City of Franklin, TN

DELIVERING EMERGENCY MEDICAL SERVICES

FINAL REPORT - REVISED

April 2012

Prepared by:
TriData Division,
System Planning Corporation
3601 Wilson Boulevard
Arlington, VA 22201

FINAL REPORT-REVISED

Delivering Emergency Medical Services to the City of Franklin, Tennessee

Submitted to:
Rocky Garzarek, Fire Chief
City of Franklin Fire Department
109 3rd Ave. South, Suite 133
Franklin, TN 37064
Phone (615) 791-3270

Submitted by:
Philip Schaenman, President
TriData Division, System Planning Corporation
3601 Wilson Boulevard
Arlington, VA 22201
(703) 351-8300
pschaenman@sysplan.com

April 2012

Table of Contents

Contents

EXECUTIVE SUMMARY

The City of Franklin asked TriData to analyze the current delivery of emergency medical services (EMS) to the citizens and visitors of the City. We provide the results of our analysis and several recommendations for the future of EMS delivery.

The City of Franklin is a burgeoning community in Williamson County that serves as a suburb of Nashville. Franklin is considered by many as one of the nicest places to live, with a local government that has retained its Triple 'A' municipal bond rating, even during these tough economic times.

The challenges of growth also include those of expanded public safety needs. Until recently, Franklin was a small city within a rural county. Franklin's growth has changed its position from a small city to a medium-sized urban/suburban area with an increasing population. Franklin must now consider whether its recent growth is a signal that changes are needed to how the City delivers EMS to its residents, businesses, and visitors.

Administration and Management

There are 159 budgeted positions in the Franklin Fire Department (FFD). This includes 144 positions in emergency operations and 15 administrative positions (including the fire chief, and a part-time position). One training captain and one administrative officer position are vacant. In 2010, the department responded to 5,924 emergencies, with 67 percent being EMS-related. All rescue and six engine companies are equipped and staffed at the paramedic level for EMS. All firefighters are dual role/cross-trained and hold a minimum of first responder certification.

The Fire Chief was hired in 2004, and has instituted several upgrades to the EMS system, with all full integration of paramedic first response achieved by 2007. The Fire Chief is assisted by a Deputy Chief who oversees emergency operations, including EMS. EMS administration is under the command of an EMS Officer. There are 32 licensed paramedics in the FFD, and the budget allows for up to five firefighters to attend training annually. Hiring new employees who have paramedic licensure can save the department $10,000 per employee. Thirty-six paramedics are needed to fully staff each rescue unit and fire engine with one paramedic on a 24/7 basis. Five additional paramedics are needed to achieve this goal.

EMS transportation is provided by Williamson County EMS (WCEMS) based on a Memorandum of Understanding (MOU) between the City and Williamson County. If the City chooses not to take over full EMS service, changes should be made to the MOU.

Response Times and Station Locations

We reviewed EMS call locations and response times based on data provided by the City and County communications centers. Data collection and analysis were difficult because of the

condition of the data. Overall, the response times for the FFD and WCEMS are good with few areas of concern. Between 11:00pm and 7:00am, the WCEMS reduces the number of ambulances available, challenging their ability to meet expected standards. EMS call processing times at the Williamson County 911 Center are near the two minute mark for 90% of calls. This is higher than the NFPA 1594 recommendation of one minute. Time is lost when transferring calls from the County 911 Center to the City Dispatch Center. Combining both operations would likely help reduce these times. Total 90th percentile response times for FFD first responders in 8:19, two minutes above NFPA 1710 guidelines. Most of the time deficiency could be corrected by greater dispatch efficiency. Using closest unit response will also decrease response times.

WCEMS units had a 90th percentile response time of 12:41, which is three minutes higher than the national guidelines. When the two units regularly assigned to Franklin are available, the 90th percentile response time drops by one minute.

City of Franklin stations are appropriately located. Two additional stations are planned for to improve coverage in the south and west part of the city. For EMS purposes, Station 7 (south) should be given first priority, even if it must start out as a medic station. Overall, current station locations pose no threat to quality EMS.

EMS Operations

EMS response issues are minimal with many that could be handled by changes in dispatch procedures. EMS demand is projected to increase yearly, reaching 4,500 by 2015. If the City chooses to add full EMS service, three paramedic transport units should be sufficient, with an additional unit possibly needed by 2015. Fears of reduced fire suppression response efficiency are likely overstated. Possible discrepancies could be reduced by (a) full adoption of a medical priority dispatch program, and (b) full use of an automatic vehicle locator (AVL) system that can help assure closest unit response.

There are concerns that FFD paramedics are not able to fully use their paramedic skills, leading to skill decay. We examined three skills, and the results do not support these concerns. Intravenous therapy (IV) Intraosseous (IO) and Endotracheal Intubation (ET) success rates between a national sample and Franklin paramedics revealed no statistically significant differences.

Current EMS quality management is done by the WCEMS program. Regardless of the choice made by the City, efforts for a local quality management program should be enhanced. A primary concern will be the addition of an electronic patient care report (E-PCR) program that will enhance data collection and quality management. Addition of the E-PCR program will cost just under $15,000.

Future Considerations

The City should assume the following as a basis for making future EMS decisions.

1. The City's population will continue to grow.
2. WCEMS will continue to experience increased EMS demand throughout the County.
3. In 2012, the City of Franklin should receive 4,200 requests for EMS, with a 5 percent annual predicted increase through 2015, surpassing 4,500 EMS responses.

The City should choose from the following recommendations:

1. Continue with the current EMS delivery model.
2. Continue with the current EMS delivery model and charge Williamson County EMS a first responder fee. The fee would provide for up to $450,000 to offset first responder expenses.
3. Takeover the provision of full-EMS service and collect up to $200,000 after first year expenses, and up to $300,000 to $700,000 annually (depending on whether three or four ambulances are staffed) thereafter. If this option is chosen, the City will be required to obtain Tennessee State licensure for the service, and have their units inspected annually. A separate medical director will also be needed.

ACKNOWLEDGEMENTS

TriData realizes that a successful project is dependent on the assistance and guidance from many constituents. We especially acknowledge the assistance of Fire Chief Rocky Garzarek and his staff for their dedication. We also acknowledge the following personnel for their assistance.

City of Franklin Officials

The Honorable Ken Moore, MD	Mayor
Eric S. Stuckey	City Administrator
Russell Truell	Assistant City Administrator of Finance and Administration
Shauna Billingsly	City Attorney
David Rahinsky	Chief, Police Department
Fred Banner	Director, Management Information Technology
Bruce Bateman	Deputy Chief, Police Department
Kevin Teague	Lieutenant, Police Department
J. Ryan Tate	Assistant Communications Supervisor
Michael Proctor	Management Information Technology
Tom Voss	Management Information Technology

Franklin Fire Department

Rocky Garzarek	Fire Chief
Michael Culberson	Deputy Chief
Todd Horton	Assistant Chief
Andy King	Fire Marshal
Sarah B. Glenn	EMS Officer
Nathan Goodin	President, IAFF Local 3758

City of Franklin EMS Community

Donna Tidwell	Director, Tennessee Department of Health, Division of EMS
Dennis Miller	Chief Executive Officer, Williamson Medical Center
Allen Lovett	Director, Williamson Medical Center
Steven Ragle II	EMS Medical Director, Williamson County EMS
Michael Wallace	Clinical Services Manager, Williamson County EMS
Bill Jorgensen	Director, Williamson County Office of Public Safety

TriData

Phillip Schaenman	Corporate Oversight
Dr. Harold C. Cohen	Project Manager
Robin Davis	GIS/Data Specialist
Steven Cohen	Senior Consultant
Maria Argabright	Executive Assistant

I. INTRODUCTION

The City of Franklin hired TriData, a professional emergency services consulting firm, to assess the future of emergency medical services (EMS) in Franklin. Currently, the City provides first responder advanced life support services, with EMS transportation being provided by Williamson County EMS, and managed by Williamson Medical Center.

Governmental Structure

The City of Franklin is governed by an elected council of nine citizens known as the Board of Mayor and Alderman. The Mayor and each Alderman are elected to four-year terms. The day-to-day workings of the City are overseen by an appointed City Administrator who is assisted by two Assistant Administrators.

Franklin has a budget of approximately $53 million that increased by 3 percent last year, the first increase in three years. The budget is still 11.9 percent below the FY 2008-2009 level. The City is fortunate to have earned a Triple 'A' bond rating from Standard and Poor rating service. Sales tax revenues increased by 3.5 percent and property tax revenues held steady. In December, the City will be able to grant employees a two percent raise, and no layoffs are forecasted. These actions were possible because the City will not fill 43 vacant positions.[1]

Population – Until recently, Franklin was a rural, agricultural based community with a small population. Within the past 20 years, Franklin's population has blossomed to 62,000, and is predicted to reach 70,000 to 75,000 within the next 10 years.

Franklin's population change is likely due to several factors including:

1. The City becoming a bedroom community for Nashville, which is 20 miles away. That includes high-value housing;
2. An increase in tourism, especially to Civil War historical sites; which is expected to continue
3. An increase in white-collar industry, that includes major employers in the healthcare, business, and technology industries; and
4. Investment by business and local leaders making Franklin one of the best places to live.[2]

[1] Stuckey, E. (2011). City of Franklin, *TN: Approved budget for FY 2011-2012*. Approved by the Board of Mayor and Alderman.
[2] Personal Communications,

The City of Franklin appears to be meeting the challenge of growth, having received several awards including: Money Magazine's Top 20 Places to Retire, Money Magazine's Top 100 Places to Live, and Top 10 Bloomberg/Business Week Best Place to Start a Business.[3]

The Challenge of Growth and EMS – The burgeoning City of Franklin is not without challenges, with one area being public safety. Transformation of a small, municipality into a city that generates over one-half of the EMS demand within Williamson County is just one of the changing dynamics in city-county relationships. There is concern that the access to and quality of emergency care may be compromised.

The Changing Healthcare Dynamic – The current EMS provider is managed by Williamson Medical Center, a county-owned hospital that has recently been the subject of takeover by a large, private medical conglomerate. Recent rumors of a sale have started to quiet down, but a private buyout may eventually occur. Should this occur, the County EMS system could change. Several private healthcare systems have questioned the benefits of operating EMS systems. Some hospitals used to provide ambulance service as a way to bring patients to their hospital. As the EMS system matures, protocols designated specialty centers, and limited-service facilities now guide patient transport destinations. These dynamics have caused hospitals to consider abandoning EMS transportation as an unprofitable liability.

Uncompensated Service Provision – During better economic times, little was said about fire departments providing first responder services gratis tor outside ambulance services. Fire departments that provide EMS first response often reach patients quickly, provide essential emergency care, and provide staffing that assists ambulance service with care and preparation for transportation to the hospital.

The provision of first responder services allows the transport agency to staff fewer ambulances, and decreases the need for rapid response by ambulances. These variables beg the question, "Should the City provide free EMS first response for outside ambulance agencies?" And if "the county ever sells Williamson Medical Center to a private entity, should the City provide free service to a private, for-profit corporation?"

Even if the City does not become the primary EMS provider, the above challenge must be answered. The financial chapter of this report will provide specifics on the potential financial impact to the City.

[3] City of Franklin. (2011). About Franklin. Retrieved from: http://www.franklin-gov.com/index.aspx?page=57

II. ADMINISTRATION AND MANAGEMENT

The City of Franklin Fire Department (FFD) is commanded by the fire chief, whose staff includes one deputy chief, two assistant chiefs (including a fire marshal), three battalion chiefs, and an EMS officer. There are 159 budgeted positions in the department. This includes 144 positions in emergency operations and 15 administrative positions (including the fire chief, and a part-time position). The current vacancies include five in emergency operations, one training captain, and one administrative officer. Officers and firefighters below the rank of assistant chief are represented by IAFF Local 3758. In Franklin, there is no recognition of collective bargaining, so there are no actual labor contractual rights or obligations.

In 2010, the department responded to 5,924 emergencies, with 67 percent being EMS-related. Responses are made from six stations. There are seven engine companies, three truck companies, four rescue units, and additional specialty services units available on a 24/7 basis. All rescue and six engine companies are equipped and staffed at the paramedic level for EMS. All firefighters are dual role/cross-trained and hold a minimum of first responder certification. All but 24 personnel are EMT certified and all new employees (and those hired after 2007 are required to obtain and keep EMT certification). Two additional stations are planned for the southern and western part of the City and their completion dates will depend on economic conditions.

Fire Chief

The fire chief is hired by and reports to the city administrator. The current fire chief was hired in 2004. Upon his appointment, he challenged his senior staff to improve the department and increase its professional standing. Franklin's ISO rating has improved from a Class 4 in 2004 to a Class 2 in 2009. EMS provider level has increased from first responder in 2005 to full ALS first response capabilities in July 2007.

The fire chief has considerable EMS experience, and has worked as a paramedic for fire-based EMS departments. Among his core objectives was to provide paramedic response capability from every station which was achieved in January 2009.

Deputy Chief

The FFD has one deputy chief who supervises operations. EMS falls under the deputy chief of operations. The operations deputy chief is responsible for day-to-day operations, and supervises the shift battalion chiefs and company officers. EMS operational issues are usually handled by the operations staff, while EMS administration is handled by the EMS Officer. Currently, EMS training is overseen by the EMS Officer, but there is considerable interaction with the training division and the Deputy Chief of Operations. A considerable amount of EMS

continuing education involves fire suppression, rescue, hazardous materials, and special operations that are the responsibility of the training division.

Assistant Chiefs

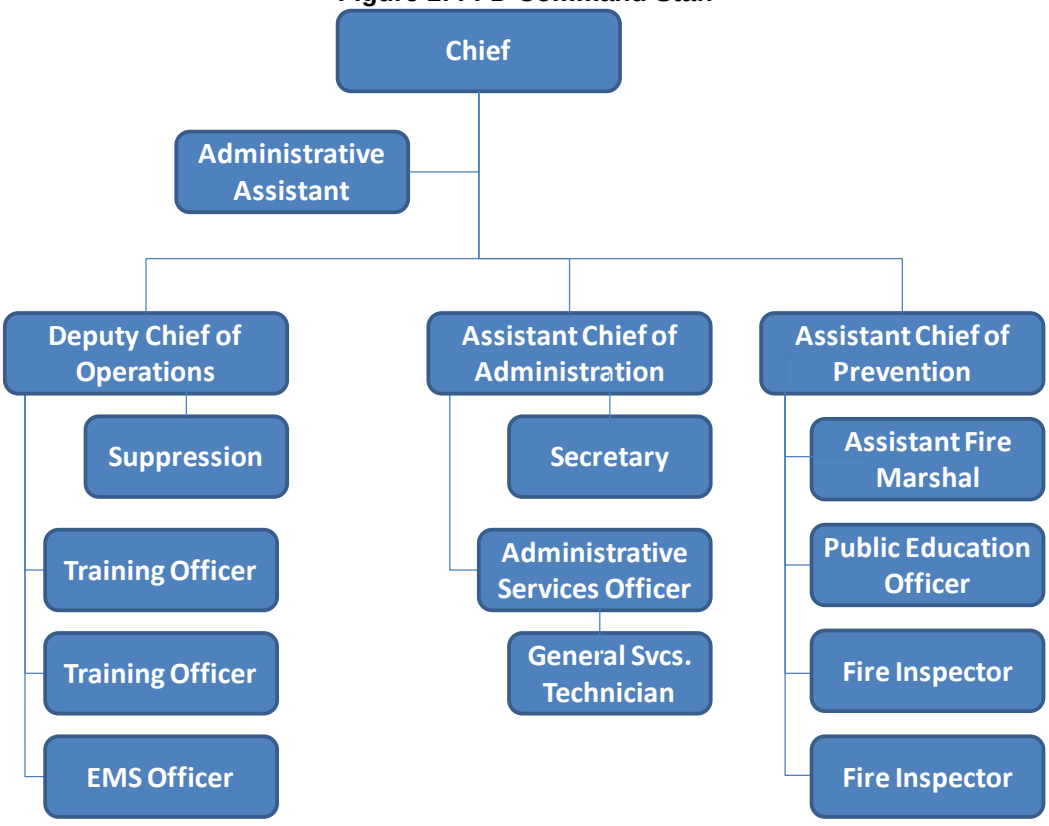
The FFD has two assistant chiefs, the Assistant Chief of Administration and the Fire Marshal. Communications and data management, including that related to EMS, falls under the Assistant Chief of Administration.

EMS Officer

The EMS officer is a non-sworn employee with administrative oversight of EMS including: training, electronic reporting, quality management, logistics, liaison with the Williamson County EMS system, Tennessee State EMS Office, and other regulatory agencies. The EMS Officer reports to the Deputy Chief of Operations, but also interacts with other command staff members. The EMS Officer position does not carry a traditional rank designation.

Figure 1 shows the Franklin Fire Department command staff.

Figure 1: FFD Command Staff



Paramedics and EMTs

There are currently 32 licensed paramedics (including the EMS Officer who is single role) in the department who are all dual role/cross-trained in fire and EMS disciplines. Budget allotments currently allow for up to five incumbent personnel to apply for paramedic school. Paramedics are usually assigned to one of three rescue units, but may also be assigned to other suppression apparatus. A paramedic stipend of $4,500 per year is provided and counts towards the providers' average final compensation. The department provides all continuing education training and pays overtime for the credentialing process. Personnel who are seeking employment are given additional points for having their paramedic license or National Registry of EMTs paramedic certification. Paramedic preference is appropriate because sending someone to paramedic school and paying their salary (often paying overtime) can cost the city $10,000 or more.

Recommendation 1: Continue to award preference points for applicants who possess their paramedic license or National Registry of EMTs Paramedic certification.

Every firefighter is expected to maintain their EMT license throughout their employment. EMT has become a prerequisite for hire. Potential firefighter recruits have several community colleges where EMT is available. Requiring EMT as a pre-requisite is valuable because it saves the department up to six weeks of training time and salary. An EMT course for 10 recruits, including instructor salaries could cost over $45,000.

Recommendation 2: Continue to require EMT licensure as a prerequisite for employment, and as a condition of continued employment.

Paramedic Staffing Model – There are no absolute standards that define how many paramedics to staff each unit or the total number. Table 1 indicates the number of paramedics needed to staff three paramedic ambulances or three paramedic rescue units.

Table 1: Paramedic Staffing Factor

Step A	Days in a Year	365
Step B	Number of Hours of Daily Staffing	24
Step C	Number of Hours per year (A X B)	8760
Step D	Number of Shifts	3
Step E	Number of Hours Scheduled per Employee/Per Year (C/D) plus adjustment	2912
Step F	Subtract Number of Hours Leave or Away from Assignment	700-(estimated)
Step G	Number of Productive Hours per Employee/Per Year (E-F)	2212
Step H	Staffing Factor (E/G)	1.32
Step I	Number of Employees Needed per position for 24/7 Staffing (H/D)	3.96

In order to staff three paramedic ambulances and six paramedic engines with at least one paramedic, the following paramedics are needed:

- Nine paramedics positions per shift *x* three shifts = 27 FTE Paramedics
- 27 FTE Paramedics *x* 1.32 = 36 (35.64) FTE Paramedics needed

The FFD will need to train four additional paramedics to achieve the above staffing goals.

Williamson County EMS

Williamson County EMS (WCEMS) is a cooperative service between Williamson Medical Center and the Williamson County Office of Emergency Services. As the state licensed EMS agency for the County, EMS provided by all first responder agencies is overseen by the WCEMS.

Memorandum of Understanding – There is a Memorandum of Understanding (MOU) between the City of Franklin Fire Department and Williamson County EMS. Though it is titled as MOU, it reads more like a contractual agreement. An MOU may be considered a contract, but an MOU may not carry the legal weight of a contract. What is the purpose of MOU between the two parties is it cooperation or is contractual? They should be partners in this venture, with the goal of providing the best emergency medical care to residents and visitors of Williamson County.

In *Section II Nature of Calls* the language *"*must be notified of any first responder agency dispatch" reads like contract language versus an understanding that both parties agreed upon. There are other examples of this in the document that includes specific lists of medications, equipment, type of staffing type of certifications, communications, and how to act on a the scene. *Section VII, item B* states that the first responder when they arrive on the scene will provide 4 steps that include secure the scene, perform the ABCs, begin resuscitative measures, and obtain a brief history. This does not belong in MOU; it should be placed in system medical protocols or procedures.

The section *Urgent Calls* describes what types of calls the fire department will respond on. We caution including this type of list, unless they are using a valid Emergency Medical Dispatch protocol that determines if a first responder response is warranted. For example, dizziness is not listed, but is often a significant emergency. Dizziness in an elderly patient can be caused by numerous aliments from stroke to a heart condition. The MOU reads more like a working contract without the penalties if the terms stated are not met by the first responder.

The MOU may be a simple document that may include the following sections: *Service Responsibility*, *Logistics*, *Operating Guidelines*, and *Terms*. The *Service Responsibility* section should outline what is expected from both agencies. *Logistics* may include staffing levels,

locations of the first responder stations or posts, and minimal equipment needed to operate as first responder. The *Operating Guidelines* may include policy guidelines from the fire department, WCEMS and the State of Tennessee Office of EMS. The *Terms* section of the MOU would be from the date of execution by both parties through a mutually agreed upon ending date. The MOU should be reviewed annually. The MOU may be amended by agreement between both parties.

Recommendation 3: If the delivery model remains the same, the City of Franklin and WCEMS should revise the MOU as recommended above.

III. RESPONSE TIMES AND STATION LOCATION

This chapter discusses current response times and the deployment of fire and EMS stations and emergency response apparatus in Franklin. As discussed in the previous chapters, there are many factors that should be taken into account when determining the appropriate number of stations, including demand for services, population, density of demand and population, size of the jurisdiction, and desired response times.

Approach

Before any analysis took place, project team members gathered and reviewed information related to properly locating fire stations, including:

1. Current apparatus deployment
2. National response time standards
3. Current FFD response time standards
4. Current and projected population in Franklin
5. Current and projected demand and workload

Actual incident data were gathered from the FFD and the Williamson County Emergency Communications Center (WCECC), which serves as the dispatch center for Williamson Medical Center (WMC). Data included addresses for geocoding, type of incident, units responding, and overall response times.[4] Geographic information system (GIS) files used for the analysis were provided by the city.

Response Time Standards

The first step in deployment analysis is a review of department-wide response times. Response time is the total amount of time elapsing between an individual calling 911 and emergency service personnel arriving at the scene. Response time can be broken down into multiple segments for analysis (call processing, dispatch, turnout, and travel time). The following provides some background standards and guidelines and then provides analysis of FFD response times.

Response time is one of the most common performance measures used by the fire service because it is understood by citizens, easy to compute, and useful in the evaluation of end results. It is the way most citizens evaluate the level of service provided; though, response time itself

[4] Geocoding is a process by which the street address of an emergency incident is translated into latitude and longitude so that it can be placed onto a map.

really is not a measure of the quality of service, though it does reflect the timeliness of service, which is one attribute desired by citizens.

While demand for services and individual unit workloads dictate how many stations and apparatus are needed in a community, the goals for response times dictate where specific resources should be placed. Though there is no single set of nationally accepted response time standards, NFPA 1710 and CAAS provide generally accepted response time standards for career fire departments and delivery models for ambulance services.

Measurement Methodology

To measure overall response time, the clock starts when an individual calls 911 (or alternate emergency number) and stops when the first emergency provider arrives at a patient's side or the scene of the incident.

Several caveats should be kept in mind. First, response times are subject to a variety of measurement errors and only measure one aspect of system performance. For example, response times are distorted when units report their arrival on scene either early or late. Second, response times are frequently not comparable across fire-rescue systems because of the differing manners in which they are calculated. Not all departments track vertical response times (that is, the time from arrival on scene to patient contact), so their total response times likely would be lower than the total response times of the few departments that do track them.

Many fire/EMS departments report average response times while others report *fractile* response times.[5] Average response times have been less and less used by the emergency service industry because small numbers of very short or long responses—often recorded in error—can distort the results. Also, the public is interested in how fast a system responds in most cases (fractile) rather than the average. More and more departments are adopting the 90th percentile for reporting response times (mostly due to NFPA 1710's use of this measure).

A fractile response time of, for example, 8 minutes at the 90th percentile means that units respond in 8 minutes, or less, 90 percent of the time. The remainder beyond the compliance fractile (90th percentile in this case) is the operational tolerance for the system, meaning the system is designed with the understanding that 10 percent of the calls will have response times over 8 minutes. Although it is possible to design a system that may ensure rapid response close to 100 percent of the time, it is generally not cost-effective.

Response times here are defined to include four components, which are further illustrated in Figure 2.

[5] Fractile measurement reports the percentage of calls responded to in *x* minutes.

Call Processing & Dispatch – Time begins when the call taker/dispatcher answers the 911 call and ends when the first unit is dispatched.

Turnout – Time elapsed between dispatch to departure from the station (or other location); it comprises activities such as donning protective gear and boarding the apparatus.

Travel – Time period begins with departure from the station and ends when the unit advises that they are on the scene. It does not include the time to actually reach the fire or patient after arrival at the street location of the incident.

Vertical – Time period begins when the unit arrives on scene and ends when personnel arrive at the side of the patient or the site of the fire. It may include going up a high-rise (and hence the term vertical response) or traveling within a hospital, shopping mall, golf course, factory, arena, stadium or other expansive site to get to the site of a fire or the side of a patient. Most departments do not record the vertical response time component.

Figure 2: Components of Total Response Time

Response Time (lay public conception)			
911 call received → **Units dispatched**	→ **Apparatus en route**	→ **First unit on scene**	→ **Arrival at patient/fire**
Call Processing – Begins when the emergency call is answered and ends when emergency responders are dispatched to the identified address of the call. Additional activities and information gathering may take place after notification of responders, but this is not included in call processing time.	**Turnout** – Begins when emergency responders are notified and ends when appropriate emergency apparatus actually leaves the station en route to the location of the emergency.	**Travel (Drive)** – Begins when the first appropriate emergency apparatus actually leaves the station and ends when the first appropriate apparatus arrives at the scene of the emergency.	**Vertical** – Begins when the first appropriate apparatus arrives at the scene of the emergency and ends when personnel arrive at the patient's side or the fire location.

Another component that assists with performance measure is when after arrival with patient, CPR or defibrillation occurs. Neither FFD nor WMC currently record the "with patient" or "CPR/defibrillation instituted" times for EMS calls. While this time is difficult to reduce, it is important to assess its impact on total response time and determine whether other components should be reduced to compensate for the vertical response component to maintain total response time goals. For example, buildings with average vertical response times over two minutes and over *x* calls per year may be classified as higher priority locations and resources placed closer in order to reduce total response times. Another option would be to assist these residents or businesses in starting a local response team to provide quick access to CPR and even defibrillation. For AED placement times, technology and clock synchronization may be used in lieu of extra radio transmissions.

Recommendation 4: The FFD should begin to record measurements for "with patient" and for "CPR/defibrillation instituted."

This also allows for realistic expectations for cardiac resuscitation outcomes. A response time of five minutes to the door is different than five minutes to the patient's side on the 30th floor. A longer interval of patient collapse to care time lessens the likelihood of successful resuscitation. Travel times of four minutes to a bedroom community may yield different outcomes than to urban, high-rise communities, because as the "with patient" times increase in high rises the probability of successful resuscitation decreases. Data on "with patient times" helps demonstrate the importance of community efforts such as Community Emergency Response Teams (CERT), industrial brigades, or high rise teams sent to industrial or high-rise locations.

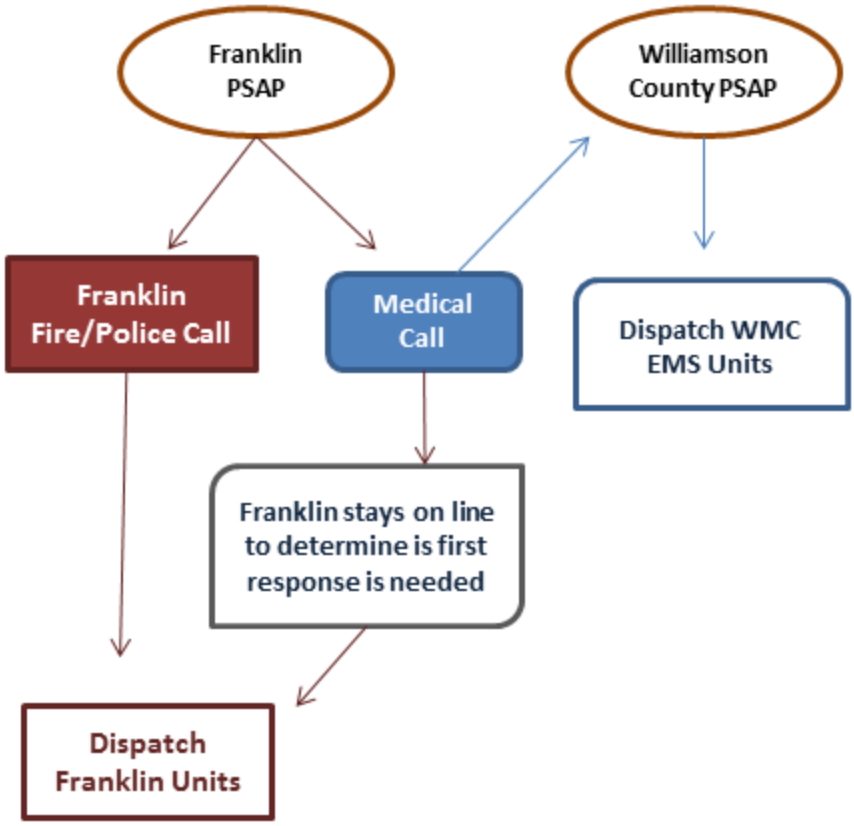
The analysis of response times here includes emergency incidents only, with a focus on emergency medical service (EMS) calls for the turnout and travel segments of the response.

Since three different agencies (FFD, WCECC, and WMC) are involved in emergency medical calls in Franklin, there are different data sets with different results to analyze. Some calls had invalid entries (did not have a time recorded) or obvious errors (unit arrived before the call came in) that were excluded from the dataset. To eliminate outliers that may distort the response statistics, times that were more than three standard deviations from the mean were excluded. If travel times have a statistical "normal distribution", 99.7 percent of incidents are expected to fall within three standard deviations. The removed 0.3 percent of incidents usually contains errors that can distort the analysis results.

Call Processing and Dispatch – Call processing time includes both call processing (taking down necessary information) and dispatch (notifying the appropriate units). Some CAD systems track each time segment separately but most do not. This section will analyze the two different call processing and dispatch operations that occur in Franklin.

There are three public safety answering points (PSAP) located in Williamson County. The cities of Franklin and Brentwood each have a PSAP that will dispatch fire and law enforcement calls within their jurisdictions. The Franklin PSAP is operated and staffed by the Franklin Police Department. The WCECC serves as the PSAP for unincorporated Williamson County. WCECC also handles the dispatching for emergency medical calls within Williamson County, including the city of Franklin. When an emergency medical call comes into the Franklin PSAP, it is transferred to Williamson County. The Franklin dispatcher then monitors the line to determine if first responders from FFD are required. The dispatcher must then identify and dispatch the first responders and notify WCECC that first responders are en-route. Figure 3 shows the call processing and dispatch relationship between FFD and WCECC for emergency medical calls.

Figure 3: Dispatch Process for the City of Franklin and Williamson County



Although WCECC and WMC are not the focus of the study, they play major roles in the EMS response phase. Also, any analysis of or changes to FFD response performance will have to consider WCECC and WMC because most customers will not perceive a difference between the agency that dispatches (WCECC) and the responders (FFD or WMC).

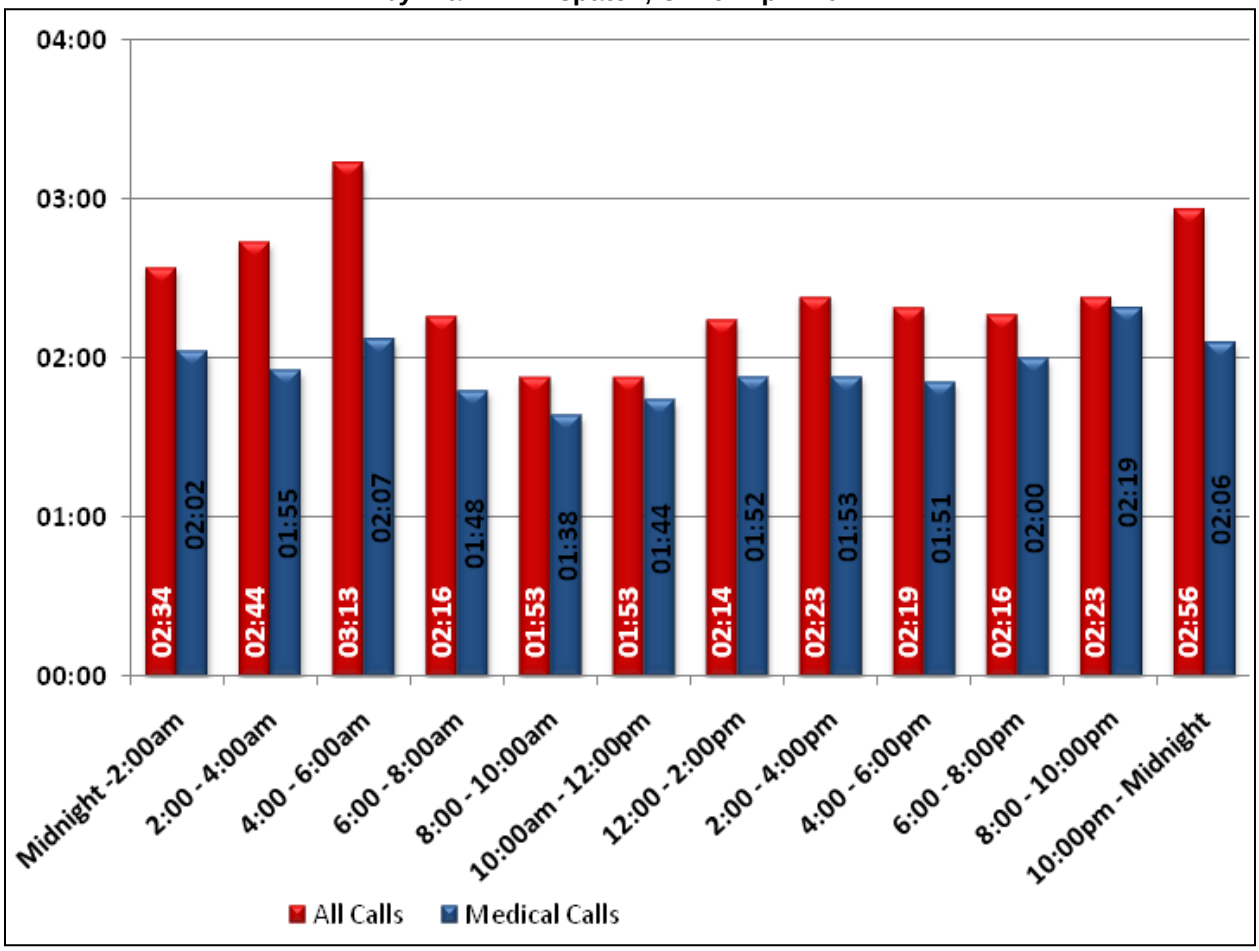
Franklin Dispatch

From CY10-April 2011, call processing and dispatch times for FFD averaged 01:15 with a 90th percentile time of 02:19. When examining the results by call type, EMS calls had a 90th percentile time of 01:53. EMS calls were processed more quickly than other call types, but above the goal of one minute. All call types are just below or just above two minutes 90 percent of the time.

Some variation can be expected by time of day to correspond with heavier or lighter call volumes. Figure 4 depicts the variation in 90th percentile call processing time by time of day for all call types (red column) and EMS calls (blue column). Call processing times for EMS calls ranged from a low of 01:38 between 8:00am and 10:00am to a high of 02:19 twelve hours later

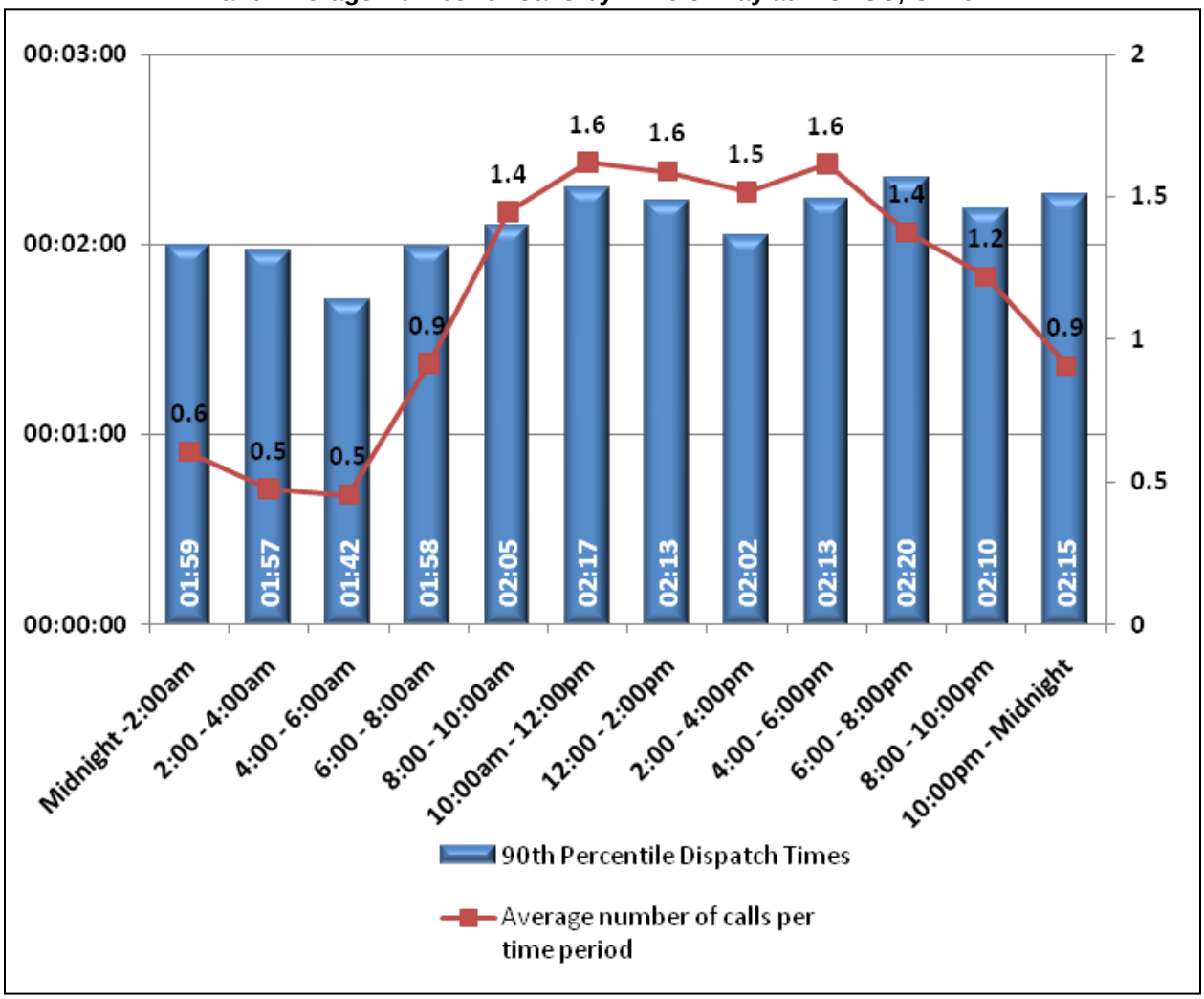
between 8:00pm and 10:00pm Call processing times were lowest between 6:00am and 10:00pm, but hovered near the 2:00 minute mark. From 10:00pm to 10:00am call processing times at the 90th percentile for all calls increased to around 3:00 minutes. Franklin call processing times are inversely related to average call volumes throughout the day, with call processing times peaking when call volumes are at their lowest levels. This is likely due to fewer dispatchers being on duty.

Figure 4: 90th Percentile Call Processing Times (All Calls and EMS Calls) by Franklin Dispatch, CY10- April 2011



Williamson EMS Dispatch – For CY10, call processing and dispatch times for WMC averaged 01:14 with a 90th percentile time of 02:11. Figure 5 depicts the variation in 90th percentile call processing time by time of day for EMS calls at Williamson County Emergency Communications Center. Call processing times for EMS calls ranged from a low of 01:42 between 4:00am and 6:00am to a high of 02:20 between 6:00pm and 8:00pm.

Figure 5: 90th Percentile Call Processing Times for EMS Calls and Average Number of Calls by Time of Day at WCECC, CY10



Call processing times were lowest in the early morning hours but stay around the 02:00 minute mark throughout the day. Average call volume for that time segment is shown as the red line in Figure 5. For the most part, call processing times closely mirror average call volumes throughout the day, with call processing times peaking when call volumes are at their highest levels, with a slight variation at night when call volume decreases but call processing times do not. The critical time is to dispatch the first unit; further call processing can occur simultaneously (i.e., talking more to the caller to obtain details).

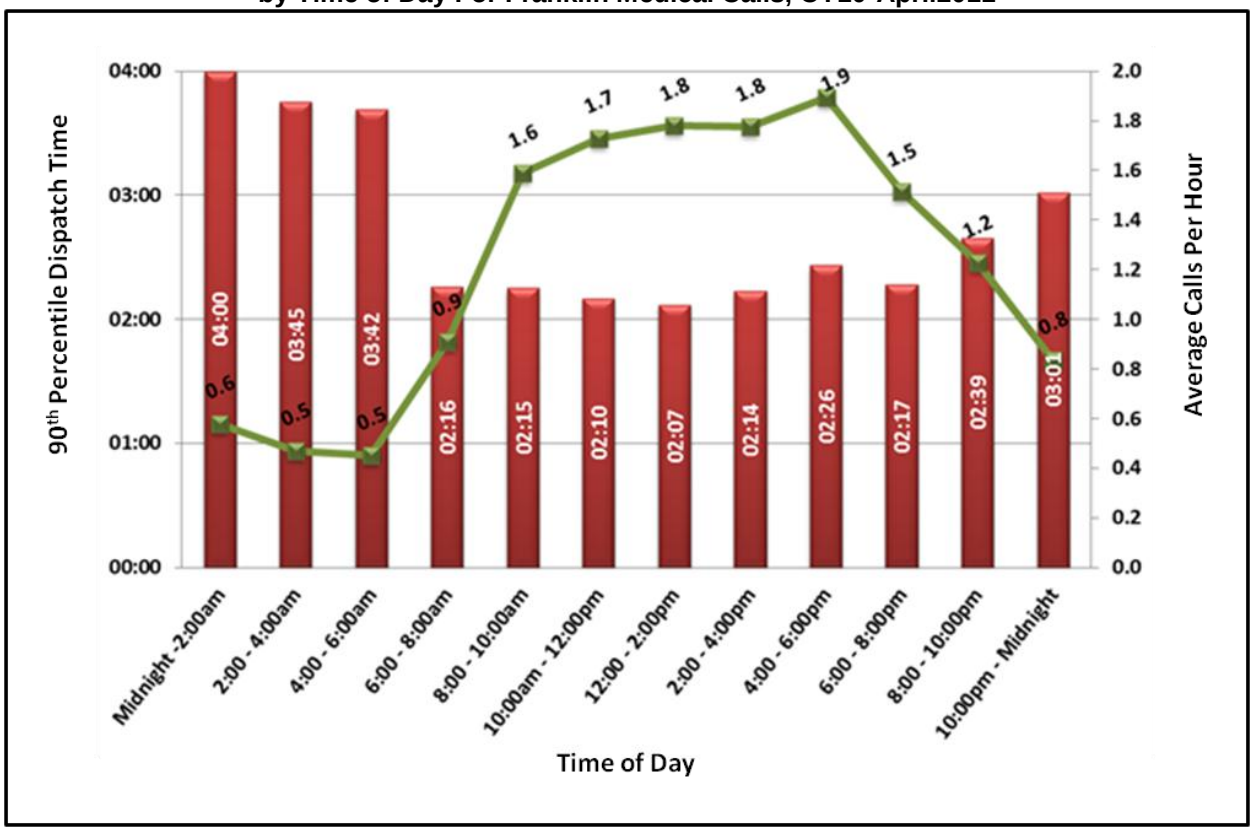
Recommendation 5: Review the call processing and dispatch process with Franklin Police Department, Williamson County Emergency Communications Center and Williamson Medical Center EMS to determine whether any changes can be made to improve call processing and dispatch times.

Turnout Time – Turnout time is measured from when the alarm is received by operations personnel to when the apparatus begins driving to the incident scene. Travel or drive time is the time it takes to go from the station, or wherever the unit is, to the emergency incident. Together these segments represent the response time. National standards, such as NFPA 1710, suggest a response time of five minutes: one minute for turnout and four minutes for travel time. For the purposes of this study, these segments will be analyzed individually since that is how they are recorded.

Franklin Turnout – The average turnout time for all call types in Franklin for CY10 – April 2011 was 01:53, with a 90th percentile time of 03:11, which is 02:11 higher than the recommended time of 1 minute. The average turnout time for medical calls was 01:24, with a 90th percentile time of 02:40. When viewed by unit and call type, 90th percentile turnout times for rescues and engines are 02:28 and 02:45, respectively, for medical calls and 02:55 and 02:56 for all call types, respectively. These units, which provide advanced life support (ALS) first response, are 90 to almost 120 seconds over the 1 minute goal for turnout.

Like call processing, turnout times can vary with the time of day. Figure 6 shows the 90th percentile turnout times and average number of calls for EMS incidents in Franklin by time of day. Turnout time increases at night because responders are often sleeping. Even though EMS responses do not require the donning of bunker gear, 90th percentile turnout times at their best are double the recommended time of 1:00 minute. FFD should review policies and procedures to see if there are any means of reducing turnout times. The problem of not having specific unit dispatch may contribute to longer turnout times (see below).

Figure 6: 90th Percentile Turnout Times and Average Call Volume by Time of Day For Franklin Medical Calls, CY10-April2011



Williamson EMS Turnout – The average turnout time for WMC Medics for CY10 was 01:09, with a 90th percentile time of 02:01, double the recommended time of 1 minute. When viewed by unit, M12 and M14 have 90th percentile turnout times of 01:58 and 02:11, respectively. These two units are located in the City of Franklin and perform the majority (71%) of EMS responses in the City. Table 2 shows the 90th percentile turnout times for CY10 for WMC EMS units responding in Franklin. The disparity of close to one minute in turnout time is of interest. If WCEMS units are at the emergency department when they receive many of their calls, it may take longer to physically get to the unit.

Table 2: 90th Percentile Turnout Time by WMC EMS Unit in the City of Franklin, CY10

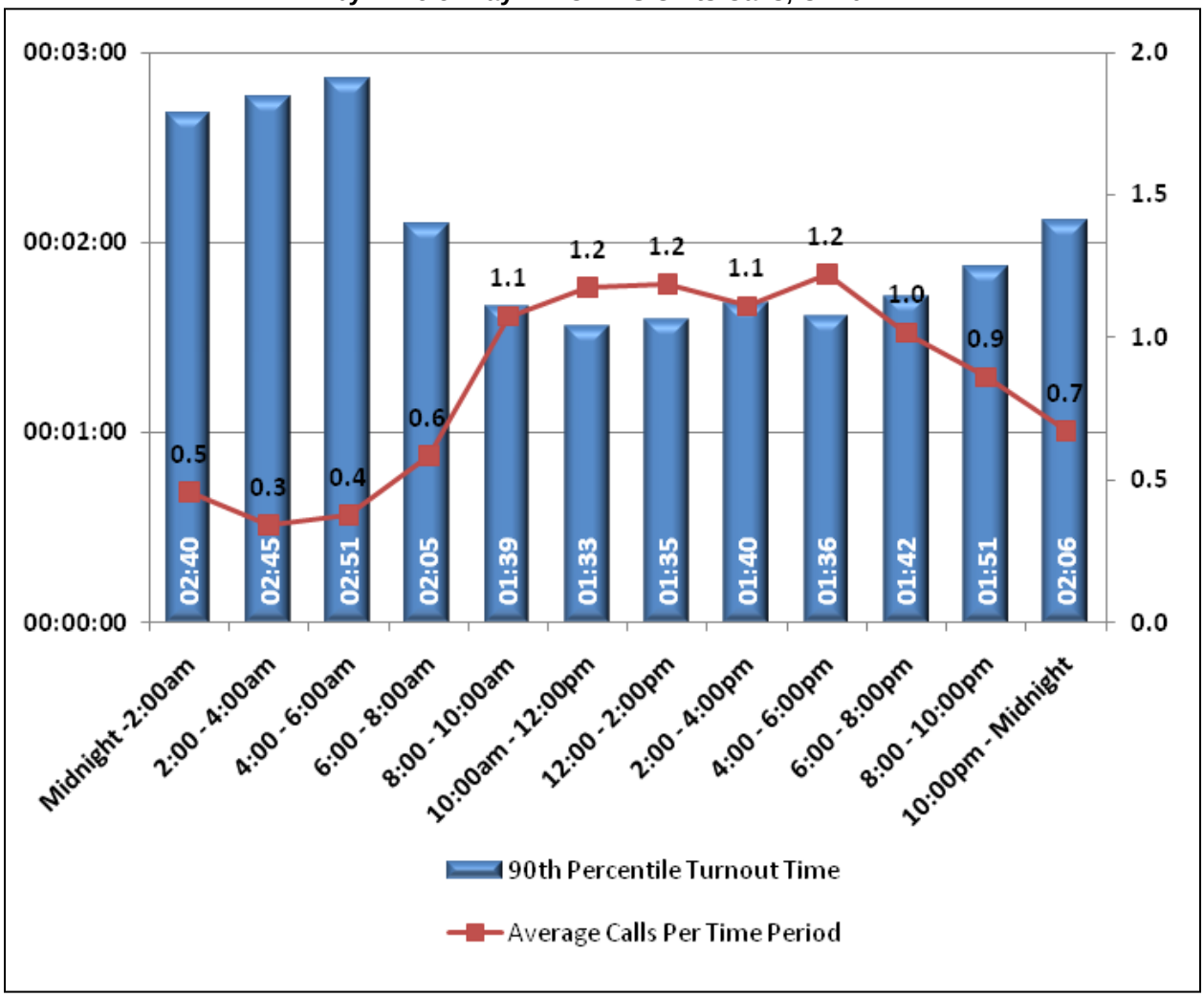
WMC Unit	90th Percentile Turnout Time
Medic 12*	01:58
Medic 14*	02:11
Medic 6**	01:20
Medic 11**	01:12
Medic 15	01:20
Medic 19	01:14
Medic 20	02:25
Medic 21	01:24
Medic 22	02:24
Medic 23	02:00

*M12 and M14 are located in the City of Franklin

**M6 and M11 are part time units and run 12 hour shifts instead of 24

Similar to Franklin turnout time, WMC EMS turnout time increases during the overnight hours, when crews normally sleep, and decrease during the day. Between 8:00am and 10:00pm, turnout times were the lowest, but still over the recommended 1:00 minute. Figure 7 shows the 90th percentile turnout times and average number of calls for WMC EMS units by time of day.

Figure 7: 90th Percentile Turnout Times and Average Call Volume by Time of Day WMC EMS Units Calls, CY10



Of the different segments of response time (call processing, turnout, and travel) it is easier and less costly to improve call processing and turnout times. Travel time is typically much more difficult and the most expensive to improve (e.g., new/more stations, new roads, or traffic signal interruption devices). Reducing the first two times will reduce total response times. Reduction in call processing and turnout time also permits longer travel times without increasing total response times; thus, stations can typically serve larger areas and still meet response time goals.

Travel Time – Travel (drive) time is measured from the station, or wherever the unit is, to the emergency incident. Station and apparatus placement has the biggest impact on travel time, (though apparatus are not always in the station when dispatched.) Additional factors influencing travel time include traffic, weather, traffic limiting devices (stop lights, speed bumps, etc.), and driver familiarity with the area. Traffic congestion and weather are beyond the department and city's control; however, traffic limiting devices and driver knowledge are not.

One key to the analysis of travel and total times is to determine the order of arrival. NFPA 1710 response time recommendations are based on the first arriving unit. Franklin and Williamson County CAD (computer-aided dispatch) systems do not synchronize or relate to each other by unique identification (incident number). Due to this it is difficult to fully analyze medical response in the City of Franklin because the chronology of the call cannot be easily pieced together for each call. The time for the first unit to arrive on scene will be the department's first unit and not the incident's. Because of the response relationship between Franklin and Williamson County, they should look at implementing a system or process for reconciling incidents by a unique identifier. This is a major issue that interferes with the ability to accurately analyze a response time comparison.

Recommendation 6: Determine a method to reconcile call identifiers in order to allow response time comparisons between the FFD, and Williamson County EMS, and identification of the time of arrival of the first EMS unit.

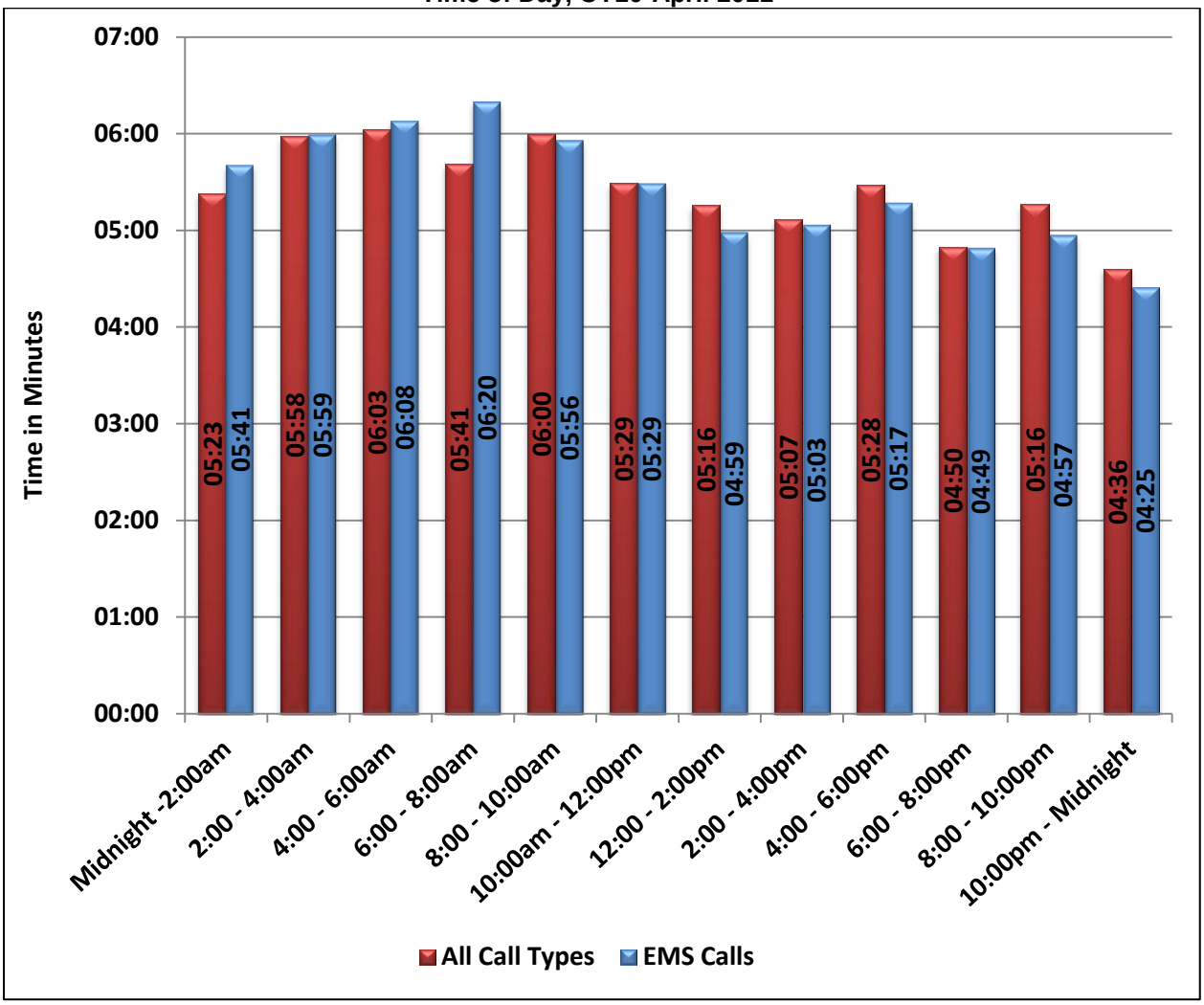
Franklin Travel – The average travel time for FFD first responder units was 03:01, with a 90th percentile of 5:11. Table 3 shows the 90th percentile travel times for the first arriving Franklin unit on EMS incidents with a minimum of 100 calls from Jan 2010 through April 2011. The NFPA recommends a travel time of 04:00 for the first unit to arrive. There are several factors that can increase travel time, such as speed limits, traffic, access to calls, and location of calls. The location of incidents and their effect on travel times are discussed later in this chapter.

Table 3: 90th Percentile Travel Times by First Arriving Unit for EMS Calls CY10-April 11

Unit Type	90th Percentile Travel Time
Engine 1	05:19
Engine 2	05:39
Engine 5	06:24
Engine 6	05:00
Ladder 3	03:58
Ladder 4	04:00
Rescue 1	04:59
Rescue 2	05:08
Rescue 3	04:22

Time of day and day of week were also analyzed to determine if factors such as morning and evening rush hour, light conditions, weekend traffic negatively affect travel times. Figure 8 shows the 90th percentile travel times for the first arriving Franklin unit on EMS calls by time of day. There does not seem to be a large variation in travel times with these factors.

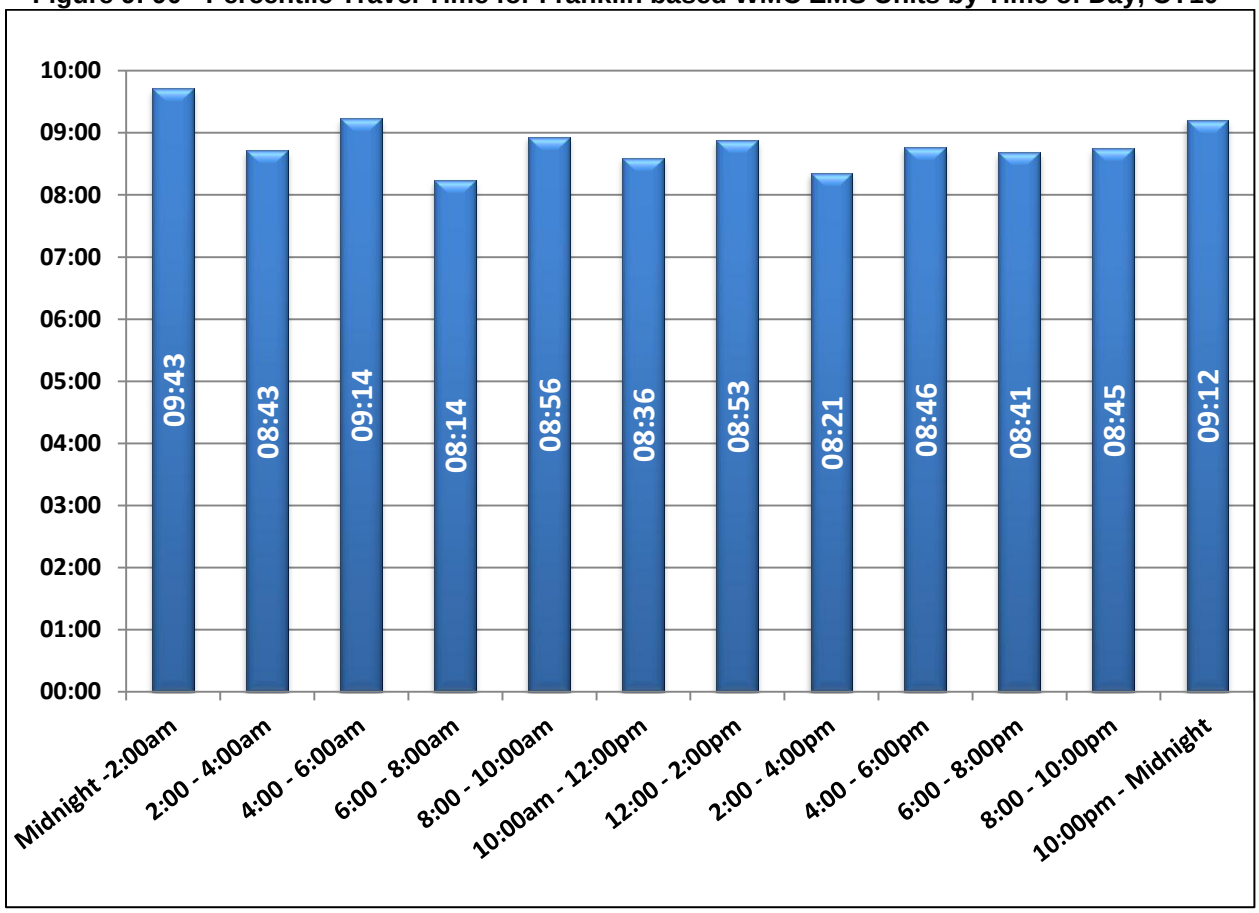
Figure 8: 90th Percentile Travel Times for First Arriving Unit For All Call Types and EMS Calls by Time of Day, CY10-April 2011



WMC EMS Travel – The analysis of travel times for WMC EMS units will focus on M12, M14, M6, and M11 (the latter two are part time units) which are stationed in Franklin, because the data analyzed was solely for calls originating in Franklin. Calls that originated in Williamson County, but outside the City of Franklin were outside the scope of the study. The average travel time for all WMC units was 05:33, with a 90th percentile of 09:05. When broken down by location, units normally stationed in Franklin had an average travel time of 05:31 and a 90th percentile travel time of 08:50 for EMS calls.

Similar to FFD units, WMC EMS travel times were analyzed by time of day. Figure 9 shows the 90th percentile travel times for WMC EMS units stationed or normally operating in the City of Franklin by time of day. Whereas the FFD times had a large increase in the early morning hours, WMC EMS units stayed relatively flat. These times are above the NFPA 1710 standard, but generally within the CAAS of 8:59 for 90 percent of their calls, except for the 2200 to 2400 hours, 2400 to 0200 hours, and 0400 to 0600 hours. This is likely due to a reduction in nighttime unit availability.

Figure 9: 90th Percentile Travel Time for Franklin based WMC EMS Units by Time of Day, CY10



A number of factors play into these response times including station location, proximity to incidents, and call volumes. It should be noted that responding units in Franklin are not always in the station when dispatched. Furthermore, units often respond outside of their first-due area when closer units are unavailable, which also increases travel times. Given the larger area of coverage, WMC units will have higher travel times compared to Franklin Fire units.

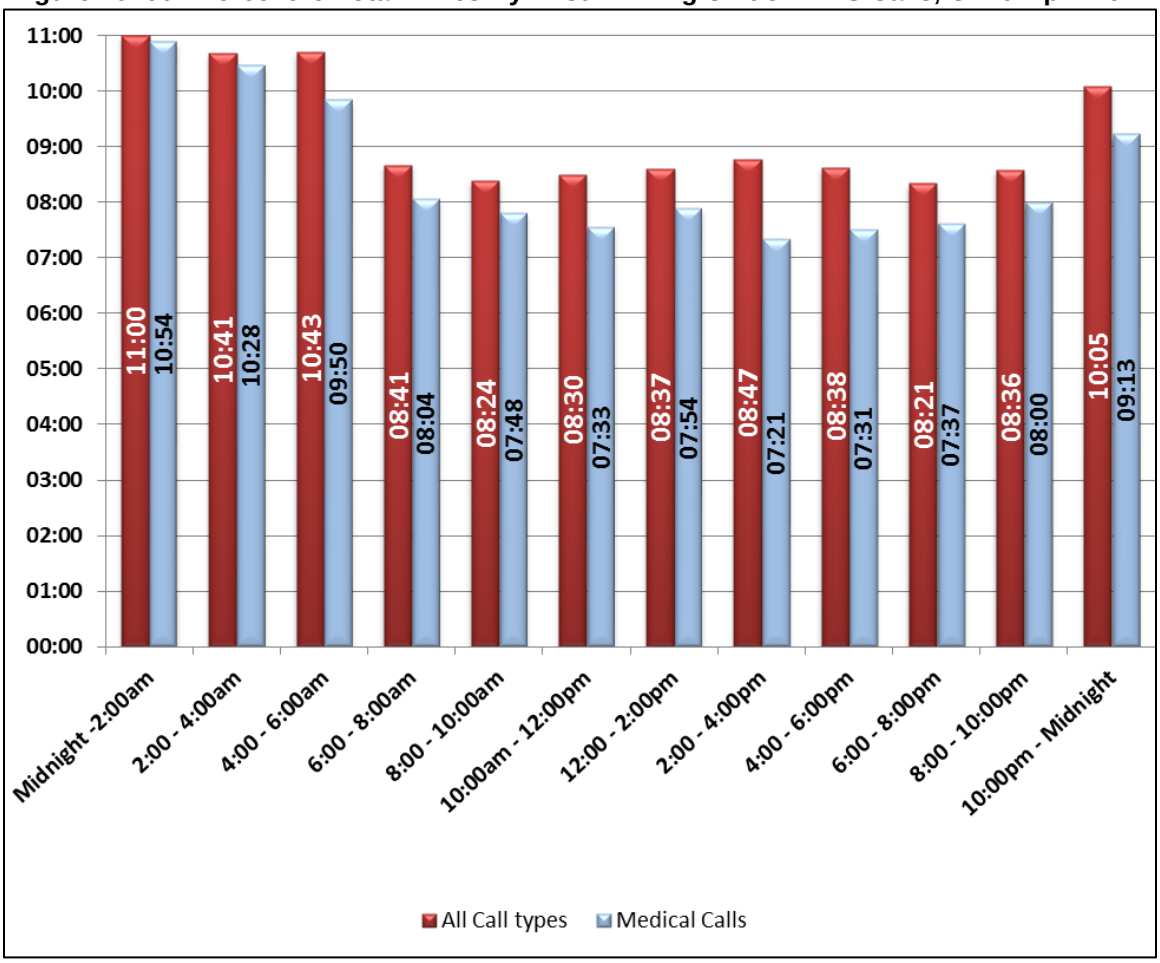
Recommendation 7: Review the incident reporting procedures between Williamson County and the City of Franklin and implement a unique identifier that allows for the reporting and analysis of an entire incident and not just the respective department's performance.

Total Response Time – For mathematical reasons, one cannot simply add the 90th percentile call processing and dispatch time segments to the 90th percentile turnout and travel time segments to reach the total 90th percentile response time.

Franklin Total: For CY10 – FFDs total response times averaged 07:00 with a 90th percentile of 10:33. When we considered times restricted to the first FFD unit on the scene, times were reduced to an average of 06:11 and a 90th percentile of 09:08.

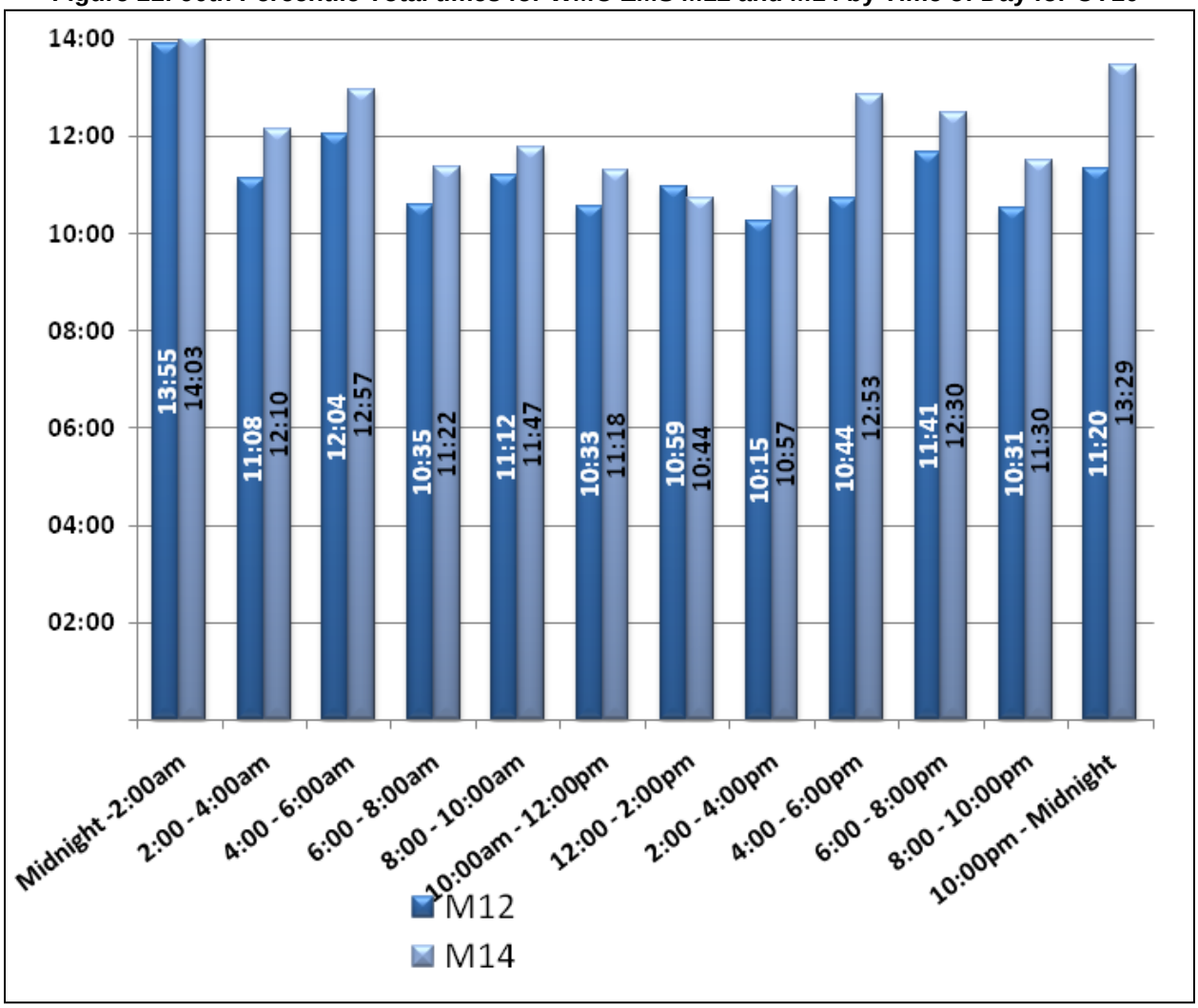
Calls for emergency medical services (EMS) make up the majority (69%) of FFD responses. From January of 2010 through April of 2011, FFD responded to 5,312 EMS calls out of the total incident volume of 7,664 calls. Total response times (8:19 at the 90th percentile for the first arriving unit) are more than two minutes higher than the recommended time of 6 minutes for EMS calls. Figure 10 shows the 90th percentile total response time for the first arriving Franklin unit on all call types and EMS calls by time of day.

Figure 10: 90th Percentile Total Times By First Arriving Unit on EMS Calls, CY10-April 2011



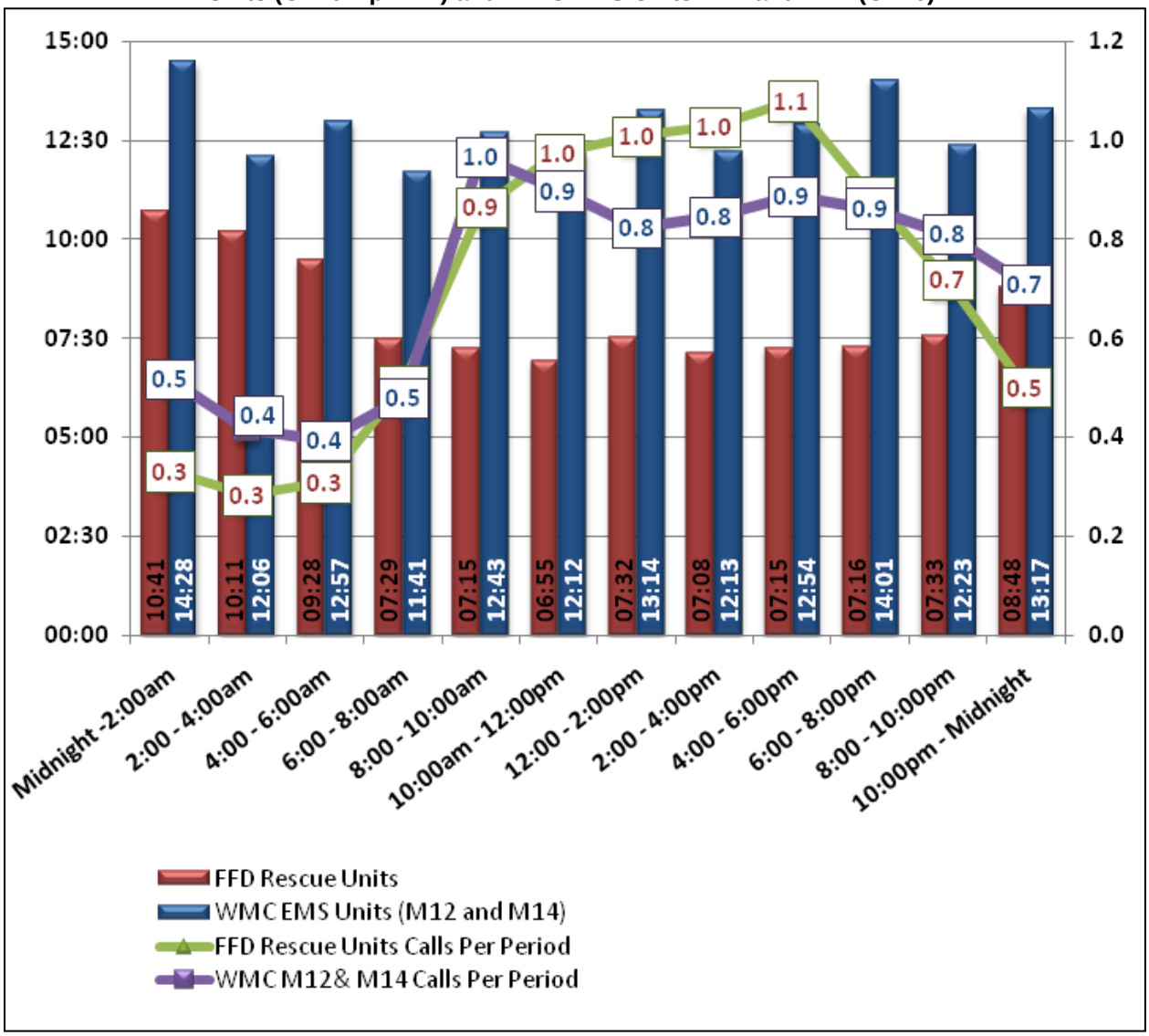
WMC EMS Total: Total CY10 response times for WMC EMS averaged 08:37 with a 90th percentile of 12:41. Since M12 and M14 respond to 60 percent of the WMC EMS calls in Franklin, their performance is going to greatly influence the overall impression of Williamson Medical Center EMS. For CY10, M12 and M14 had total response times of 11:22 and 11:59, respectively. This is 1.5 to 2 minutes over the NFPA 1710 recommendation of 10 minutes (1 minute for dispatch, 1 minute for turnout, and 8 minutes for travel). Figure 11 shows the 90th percentile total response time for M12 and M14 by time of day for CY10.

Figure 11: 90th Percentile Total times for WMC EMS M12 and M14 by Time of Day for CY10



To get a better understanding of response times for medical calls in the City of Franklin, Figure 12 shows the 90th percentile total response times (from time of 911 call to unit arrival) and average call volume for Franklin Rescues 1, 2, and, 3 which are normally used on medical calls and WMC EMS M12 and M14 which are stationed in Franklin and the primary transport units. Although call volumes are relatively the same, total time for WMC EMS averages 4 to 5 minutes higher than FFD.

Figure 12: 90th Percentile Total Times and Average Call Volume by Time of Day for FFD Rescue Units (CY10-April 11) and WMC EMS Units M12 and M14 (CY10)



The department should continue to take steps to reduce the times and improve 90th percentile compliance. Additional stations will reduce travel time and reduce the rate of out of area units responding (discussed later in the chapter), and the department should look at policies and procedures to reduce turnout time closer to the recommended goals of 1 minute. As discussed earlier, FFD and FPD need to work with Williamson County on simplifying the dispatch procedure to reduce the amount of time it takes to get an apparatus rolling.

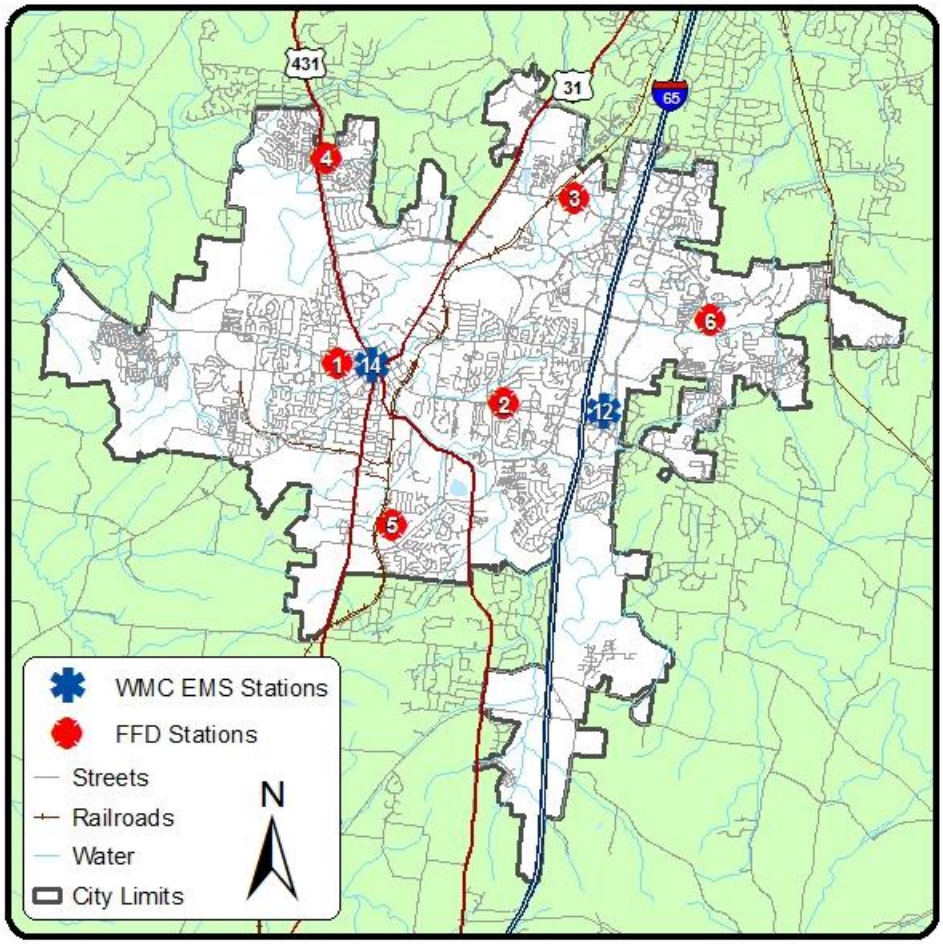
Analysis of Station and Apparatus Locations

This section provides an in-depth look at station location and apparatus placement. The primary objective is to determine what areas, if any, are in need of additional resources and how resources can be distributed to serve the city more efficiently. Travel areas are shown for stations to determine what areas of Franklin should be covered in a given amount of time.

Maps are included to show theoretical response reaches based upon the current station and apparatus locations. These theoretical response reaches are based on the length of road segments and speed limit attributes contained in road centerline data from the Franklin Fire Department. Road centerline data was combined with city provided data to ensure adequate coverage of roads and information such as speed limits and one-way routes.

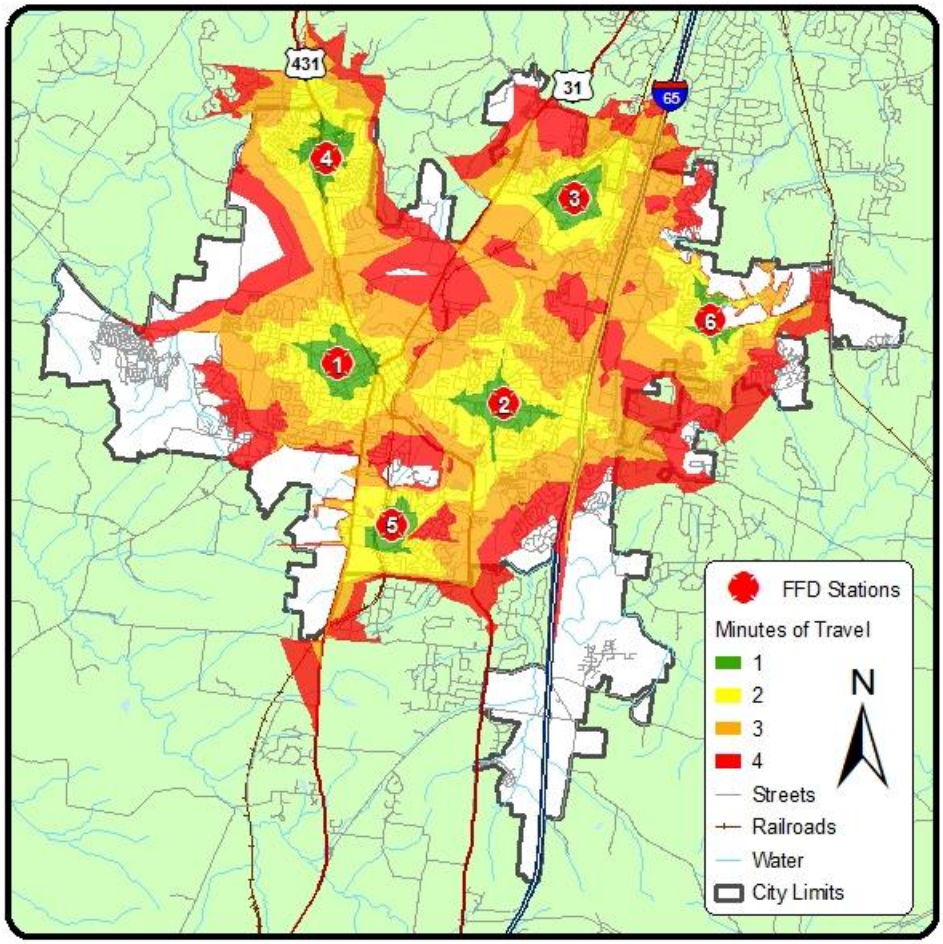
FFD provides fire and EMS response from 6 fire stations. Engines are housed at 4 of the stations (1, 2, 5, and 6) and Quints (an engine with aerial ladder capability) are located at Stations 3, 4, and 5. Aerial trucks are located at stations 1, 2, and 6. Rescues, which handle most of the EMS responses, are located at Stations 1, 2, and 3. Williamson Medical Center provides EMS transport from two stations in the City of Franklin. Figure 13 shows the current Franklin Fire Department and Williamson Medical Center EMS stations.

Figure 13: FFD and WMC EMS Stations



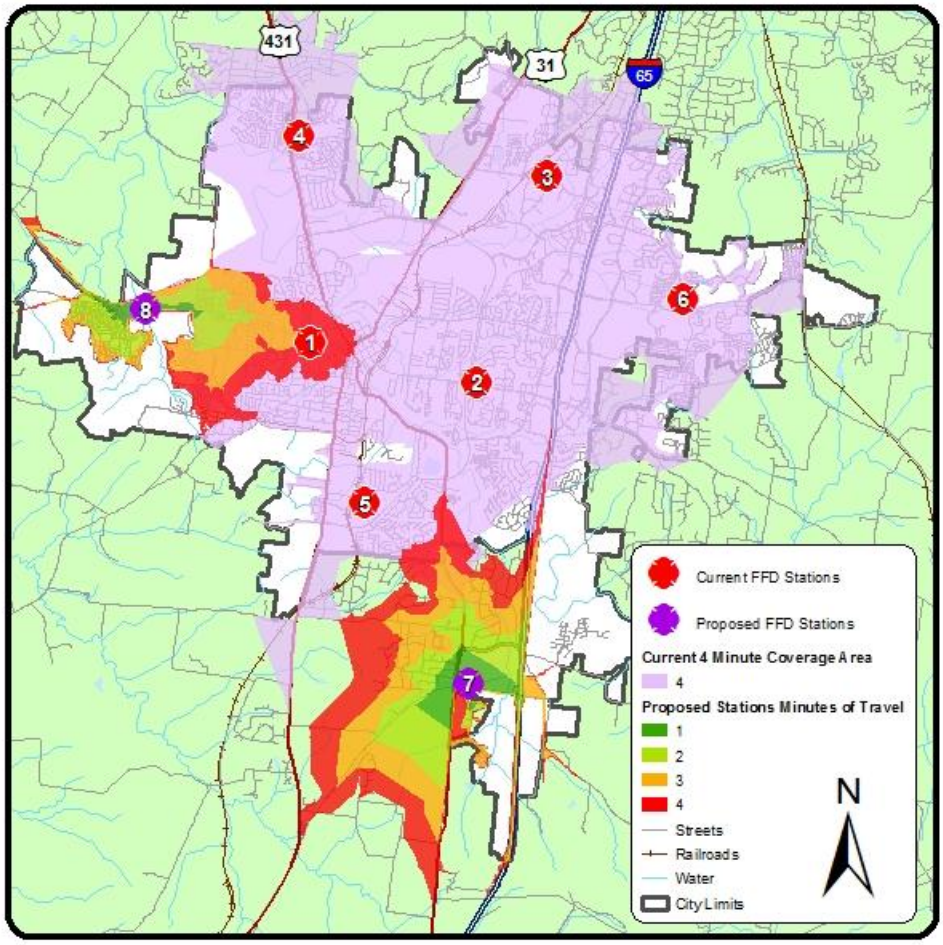
As discussed in the previous response time section, NFPA 1710 recommends that the first unit on scene arrive within 6:00 minutes of the initial call. Allowing 1:00 minute of dispatch and 1:00 minute of turnout gives a travel time of 4:00 minutes. Figure 13 shows the theoretical 4:00 minute travel times for units departing from their stations.

Figure 14: FFD 4-Minute Theoretical Coverage Area



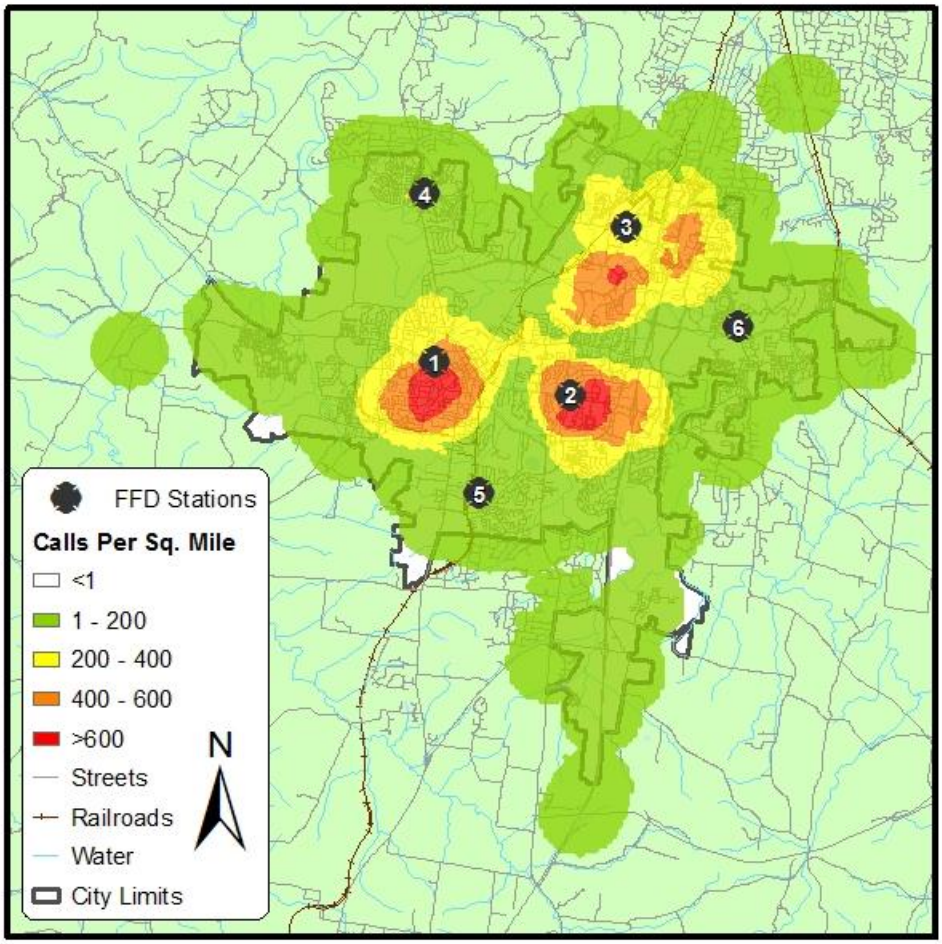
The current deployment results in 4-minute travel time gaps in the Southeastern and Western sections of the City. Currently, two stations (identified as Stations 7 and 8) have been proposed to serve these locations. Figure 15 shows the 4 minute theoretical coverage area for the proposed stations and their interaction with the current coverage area. The new stations would reduce the travel time gaps considerably.

Figure 15: Proposed FFD Stations 4-Minute Theoretical Coverage and Current 4-Minute Theoretical Coverage



Knowing where incidents are occurring is one of the most important considerations when looking at station and apparatus location. A gap in response coverage is less important if there are few calls to the gap. Conversely, if there are many calls in a gap area, new stations are all the more important. Therefore, this analysis looked at incident density. The CY10 –April 2011 CAD data included 7,663 unique emergency incidents, of which 7,651 (99 percent) geocoded. Using a density surface derived from the geocoded incidents, Figure 16 shows the density of emergency incidents per square mile.

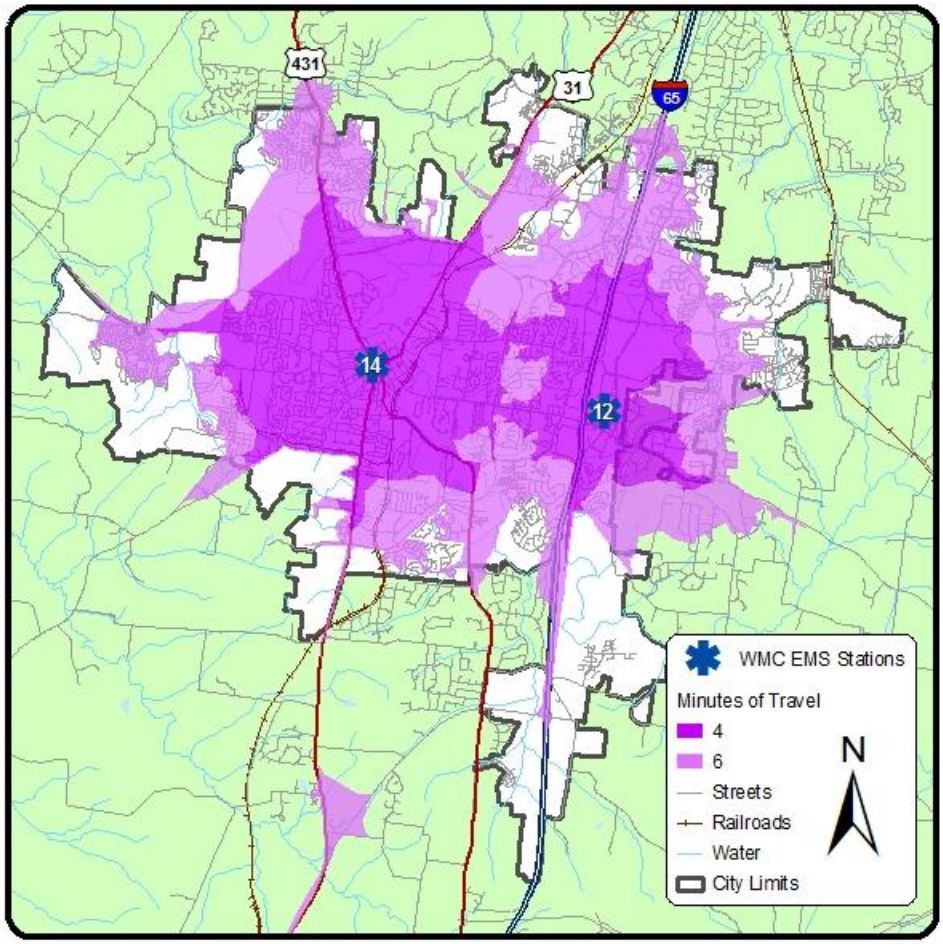
Figure 16: FFD Incident Density (All Call Types), CY10-April 2011



Based on where the incidents are occurring and the 4-minute theoretical response reach, a large majority of the incidents are able to be reached in 4 minutes. In fact, the majority of calls are within only a few blocks of stations 1 and 2, both of which are staffed by an engine, truck, and a rescue.

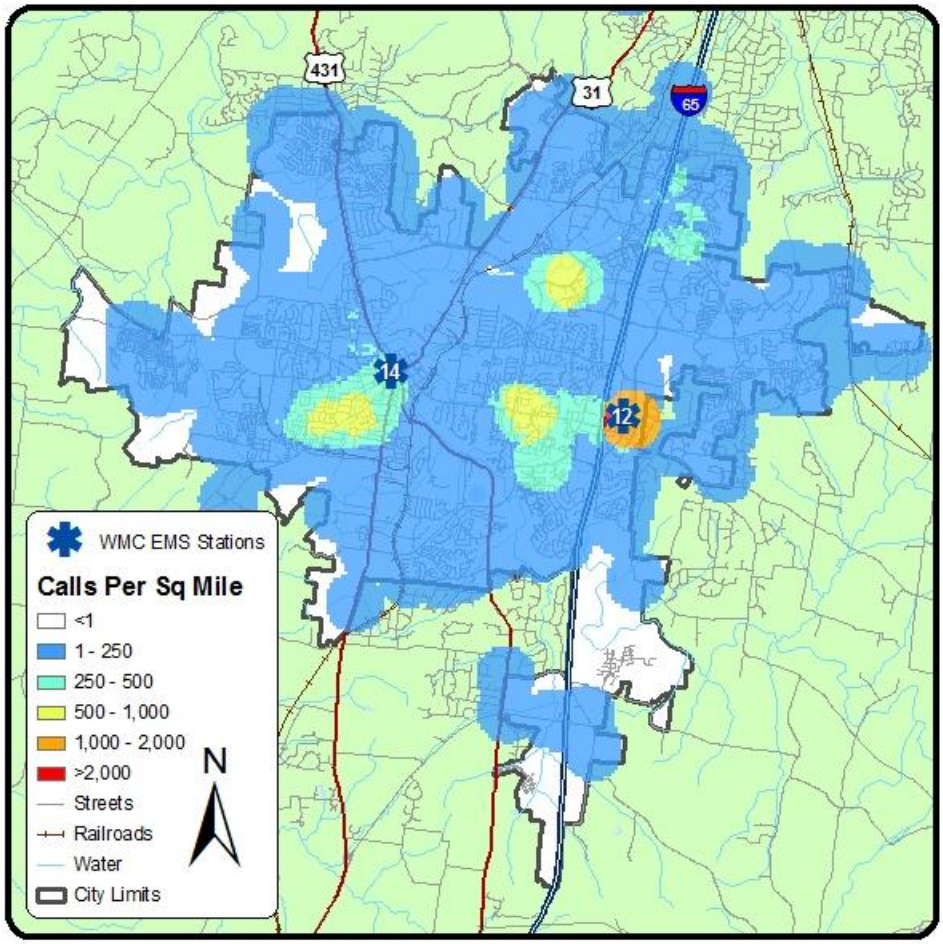
WMC EMS Coverage – As a response partner and the emergency transport service in Franklin, it is important to also analyze the deployment of WMC EMS stations and their coverage areas. The current 4-minute theoretical response reach for medic units provides adequate coverage for most of the city, with almost the entire city covered with 6 minutes of travel. Figure 17 shows this 4-minute and 6-minute response reach for the two Williamson EMS Stations.

Figure 17: 4- and 6-minute WMC EMS Theoretical Coverage



WMC EMS also places two units on 12 hour shifts that "roam" the city to provide backup coverage. Due to their transitory nature, it is difficult to create a coverage polygon for them. It should be noted that their main role is to "backfill" units out on call. A density map was created by selecting only EMS calls from the CAD files and calculating the number of incident per square mile from CY10. Figure 18 shows that most EMS calls occur within a few blocks of stations that currently house medics. However, if two calls occur simultaneously, a medic unit from another station will have to respond, increasing the travel time. Williamson EMS covers 92% of Franklin's calls with the current response profile.

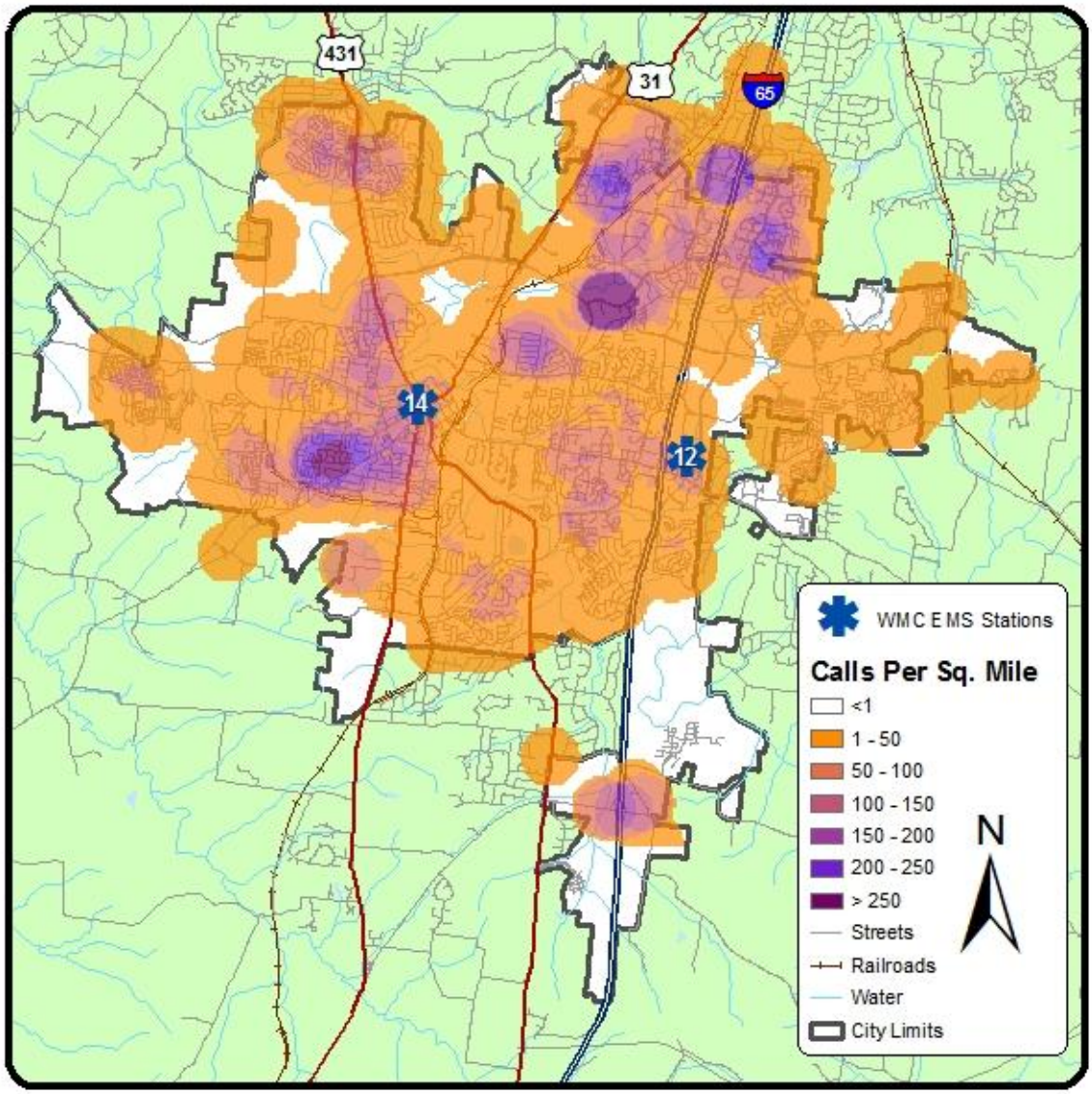
Figure 18: WMC EMS Call Density, CY10



Although the hospital-based EMS System is not bound by NFPA standards, NFPA 1710 recommends ALS resources arrive within 8 minutes 90 percent of the time, and CAAS recommends 8:59 within 90 percent of the time. With the high dispatch and turnout times, travel areas are severely limited and most calls cannot be reached within that goal.

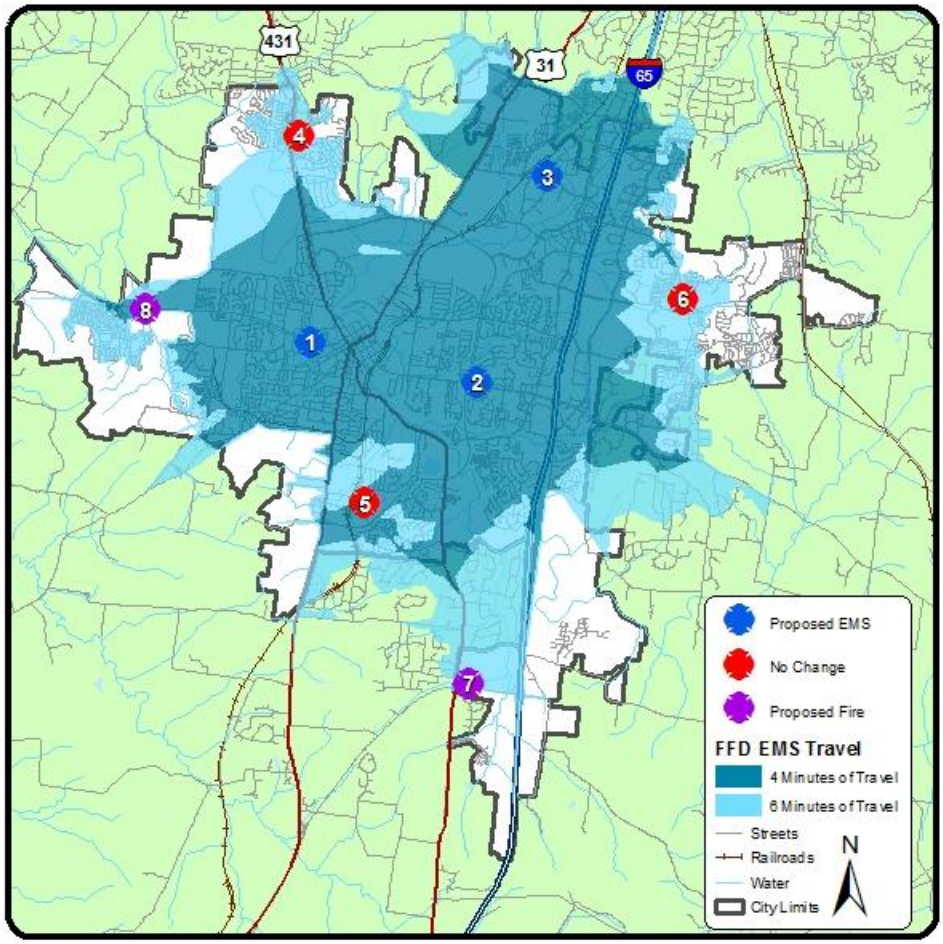
As shown in the CAD analysis section above, most calls are not responded to in less than 8 minutes. Figure 19 shows the location of calls from CY10 where the first unit on scene took over 8 minutes to arrive from the time of the 911 call. Although most hot spots are at the edges of the city, far south and north, there is a hot spot very close to M14.

Figure 19: EMS Incident Density, CY07-09



For Franklin Fire Department, most of the EMS response is performed by the rescue units located at Stations 1, 2, and 3. The theoretical 4 and 6 minute coverage areas for Rescues 1, 2, and 3 are shown in Figure 20.

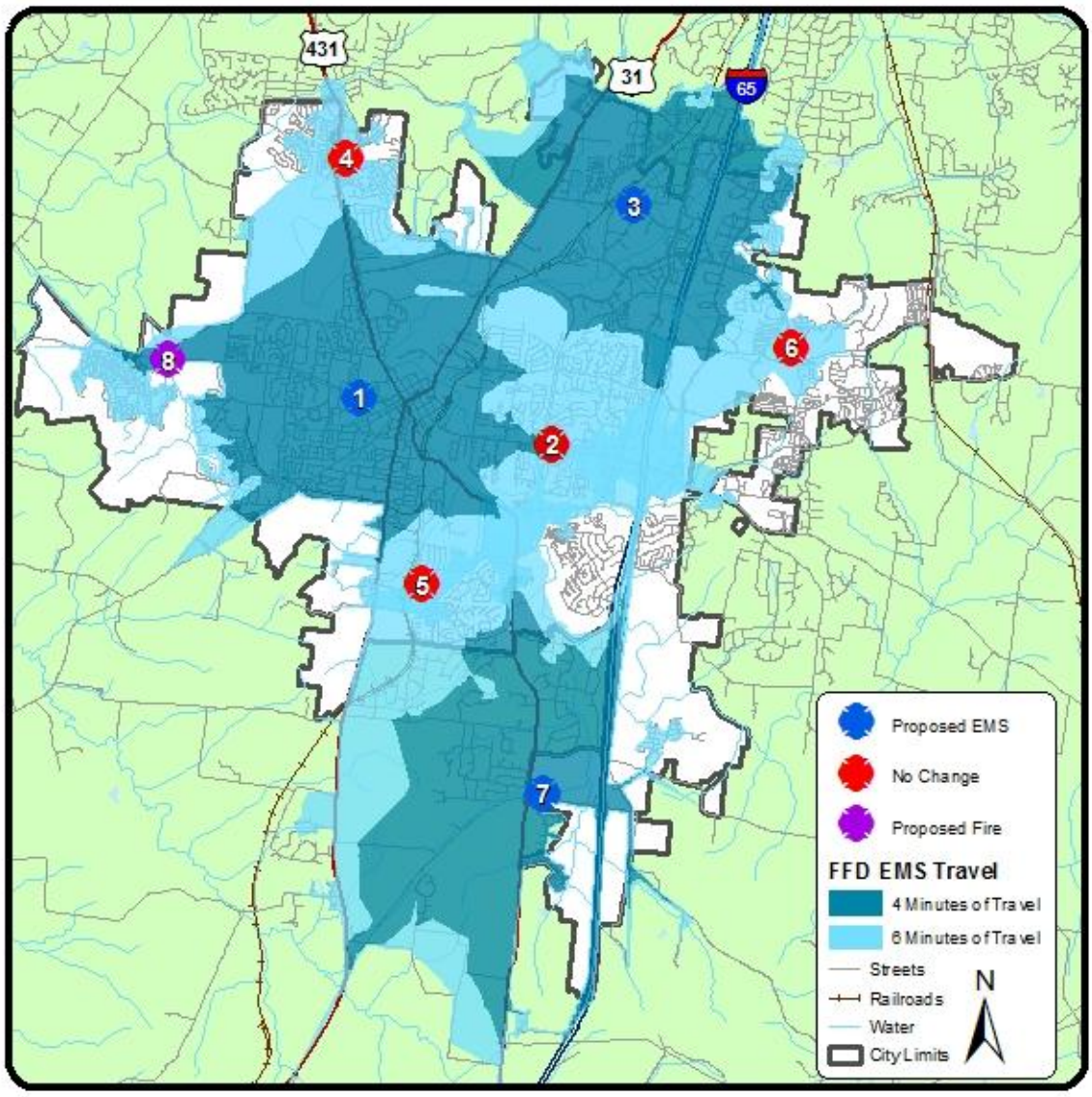
Figure 20: 4- and 6-minute Theoretical Coverage Area for FFD Rescues 1, 2, and 3



If these Rescue units were converted to transport units, their coverage for 4 minute travel would be greater due to the extra unit. Using the CY10 calls from Figure 20, Rescues 1, 2, and 3 would be able to theoretically reach 82% (4141 out of the 5041 geocoded calls) with 4 minutes of travel and 91% (4592 out of 5041) with 6 minutes of travel. This is higher than the 41 percent (2801 out of 5041) and 86 % (4362 out of 5041) of calls that WMC EMS units can reach with 4 minutes and 6 minutes of travel, respectively. Given that FFD has an additional unit, this is not surprising, but would this increase EMS transport coverage in the city, without building additional stations or making major capital investments. It is important to note that the FFD rescues are probably involved in the most of the calls listed for WMC EMS units, but because of the lack of unique identifier to join the two CAD records between Franklin and Williamson County, it is difficult to say.

There is another alternative that includes placing a transport unit at Station 7 instead of Station 2. Figure 21 shows the 4 and 6 minute theoretical response times if a transport unit was placed at Station 7. This choice would improve coverage in the southern part of the City, but negatively affect the eastern part.

Figure 21: 4- and 6-minute Theoretical Coverage Areas for EMS Units at Stations 1, 3, and 7



Simultaneous Responses

Another concern is the occurrence of spontaneous EMS calls within the City. The following information concerns the question of impact on the possibilities of simultaneous EMS calls occurring in the City.

Current Demand - Based on 2010 statistics, the following represents the number of simultaneous EMS calls that occurred. Table 4 shows how often two or greater simultaneous responses occurred. During 82.45% of EMS responses, there were no simultaneous EMS responses within the City. During the 17.55% of the time that spontaneous occurred, in most cases (15.4%) only two responses occurred.

Table 4: City of Franklin Simultaneous EMS Requests 2010

Simultaneous Responses	Number	Percentage
2	1247	15.4%
3	142	1.75%
4	18	0.22%
5	9	0.11%
6	4	0.05%
7	2	0.02%

Time on Task Information

To obtain a true idea of simultaneous EMS response impact, a measurement of time on task is needed Table 5 shows the time on task for first responder units. The mean time on task for first response units is 19 minutes and 58 seconds, with a standard deviation of 12 minutes and 25 seconds. The 90th percentile time on task was 29 minutes and 43 seconds.

Table 5: Time on Task for EMS First Response

Mean	0:19:58
SD	0:12:25
90th %	0:29:43

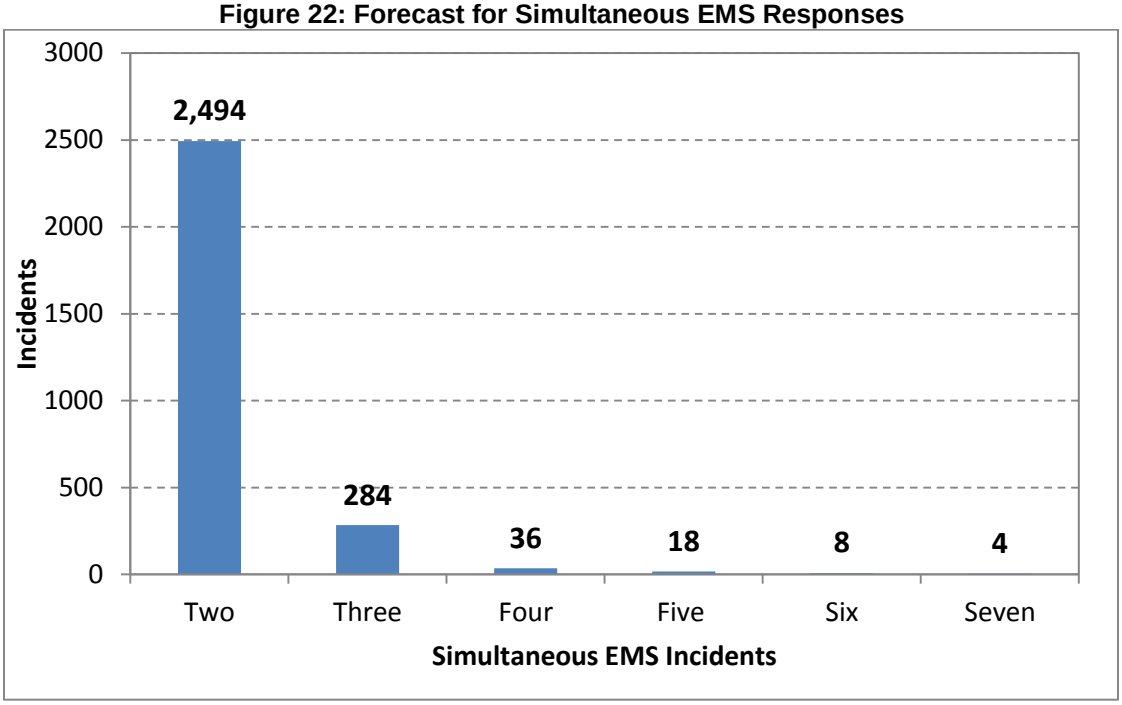
To calculate the impact when involving transport units, we calculated a mean time on task of 41 minutes. Based on this calculation we find it necessary to recalculate the simultaneous EMS response potential and provide an updated forecast. Table 6 provides the demand forecast.

Table 6: Simultaneous EMS Demand Forecast

Simultaneous Responses	Number	Percentage
2	2494	30.8%
3	284	3.5%
4	36	0.44%
5	18	0.22%
6	8	0.1%
7	4	0.04%

Figure 22 shows a graphic image of the probabilities of simultaneous EMS responses within the City.

Figure 22: Forecast for Simultaneous EMS Responses



Discussion

Examination of the data reveals that with three ambulances, the City will annually have 64 incidents of five or more simultaneous EMS incidents. A fourth ambulance will reduce the number to 30. These average 2.5 incidents per month will be successfully managed with mutual aid units.

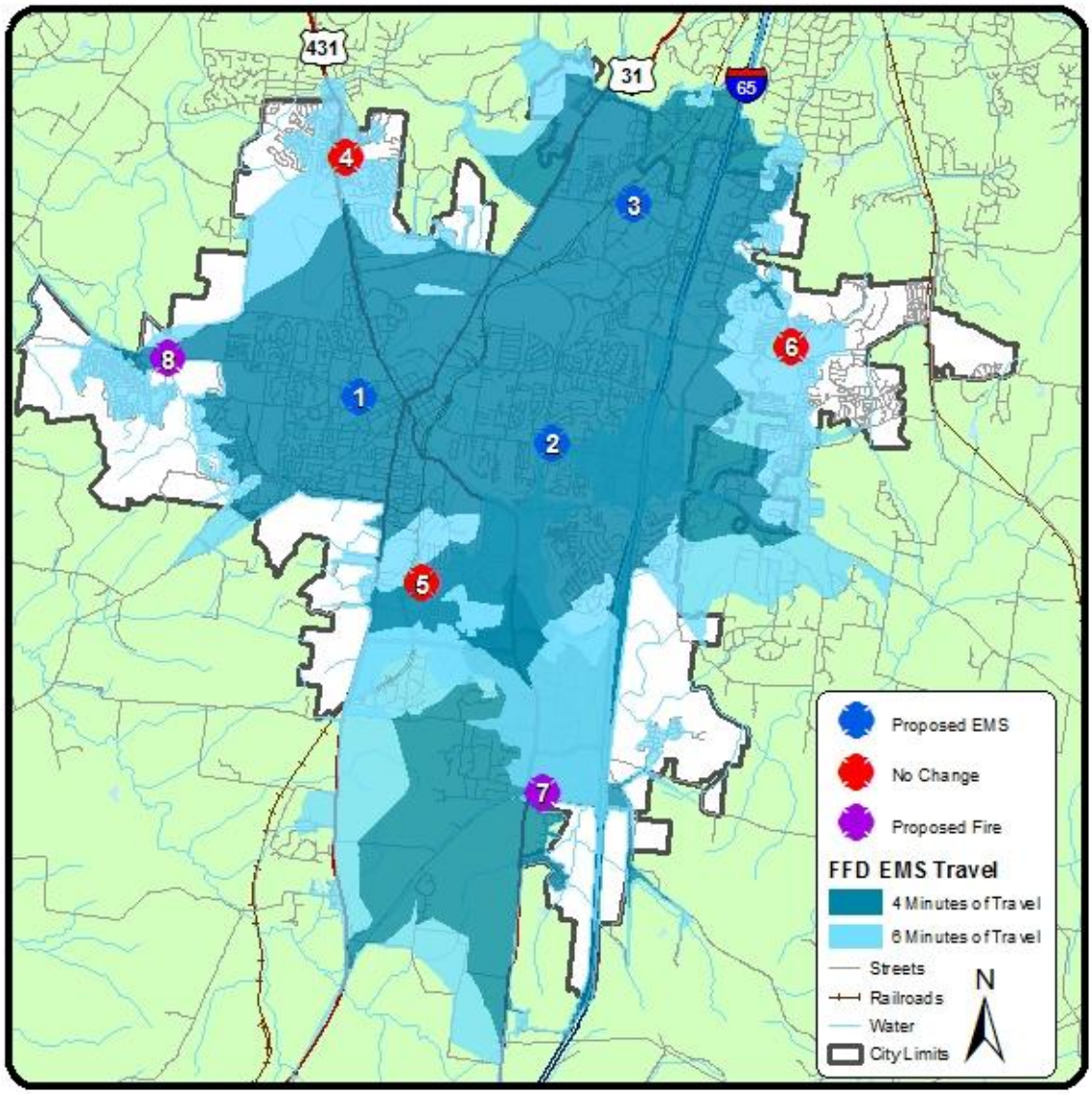
Conclusion

Based on the above data, three transport ambulances will be sufficient to provide coverage for the City. A fourth ambulance would be appropriate to insure emergent coverage. This unit could be staffed as a first call first until Station 7 is built.

Overall, the FFD provides good protection and medical response to the residents of Franklin; however, the response times exceed recommended 90th percentile goals. Methods to reduce the dispatch and turnout times should be evaluated and implemented. This will help offset high travel times that are affected by a number of external factors, such as traffic, calming devices and residential speed limits.

If Stations 7 and 8 are built and Franklin takes on transport service, it would be prudent, but not necessary, to include a transport unit at Station 7. Growth and response patterns should continue to be monitored. These stations are sited well to increase coverage and overlap to allow for backup. Figure 23 shows the 4 and 6 minute travel theoretical coverage for EMS units at Stations 1, 2, 3 and 7.

Figure 23: 4- and 6-minute Theoretical Coverage Area for Stations 1, 2, 3, and 7



IV. EMS OPERATIONS

Franklin Fire Department provides first responder paramedic service augmented by Williamson County EMS that provides exclusive paramedic ambulance transportation.

911 Centers

As discussed earlier, the City of Franklin Communication Center (COFCC) is the PSAP as well as Primary Service Dispatch Point for fire and police. An EMS call received at the COFCC is transferred to the Williamson County 911 Communication Center for dispatch and pre-arrival instructions. The COFCC stays on line and monitors communications and dispatches the fire department. This is a duplication of services and causes delays or lost calls during the transfer.

The COFCC has a state of the art center that is considerable in size and is only partially used. While 911 Centers are beyond the scope of the project, their operations affect EMS response in Franklin. A consolidated City-County 911 Center would likely assist in reducing call processing times and reduce EMS response times, without adding additional units or personnel. This would allow all EMS requests to be received and dispatched from one answering point, reducing delays and lessen the chance of losing a 911 call. Moving into the City facility will allow an entire system upgrade while sharing costs.

Recommendation 8: The City of Franklin and Williamson County should form a task force to determine if there are advantages to consolidating their 911 Communications Centers.

Regardless whether the City of Franklin assumes full EMS service, a good investment in the future would be to train all telecommunications operators in using a formal medical priority dispatch program. The City of Franklin is eligible for 911 funding from Williamson County that has not been requested. The funding could be used for medical priority dispatch training.

Recommendation 9: The City of Franklin should request the reserved funding they are entitled to from County 911, that could be used to train the telecommunicators in medical priority dispatch.

EMS Response/Alert System **–** When the FFD is dispatched, the telecommunicator sets off the station tones in all the stations. If Rescue 2 is committed to a call, and then a second call in their area occurs, all station tones are set off and Station 2 is dispatched. Our investigation, including interviews with various city leaders, revealed that a software problem constrains the City to this system. The City should upgrade this system as soon as possible. Specific units should be assigned to calls, and not the best guess of a company officer. Most CAD systems will easily accept this programming. Lack of specific assignment may lead to the wrong unit responding, and extended response times. Second, the sounding of loud alarms in stations that are not needed to respond is not a benign activity. While these alerting systems get people's

attention, they also startle employees, cause an increased heart rate, and blood pressure, and may even lead to cardiac arrhythmia. There are also increased respirations, increased production of catecholamine exacerbating the fight or flight mechanism. These events can lead to cardiac arrhythmia and even sudden death.[6] [7] Public health researchers have associated the exposure to loud noise at work with increased cardiac disease.[8] While all noise exposure cannot be eliminated, those environmental risks that can be should be. Being alerted or awakened for incidents to which they are not assigned is unnecessary and fixable.

We attempted to determine if there was a low cost solution to this problem. Our research found that the City would have to purchase the MossCAD system (or a similar system) in order to accomplish this. Based on the number of stations, the cost for a MossCAD system could approach $350,000. In the near future, systemwide upgrades are planned that should rectify the problem. Therefore, spending a large sum for a temporary upgrade cannot be recommended,

Recommendation 10: Assure that the next generation radio system is equipped with the proper technology to accomplish specific station, and specific vehicle alerting.

In 2004, a fire department performance audit made several similar recommendations. We found that these were still appropriate and should continue to be pursued.[9]

Automatic Vehicle Locators – The Auto Vehicle Locator (AVL) is currently being used, but not to its full capability. These devices allow the COFCS to monitor the location of each unit in real-time, and determine which units are closer, regardless of their permanent assignment. AVL technologies will assist the City in assuring that the closest appropriate unit is dispatched to an emergency call. Knowledge of location could improve employee safety concerns, decrease response times, and increase productivity. The infrastructure is in place for the City of Franklin to use AVL to the capabilities for which it was intended. The question appears to be whether the current system is reliable. We believe that should the City chose to provide EMS transportation, AVL becomes more essential to determine closest unit availability for EMS response.

Recommendation 11: AVL technologies should be used to their full potential. Equip all vehicles with AVL, and use the system to assign vehicles to calls.

---

[6] Brooke, (2006). Girl is killed by her mobile phone alarm. Daily Mail London, England. Retrieved from: http://www.lexisnexis.com.library.capella.edu/hottopics/lnacademic/?shr=t&csi=138794&sr=HLEAD(Girl+is+killed+by+her+mobile+phone+alarm)+and+date+is+December,%202006

[7] Kaplan, P.W. & Fisher, R.S. (2005). *Imitators of epilepsy*. [2nd ed.]. New York: Demos Medical Publishing, Inc.

[8] Gan, W.Q., Davies, H.W. & Demers, P.A. (2010). *Exposure to occupational noise and cardiovascular disease in the United States: the National Health and Nutrition Examination Survey 1999–2004. Occupational and Environmental Medicine,* doi:10.1136/oem.2010.055269

[9] Management Advisory Group, Inc. (2004). *Performance audit of the fire department: City of Franklin, TN*. pp. 4.2-4.3.

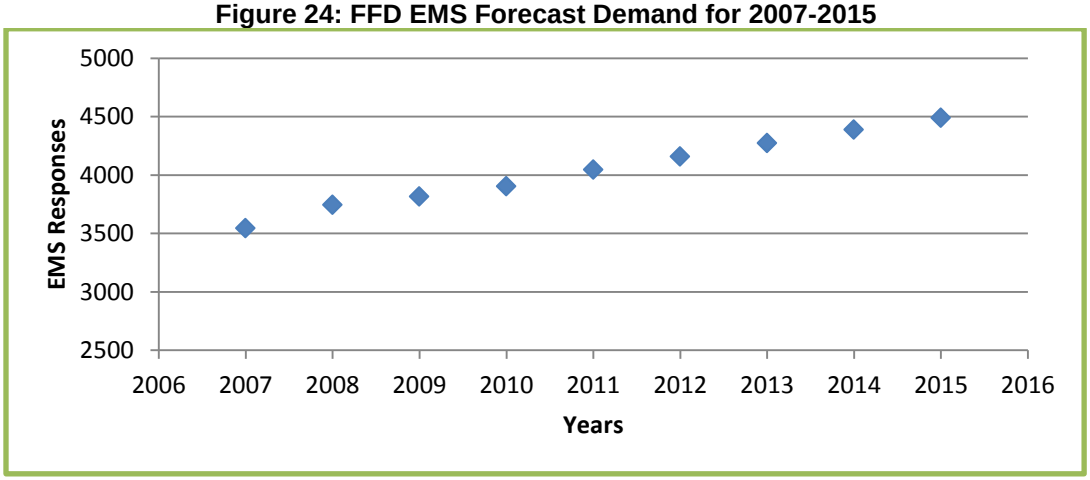
EMS First Response

The FFD provides first responder services for all EMS incidents that occur within the City. In most cases, first response is provided by one of the three rescue units assigned to Stations 1, 2, or 3. If the FFD decides to provide EMS transportation and coverts the rescue units into paramedic ambulances, then this deployment will need to change. EMS first response should be provided by the closest available unit.

Recommendation 12: If the FFD adopts paramedic ambulance service, EMS response should be provided by the closest unit.

EMS Demand Forecast – We calculated a potential EMS demand thru 2015, using a computer-based statistical model. Data were available to determine actual EMS responses between 2007-2010, and forecasted demand for 2011-2015. Figure 24 shows that EMS demand should reach 4,500.

Figure 24: FFD EMS Forecast Demand for 2007-2015



The above model is based on a static growth pattern and is applicable for first responder services. The addition of ambulance service may result in a greater number of responses because all EMS calls will be responded to by ambulances.

Effect on Fire Suppression Operations – A new first responder pattern will have some effect on suppression operations. Theoretically, an engine or truck company responding to a medical emergency could be unavailable for a fire suppression response. In practice, the same unit is more likely to miss a medical emergency while responding to a fire call.

Two specific actions can be taken to mitigate the chances of missing a fire suppression call while providing medical first response.

- Using a medical priority dispatch program will reduce the need for first response to lower priority calls. EMS calls classified as Level A or Level B would not require a first responder unit. Level C calls would only require a first responder unit if the closest paramedic ambulance was unavailable.

- Using AVL will identify which units are actually closer than the other. For example, if a paramedic ambulance is returning from a call, they may be closer to an emergency than a first responder unit.

Another potential liability exists when the paramedic ambulance unit is transporting a patient. Transportation duties will keep units out of service approximately one-half to two thirds longer than rescue units. It is difficult to determine how many additional medical calls that will be assigned to suppression units. Proper use of the above mitigation techniques will help reduce this liability. The City should monitor the situation to determine the extent of the situation and whether additional paramedic ambulances may eventually be necessary.

EMS Delivery Profile

The current operations profile involves the FFD providing advanced life support first response and Williamson County EMS providing advanced life support transportation. Overall, the system functions well, and EMS providers work well together. As expected, this study has increased stress levels, but both the FFD, and WCEMS have maintained their professional demeanor through words and actions.

According to Tennessee law, the licensed ambulance provider is responsible for overseeing all EMS transportation and first responder services. Therefore, the WCEMS oversees credentialing, clinical practice, medical direction, quality management, training, and documentation practices. Should the FFD become a separate ambulance agency, they would apply for state licensure, and if approved, become the licensed agency. According to the Tennessee State EMS Office, once the regional consultant recommends license approval, it is usually granted.

Credentialing – After obtaining Tennessee paramedic licensure, paramedics wishing to practice in Williamson County must be credentialed (awarded practicing privileges) by Williamson County EMS. The credentialing process is elaborate and generally works well. One aspect, clinical ride time, presented a challenge that WCEMS and FFD have successfully worked out.

The following steps are required for paramedics to achieve WCEMS credentialing.

1. The FFD notifies the WCEMS that a paramedic wishes to obtain credentialing.
2. WCEMS then assigns an approved field training officer (FTO) to mentor the candidate.
3. The FTO and the candidate work out a ride-a-long schedule. Officially, 120 hours of ride-a-ling time was required. Recently, the WCEMS has agreed to an objective-based ride-a-long schedule. EMTs are required to complete a similar process that was 60 hours, but is now objective-based.

4. The candidate is assigned to a second FTO for a 12 hour testing ride-a-long session.
5. The candidate must attend a protocol review session conducted by a WCEMS training officer.
6. The candidate must complete a skills competency evaluation before a WCEMS training officer.
7. The WCEMS contacts the FFD concerning the granting of credentials.

A point of contention between FFD and WCEMS was the 120-hour requirement because it was required of paramedics regardless of skill-level or experience. This unnecessarily delayed some candidates from functioning in a paramedic position. Further, the process became a financial liability because candidates often had to be paid overtime during the credentialing process. Recently, the WCEMS and FFD agreed to objective-based criteria to determine successful completion of the ride-a-long portion of the credentialing process. We believe that this process should be adopted permanently.

Recommendation 13: Continue the objective-based approach used in the paramedic and EMT credentialing process.

Clinical Practice – The current clinical structure in Williamson County EMS as it pertains to the City of Franklin consists of a Medical Director (employed by the emergency physician group contracted by the hospital), Clinical Services Manager (hired by WCEMS), EMS Officer (City of Franklin Fire Department employee) and the field personnel for the City of Franklin. The FFD Fire Chief and the WCEMS Director oversee their respective departments.

Based on our visit and a report from Williamson County EMS the County has concerns that FFD paramedics may not have enough opportunity to effectively practice certain skills. We attempted to determine the skill quality for three measurable paramedic skills: Intravenous (IV) Therapy, Intraosseous (IO), and Endotracheal Intubation (ETI). There were some challenges in obtaining the data, some initial errors occurred, but we were able to get what we needed. WCEMS should be able to quickly retrieve this data and FFD should also keep track of specific skills performance.

Intravenous Therapy: The ability to successfully place an IV is considered critical to the ability to administer lifesaving treatment. While there are now more alternatives to administering lifesaving treatment, IV therapy is still considered important for critical patients.

Within the last year, FFD paramedics attempted 318 Ivs and were successful 235 times (73.9 percent). Table 7 compares IV success rates for FFD with our skills database. Our database revealed an overall success rate of 76.24% with the FFD success rate of 73.9%. A statistical test for proportions reveals no statistically significant difference in success rates.

Table 7: FFD IV Success Rate Compared to Database

Jurisdiction	Attempts	Success	Percent Success
St. Paul, MN	5,521	4,257	77.1%
Delaware EMS[10]	2,584	2,142	83.0%
Ohio EMS[11]	137,554	102,703	74.66%
Contra Costa, CA[12]	28,000	22,960	82.0%
Bonita Springs, FL[13]	310	268	86.4%
Estero, FL[14]	188	145	75.0%
Alameda, CA[15]	1,931	1,632	86.52%
Palo Alto, CA[16]	1,240	1,028	82.9%
Total	**177,328**	**135,195**	**76.24%**
Franklin, TN	**318**	**235**	**73.9%** **p = ns**

Intraosseous Therapy: Accessing the peripheral circulation by intraosseous access is an old intervention that has re-emerged in emergency medicine. At first the skill was limited to pediatric patients, but use in adults is increasing. This is usually a secondary skill, reserved for critical patients in whom IV access is not quickly attainable. Most of the above data were from pediatric IO Therapy.

The FFD performed IO attempts on three patients with two attempts being successful (66.67%). Table 8 shows a comparison of success rates with EMS systems in our database. The numbers are too low to determine statistical significance. Nationally, success rates for IO access are starting to approach 100% due to changes in technology. The EZ-IO device (or similar) has increased success rates in the pre-hospital and in-hospital settings.

Recommendation 14: The FFD should adopt the EZ-IO as its IO access device.

[10] Cataldi, E., McGinnis-Hainsworth, D., Megargel, R., Bollinger, M. and O'Connor, R. "A Comparison of Intraosseous and Intravenous Access in Adults and Children in the Prehospital Setting." Paper presented at the annual meeting of the National Association of EMS Physicians, Registry Resort, Naples, FL <Not Available>. 2008-12-12 from http://www.allacademic.com/meta/p64896_index.html

[11] OEMS. (2003). The Run Report: Bringing you information from EMSIRS. Ohio Division of Public Safety. www.ohiopublicsafety.com

[12] Frost, P. (2008, February). Contra Costa Emergency Medical Services Best Practices. Issue 2 [Corrected]. Contra Costa Health Services, CA.

[13] SPC/TriData. (2009). Assessment and Five-Year Plan for the Bonita Springs Fire and Rescue Control District. Arlington, VA: SPC/TriData.

[14] SPC/TriData. (2009). Assessment and Five-Year Plan for Estero Fire-Rescue. Arlington, VA: SPC/TriData.

[15] SPC/TriData. (2010). *Assessment of EMS for the City of Alameda*, CA. Arlington, VA: SPC/TriData.

[16] SPC/TriData. (2011). *EMS Add-On for the Palo Alto Fire Department* (Draft). Arlington, VA: SPC/TriData

Table 8: Intraosseous Access Success Rate for FFD

Study	Attempts	Success	Percent Success
Banargee, et al.[17]	30	30	100%
Glaeser, et. Al.[18]	152	116	76%
Macnab, et. Al.[19]	50	41	84%
Nijssen-Jordan [20]	42	36	86%
Portland Fire Rescue[21]	4	1	25%
Estero[22]	10	9	90%
Alameda, CA[23]	20	17	85%
Palo Alto, CA[24]	15	15	100%
Total	**323**	**265**	**82.04%**
Franklin	**3**	**2**	**66.23%** **p = ns**

Endotracheal Intubation: Within the last decade, the utility of this advanced airway procedure in with EMS settings has become controversial. Some believe that this remains the airway of choice for critically ill patients. Others feel that there are safer and equally effective back-up rescue airway devices. Still others believe that comparatively low success rates, and possible complications are an indication that too many EMS providers at multiple levels are being trained to use this skill. ET intubation is even being used less in hospital settings. Safer anesthesia, better technology for procedures, and less "exploratory" surgery are reducing the need for ET use.

During the previous two years, FFD paramedics attempted ETI on 28 patients and successfully intubated 20 patients (71.43 percent). This rate compared with our database success rate of 77.09 percent. A statistical test for proportions revealed no statistically significant difference in ETI success rates. The FFD has used the Combitube as an alternative rescue airway

[17] Banerjee, S., Singhi, S.C., Singh, S., & Singh, M. (1994). The intraosseous route is a suitable alternative to intravenous route for fluid resuscitation in severely dehydrated children. Indian. Pediatrics 31(12), 1511-20.
[18] Glaesner, P.W., Hellmich, T.R., Szewczuga, D., Losek, J.D., & Smith, D.S. (1993). Five-year experience in prehospital intraosseous infusion in children and adults. Annals of Emergency Medicine 22(7), 1119-24.
[19] Macnab, A., Christenson, J., Findlay, J., Horwood, B., Johnson, D., Jones, L., Phillips, K., Pollack, C., Jr., Robinson, D.J., Rumball, C., Stair, T., Tiffany, B., & Whelan, M. (2000). A new system for sternal infusion in adults. Prehospital Emergency Care 4(2), 173-7.
[20] Nijssen-Jordan, C. (2000). Emergency department utilization and success rates for intraosseous influsion in pediatric resuscitation. Canadian Journal of Emergency Medicine 2(1) 1-7.
[21] SPC/TriData. (2006). Comprehensive Assessment of the Portland, OR Fire and Rescue. Arlington, VA: SPC/TriData Corporation
[22] SPC/TriData. (2009). Assessment and Five-Year Plan for Estero Fire-Rescue. Arlington, VA: SPC/TriData
[23] SPC/TriData. (2010). *Assessment of EMS for the City of Alameda*, CA. Arlington, VA: SPC/TriData
[24] SPC/TriData. (2011). *EMS Add-On for the Palo Alto Fire Department* (Draft). Arlington, VA: SPC/TriData

device when ETI is either impractical or unsuccessful. Newer rescue airways like the King airway are being considered, but cannot be adopted without authorization from WCEMS.

Table 9: Successful ETI for Franklin Fire Department

Source	Attempts	Success	Percent Success
Nova Scotia[25]	112	103	94.3%
Cady, C & Pirrallo, R.[26]	2,144	1,969	91.6%
Colwell, C.B., Et.al.[27]	124	120	96.7%
Garza, Et. Al.[28]	1,066	909	85.3%
Wang, Et al.[29]	783	680	86.8%
Deakin, Et. Al.[30]	52	35	71.2%
Gerich, Et. Al.[31]	383	373	97.4%
Guire, Et. Al.[32]	263	223	84.8%
El Dorado County EMS[33]	63	57	90.0%
Saint Paul[34]	103	89	86.4%
Ohio EMS[35]	3,686	2,531	68.67%
Portland, OR Fire[36]	370	336	90.8%
Alameda, CA[37]	99	57	57.58%
Palo Alto[38]	24	11	45.83%

[25] Nova Scotia Emergency Health Services. (2005). Medical Quality Performance Measure Report. Unavailable: [On-line].

[26] Cady, C.E. & Pirrallo, R.G. (2005). The effect of Combitube use on paramedic experience in orotracheal intubation. American Journal of Emergency Medicine, 23(7), 868-71.

[27] Colwell, C.B., McVaney, K.E., Haukoos, J.S., Wiebe, D.P., Gravitz, C.S., Dunn, W.W. & Bryan, T (2005). An evaluation of out-of-hospital advanced airway management in an urban setting. Academic Emergency Medicine 12(5), 417-22.

[28] Garza, A.G., Gratton, M.C., Coontz, D., Noble, E. & Ma, O.J. (2003). Effect of paramedic experience on orotracheal intubation success rates. Journal of Emergency Medicine 25(2), 251-6.

[29] Wang, H.E., Kupas, D.F., Paris, P.M., Bates, R.R., & Yealy, D.M. (2003). Resuscitation 58(1), 49-58.

[30] Deakin, C.D., Peters, R., Tomlinson, P., & Cassidy, M. (2005). Securing the prehospital airway: A comparison of laryngeal mask insertion and endotracheal intubation by UK paramedics. Emergency Medicine Journal 22, 64-67.

[31] Gerich, T.G., Schmidt, U., Hubrich, V., Lobenhoffer, H.P., & Tscherne, H. (1998). Prehospital airway management in the acutely injured patient: The role of surgical cricothyrotomy revisited. Journal of Trauma 45(2), 312-314.

[32] McGuire, T. (2001, February). EMS News: Alameda County Emergency Medical Services Agency Newsletter 16(1). Available: [On-line.], p. 1.

[33] El Dorado County EMS (2004). EMS quality management data. Unpublished Data.

[34] SPC/TriData (2007). Comprehensive Management Study of the Saint Paul Fire & Safety Services Department. Arlington, VA: SPC/TriData Corporation.

[35] OEMS. (2003). The Run Report: Bringing you information from EMSIRS. Ohio Division of Public Safety. www.ohiopublicsafety.com

[36] SPC/TriData. (2006). Comprehensive Assessment of the Portland, OR Fire and Rescue. Arlington, VA: SPC/TriData Corporation.

[37] SPC/TriData. (2010). *Assessment of EMS for the City of Alameda*, CA. Arlington, VA: SPC/TriData

[38] SPC/TriData. (2011). *EMS Add-On for the Palo Alto Fire Department* (Draft). Arlington, VA: SPC/TriData

Source	Attempts	Success	Percent Success
Overall	**9,169**	**7,068**	**77.09%**
Franklin, TN	**28**	**20**	**71.43%** **p = ns**

These results do not support claims of poor skill performance, but send a signal that there should not be an unlimited number of paramedics trained or permitted to practice.

Medical Direction **–** EMS Medical Direction for the FFD is provided by the WCEMS Medical Director. The physician is a board-certified emergency physician who works for the emergency medicine group contracted to the Williamson Medical Center. Medical direction is effective and the medical director is monitoring skill usage. The FFD would benefit from increased communications between the medical director and the EMS Officer. The EMS Officer has requested regular meetings with the medical director, but there appears to be challenges to accomplishing this. There appears to be interference by WCEMS in allowing this to occur. After our meeting with WCEMS staff, the medical director, and the FFD EMS Officer, it appeared that the situation would be corrected. Our follow-up meetings with FFD revealed that this has not occurred. The EMS Medical Director has limited field response capabilities. While on-site supervision on every call is unnecessary, there are times where on scene medical direction is beneficial.

Recommendation 15: Assure that the FFD EMS Officer and EMS providers have increased contact with the medical director.

If the FFD decides to become a licensed agency, it will be required to appoint a qualified physician medical director. Generally, the state requires that the EMS medical director be granted a degree of Doctor of Medicine (MD) or Doctor of Osteopathy (DO) from an accredited medical school, be licensed to practice medicine in Tennessee, demonstrate understanding of and experience in providing medical direction of emergency medical services, and be approved by the Tennessee State EMS Medical Director. Demonstration of knowledge, skills, and abilities can be recognized by the candidate being board-certified in emergency medicine by the American Board of Medical Specialties or the American Board of Osteopathic Medical Specialties, and obtaining requisite experience. Physicians with other medical board certifications who are experienced in EMS medical direction are also acceptable.[39]

Services of an EMS medical director will likely cost $20,000 to $30,000 annually. Since the FFD will be transporting patients to Williamson Medical Center, the emergency medicine physicians group should consider providing medical direction at a reduced cost. There is no barrier to the WCEMS medical director or another emergency physician at the hospital serving

[39] Alonso-Serra, H., Blanton, D., and O'Connor, R.E. (1998). Physician medical direction in ems. *Prehospital Emergency Care, 2*(2), 153-157 retrieved from http://www.naemsp.org/pdf/physicianmedical.pdf

as the FFD medical director. Part of EMS medical oversight includes the ability for EMS physicians to respond to on-scene emergencies. As part of a long-term plan for medical direction, the City should consider providing their medical director with a vehicle and full response gear.

Quality Management **–** EMS Quality Management is a series of procedures involving the analysis of administrative, clinical, and financial procedures used to determine the strengths and weaknesses of the service. Quality management includes the review of patient care reports (PCRs) to determine skills competency, compliance with patient care protocols, determination of patient care outcomes, and for investigation and review of complaints involving patient care issues.

The WCEMS is responsible for the EMS quality management for all Williamson County first responder agencies. The process involves a collaborative process between the licensed agency and the first responder agencies to assist each agency in measuring the quality of care provided. We found that the process has merit but in Franklins' situation needs further local input. Developing an internal QI program in conjunction with Williamson County EMS may improve the communication and feedback to the field personnel. The internal QI program should include a 100 percent review of PCRs, and monitoring of skill performance. There should be a review of patient care reports involving EMS dispatch, FFD first responders, and WCEMS crews, and hospital medical teams.

FFD's EMS Officer should lead the department internal QM program and be the liaison with each agency. The EMS Officer should specify indicators that the fire department wants to measure. For example, data form information and response times are complete and within standards, narrative information is complete including history, primary and secondary surveys are documented, and all ALS calls follow the Williamson County EMS protocols. The QM program may look for specific protocol and QM deviations, provides education to the paramedics involved, determines if system issues contribute to deviations, and report specific protocol deviations to the Clinical Officer Chief for possible further action.

As the indictors are measured and tracked, there needs to be an improvement plan in place. The steps involved include education, retraining, and case reviews.

- **Education:** The EMS Officer can provide one on one education (case specific) or in a group setting regarding a topic (cardiac arrest management).
- **Retraining:** After reviewing PCRs a specific skill, like intravenous therapy that needs improvement and provide a retraining program to those paramedics that are involved.
- **Case Reviews:** This format is used as an educational tool to review quality improvement indicators and also provide support to those indicators.

According to Williamson County EMS, the new PCR program will permit the City of Franklin Fire Department paramedics names to be part of the documentation. This change will allow the above, tracking of skills, data collection and reporting streamlined and with relative ease. As part of quality improvement, the EMS Officer should be more active in QM planning, and tracking specific skills performance.

Recommendation 16: The City of Franklin Fire Department should create and institute an EMS quality improvement plan.

Training: The WCEMS and FFD have created a cooperative training program between organizations that includes basic and advanced life support services. While WCEMS is responsible for providing access to all certification/licensing and recertification/relicensing processes, each organization contributes to mutual training of EMS providers.[40] As with the quality management process, the FFD should keep precise records of employee training opportunities and attendance.

The WCEMS and the FFD are considering investment in a learning management system to allow access to more EMS education opportunities and better recordkeeping.[41] Regardless of who provides care, sharing in a training management system will be beneficial to each agency.

Documentation - There are two important points to cover here, patient care reporting, and controlled medication monitoring. Currently, the FFD submits patient care reports using a traditional paper system. Across the country and in Williamson County, EMS systems are moving to an electronic patient care reporting process. This is necessary to increase accountability, develop a valid quality management process, and to contribute to the national EMS information system (NEMSIS).

Electronic Patient Care Reporting (E-PCR): WCEMS is preparing to transfer to the ESO electronic reporting system. It appears to be compatible with the WCEMS CAD system and should allow for data collection, storage, and processing. For the system to be credible, call data should be able to populate the reporting system in real-time with location and time data. This minimizes the overbearing problem of EMS being unable to synchronize clocks to assure data continuity and uniformity. First responders should also be part of the systematic data process. A distinctive advantage to a combined dispatch system would be the ability of both organizations to streamline and validate their E-PCR processes. Another important aspect is compatibility with hospital information systems. Real-time transfer of data is far superior to retrospective entry of

[40] Although the responsible agency is responsible for providing access to training, the individual is responsible for keeping any certifications or licenses.

[41] An overview of EMS Learning Management systems, including an audio conference is available at http://www.archive.org/details/AnOverviewOfLearningManagementSystemsEmsEducastEpisode30

data. For EMS to fulfill its role as part of the healthcare system, patient information and interventions must quickly become part of the patient medical records.

Data collection hardware is available in two forms: laptop computers or hand-held tablet. Laptop computers are acceptable, but there is a better choice. The department should choose hand-held technology over the traditional laptop. Hand-held technology is lighter, less expensive, and offers greater portability. The cost to replace a damaged Toughbook approaches $3,000, while hand-held costs around $700. The vehicle mounting for the laptop costs over $1,000, and reduces space in the ambulance or engine cab.

We estimate the cost of E-PCR hardware and software as follows:

- Hardware – Four handheld tablets @ $700.00 = $2,800.00 (includes license)
- Software - $8,800 per year (will cover three active units)
- Cardiac Monitor Interface - $3,000 (one time)

Regardless of the E-PCR hardware or software chosen, the implementation plan is critical to program success. In our experience, we have found that certain actions help assure successful implementation.

- Time must be dedicated to training and practice with the hardware and software.
- System "experts" should be chosen and available for each shift. These "experts" should be dedicated to the process, receive additional training, and be willing to patiently work with providers.
- Ability must trump rank or years of service when appointing "experts"
- Feedback to employees is essential concerning both technical and patient care issues.

Controlled Medications – The ordering, distribution, administration, and monitoring of controlled medications are important factors, especially if the FFD decides to become a state licensed agency. Currently, WCEMS paramedics are authorized to administer morphine for pain-relief, and midazolam for uncontrolled seizures, and sedation before certain procedures. These medications are widely used and are generally considered safe for the EMS setting. These medications are under strict federal controls, requiring precise procedures for accountability. At this time, FFD is not authorized to carry these medications.

If the FFD becomes a licensed agency, they will be required to design controlled substance procedures including; inspection, handling, logging, broken or damaged substances, and discrepancies.

Inspection: The controlled substances may be kept under double locks or using a container numbered seal system while stored on the vehicles. Only the paramedics on duty, and the EMS Officer [42]should have access to the controlled substances. A daily inspection is needed to insure that controlled substances are present and match the day before inspection. All inspections, loggings or any other documentation shall require 2 signatures, the paramedic and the company officer for example (see Logging Section below). If the fire department decides to replace the controlled substances from their own stock, we recommend installing a commercial drug vault.

The on duty paramedic should perform daily count of the controlled substances on the vehicle and the station. After the inspection the information is logged in the *Daily Controlled Substance Log*. The on duty paramedic is responsible to make sure that the physical count of the controlled substances matches the count in the daily controlled substance log. Weekly inspections of all controlled substances should be performed and documented. The weekly vehicle inspection should consist of breaking the old seal, physically look at each drug, make sure that the count is correct, make sure that the drug packaging is intact and reseal the container with a new seal.

Handling: Controlled substance should be used by paramedics according to the Williamson County EMS System Protocol or on-line medical direction. The paramedic should keep all unused amount in possession until properly disposed of. Any unused amount of controlled substance should be destroyed in front of a witness and documented on patient care report. If using a number sealed system, the paramedic should keep the broken seal or document the seal number on the patient care report. The old seal number is required to restock the unit.

Logging: Controlled substance usage should be document in the section corresponding to the controlled substance that was used. i.e. Morphine usage should be logged in the Morphine section.

Each time a controlled substance is logged in or out, the paramedic shall document the date, vehicle number, the amount removed or added the run number, their signature, a witness signature, and the old and new seal numbers. If an error is made while making an entry into any logs, the paramedic should draw a line across the entire entry and write the word "void". The next available line should be used to log the controlled substance.

Broken or Damaged: If a controlled substance gets broken or damage, the paramedic should complete an incident report explaining how the controlled substance was damaged or broken. The controlled substance needs to be logged out of the daily controlled substance log. A

[42] Where the term "EMS Officer" is used in this section, it means the EMS Officer or designee, such as one of the EMS Captains. A rotating call list could be used to cover nights and weekends.

separate log should be created titled *Contamination Log*. The paramedic involved would be responsible for logging in any occurrence and notifying the EMS Officer.

Discrepancies: The EMS Officer, company officer, and battalion chief, and EMS medical director should be immediately notified of any discrepancies. An incident report will be completed by the parties involved and investigation will be started. If the discrepancy occurs at shift change, all employees involve will remain at work until the discrepancy has been resolved or until released by the battalion chief or EMS Officer. Within five days, the EMS Officer will submit a report to the Deputy Chief of Operations and the EMS medical director.

If a controlled substance has been stolen or is missing, the appropriate law enforcement agency shall be contacted immediately and will determine if a criminal investigation is needed.

Recommendation 17: Institute a controlled substance policy for carrying morphine and midazolam on transport units.

Newer technologies are becoming available to reduce unauthorized access, medication alteration, or theft. The FFD should continue to monitor the industry for devices that secure medications, and make automatic notifications for unauthorized entry or tampering.

V. FUTURE OPTIONS FOR EMS

Based on our findings, we have determined that the City of Franklin has three basic choices to consider. Before describing these choices, the following assumptions are offered.

- The City will continue to grow as predicted.
- Williamson County EMS will continue to experience increased demands in all areas of the County.
- In 2012, the City of Franklin should receive 4,200 requests for EMS, with a 5 percent annual predicted increase through 2015 surpassing 4,500 responses.

Option 1. Continue With the Current Service Delivery Model

The current service delivery model calls for the FFD to provide advanced life support first responder services with advanced life support transportation provided by Williamson County EMS. This model does provide for adequate service, and could be continued. The FFD provides excellent first responder service, reaching over 90 percent of their calls within five minutes dispatch. Williamson County EMS is meeting the CAAS standard of 90 percent response within 8:59 during 18 of 24 hours daily. Table 10 displays the time periods when the standards are not met.

Table 10: Time Periods When WCEMS Does Not Meet CAAS Standards

Time Period	90% Response Time
10:00pm to 12:00 MN	9:12
12:00 MN to 2:00am	9:43
4:00am to 6:00am	9:13

During these time periods, Williamson County's dynamic deployment model calls for fewer ambulances. This is a likely reason for response time deficiencies. Usually, EMS demand is reduced during these identified gaps. Overall, these response time gaps are not serious, but should be monitored.

The business as usual model has significant deficiencies, especially because the City's first responder services are uncompensated. FFD first responder services are essential because without such services, WCEMS would be unable to meet NFPA 1710 first responder standards.

We think that the current delivery model is illogical. What other City agency will provide free service to the County to allow another agency to meet their obligations? If WCEMS did not have FFD first responder services, they would likely have to add at least two additional 24-hour units, and convert two, 12-hour units to 24 hours. It would be difficult for WCEMS to make this work. They would have to staff extra ambulances even though a transported may not be needed,

but just to maintain a reasonable minimum response time. Otherwise, WCEMS would have to staff some type of first responder units.

Option 2. Negotiate a First Responder Fee with Williamson County EMS

A negotiated first responder fee will help the FFD offset their expenses for services. The department could charge a flat per call fee, and add additional charges for CPR assist, fire personnel accompanying the ambulance. Billing citizens for first responder services is probably legal, but not likely to yield positive results. Few if any insurance companies cover first responder services, so these bills would require cash payments. There would likely be great public backlash, and little revenue collected.

For the above reasons, the City should consider under the option to bill the County for first responder services. For 4,500 EMS requests, the City could charge a flat fee of $100.00 per call for potential annual revenue of $450,000. The WCEMS would probably object to paying this fee, but a fee would cost less than placing the equivalent of three additional ambulances in-service.

An alternative is to strictly follow a medical priority dispatch program. Medical priority dispatch requires the dispatcher to follow a protocol- driven menu to classify calls based on potential seriousness. Calls classified as Category C, D, and E level have the potential to be more serious and require fire first response. The FFD could still respond to Category A or B calls but WCEMS would not be required to pay for these services

Option 3. Provide Full-Service EMS

Another option is for the FFD to provide full-service EMS, including first response, and ambulance transportation. By becoming the exclusive ambulance provider, the City could collect ambulance fees from insurance companies, with a partial copay billable to users of the system. To calculate the possible revenue from this option, we take (a) the number of ambulance requests multiplied by 0.7; (b) the remainder is multiplied by a set fee per call. Although Medicare is not the only insurance, it is the one most often used; (c) the number of loaded miles travelled is multiplied by the Medicare set rate; (d) the above numbers are combined to determine the maximum amount of reimbursement. The total available is lowered by 6.5 to 8.0% to offset costs for collection of bills. Table 11 provides a prospectus for one year of ambulance fees.

Table 11: Estimated Annual Collections for CY 2012

EMS Calls	Transports (70%)	Average Reimbursement ($450.00)	Mileage (6.5@$8.00)	Total Net	*Collection Rate (.7)	Subtract Collection fee (.07)
4500	3150	$1,417,500	$163,800	$1,581,300	$1,106,910	$1,029,426

Table 12 lists the estimated cost of initial investment the City would be required to commit to. Since the three current rescue units cannot be converted to ambulances by upgrading the rescue modules, four new ambulances must be purchased. The price of an ambulance varies depending on the features an organization requests. Any time an organization changes the construction of a standard ambulance, expect a cost increase. The new NFPA standards may increase the cost of an ambulance 10-20%. Costs for standard stretchers will total $12,000 to $20,000, while costs for power stretchers will total approximately $40,000. Power stretchers are more expensive and add weight to the stretchers. They may also lead to decreased musculoskeletal injuries that occur during lifting. Another necessary purchase is four stair chairs. These units help crews carry patients up and down steps. The cost for four stair chairs is $8,000 to $24,000. Higher-end models are economically more efficient, and may reduce provider injuries.

There are enough field personnel to staff EMS units. The minimum crew should be one paramedic and one EMT, with one paramedic on each engine company. The City should add two Assistant EMS Officers, one in-charge of EMS training, and the other in charge of EMS Quality Management. Another option is to reclassify the EMS Officer to Battalion Chief, and add two additional captains to handle the above. The EMS staff could also be responsible for health and safety, and provide EMS supervision when needed.

Adding two additional EMS Captains would not add the number of authorized positions because one Training Captain and one non-uniformed administrative position (captain-level) are unfilled.

Table 12: Initial Costs for FFD Full EMS Start-Up

Item	Cost
Paramedic transport ambulances (4)	$500,000- $800,000
Stretchers	$12,000 $40,000
Stair Chairs	$8,000 - $24,000
Cardiac Monitor and other ALS supplies	$100,000
EMS Training Captain	$80,000
EMS Quality Management Captain	$80,000
EMS Medical Director	$30,000
State Licensing Fee	$6,000
Start-up for E-PCR Program	$14,600
Total	**$830,600 – $1,174,600**

The above charges are for the initial phase only. The unit costs, and initial licensing fees are one-time only. Table 13 identifies the legacy costs for EMS transport. We assumed a CPI increase of 3% annually.

Table 13: Legacy Costs

Item	Cost
ALS Equipment Maintenance	$1,000
Medical Gases (Oxygen)	$3,000
Insurance (Vehicle, Equipment, and General Liability	$10,000
EMS Quality Management Captain	$82,400
EMS Training Captain	$82,400
EMS Medical Director	$30,900
E-PCR	$9,064
Cellphone for E-PCR	$8,600
Radio Maintenance	$3,000
Office Supplies and Printing	$2,500
Additional Training	$15,000
Travel	$2,000
Vehicle Maintenance	$17,500
Vehicle Repairs	$10,000
Postage and Freight	$3,000
Dues, Subscriptions, and Databases	$500
Total Annual	$280,846

Legacy Human Resources Costs – We also calculated the annual costs for the staffing of four ambulances on a 24/7 basis. Staffing these units would take four paramedics and four firefighters daily. Table xx shows the salary for each position (five-year time in grade) multiplied by three shifts, multiplied again by 1.32 to cover benefit costs, which produced a cost per position. We then multiplied the number of positions by the staffing factor of 1.32.

Table 14: Total Cost of Staffing Four Ambulances

Positions	Numbers X 1.32	Salary X 1.32	Total
Firefighter-Paramedic	16	$37,797 X 1.32 = $49,8	$798,273
Firefighter-EMT	16	$42,803 X 1.32 = $55,644	$903,999

The total cost for staffing these units is **$1,702,272**. Twenty-four of the 32 positions are allocated to staff three rescue units. Remaining positions would be used to staff a fourth ambulance. Funding for the additional positions equals **$425,568**.

Total Annual Legacy Costs – Adding the Annual Legacy Costs plus the Annual Human Resources Legacy Cost = The Total Annual Legacy Costs. In this case, the Total Annual Legacy Costs ($280,846 + $425,568) = **$706,414**.

The Changing Culture – Should the FFD choose to become a licensed agency and stand on its own, the biggest change will likely be in the culture of the organization. To provide full EMS service, the following actions would be essential.

- All firefighters should be at minimum EMT certified.
- As designated by medical priority dispatch, the closest unit will provide EMS first response.
- All paramedics and EMTs should be qualified to serve on a paramedic ambulance.
- Company officers should have the authority to move personnel in order to rotate ambulance assignments and insure skills maintenance.
- Adequate time must be dedicated to the training and maintenance of the E-PCR program.
- The department should continue to give hiring preference to Tennessee licensed or those certified as an EMT-P by the National Registry of EMTs.

Department personnel must understand that accountability, quality management, and staff priorities will increase towards EMS. Even when used to providing paramedic first responder service, the move to full service EMS changes the playing field. Individual officers and EMS providers will realize an increase in duties and responsibilities, and even greater involvement with the community.

Once the FFD begins transportation, it should expect that their ambulances will be on calls for a longer time than the current rescues. Another factor is the potential for slow hospital turnaround times and a delay in getting back to service. The EMS Officer should monitor these times as part of the quality management process. A plan should be in place for problem resolution with the hospital emergency department. Also, a mutual aid agreement between the FFD and WCEMS would be necessary under this option.

Considerations for the Near Future under Option 3 – Should the City of Franklin choose to begin EMS transport, there will be several items that should be evaluated at the one year point.

- The strengths and weaknesses of the quality management program
- The effectiveness of the department to hospital feedback mechanism for patient care
- EMS skills proficiency

- The need for additional EMS clinical supervision
- An evaluation of EMS response times against NFPA 1710 and CAAS standards.
- The future need for a paramedic ambulance at Station 7 (after construction). Evaluation may determine that having an EMS unit at that location may be more important than a full fire station. If ambulance service is not adopted, a paramedic first responder unit could be considered.

Concluding Thoughts

The City of Franklin is in a good position to make some decisions for the future. We believe there are three basic choices available, any of which are acceptable. The City Mayor and Board of Alderman have to choose which level of commitment is most appropriate for the City. Regardless of the option chosen, there are several actions that should be taken by the City and the Franklin Fire Department.

1. There must be improvements in the EMS dispatch process. This alone could reduce response times without any operational changes. Specific changes include:
    a. Consolidation of the City and County 911 Dispatch Centers.
    b. Implementation of a formal Medical Priority Dispatch program
    c. Upgrading of dispatch software to allow for specific unit dispatch
    d. Full use of AVL services to ensure closest unit response.
2. The Franklin Fire Department should institute a complementary EMS quality management program. If the current response model is maintained, the program will complement the current WCEMS model. The program should include:
    a. Tracking skills proficiency
    b. System-wide EMS case review that includes all constituents starting with EMS dispatch, and include FFD first responders, and WCEMS personnel.
    c. Increase direct contact with the EMS medical director.
    d. Review patient care outcomes, including how FFD first response affected patient care.

Choice One – No changes in EMS delivery.

- Franklin Fire Department continues their role as a paramedic first response agency
- WCEMS remains the licensed EMS agency and provides paramedic ambulance service

Choice Two – No changes in EMS delivery, but the City should charge the County a fee for EMS first responder services.

- Could provide for up to $450,000 in first responder fees
- WCEMS may initially be resistant, but first responder fees would be less costly than putting additional ambulances in-service
- Costs could be mitigated by using medical priority dispatch to guide the use of first responders

Choice Three – Franklin Fire Department provides full-service EMS.

- Can be accomplished by converting the three rescue units to paramedic ambulances
- Could bring in approximately $1.04 million in annual revenue
- Start-up cost for the first year is approximately $700,600
- Requires additional commitments, but gives the City greater control of EMS

VI. LIST OF RECOMMENDATIONS

Recommendation 1: Continue to award preference points for applicants who possess their paramedic license or National Registry of EMTs Paramedic certification.

Recommendation 2: Continue to require EMT licensure as a prerequisite for employment, and as a condition of continued employment.

Recommendation 3: If the delivery model remains the same, the City of Franklin and WCEMS should revise the MOU as recommended above.

Recommendation 4: The FFD should begin to record measurements for "with patient" and for "CPR/defibrillation instituted."

Recommendation 5: Review the call processing and dispatch process with Franklin Police Department, Williamson County Emergency Communications Center and Williamson Medical Center EMS to determine whether any changes can be made to improve call processing and dispatch times.

Recommendation 6: Determine a method to reconcile call identifiers in order to allow response time comparisons between the FFD, and Williamson County EMS, and identification of the time of arrival of the first EMS unit.

Recommendation 7: Review the incident reporting procedures between Williamson County and the City of Franklin and implement a unique identifier that allows for the reporting and analysis of an entire incident and not just the respective department's performance.

Recommendation 8: The City of Franklin and Williamson County should form a task force to determine if there are advantages to consolidating their 911 Communications Centers.

Recommendation 9: The City of Franklin should request the reserved funding they are entitled to from County 911, that could be used to train the telecommunicators in medical priority dispatch.

Recommendation 10: Assure that the next generation radio system is equipped with the proper technology to accomplish specific station, and specific vehicle alerting.

Recommendation 11: AVL technologies should be used to their full potential. Equip all vehicles with AVL, and use the system to assign vehicles to calls.

Recommendation 12: If the FFD adopts paramedic ambulance service, EMS response should be provided by the closest unit.

Recommendation 13: Continue the objective-based approach used in the paramedic and EMT credentialing process.

Recommendation 14: The FFD should adopt the EZ-IO as its IO access device.

Recommendation 15: Assure that the FFD EMS Officer and EMS providers have increased contact with the medical director.

Recommendation 16: The City of Franklin Fire Department should create and institute an EMS quality improvement plan.

Recommendation 17: Institute a controlled substance policy for carrying morphine and midazolam on transport units.