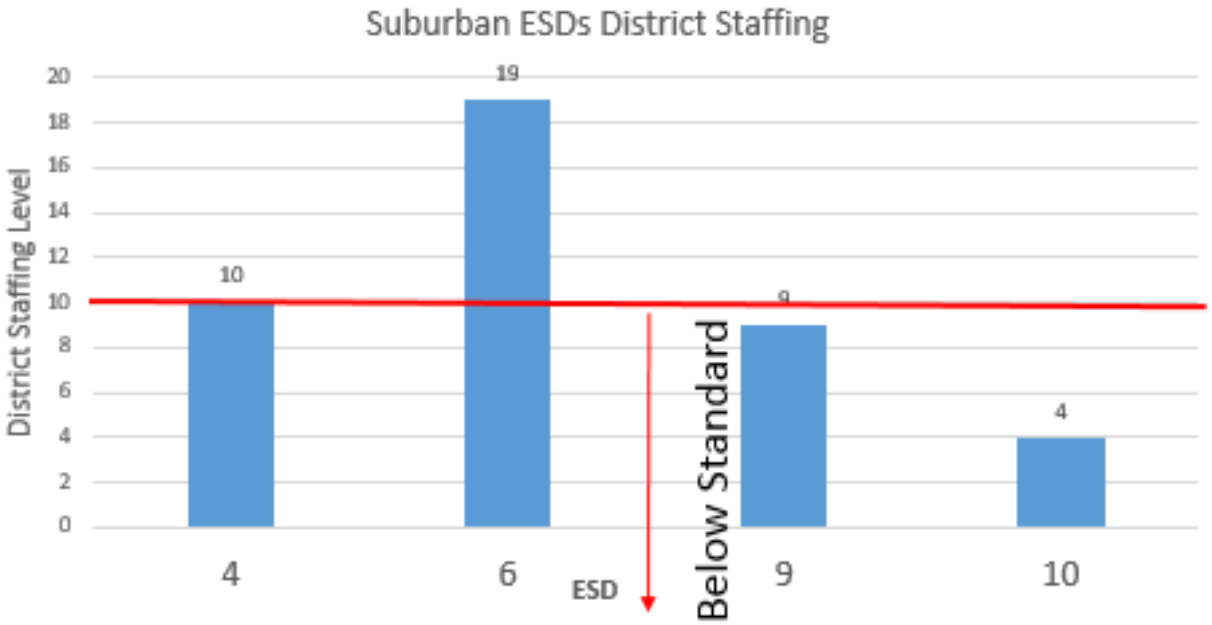
Figure 4.20 (Below) 2014 Urban zone minimum staffing levels and NFPA 1720 standard



Source: ESD Survey and NFPA 1720

As shown in figure 4.20 above, urban ESDs do not meet minimum staffing requirements outlined in NFPA 1720 staffing standards for urban fire department districts. ESD #5 comes nowhere close to the minimum district staffing standards. This is one of the reasons ESD #5 relies heavily on volunteer firefighters.

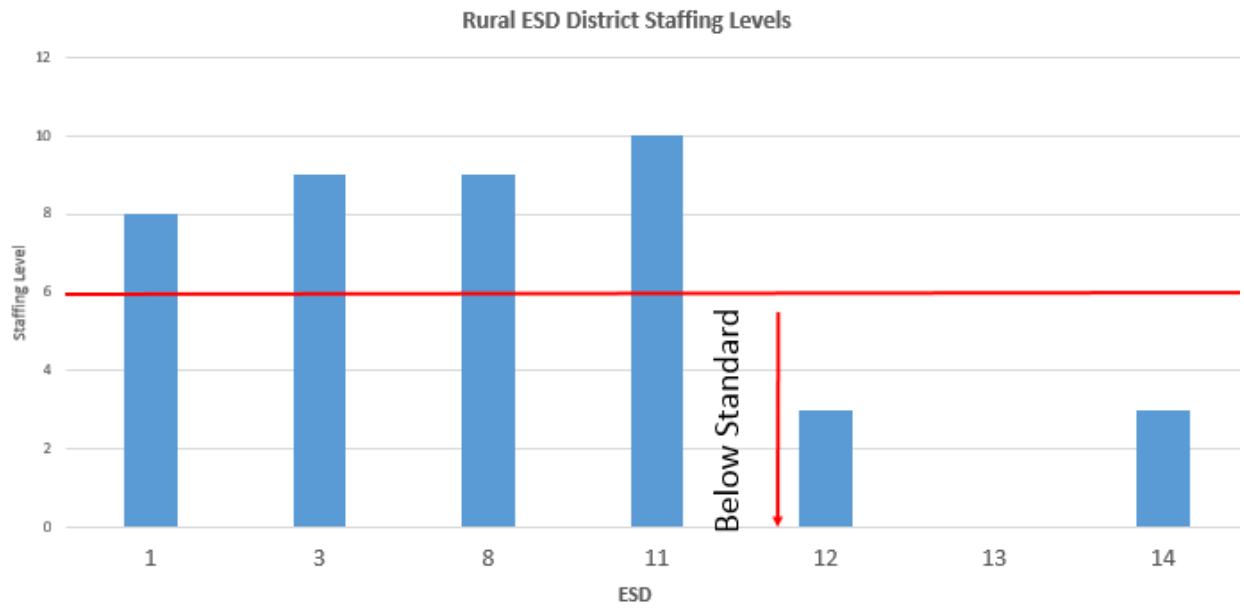
Figure 4.21 (Below) 2014 Suburban zone minimum staffing levels and NFPA 1720 standard



Source: ESD Survey and NFPA 1720

As illustrated above in figure 4.21, ESD #9 and ESD #10 do not meet minimum staffing standards as outlined in NFPA 1720. ESD #4 barely meets their district's minimum staffing requirements.

Figure 4.22 (Below) 2014 Rural zone minimum staffing levels and NFPA 1720 standard



Source: ESD Survey and NFPA 1720

As shown in 4.22, ESD #12 and ESD #14 do not meet minimum staffing requirements for their districts. Only five of the reporting ESDs have at least one "Battalion Chief" supervisory resource available around the clock. Other ESDs report to have the resources on a limited basis. Some ESDs do not have the ability to provide this resource at all. Instead, supervisory responsibilities are tasked to Lieutenants who staff front line engines. ESDs with separate "Battalion Chief" supervisory capabilities are able to accomplish more than those ESDs that do not have this invaluable resource. This may include such functions like incident command, inter-organizational communication, fireground safety operations, and various managerial administrative roles.

It is important to note that although some ESDs are meeting minimum *district* staffing standards set forth by the NFPA, they may not be an *effective force* against structure fires. As

mentioned in chapter 2, the NFPA mandates that initial firefighting operations shall be organized to ensure that at least *four members* are assembled before interior fire suppression operations are initiated in a hazardous area. Therefore, a three person staffed engine company *cannot* make an offensive entry into a structure unless there are obvious indicators of life safety threats inside the structure.

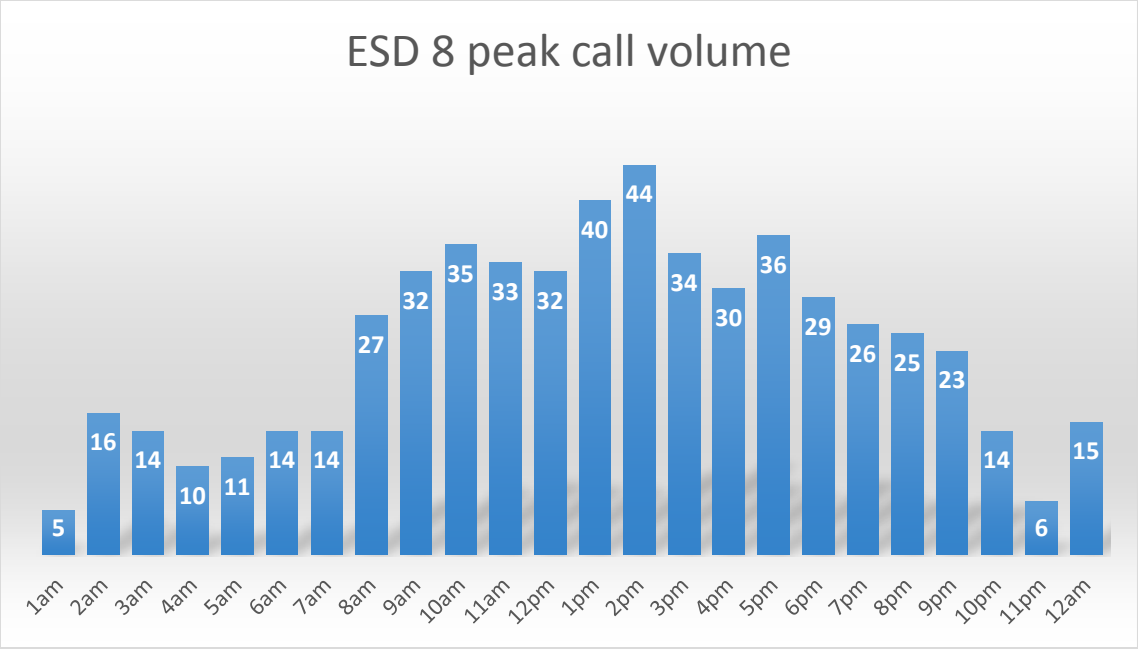
Some ESDs are discovering innovative ways to address staffing shortages. ESD #1 in North Lake Travis, for example, has reconfigured their response capabilities to better align themselves with the type of incident. This reconfiguration has allowed ESD #1 to increase average staffing levels at the two main fire stations which handle incidents within the cities of Lago Vista and Jonestown. These stations are more centrally located and offer them the opportunity to better serve their residents. The prior staffing configuration of ESD #1 consisted of two firefighters at each of three stations, who would always respond to an emergency in a fire engine no matter the call type. The new staffing configuration adopted this year allows for two firefighters to respond in a smaller "squad" type vehicle (usually an emergency equipped SUV). The other firefighter remains at the station readily available to respond in a fire engine to other incidents that may arise in their district.

ESD #11 has also taken advantage of "non-traditional" staffing configurations. This ESD has one of the largest response areas in all of Travis County. ESD #11 serves southeast Travis County and has adopted a plan that reconfigures the way emergency vehicles respond to emergencies. In the event of a fire, one firefighter drives a fire engine while the rest of the firefighters are able to rapidly respond in a "squad" type vehicle. Firefighters responding in the SUV squad vehicle arrive at the scene much faster than they ordinarily would have prior to the implementation of the new configuration. Once firefighters arrive at the scene of the fire, they

are given time to conduct a scene size up, don their protective gear, and conduct initial fire ground operations tasks that are necessary prior to the utilization of "water attack lines."

Other strategies to address staffing shortfalls maximize the utilization of firefighter staffing schedules. ESD #8 managers began to staff station 803 in the western portion of Pedernales on January 1, 2014. This station serves an area that was ravaged by the 2011 wildfires. Managers of ESD #8 realized that peak call volume occurred between the hours of 9:00 am and 9:00 pm. Therefore, the station is being staffed from 9:00am until 9:00pm, 12 hours per day, 365 days per year. Historic data illustrated below in figure 4.23 was used to determine the staffing hours for this station.

Figure 4.23 (Below) 2013 Peak call volume in ESD #8



Source: ESD #8 2013 annual report

Another way ESDs are augmenting staffing costs has been by the utilization of a part time and volunteer work force. ESD #5 in Manchaca has only six full-time firefighters while at

the same time employing 25 part-time firefighters and 35 volunteers. ESD #5 officials calculate that it would cost $5 million to become a regular full time staffed department. This is something the department simply cannot afford.

Some ESDs offer training that is free or steeply discounted to fire service cadets. ESD #4 and ESD #5 both have training academies that allow these departments to continually fill the ranks when vacancies arise.

The majority of the ESDs across Travis County have struggled to maintain an attractive benefits and incentive package that retains firefighters for a career path within their respective departments. ESD #6 believes their pension plan is the most competitive among other ESDs and municipalities in Central Texas. ESD #6 is able to retain a disproportionate number of firefighters with a lucrative retirement plan which offers a 19.2% contribution from the district. This figure combined with an employee contribution of 19.6% brings the total defined pension plan up to a 38.8% contribution. This amount will increase to 39.2% in 2015 (ESD #6 interview). ESD #6 also offers members a 1:3 matched deferred retirement options plan (457b) as a second option. The employee can contribute as much as permissible by law and regulatory standards.

One of the goals of the board members of ESD #6 has been to maintain a motivated workforce. The board has acknowledged that one way to keep performance and morale high is to offer competitive salaries and retirement packages. However, at the same time, they have also recognized that these are only temporary motivators. ESD #6 has prized itself in the areas of training and employee development which are continuously being enhanced. They have also identified an increase in morale with the ability to recognize employees who achieve excellent in their duties.

ESD #1 has been able to attract and retain firefighters by offering a variety of firefighting training programs offered by the National Fire Academy (NFA). Over half of the firefighters ESD #1 are enrolled in some form of training through the NFA.

Emergency Medical Services (Training)

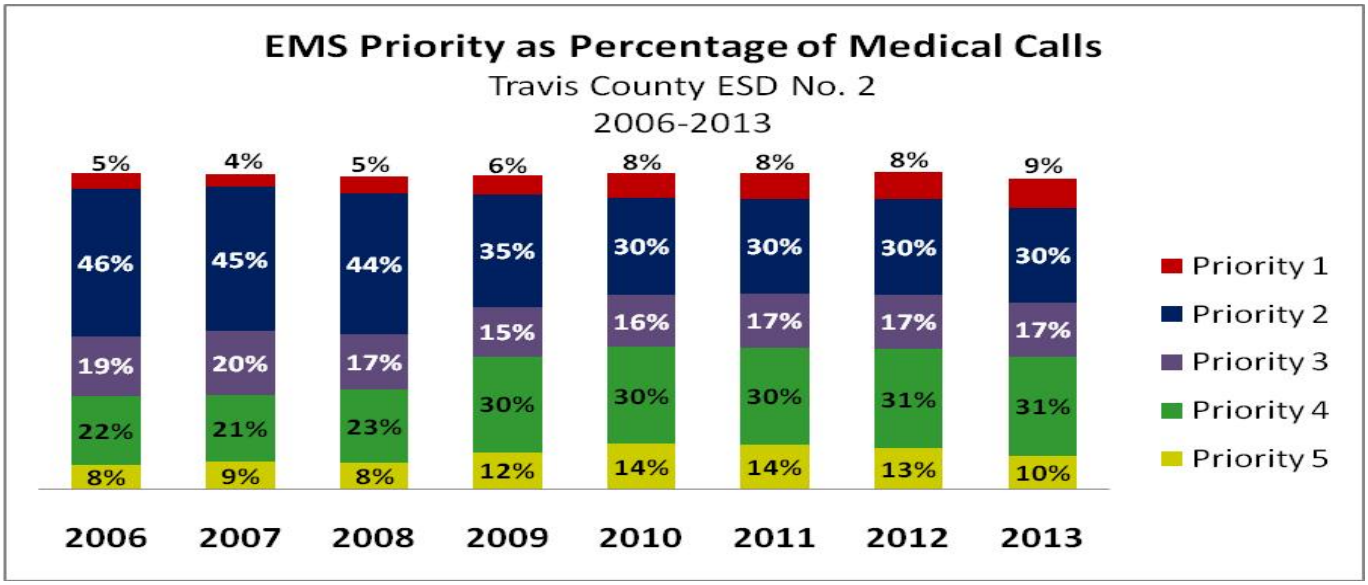
The lack of sophisticated centralized data collection systems contributed to a marginal amount of data collected pertaining to EMS benchmarking standards. The ATCEMS organization has a county wide Zoll/epcr electronic tablet patient care record consistently used by every EMT and paramedic in Travis County. Data collected is easily manageable and directly assists them with their quality assurance program.

Although ATCEMS has a streamlined medical intervention data collection program in place, ESDs have not adopted this standard. Analyzing EMS benchmarking standards for ATCEMS (e.g. STEMI to balloon time, ROSC) is a *system* performance matrix that helps evaluate performance mainly for ATCEMS, but unfortunately, does not help capture performance measures for the individual ESDs themselves. ESD #6, however, has adopted the use of this system and consistently uses it. Other Travis County ESDs continue to document patient care by using pen and paper.

Since the majority of incidents handled by ESDs in Travis County are for medical emergencies, survey questions in this category attempted to collect data pertaining to certification level of each first responder. It is important to note that although some ESD first responders hold an advanced level certification, they may not be credentialed through the ATCOMD to practice at their respective certification level. If a paramedic is not credentialed through the ATCOMD to practice at the ALS level they may in many cases be cleared to practice

at the BLS level instead. The credentialing process includes a rigorous and challenging evaluation process alongside veteran ATCEMS paramedics along with a COG testing process and medical assessment and interventions scenario. ESD #6 currently utilizes 13 paramedics most of which are credentialed through the ATCOMD to practice at their respective levels. ESD #2 was able to recently garner funding for a paramedic program that will soon allow for ESD "paramedic assessment engines" to assess patients prior to the arrival of ATCEMS paramedics. The decision to have internal paramedics was made in response to a large volume of medical emergency incidents that their district encounters. More than 70% of the call volume in ESD #2 is for EMS incidents.

Figure 4.24 EMS incidents dispatched within ESD #2 from 2006-2013 represented by Priority (Priority 1 calls are life-threats as opposed to priority 5 incidents, still requiring assessment/evaluation but are not time critical medical emergencies).



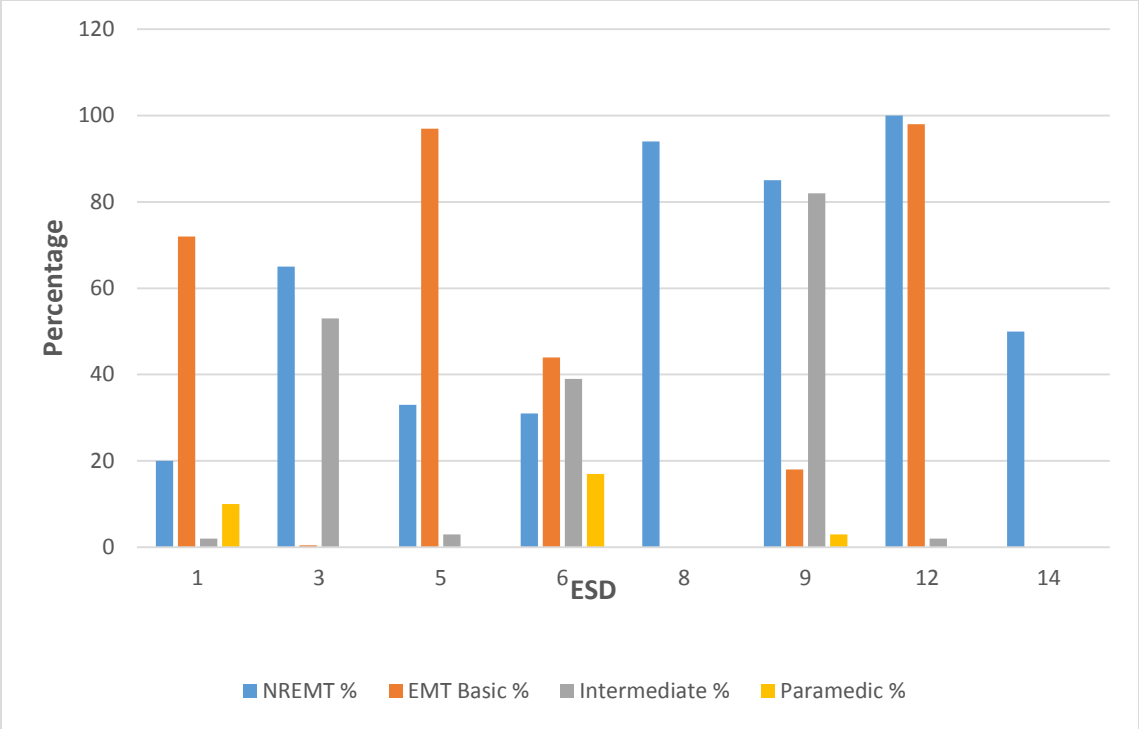
Source: ESD #2 (http://www.pflugervillefire.org/index.php/the-department/statistics)

When reviewing figure 4.24, it is important to note that not all incidents that are dispatched as life-threatening (priority one and two) are actually life-threatening. Priority call type is determined by the call taker based on what is communicated over the phone. First responders determine the severity of the medical emergency after their arrival.

82% of first responders in ESD #9 are credentialed at the intermediate level. Similarly 53% of first responders in ESD #3 hold the same credentials. This is an important certification to maintain. This level of certification allows for the provider to start IVs, administer nebulized medication and in some cases treat for anaphylaxis when paramedics are still responding to the incident. In many cases ESD first responders arrive on scene minutes before an ATCEMS resource. This gives the first responders the opportunity to "hold the line" until paramedics with a higher level of certification can arrive at the patient's side.

Some ESDs have widely adopted NREMT as a standard for certification while others have not. All twelve ESD #12 first responders hold a current NREMT certification. 94% of ESD #8 first responders maintain an NREMT certification. Conversely, only 20% of ESD #1 first responders maintain this certification. These certification levels are further illustrated in figure 4.25. Some ESDs were unable to report first responder certification levels.

Figure 4.25 (Below) Travis County ESD first responder EMS certification levels as a percentage



Source: ESD Survey

Surveys attempted to gather information pertaining to not only first responder certification level, but also medical continuing education mandated by each ESD. It is important to note that departments that may not have medical CE budgeted into their expenditures may account for this through regular duty day hours. Just because there is not any funding for medical CE does not mean that they are not participating in the training. Often times, ESD managers utilize firefighter "down time" to provide proficiency and medical CE training. This training is conducted through distance learning (online) and also in person with field training officers (Lieutenants) who work for their respective departments. It is apparent that ESDs with budget constraints are being forced to conduct training during regularly scheduled duty days as opposed to training that is allotted during overtime hours.

ESD #8 relies on medical CE training through a blanket $20,000 training budget. Some examples of the medical CE training that ESD #8 has conducted has been in the areas of bath salts, heat exhaustion, pediatrics, trauma, and documentation just to name a few (ESD #8 2013 annual report). ESD #6 has separate medical CE mandates depending on the level of first responder certification. National Registry paramedics are mandated 134 hours per year, while Non-National Registry paramedics are mandated only 67 hours per year.

2010 Take Heart Austin Survivor Celebration at Austin City Hall chambers

Author (left) and first responders who successfully resuscitated patient who experienced a cardiac arrest

Photograph by author

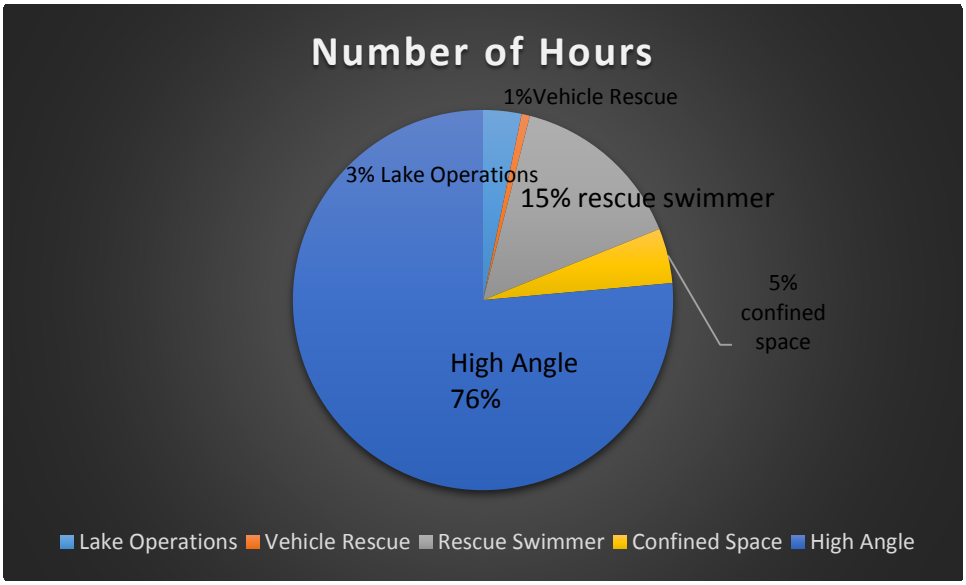
Proficiency Training

Medical first responder certification levels in ESDs across Travis County are not the only training standards that are scattered. The 13 ESDs across Travis County do not share the same standards for training or qualifications. Less than half of the firefighters in ESD #1 hold specialized training certifications even though their district faces challenging geographic terrain that requires a need for such things as water and rope rescue capabilities. ESD #1 sometimes has to rely on other agencies (e.g. Travis County Starflight, AFD or ATCEMS) with rescue capabilities. ESD #9, ESD #10 and ESD #12 all self-reported to have at least 90% of their personnel current in specialized training.

ESD #8 curtailed their overall training focus on an analysis of call volume within their district in 2012. The data showed that the majority of responses were EMS related and when combined with Rescue incidents, totaled 60% of responses. Their department was able to increase the number of classes offered from 58 in 2012 to 136 in 2013. The total training contact hours increased from 1643 in 2012 to 2560 in 2013. The 2013 fire training focus topics included NIMS, pre fire plan, pump operations, RIC, and wildland just to name a few.

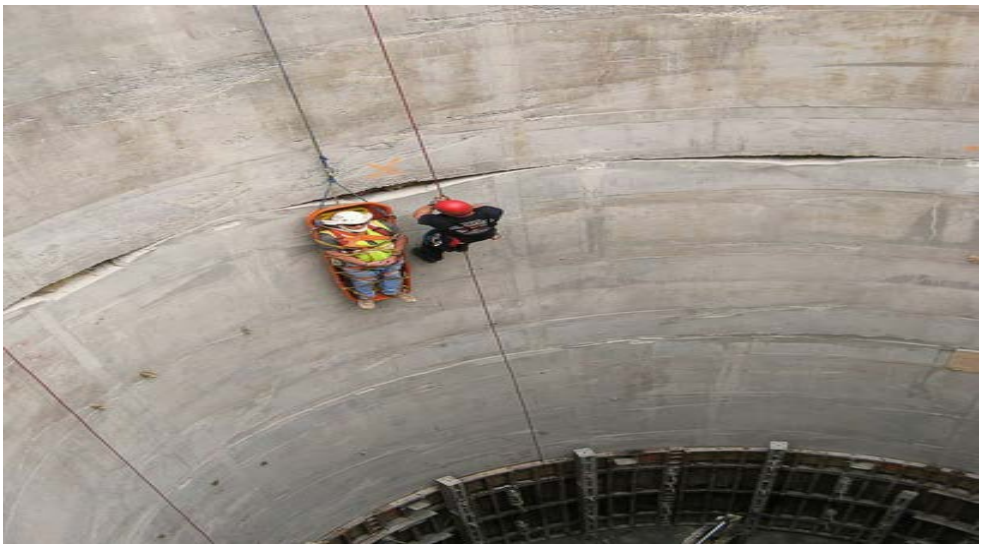
ESD #8 prescreens all applicants to be certified as a still water rescue technician as a minimum. This includes responses from rescuers on all types of watercraft. All rescuers that respond to high angle rescue incidents must be certified at the general rescuer level. The department's 2013 specialized training program focused on incidents they may potentially have to handle. These training hours are illustrated in the pie chart in figure 4.26.

Figure 4.26 (Below) ESD #8 2013 rescue specialty training program broken down by number of hours completed



Source: ESD #8 2013 Annual Report

(Below) ESD #6 rescuers ascending during a high angle rescue



Source: Eric Carlson, ESD 6

ESD #6 Firefighters perform still water rescue techniques on Lake Travis

Source: Eric Carlson, ESD #6

An obvious need exists for a unified standard of training for all fire departments using the same procedures and standards for specialized training. During an active structure fire there may be multiple fire departments from various agencies who share mutual aid or automatic aid, thereby performing a variety of fireground tasks. One department with uniform standards, policies and procedures would offer a higher quality of service than multiple scattered agencies with separate policies and standards.

Surveys and interviews conducted also attempted to gather data pertaining to firefighter injuries directly related to fireground operations which in some cases could be indicative of poor leadership and training as mentioned in chapter two. Other injuries such as injuries at the fire station and EMS lifting related injuries were not included in these figures. The ongoing pattern of missing data is apparent within this section also. 6 of the 13 ESDs surveyed were not able to

provide data relating to firefighter injuries over the course of the last five years. The data relating to firefighter injuries is listed below in table 4.10.

Table 4.10 Travis County ESD firefighter injuries during fireground operations from 2009-2013

Firefighter injuries during fireground operations	
ESD	**Injuries 2009-2013**
1	7
2	14
3	3
4	unk
5	4
6	19
8	unk
9	3
10	1
11	unk
12	unk
13	unk
14	unk

Source: ESD Survey and open records requests

Fire Prevention

Fire prevention activities are what hold communities and their public safety organizations together. Surveys indicated several ESDs in Travis County have reported fewer fires due to their own prevention efforts. Advantages of internal prevention programs that were reported include local control, increased citizen satisfaction, higher quality of service than external programs, increased inspector accessibility, and better communication abilities. ESDs strive to be safety oriented in everything they do by going above and beyond minimal expectations mandated by the state.

Surveys attempted to gather data pertaining to fire prevention education budget, target audience and whether or not there has been an observable change. This information is shown in table 4.11.

Table 4.11 ESD Prevention education in Travis County

Travis County ESD Fire Prevention Education			
ESD	**Budget**	**Target Audience**	**Observable Change**
1	$5,000	homeowners, children	Yes
3	$5,600	Homeowners, evacuation planning	No
5	$25,000	children, adults	yes fewer fires
6	$20,000	K-12 65%, underserved/elderly 10%, Adults 10%, Developers/small cities 15%	YES juvenile firesetting and wildland fires
8	unk	ready set go, pre-fire planning, wui presentations, every business visited twice a year, every hoa is educated, 40 firewise rated communities are educated	unk
9	$3,000	residents and their families, junior firesetter	No
10	$500	children	No
12	$12000	schools & HOAs	unk
14		by request only, or annual events	unk

Source: ESD Survey

ESDs that have internal prevention programs value their ability to self-manage the goals and missions of their districts. This is often times a collaborative effort conducted by ESD administrative staff and the boards that oversee each ESD. Some ESDs may have to shift their efforts from an education model to an inspection/enforcement model depending on season, population growth, caseload and rate of development. The target population for fire prevention education models may also change with varying problems that may arise within their district. These ESDs value their ability to be autonomous. They believe that having an outside organization apart of this process would be detrimental to the citizens they serve.

Fire warden training, for instance, has been an invaluable program to ESD #9, which offers training for business office complex managers in building evacuation, personnel accountability practices, and the proper use of fire extinguishers to name a few. One ESD official reported that fire warden training was one of the reasons for the low fatality rate of those civilians who were involved in the 2010 IRS echelon building plane crash which took place in Austin.

Officials who understand the complexities of a wildland fire know that it is not a matter of if a fire will occur, but when. ESD #6 has taken advantage of using fuel management crews that are funded through grants. Their department receives $250,000 per year to fund this program. This program helps their community become less susceptible to the effects of a wildland fire. Residents of ESD #9 recently completed fundraising to build a wildfire emergency escape route at the end of the High Road in 2013. The project was organized by the residents with assistance by ESD #9's fire prevention division.

ESD #6 also has a comprehensive understanding of what it takes to attract and maintain businesses in the community. The district's financial officer is very pleased with how the business continuity plan has helped streamline the process that businesses undergo when recovering from fire related disasters. This program helps with the long-term planning process that is involved with businesses that attempt to recover from major fire losses. This not only helps business owners get recover financially, but at the same time helps their department maintain tax base valuation within their district, which is a large aspect of their planning process.

Fire Inspection Activities

There is a strong sense of community that is built and maintained by a fire department's prevention programs. ESD #9 reported that their internal inspection program allows them to have an excellent working relationships with schools within the district. A simple fix inspection that would normally take an extensive period of time through a large, complicated bureaucratic process of a larger agency is addressed quickly by the ESD inspector. An official employed by the school district can place a phone call to an inspector that they are familiar with, and schedule an inspection during the same week. They might have a simple question that may need to be answered. This is one way that ESDs are building trust in the community and everlasting bonds that the citizens value.

ESD #2, 5, 6, 9, 12 and 14 have internal fire inspection activities. ESD #1, 3 and 11 all reported to use external services such as the TCFMO. At one point in time, ESD #3 utilized internal fire inspectors, but later discovered that it was a difficult and daunting task to undertake. Major hurdles were encountered while attempting to enforce their own fire codes. State laws which have recently changed dictate that the county tax code cannot be separate from fire code enforced by ESDs. Many ESDs that do not have internal services reason with maintaining staffing, training and expertise to do the same thing that TCFMO is already doing. Since ESDs do not have the same authority county departments do for fire code enforcement, burdensome civil suits have to be initiated in order to attempt to force individuals to comply with the code. For many ESDs this task was not cost-effective and was therefore discontinued.

Some ESDs, however, report that they are capitalizing from the use of their own internal fire prevention program that they wouldn't be able to do if the service were external to Travis County. ESDs with external inspectors indicate their residents have a lower level of satisfaction due to a delay in response and process time. These ESDs believe that resources at the county level are simply too overwhelmed. Smaller ESDs which have internal inspectors share the same reward with local business development groups within their district that want to see businesses become established. Conducting inspections and building processes locally allows ESDs to apply a better alternative to Austin's process which can take upwards of 45 days to complete. ESDs with internal inspection programs report a 7-10 day review process for an entire project (ESD #9 interview). This builds rapport and trust amongst developers and business owners within their jurisdiction. This model helps attract and keep business owners in the district instead of neighboring areas. ESDs report that many businesses in their district exist because of failed planning process attempts with neighboring districts.

A tremendous effort has been put forth by prevention department officials in order to educate the community of new regulations that may affect their district. Due to the threat that is faced with the WUI in ESD #9, some cities have passed local fire codes which mandate the installment of sprinkler systems in new residential structures that are being built. Prevention department officials believe that if the county were to take control of this process that all of the progress made thus far would be erased.

Another advantage reported by ESDs with internal inspectors is the ability of some of their frontline firefighters to be part of the planning and construction processes within their districts. This close relationship established with these planners and developers allows for these firefighters to be able to make a physical presence at the site of these projects which in turn helps

them become more safety oriented with structures within their districts. This familiarity helps engine companies with their pre-incident planning process. The same prevention department teams are able to consistently assist developers and foremen with compliance safety mandates, which in turn helps streamline the entire process.

According to some ESDs, revenues generated from fire prevention programs are financially worthwhile. One ESD estimates their annual revenues to be $60,000 for the prevention program. This pays for the full time inspector and public education.

Fire Investigation Activities

(Below) Arson Investigation in Progress

Source: https://www.mdsp.org/Portals/0/images/osfm/Investigations/Fire%20Investigators%20Scene%20Dig.jpg

Table 4.12 Travis County ESD Fire Investigator Activities 2013

Travis County ESD Fire Investigation Activities 2013						
ESD	**Investigators**	**Investigations Conducted 2009-2013**	**Interviews**	**Cause Determined**	**Cleared without determination of cause**	**Successful prosecutions**
5	1PT	3	0	80%	10%	0
6	3FT			50%	50%	0
9	2FT, 1PT	25	25	90%	1%	0
14	2PT					

Source: ESD Survey

Fire investigation activities by ESDs in Travis County are minimal, as illustrated in table 4.11. Only four ESDs reported to have internal fire investigators. Of those four ESDs that have investigators, only two have full time investigators. ESDs reported to have fire investigators refer cases to the TCFMO that warrant prosecution or further investigation.

ESD #5 and ESD #9 report high fire cause determination percentages of 80% and 90% respectively. Due to the minimal amount of data gathered for this category, conclusions were difficult to draw.

Chapter 5: Discussions and Recommendations:

Chapter Purpose

This chapter highlights the need for further discussion related to ESD funding and performance. Recommendations for future research are also discussed. Solutions are presented in this chapter based on an exhaustive literature review, and a comprehensive understanding of challenges faced by each ESD in Travis County. The following is a discussion regarding options to best handle the challenges faced by ESDs in Travis County.

Financial Constraints

ESDs were originally structured to assist rural communities with better funding options than what a volunteer force could do. Now ESDs with growing populations see the ad valorem tax structure as counter-intuitive to their viability. One of the main reasons ESDs in Travis County are not meeting important industry standards is due to financial challenges that are becoming more and more apparent. Total revenues in millions for each ESD is illustrated below in table 5.1.

Table 5.1 (Below) Total revenues for Travis County ESDs in 2013 (most recent financial data available)

ESD Revenues 2013 in millions $				
ESD	**Total**	**Prop. Tax**	**Other**	**Sales Tax**
1	2.18	2.16	0.02	0
2	10.9	5.98	unk	4.39
3	4.26	2.06	0.3	1.9
4	2.48	1.4	0.13	0.95
5	1.92	0.895	0	1.026
6	11.53	8.7	0.27	2.5m
8	1.9	1.44	0	0.281
9	4.54	4.33	0	0
10	1.32	1.31	0	0
11	2.8	0.71	0.37	2.08
12	1.12	1.02	0.19	0.05
13	0.05	0.05	0	0
14	0.743	0.743	0	0

Source: Travis county annual financial statements

ESD #8 has seen little to no growth in revenue from property taxes, despite growing populations in the area and higher demands for improved service. In 2013, property owners in ESD #8 paid significantly less than what they paid in 2008.

It is also important to note that often times, ESDs do not receive tax revenue from new developments and newly constructed buildings within their jurisdiction for upwards of 18 months. In the meantime, each ESD must pay for operations on a continual basis regardless of these payment schedules.

The cost of running and maintaining a fire department can be very expensive. Strong collective bargaining agreements may make it even more difficult for a city to initiate this daunting task. Municipalities that reside within the jurisdiction of an ESD often times have no

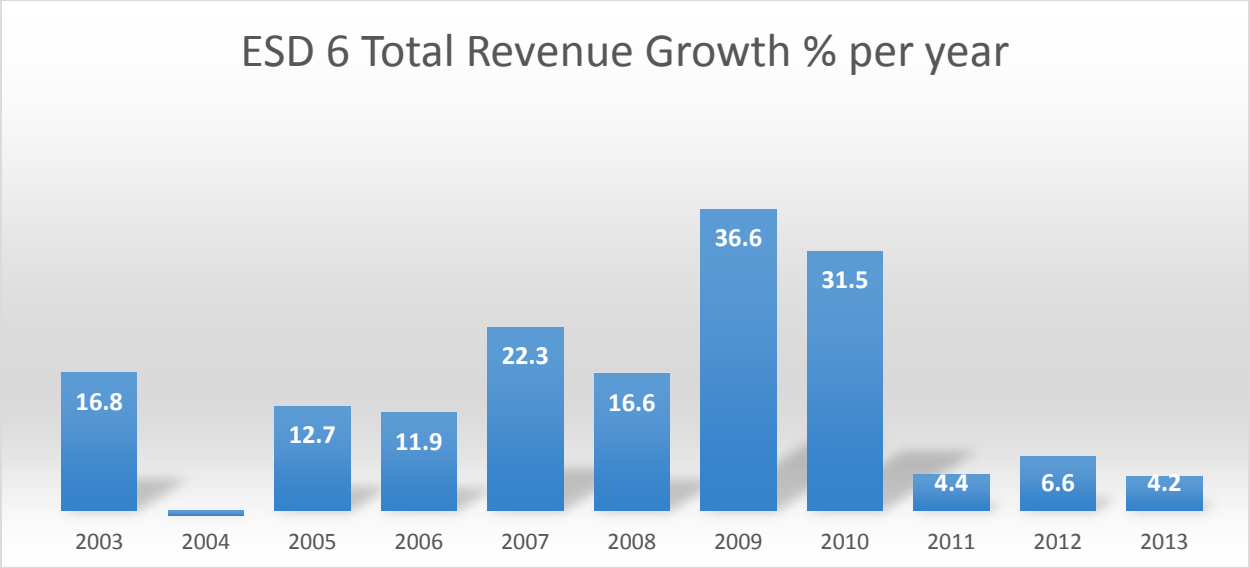
financial incentive to create a municipal fire department. This may cause tensions between the ESD and the municipalities they serve.

Due to the fact that municipal fire departments (e.g. AFD) receive funding derived from their general fund, it is difficult to determine the amount imposed on the taxpayer within the municipality. SAFE-D, however, has been able to estimate this cost for some municipalities. For the city of San Marcos, the costs before capital expenditures, and not including any EMS expenses, were estimated at 19 cents per $100 valuation. With capital expenditures, the equivalent was estimated at 23 cents per $100 valuation. The city of Sunset Valley pays approximately $453,000 annually for contracted fire service from the city of Austin (City of Sunset Valley phone interview). SAFE-D also noted that the current contract for fire service between the City of Sunset Valley and the city of Austin to be the equivalent of 30 cents per $100 of valuation.

Although collective bargaining can be an excellent retention tool, at the same time it has created severe financial challenges for many ESDs in Travis County. Personnel related costs directly related to collective bargaining (salaries, benefits, legal fees, retirement plans) are consistently the highest expenditures for any public safety department to undertake.

ESD #6 is arguably one of the most competitive ESDs in Travis County with regard to wages and retirement benefits. Firefighters who belong to this ESD have a strong collective bargaining agreement. Even though personnel related expenditures have increased, revenue growth has remained stagnant as shown in the figure below.

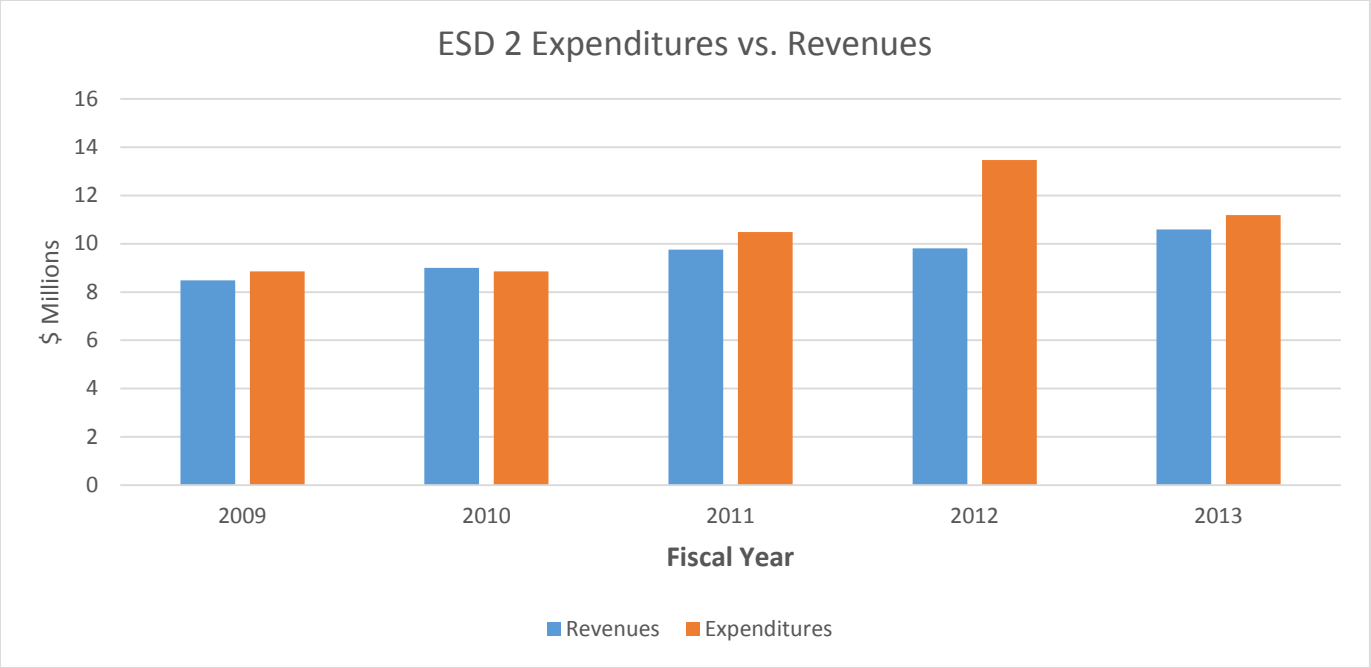
Figure 5.1 (Below) ESD #6 ten year revenue growth by year



Source: James De Witt, CFO, ESD #6

It is not a matter of if, but instead a question of when many Travis County ESDs will become insolvent. Some ESDs are barely surviving. Some failed long ago. ESD #2 has been operating in the red for four of the last five years. Expenditures have consistently outpaced revenues. In 2010, revenues barely outpaced expenditures as illustrated in figure 5.2 (below).

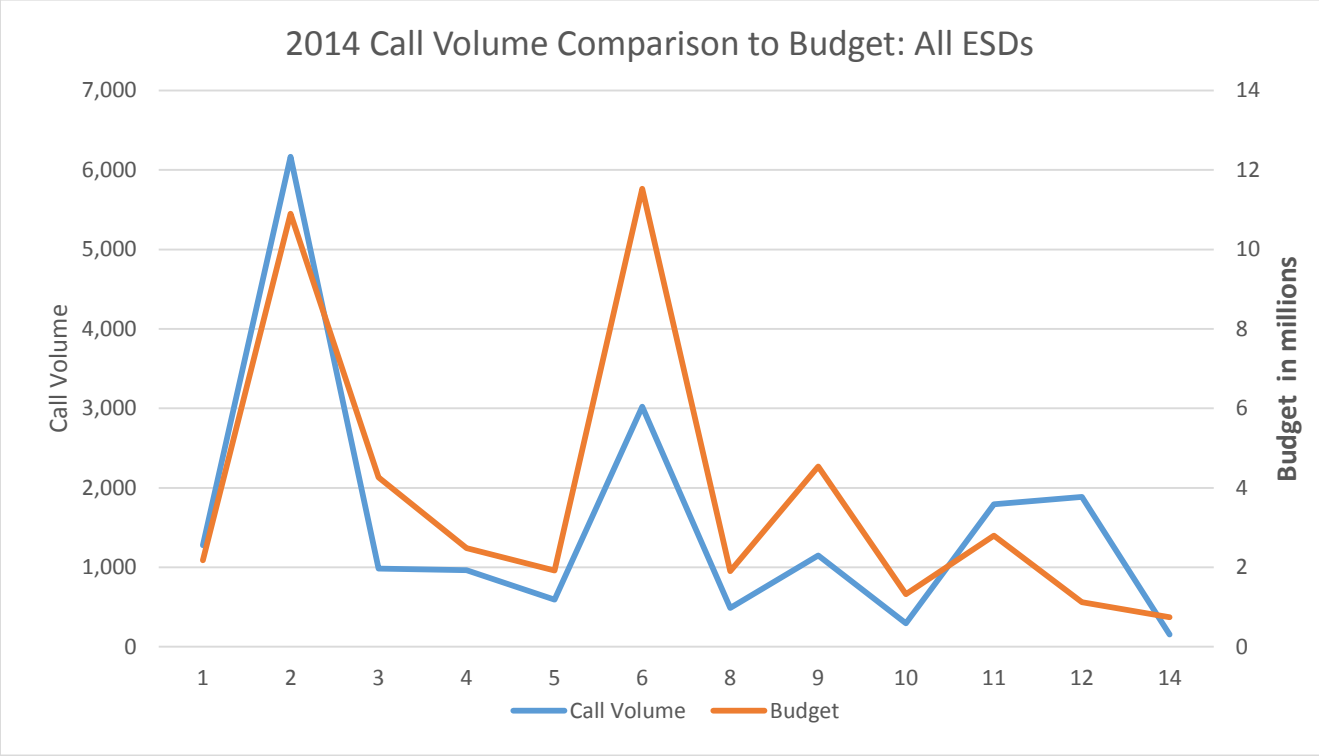
Figure 5.2 (Below) ESD #2 Revenues as compared to Expenditures 2009-2013



Source: ESD #2 Financial Audits & Austin Fire Department Communications

A steady growth in call volume over the last five years has outpaced revenue increases in ESD #2. In 2006, ESD #2 had a total of 57 firefighters with an average response time of 11:05. Their population served was 65,000, and call volume was 4,896. Property tax funding was $3.7 million. In 2011, the number of firefighters staffed by the department increased by only 11 to a total of 68. Their population served grew to 97,000, and call volume increased to 6,814.

Figure 5.3 (Below) Illustrates the large gaps that exist between call volume and revenues for each ESD.



Source: ESD Financial Audits and AFD Planning and Research Division

Threats

ESDs across Travis County face a variety of threats that span across geographical and political boundaries. These threats include, but are not limited to, annexation by neighboring cities, water availability, underfunding, soaring populations, the wildland urban interface, challenging geographic terrain, lucrative employment benefits of competitive fire departments, and ultimately insolvency. Some threats are more serious, and imminent than others. Most of the threats within Travis County are geographically dependent.

A Repeated Economic Downturn

None of the ESDs were immune to the effects of the recession. Some ESD officials fear that the economy may face a second recession similar to the one they experienced during the last five years. Not only did underfunded ESDs suffer, well-funded ESDs experienced financial hurdles at levels they have never confronted. Many of these ESDs had to use debt-financing in order to survive. Although these severe financial obstacles appear to have been overcome temporarily, the possibility still exists for certain regions of the county to experience another slowdown in the future, especially for those ESDs that lay in proximity to home rule cities.

Annexation

Cities under home rule in Texas have the "inherent power" to force annexation upon residents who reside within neighboring unincorporated land regardless of the residents' desire to do so. ESDs and the residents that rely on them for service within these unincorporated areas have no authority to stop an annexation from neighboring areas from occurring. The City of Austin has an interest to aggressively annex unincorporated land with lucrative tax base. When looking at ESD response maps, this pattern of "lucrative and highly selective annexation" is apparent across Travis County. In southeast Travis County, there is a very small contiguous line that stretches from the Austin-Bergstrom International Airport (ABIA) down to the Circuit of the Americas property, which helps Austin capture the tax base within this area. This process leaves areas without tax base to remain under the response matrix of ESDs. Some examples of this may include manufactured home lots or low income housing.

Recent legislation was passed in 2013 to address the decreasing quality of service experienced by some newly annexed areas. One area specifically is serviced by AFD. This area

is located adjacent to ESD #11 and the Circuit of the Americas venue. The 83rd Texas legislature (Senate Bill 1596) now mandates that annexations do not reduce services to newly annexed areas.

ESDs lose out because they not only experience an eroding tax base, but also continue to have the obligation to continue to service areas that remain within their jurisdiction that bring in little property tax revenue. The Formula One example presented in the previous paragraph includes the Formula 1 racing event, Moto GP racing event, 360 concert amphitheater and numerous other entertainment events that bring upwards of $2 million annually in sales tax revenue. ESD #11 serves an underprivileged population that has minimal property valuation. More importantly, ESD #11 is responsible for a population of close to 30,000 with a response area stretching across 114 square miles. The property tax valuation within this ESD brings in only $710,000 in property tax revenue annually. This ESD relies heavily on sales and use tax. During this last budget year the ESD was able to acquire just over $2 million in sales tax revenue. ESD #11 representatives estimate that the amount lost due to the City of Austin annexation is close to $2 million annually. This equates to almost the entire budget of ESD #11.

ESD #5 is another ESD that struggles with incremental annexation that plagues their district. ESD #5 officials express their frustration with how the City of Austin has selectively and strategically annexed certain areas within their district that contain lucrative tax base. As soon as apartment complexes are constructed, they are soon thereafter annexed by the City of Austin. ESD #5 loses the tax base that is provided by these apartment complexes, and has no authority to prevent this from happening.

ESD #6 stands to lose the River place subdivision to the City of Austin in 2017. This area has consistently provided reliable tax base to their ESD which they will no longer be able to

collect. Steiner Ranch is another large affluent housing subdivision that is on the City of Austin annexation radar.

ESD #9 is anticipated to lose $400,000 in annual revenues when the Lost Creek annexation is finalized by the City of Austin next year. ESD #9 will have no other choice but to raise taxes for the remaining residents within the jurisdiction. Fortunately, ESD #9 is one of the few ESDs in Travis County who have not reached their ad valorem tax ceiling.

Cities Converting to a Municipal Fire Service

Many ESDs within Travis County not only serve unincorporated areas, but also municipalities, towns and villages. These cities have always had the option to end services with ESDs altogether. Although the process of creating an internal municipal fire department can be complicated and costly, some city mangers prefer it because it gives them better control over the functions of the department. It also allows for a better funding structure and therefore a better performing fire department than the status quo ESD.

ESD #2 has faced this very possibility in the past. The City of Pflugerville residents are exclusively served by ESD #2. If the City of Pflugerville decided to create a municipal fire department, ESD #2 would only be responsible for some of the unincorporated areas surrounding the city, and would eventually become financially insolvent. It is unknown, at this time, what the future holds for this dilemma.

ESD officials and labor union representatives have advocated for the implementation of policies that would help facilitate the transition of ESD firefighters into the hiring processes of newly formed municipal fire departments and those departments that have annexed unincorporated areas within the boundaries of ESDs. However, in some instances, this process

has faced legal challenges from existing labor unions from both sides of the collective bargaining table. A similar scenario recently occurred when merger talks between ESD #6 and the City of Austin fell through over disagreements regarding pension funding and roles of newly acquired firefighters.

Recommendations

A number of solutions (both financial and operational) can be applied to the challenges ESDs in Travis County face. Based on the findings and observations of this research project, the following solutions have been categorized based on feasibility and sustainability. The best sustainability category is high (green) followed by medium (yellow) and low (red). The best option category is consists of a combination of both feasibility and sustainability scores.

Increased leadership and accountability

Across Travis County there are a total of 13 ESDs, with 13 respective boards, each of which contain five members. There are approximately 65 board members serving across Travis County, each of which who must be appointed or reappointed every two years by Travis County Commissioners. The appointment/reappointment process in and of itself can be a daunting and exhaustive process for any government organization to undertake. In addition to this, there are 13 fire chiefs, and 13 separate administrative staff sections. Numerous ESDs in Travis County have only one fire truck, yet still have some or all of the duplication of support staff that other ESDs already have.

The fragmentation of leadership organizations across Travis County has proven to be chaotic. There is no centralized organizational structure. A structured and organized form of sharing information appears to be non-existent amongst most ESDs. It is clear that ESD boards

and administrative managers need improved collective cooperation. This would also aid in the sharing and dissemination of ideas.

Data gathered during the interview process indicates a lack of oversight and involvement amongst board members and ESD administrative officials across Travis County, which has caused the quality of services to deteriorate. This lack of engagement has led to a lack of accountability to the citizens they serve. Some Fire Chiefs in the past have been maintaining fire departments with no oversight at all. Their efforts have not been collaborative. ESD board members may be physically present at meeting but are simply not engaged. Some ESD boards have approved expenditures without evaluating how these expenditures would improve their district.

ESD #6 managers report having a close, positive working relationship with the board that oversees their department. ESD #6 also has close partnerships with the Lake Travis Community Foundation, an advisory committee that makes recommendations for the department in addition to the ESD board. This organization also assists with fundraising activities to help augment the budget shortfalls that are faced.

Centralized Data Collection Systems

One of the major flaws of having multiple ESDs across Travis County is the lack of a centralized data collection systems. The best data to obtain is data that is measurable and comparable. Although attempts have been made to unify this process by county officials, there is no definitive data collection model that all ESDs currently utilize.

Only 5 ESDs out of all that were surveyed had knowledge of the number of structure fire responses from 2009-2013. Other ESDs surveyed were not aware of their fire extension

percentage information. There appears to be no convenient mechanism to access data from the ESD RMS systems or through NFIRS. Despite the fact that AFD has made major strides to consolidate their dispatching center by purchasing common equipment and utilizing similar fireground policies, the system appears to be flawed.

Some ESDs use the firehouse data collection system for inspections while some ESDs use external programs with the TCFMO. This program helps these departments gather information directly related to inspection activities, such as plan reviews and complaint inspections. This data can easily be linked to CAD when responding to calls. Firefighters can then have a better understanding of the inspection activities of the structure when responding to calls that may arise. This may also give them a better understanding of the threats they may encounter while responding to fire alarms or actual structure fires. The Austin-Travis County EMS department uses a Zoll electronic patient care record tablet to document patient care details and interventions. Other ESDs continue to use pen and paper to document patient care, while some share the same electronic record system as the county wide EMS system. Advantages to using the electronic records systems include the increased ability to make improvements based on electronically documented interventions. This also helps with timely quality assurance and improvement. Another advantage of this program is the ability to bill for services in a timely manner.

Consolidation

Although most ESD managers agree that a consolidated metropolitan ESD would be the most beneficial, there have been concerns and disagreements as to how the consolidation would be formulated. Some ESDs are concerned that if consolidation were to occur, stations which currently serve their district would be discontinued and the residents would be served by a fire

station located further away. Residents would have to rely on firefighters that may in some cases take an additional ten minutes or more to arrive. These residents would be accustomed to having shorter response times. Additionally, these residents would be paying the same amount in taxes (or more) for a lower level of service. Some ESD officials feel that this would be a disservice to residents within their district who rely on a fire department with which they have built close relationships. Although this model may cause pockets of disparity, the possibility of an overall increase in quality of service across the entire county would be likely.

"The consolidation of fire departments is beneficial by means of economies of scale" (Coleman, 2003, pg. 22). If consolidation were to occur, the bulk purchasing power potential for a large consolidated ESD would be a more fiscally responsible option than the weaker purchasing power of 13 individual ESDs. "The entire purpose of consolidating is to have economies of scale that provide a mutual benefit to the entities agreeing to contribute to it" (Coleman, 2003, pg. 22). Some territorial aspects of fire coverage must be given up in order to benefit from economies of scale.

Representatives of an affluent community may be opposed to consolidation due to feeling the pressure of having their resources distributed to jurisdictions across the county where they are not being served. Many residents experience this when school taxes are redistributed to schools in less fortunate parts of the state where the funds are needed the most. The "robin-hood syndrome" is a term frequently used during discussions about county wide services.

In addition to some of the advantages listed above, consolidation would also allow for a unified fire service that would be able to share the same training standards, the same communication capabilities, operate uniformly during emergency situations, and have better

collective cooperation skills than several fragmented departments that have no familiarity with each other.

According to some ESD chiefs, the thought of "change" has been difficult for fire public safety organizations to embrace. Just the mention of "change" is a very sensitive topic for many ESD managers and for the public to discuss. Change is an area of discussion that is often times avoided. Change brings uncertainty. This is traditionally one of the main reasons consolidated efforts have been extinguished in Travis County. ESD board members, administrative officials and managers are afraid to tread into unchartered territory.

Consolidated Systems

The Austin-Travis County EMS system is a consolidated EMS system that shares funding between the general fund of the City of Austin, and the Travis County emergency services "interlocal" agreement that has been in place for over 40 years. Austin-Travis County EMS has been touted as one of the best providers in the country by all metrics that measure performance in the EMS Industry. Employees of ATCEMS are City of Austin employees with comparable benefits and salaries to other public sector prehospital medical providers across Central Texas. Jurisdictional boundaries are blurred. Although some aspects of response times may differ, a resident of Travis County, no matter the physical location, will receive the same level of ALS service regardless of which ESD jurisdiction the call may have originated from. ATCEMS serves with a uniform standard of care without geographic, financial or political boundaries within the Travis County response area of 1100 miles.

One ESD official shared concerns of unintended consequences as it is related to a consolidated county wide system. He fears that there may be opposition from certain ESDs in

the western region of the county that aren't underfunded. "I also think my firefighters would receive a cut in pay and benefits if this were to happen. If you tell someone they are going to lose $5,000–$6,000 a year, they may go look somewhere else [for a job]. It could lead to unexpected turnover." (Webb, et al., 2014)

Different Public Safety Funding Models

Other public safety organizations around the nation have varying funding structures that do not have similar tax ceilings and do not face the same political hurdles that ESDs in Texas do. Some of these tax structures have kept these agencies sustainable for the long term.

LACoFD

The Los Angeles County Fire Department is a consolidated county funded model fire department that provides fire and ems services to residents who reside in the unincorporated portions of Los Angeles County and to contract municipalities within their jurisdiction. Cities that contract for fire service may also contract for other various services such as city prosecutor, animal control and law enforcement to name a few. The LA County Fire Department is not subject to the same budget constraints that ESDs have had to face. Contract cities like Malibu for instance, pay for law enforcement service from their general fund. The city councils manage the scope of these services through negotiation with the office of the County Sheriff. Property owners in cities that are members of the fire protection district pay for fire and paramedic services through a property tax assessment. The Board of Supervisors oversees the fire protection district as well as the County Fire Department that provides the services (Waldie, 2004).

The City of Calabassas, CA, for instance, contracts with the Consolidated Fire Protection District of Los Angeles County (under the Los Angeles County Fire Department organizational

structure). The City receives fire protection and paramedic services as well as wildland fire protection and forestry tree service for a negotiated fee. Each city has the option to pay for fire protection or general law enforcement through a structured fee payment service, or through a property tax assessment value determined by each government entity.

Cities situated in Los Angeles County also have the opportunity to best align themselves with public safety protection services that best fit the needs of their community. For law enforcement services, a city can elect to contract with the county for general law enforcement services only. Other options include traffic law enforcement, detective services, helicopter programs, and special occasions response. For fire protection service, options include fire suppression service (fee for service), fire suppression service (tax share), beach lifeguards, and options for additional memorandums of understanding. See Los Angeles County service agreement matrix for more information (http://ceo.lacounty.gov/IGR/PDF/ccs.pdf).

Special tax proceeds are used to fund operations of the districts emergency paramedic rescue, fire protection, firefighting, search and rescue, disaster response, hazardous material, and EMS. The fee structure for these services is depicted below in the Los Angeles County Consolidated Fire Protection District Rate and Method of Special Tax for the Paramedic and Fire Emergency Protection Measure

Table 5.2 Los Angeles County Fire Department property taxation formula

LACoFD Special Tax Rates for Fiscal Year 2014-2015		
Land Use	**Special Tax Rate**	**Special Tax Rate w/ Sprinkler Credit**
Single Family Residential	$64.78	NOT APPLICABLE
Mobile Home in Park	$32.39	NOT APPLICABLE
Multi-Family Residential	$81.82 + $.0084 per sq. ft. over 1,555 sq. ft.	$81.82 + $.0079 per sq. ft. over 1,555 sq. ft.
Non-Residential	$78.40 + $.0528 per sq. ft. over 1,555 sq. ft.*	$78.40 + $.0508 per sq. ft. over 1,555 sq. ft.*
High Rise	$95.43 + $.0645 per sq. ft. over 1,555 sq. ft.*	$95.43 + $.0616 per sq. ft. over 1,555 sq. ft.*
Special Use	$119.30 + $.0805 per sq. ft. over 1,555 sq. ft.*	$119.30 + $.0769 per sq. ft. over 1,555 sq. ft.*
Vacant Land - 2 acres or less	$16.20	NOT APPLICABLE
Vacant Land - more than 2 acres and less than or equal to 10 acres	$21.37	NOT APPLICABLE
Vacant Land - more than 10 acres and less than or equal to 50 acres	$42.77	NOT APPLICABLE
Vacant Land - more than 50 acres	$64.78	NOT APPLICABLE

*Capped at 100,000 sq. ft. per parcel

Source: Risk Management Division, Los Angeles County Fire Department

It is also important to note that municipalities in the Southern California area that desire incorporation must have a solid infrastructure system before they can even begin to start offering public safety services within their jurisdiction. ESDs, on the other hand, operate in areas that may have little to no infrastructure. ESD #1 and ESD #8 are prime examples of this, where dirt roads can hamper response times and makes access and egress a daunting task. Often times, fire

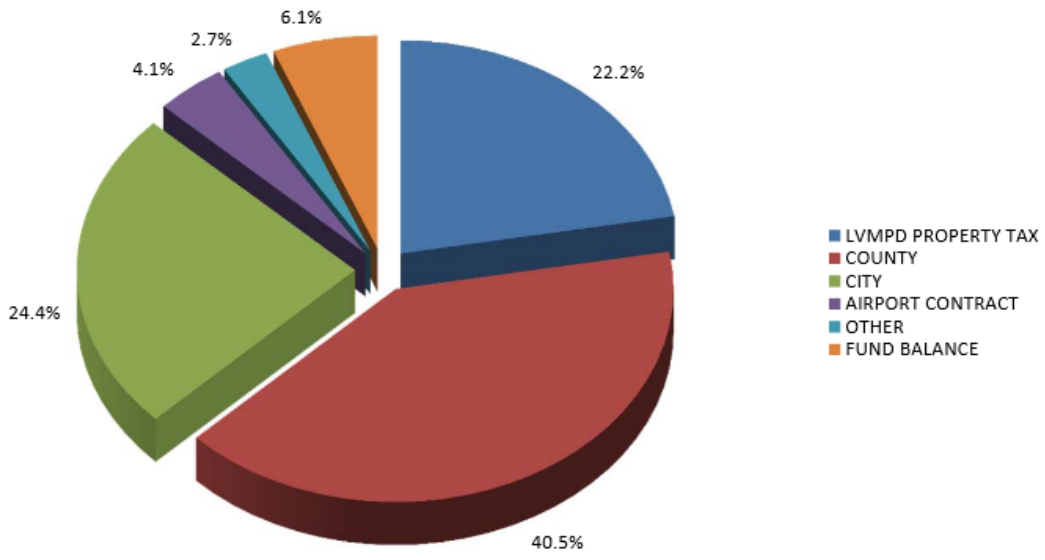
engine companies are forced to park a long distance from the scene of the incident, and have to hike long distances before they can make patient contact during a medical emergency.

LVMPD

The Las Vegas Metropolitan Police Department is a city and county funded law enforcement agency. LVMPD receives its funds through a funding formula which integrates a 37.6% contribution from the City of Las Vegas, and a 62.4% contribution from Clark County. Revenues also include funds derived from airport contract and "other" sources. Funding is based on a complex formula that includes population, calls for service, and felony crimes in the prior year. (lvmpd.com 2014)

The 1988 LVMPD property tax is derived from an annual ad valorem property tax rate of 8 cents per $100 assessed valuation by the City of Las Vegas and unincorporated Clark County. The 1996 LVMPD property tax is derived from an annual ad valorem property tax rate which cannot exceed 20 cents per $100 assessed valuation in the LVMPD jurisdiction. The combined total proceeds from the special property taxes support 650 police officers. (LVMPD 2013-2014 budget in brief)

Figure 5.4 Sources of revenue for the LVMPD



Source: 2013-2014 LVMPD Budget in Brief

Creation of Overlapping ESDs

The option to create an overlapping ESD for EMS services is available to ESDs in Travis County, however, the option to pursue this would be very difficult due to high startup costs and political barriers. ESD #2 attempted to do this recently but was unsuccessful due to voter disapproval. The ad valorem tax rate imposed on residents in this jurisdiction would have potentially doubled without any proof that the service would be any better than the one that already exists with the current EMS provider (ATCEMS).

The other hurdle that exists with the creation of an overlapping ESD is the need for supplemental EMS resources during peak times when ambulances are already assigned to calls. The current agreement satisfies this problem already, since it is a countywide resource.

Add Automatic Aid Agreements

Automatic aid agreements are plans developed between two or more fire departments. Not to be confused with mutual aid, automatic aid involves the dispatching of resources *prior* to the arrival of first in units. Automatic aid is established through a written intergovernmental agreement that provides for the simultaneous dispatch of a predetermined response of personnel and equipment to a neighboring jurisdiction upon receipt of an alarm and is included as part of a communication center's dispatch protocols (NFPA 1710, 2010, pg. 14).

Many residents of Travis County live within very confusing and suddenly changing jurisdictional boundaries that leave them wondering which Fire Department services their area. Residents of ESD #4, for instance, are stretched across 40 square miles of the county, which are separated into five unincorporated "islands." This ESD originally was a large rural fire protection district whose jurisdiction was much larger before the City of Austin annexed a large portion of their response area. In the past, residents of the City of Austin may have resided closer to an ESD #4 County Fire Station than an AFD station. Although a fully staffed engine with first responders sits idle close to their residence, they may have to wait lengthy periods of time for a city fire engine to arrive, due to the jurisdictional boundaries and traditional lack of automatic aid agreements. A large, unified consolidated department would lessen the chance of something like this from happening.

It is apparent that taxpayers in surrounding jurisdictions are also having to pay for automatic aid from their municipal fire agencies to supplement the underserved population living in ESD response areas. For example, in 2013, there were a total of 25 responses from ESD #4 response vehicles into the City of Austin. On the contrary, AFD fire engines responded to 116 incidents within ESD #4.

The City of Austin has currently ended all discussions regarding future automatic aid contracts due to the ongoing litigation between the city and the Austin Firefighters Association Local 975. The local is concerned over the fact that AFD in essence is contracting for services within the City of Austin by firefighters who are not employed by AFD.

In Manchaca, ESD #5 has been able to establish agreements for automatic aid with ESD #11, but agreements with AFD do not exist. Although there are some boundaries within the jurisdiction of ESD #5 that would have shorter response times by Hays County first responder organizations, these automatic aid agreements do not extend beyond county lines due to differences in forms of radio communication equipment that are used by both departments. Hays County emergency responders use a VHF band radio system.

Some ESDs do not have the luxury of sharing automatic aid agreements with neighboring jurisdictions. Some ESDs are not able to participate in automatic aid or even mutual aid agreements due to not being able to meet strict credentialing process standards that fire departments with high standards establish. Some of these ESDs rely only on TIFMAS for mutual aid. ESD #1 shares boundaries with only one other Travis County ESD, which only operates one fire engine. The rest of their jurisdiction is bordered by Burnet County, Williamson County and Lake Travis, furthering the need for regional aid agreements that are not restricted by county lines. Currently there is no bridge over the Colorado River that allows for ESDs to access each other for automatic or mutual aid. ESD #1 officials report that they anticipate the placement of at least 1,800 new homes in several different newly constructed subdivisions in the near future. The need for shared automatic aid agreements will be especially important once residents occupy these new subdivisions.

The lack of automatic aid for many of the ESDs in Travis County presents a challenge for both the residents and the ESDs that serve them. Although automatic aid is a potential solution to some of the problems that have been described in this research project, it is only a temporary solution that does not address the root of the problem.

Contract for Service

Beginning in 1973, the City of Sunset Valley came under the protection of the Manchaca Volunteer Fire Department (now ESD #5). As the City grew and the number of volunteers diminished, the city entered into an inter-local agreement with AFD to provide fire services in 1998. In 2013, the City of Sunset Valley paid $453,037 for fire services through a contractual agreement with AFD. Although the funding structure of an ESD may present challenges with undertaking contract service agreements with municipalities such as this one, they may be worth exploring in the future.

Grant Funding

Although the amount of funds received through grant funding does not compare to revenues created through sales and ad valorem tax, grant funding is still an important means of revenue. The major fires which occurred during Labor Day weekend, 2011, strained many of the fire resources across Travis County. Many of these organizations sought funding through FEMA for their efforts during these catastrophic events. Their efforts paid off when they were awarded some of the grant funding amounts listed below.

Table 5.3 Grant funding received by FEMA for 2011 Labor Day fires

Pedernales Fires 2011 Grant Funding	
ESD	**Amount**
8	$52,099
9	$18,179
3	$17,718
4	$8,255
6	$7,951
14	$7,110
1	$5,581
10	$4,106

Source: http://impactnews.com/austin-metro/leander-cedar-park/fema-reimburses-first-responders-for-2011-wildfires/

In addition to some of the grant funding listed above in table 5.3, ESD #6 has been able to secure a grant worth upwards of $250,000 a year to perform fuel mitigation within their jurisdiction. The fuel mitigation program focuses on property protection, evacuation planning, and hazard fuel reduction. This involves clearing brush through controlled burns through homeowner and community defensible space treatments.

(Below) A fire crew in ESD #6 conducting a controlled burn as part of the fuel mitigation program

Source: Eric Carlson, ESD #6

The Staffing for Adequate Fire and Emergency Response Grants (SAFER) was created to provide funding directly to fire departments and volunteer firefighter interest organizations to help them increase or maintain the number of trained, "front line" firefighters available in their communities. The goal of SAFER is to enhance the local fire departments' abilities to comply with staffing, response and operational standards established by the NFPA (NFPA 1710 and/or NFPA 1720). (FEMA, 2014)

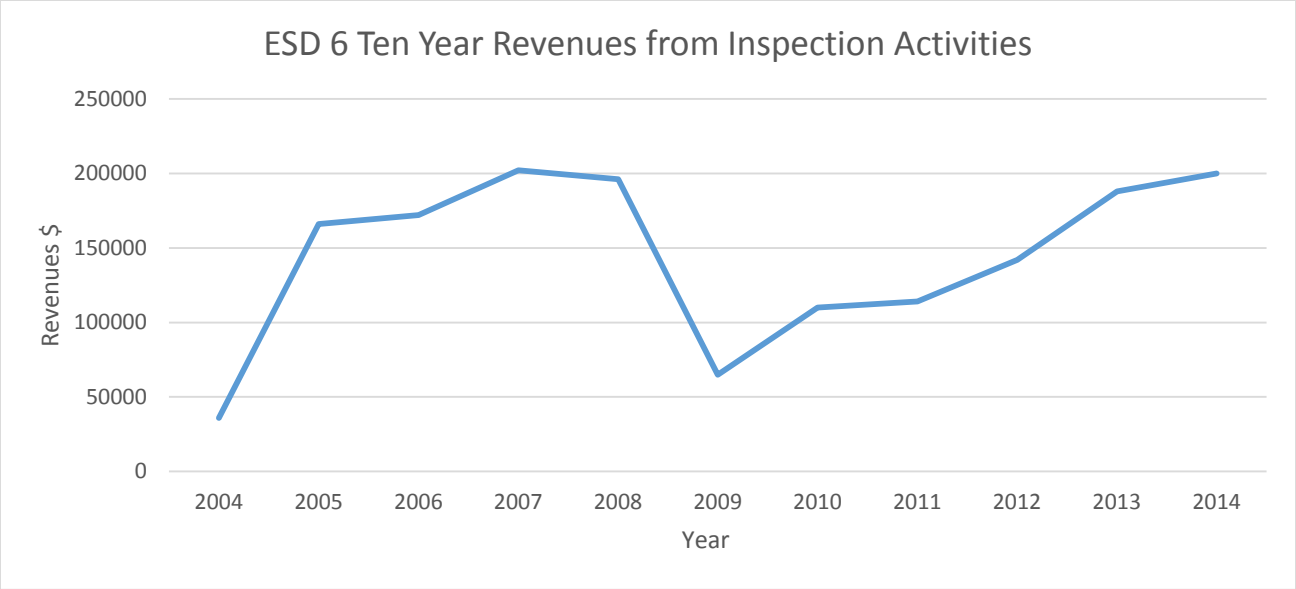
Data gathered from surveys and interviews indicate that ESDs in Travis County do not utilize dedicated internal grant writers. Grants are currently being applied for by administrative

staff who are already overburdened with day to day operations. A consolidated system with a dedicated grant writer may have the possibility of increased number of grant awards or grant amounts and should be considered in the future. A grant writer position may not be cost-effective for each individual ESD.

Revenues from fees

Although minimal, the option to raise revenues from fees may prove to be cost-effective, especially for those ESDs who perform fire inspection services. These fees may be integrated into the permit process, the inspection process, and ongoing evaluations process. ESDs may find that revenues from fees not only allow inspection programs to be financially sustainable, but also more than cost-effective. Figure 5.5 illustrates the amount of revenues that have been collected by ESD #6 over the last ten years.

Figure 5.5 ESD #6 Fire inspection revenues from 2004-2014



Source: James De Witt, CFO, ESD #6

Sales Tax Revenues

Four ESDs in Travis County currently do not collect any form of sales and use tax whatsoever. Although some ESDs may have already explored the option to capitalize from this steady revenue stream, some need to explore deeper. Administrative officials need to garner a thorough understanding of the services that may be funded by the sales and use tax within their district.

Officials from ESD #1 reported that Capital Metro is currently collecting 1% of the sales tax within their jurisdiction. Administrators may discover that the number of residents who utilize this service is minimal, and that residents within their district would be better served by a better funded fire department.

ESD #2 was recently able to increase funding from sales tax revenue. ESD #2 justified a half cent sales tax shift by demonstrating to some residents the need for additional ALS resources within their jurisdiction. Pflugerville's Community Development Corporation (PCDC) believes that the loss of revenue will cause a future loss of economic development in the city's ETJ. This has caused tensions between the two organizations. Communities that have an interest in increasing revenues for their ESDs should be particularly careful to how these funds will be increased, and which funds may be depleted as a result of the increase in funding. The decrease in funding to the PCDC could jeopardize the potential for increased tax base within the district.

In some jurisdictions within Travis County, the Capital Metropolitan Transportation Authority provides transportation services to residents within ESD jurisdictions. These services may include, in some remote areas, shuttle services to indigent and handicapped people. City and County officials should periodically perform a needs assessment of these services to discover if these services that are funded by the local sales tax are necessary and cost-effective.

Other ESDs have taken full advantage of the sales and use tax and overlapping sales taxes. ESD #4 collects the full 1% within their district of base sales, and also collects an additional 2% in overlapping tax, most of which is not collected by Austin's Capital Metro transportation service.

Table 5.4 Sales and use tax rates in Travis County

2014 Special Purpose Districts Sales and Use Tax Rates Travis County		
ESD	**Primary Sales and Use Tax Rate (cents)**	**Overlapping Sales and Use Tax Rate (cents)**
1	0	N/A
2	1	0.5
3	2	N/A
4	1	2
5	1	2
6	1	1.75
8	0.75	1.75
9	0	N/A
10	0	N/A
11	1	1.5
12	0.5	2
13	0	0
14	1	N/A

Source: Texas Comptroller of Public Accounts

http://www.window.state.tx.us/taxinfo/local/spd.html

Restructure Ad Valorem tax maximization laws

As discussed in chapter one, previous attempts have been made to increase the ad valorem tax rate through the Texas legislature, but these attempts have proven to be unsuccessful. Although Travis County is not the only ESD within the state that appears to be facing financial shortcomings, many of the other ESDs within the state are not experiencing the same financial problems. Additionally, since Texas is a fiscally conservative state, any legislation that attempts to raise taxes on private property owners is highly scrutinized.

Incident Billing

Non-traditional billing practices are being sought by some ESDs in order to offset their ever increasing operational costs. ESD #3 has initiated the practice of billing individuals who are involved in motor vehicle accidents within their jurisdiction. A third party (revenue rescue) bills approximately $200 for each response. An additional fee is assessed if extrication type rescue services are rendered. This billing practice is done regardless of the individual's place of residence (ad valorem taxpayer status does not matter in this case). Billing is submitted very invariable, with $0 collection most times. The billing company has been instructed to not pursue payment from an individual, only from their insurance company. ESD commissioners do not want residents to be forced to make payment if their insurance carrier denies payment.

Table 5.5 Solutions prioritized based on sustainability and feasibility with barriers taken into consideration

Solutions Prioritization Model				
Solution	**Feasibility**	**Sustainability**	**Over all**	**Barriers**
Increased leadership & Accountability	H	H	H	Difficult to execute without consolidation
Creation of Centralized Data Collection Systems	H	H	H	Costly, difficult without consolidation
Consolidation (county fire dept.)	H	H	H	No authority to force consolidation, competing interests, "Robinhood" syndrome
Consolidation (metro fire dept.)	M	H	M	No authority to force consolidation, competing interests, prior attempts to merge ESDs with AFD failed
Grant Funding	H	L	M	Revenue front loaded, Minimal revenue generated over time
Create/Increase Sales Tax Rate	H	M	M	Annexation, competition with other services
Creation of Overlapping Tax Districts (Internal EMS Service)	L	H	M	Voter disapproval, municipality disapproval, High front end costs
Incident (collision) Billing	H	L	M	minimal revenue
Municipal Subsidies	L	H	M	municipality disapproval
Restructure ad valorem tax	L	H	M	Legal and political obstacles are difficult to overcome, Numerous attempts already made unsuccessfully
Add Automatic Aid Agreements	M	M	M	IAFF lawsuit
Increase Revenues from fees (inspections, permits etc.)	M	M	M	Services (inspections) may not be offered, revenue not sustainable or cost effective in some cases
contract for service	L	M	L	Cities pay little for ESD service, no incentive to adopt this model
Fundraisers	M	L	L	Minimal revenue, not cost effective

Conclusion

There is no question that the majority of ESDs in Travis County are failing to provide adequate fire protection for their citizens. The alarming deterioration of fire protection will only worsen without a well-planned solution that takes long-term funding and overall sustainability into consideration. The culmination of the efforts put forth during this ESD evaluation process have proven consolidation to be the most appropriate solution to the problems faced by Travis County ESDs.

Although a good faith effort has been put forth by many of the ESDs to partially mend major performance gaps, these individual ESDs do not possess the ability to solve these long-term sustainability problems. The consolidation effort must be a collaborative effort where ESD managers put the public's safety before their own individual interests. Previous failed attempts at incremental city-county consolidation have proven that each organization must be willing to make compromises throughout the consolidation process. This shared effort will include collaboration amongst County Commissioners, ESD Chiefs, state representatives, city/local government representatives (which operate within each ESD), and Travis County emergency service managers.

A comprehensive county-wide consolidated fire protection system would provide for a more financially efficient and responsive service that would be better prepared to meet the demands of the communities they serve. Some ESDs mentioned in this study are already on life support. Many others will be on life support in the near future and will ultimately become insolvent without expedient corrective action by public safety managers and ESD administrative staff representatives.

Recommendations for Future Research

Future research for this project needs to evaluate the length of sustainability for each ESD in Travis County given current expenditures, revenues, annexations and financial liabilities. It is only a matter of time before every ESD becomes unsustainable, and ultimately, financially insolvent.

The political obstacles encountered to increase ad valorem tax ceilings also need to be explored. This could involve evaluations of the bills that were drafted during the legislative process, origins of opposition, and reasons for the opposition.

Given the fact that consolidation is the most feasible and sustainable option, future research should explore both advantages and disadvantages of the formation of a large metropolitan fire department (AFD inclusive) versus a consolidated county fire department (inclusive of ESDs only). Incremental consolidation versus a blanket consolidation process should also be explored along with a plan to restructure administrative staff.

Abbreviations and Reference List

Austin Fire Department – (AFD) Municipal fire department whose primary role is fire protection within the Austin city limits. This department operates out of the City of Austin general fund for public safety and not subject to an ad valorem tax structure.

Authority Having Jurisdiction – (AHJ) The organization responsible for handling emergency incidents within the specified response area

Advanced Life Support – (ALS) A set of advanced skill life-saving protocols and skills that extend Life Support to further support breathing and circulation. These skills include interventions such as Intravenous fluid administration, endotracheal intubation and medication administration.

Basic Life Support – (BLS) Level of medical care which is used for victims of life-threatening illnesses or injuries until they can be given advanced level life support or full medical care at a hospital.

Computer Aided Dispatch – (CAD) A method of dispatching emergency services assisted by computer.

Compressed Air Foam System - (CAFS) A system used in firefighting to deliver fire retardant foam for the purpose of extinguishing a fire or protecting unburned areas from becoming involved in flame.

CE-BAR – (ESD 10) ESD response area includes the Barton Creek area of Western Travis County adjacent to ESD 6 and ESD 9.

Clinical Operating Guidelines (COGs) written physician directed protocols intended to optimize patient care that are informed by a systematic review of evidence and an assessment of the benefits and harms of alternative care options

Emergency Care Attendant – (ECA) Responds to emergency calls as a first responder, using a minimal set of basic medical skills and procedures that they have been trained and directed to do.

Emergency Medical Service (s) – (EMS) Type of emergency service dedicated to providing out-of-hospital acute medical care, transport to definitive care, and other medical transport to patients with illnesses and injuries which prevent the patient from transporting themselves.

Emergency Medical Technician - (EMT) A form of medical first responder trained to perform life support skills to the sick and injured whereas B = Basic, I = Intermediate, P=Paramedic

Emergency Service District – (ESD) A political subdivision of the State of Texas, similar to a School District, Library District or Hospital District, which may provide fire protection, emergency medical services or both.

Extraterritorial Jurisdiction – (ETJ) The external territory surrounding a city which gives it the legal ability to exercise authority beyond its normal boundaries.

Firefighter – (FF)

Firefighter Paramedic – (FF/PM)

Fire Suppression Rating Schedule – (FSRS)

Full Time Equivalent – (FTE) A full time worker

Gallons Per Minute - GPM

Insurance Services Office – (ISO) A provider of data, underwriting, risk management and legal/regulatory services (with special focus on community fire-protection efforts and Building Code Effectiveness Evaluation) to property-casualty insurers and other clients

Juvenile Firesetter Intervention Program – (JFIP) A nationally standardized program to provide prevention education/intervention and referrals if warranted for children and families to reduce the frequency and severity of fires set by juveniles.

Lake Travis Fire Rescue (ESD 6, LTFR) – ESD situated in western Travis County. Situated adjacent to ESD 8 and Hays County.

Las Vegas Metropolitan Police Department (LVMPD) – A joint city-county law enforcement agency in Southern Nevada

Liters Per Minute – (LPM)

Manchaca Volunteer Fire Department - (ESD 5)(MVFD) ESD located in southern Travis County adjacent to South Austin and Hays County

National Fire Academy – (NFA) provides national leadership to foster a solid foundation for fire and emergency services stakeholders in prevention, preparedness and response.

National Fire Incident Reporting System – (NFIRS) – National system established for fire reporting and analysis capability.

National Firefighter Protection Association – (NFPA) Organization whose mission is to reduce the worldwide burden of fire and other hazards on the quality of life by providing and advocating consensus codes and standards, research, training, and education.

North Lake Travis Fire Rescue (ESD 1, NLTFR) – Fire Department whose jurisdiction is located in Northwest Travis County adjacent to Burnet and Williamson Counties.

National Registry of Emergency Medical Technicians – (NREMT) – Organization which serves as the National EMS Certification organization by providing a valid, uniform process to assess the knowledge and skills required for competent practice by EMS professionals throughout their careers and maintains a registry of certification status.

Occupational Safety and Health Administration- (OSHA) The main federal agency charged with the enforcement of safety and health legislation

Paramedic – (PM) Medical first responder trained at the highest level of prehospital care standards who employs ALS interventions

Public Protection Classification – (PPC) ISO gauges the fire protection capability of the local fire department to respond to structure fires on a property

Rapid Intervention Crew- (RIC) A team of two or more firefighters dedicated solely to the search and rescue of other firefighters in distress

Return of Spontaneous circulation – (ROSC) resumption of sustained perfusing cardiac activity associated with significant respiratory effort after cardiac arrest.

Records Management System – (RMS) A computerized data gathering system for public safety organizations

Standard Cubic Feet Per Minute – (SCFPM)

ST Elevation Myocardial Infarction (STEMI) A heart attack

Texas Department of Insurance – (TDI) A state-based national system designed to protect policyholders and to serve the greater public interest through the effective regulation of the U.S. insurance marketplace.

Travis County Fire Control – (TCFC, ESD 4)

Travis County Fire Marshal's Office – (TCFMO) – Office responsible for fire investigations, fire inspections, and fire code enforcement within the unincorporated areas of Travis County.

Texas Commission on Fire Protection – (TCFP) The state agency regulating firefighter certification programs

Travis County Fire Rescue (TCFR, ESD 11) Jurisdiction located in Southeast Travis County

United States Fire Administration – (USFA) - An entity of the U.S. Department of Homeland Security's Federal Emergency Management Agency, which provides national leadership to foster a solid foundation for fire and emergency services stakeholders in prevention, preparedness and response.

Wildland Urban Interface – (WUI) – The zone of transition between unoccupied land and human development.

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