Evaluating the Clearcreek Fire District Apparatus Maintenance Practices

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CERTIFICATION STATEMENT

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ABSTRACT

The problem this study researched is that Clearcreek Fire District utilizes a private company for mechanical service which limits the internal controls and oversight in regards to efficiency, quality, and costs. The purpose of this descriptive research was to evaluate the current apparatus maintenance practices with emphasis placed on cost, efficiency, and available options for improving the apparatus maintenance program.

The following questions were answered by this descriptive research:

1. How is the Clearcreek Fire District currently performing apparatus maintenance?
2. What local, state, and national mandates govern, and what standards apply to fire apparatus maintenance?
3. What systems are other departments of like size and budget utilizing for apparatus maintenance?
4. What can be done to reduce costs and increase efficiency of the apparatus maintenance practices at Clearcreek Fire District?

The procedures used were a comprehensive literature review, internal and external surveys, and an interview with the CCFD Fire Chief. The results showed that the CCFD lacks a system that promotes internal controls, accountability, and efficiency.

This research led to the recommendation of the following actions: Utilize the newly reassigned Captain to conduct a comprehensive overview of the current apparatus maintenance practices, the development of policy and procedure for the management of apparatus maintenance, and the development of a job description and qualifications that can be used to hire a township mechanic.

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INTRODUCTION

Statement of the Problem

The Clearcreek Fire District (CCFD) utilizes a private company for mechanical service and maintenance which limits the internal controls and oversight in regards to efficiency, quality, and costs.

Purpose of the Study

The purpose of this descriptive research is to evaluate the current CCFD apparatus maintenance practices with emphasis placed on cost, efficiency, and available options for improving the apparatus maintenance program.

Research Questions.

The following questions will be answered by using descriptive research.

1. How is the CCFD currently performing apparatus maintenance?
2. What local, state, and national mandates govern, and what standards apply to fire apparatus maintenance?
3. What systems are other departments of like size and budget utilizing for apparatus maintenance?
4. What can be done to reduce costs and increase efficiency of the apparatus maintenance practices at the CCFD?

BACKGROUND AND SIGNIFICANCE

The CCFD is located in the northern portion of Warren County just north of the county seat Lebanon, Ohio. Interstate 75 runs through the CCFD and serves as the western boundary of the district. The CCFD is comprised of a large volume of residential homes, rural and agricultural areas, commercial/industrial parks, a historic district, and a small airport. The northern end of the jurisdiction has seen rapid growth including commercial, retail, restaurant, and entertainment development. The CCFD provides fire and EMS services to the city of Springboro as well as Clearcreek Township. The CCFD community totals around 30,000 residents according to the latest United States census data.

The CCFD is funded by three continuous property tax levies that are currently in effect generating around $5,400,000 annually. The property taxes collected in the city and the township must be utilized for the funding of fire and emergency services. The CCFD collects EMS transport revenue that totals close to $500,000 annually. The CCFD also applies for additional funding streams through state and federal grants. The current budget for CCFD is $7,200,000. The CCFD is currently pulling money from a reserve fund in order to bridge the gap between income and expenditures. The CCFD currently has unencumbered funds totaling $5,400,000. The unencumbered fund balance is expected to be completely depleted in fiscal year 2022.

The CCFD provides fire and EMS services out of three strategically located fire stations that cover a total of 50 square miles of the city and township. The CCFD has two different staffing models in providing fire and EMS services. At headquarters, an engine, medic, and a battalion shift supervisor are staffed. The staffing at headquarters has a minimum staffing of six. The two other substations utilize split crew staffing for an engine and medic. The split crew

staffing model utilizes a minimum staffing of three. Split crew staffing utilizes one crew to staff two different pieces of apparatus (engine, medic) instead of utilizing two crews. The split crew staffing model is driven by a concept known as first emergency first. This concept can be defined as the crew will respond in the appropriate apparatus for a given dispatch. For example, if a medic call is dispatched the crew will respond in the ambulance and the engine will remain unstaffed for the duration of the incident.

In total, the CCFD operates three frontline engines, three frontline medics, and a battalion supervisor. Two additional medics and an engine are in reserve and capable of being pushed into service due to maintenance or mechanical needs. The CCFD also has a ladder and brush truck in its fleet, but those pieces of equipment are rarely staffed by on duty shift personnel.

The CCFD administrative staff is comprised of a chief, assistant chief, two captains, and an inspector lieutenant. Each of these officers is assigned a staff vehicle for work related use. The CCFD also has a utility truck and an additional staff car that is currently not assigned. In late 2013, the CCFD acquired a mass casualty unit that was previously awarded to Warren County through a grant provided by the Department of Homeland Security. The CCFD assumed the responsibility of housing this tractor trailer unit and also providing the needed maintenance and mechanical service. The total number of apparatus/vehicles in the CCFD fleet is twenty. The age of all apparatus in the CCFD fleet varies. The apparatus/vehicles range in age from 24 years to 2 years old. The average age of all fire/EMS apparatus is 10 years. The average age of all staff vehicles is 6 years (See Appendix A).

The call volume for CCFD was 3,152 in 2016 compared with 1,984 in 2003. This is an increase of 58% in a thirteen year period. Additionally, the calls are being handled by three different stations and apparatus as opposed to the prior model of one station. The current call

volume is being handled by three engines, three medics, and a battalion supervisor instead of one engine, one medic and an on call duty officer. This has placed a burden on the maintenance company to ensure more apparatus is in service and operating in a safe manner.

The CCFD passed its last fire levy in 2000. The purpose of this levy was to increase our service delivery capability due to the tremendous community growth and increases in run volume. The target goals were to build two additional fire stations and outfit them with the needed personnel and apparatus. The fire levy was designed to provide the required income to fund the ten-year strategic plan. Due to being fiscally responsible the levy has far exceeded the initial terms of the strategic plan and continues to be the primary funding mechanism to date. In addition to providing the needed fire stations and apparatus, the CCFD has transitioned from a combination department primarily utilizing part-time personnel to an all full-time career department. The transition from a combination department to an all career department has come with a substantially larger budget the current levy was not designed to support. The levy has not been placed on the ballot again, and currently there is no timetable for the levy to be placed on the ballot either. The unencumbered funds are being spent down and a new strategic plan is being developed. At the conclusion of the strategic plan, input will be solicited from key internal and external stakeholders and the CCFD fire administration will have a better idea of how to design a levy for future operations.

The CCFD placed a fire levy on the ballot in 2013 to secure funding for the future. At the time the levy was placed on the ballot the CCFD had approximately $6,000,000 in reserves. Although the money in reserves was sufficient, the expenditures had exceeded the income and the CCFD was operating in a deficit. The levy was rejected by the voters. One of the major concerns voiced by the public was that there was a considerable balance of money that had been

carried over and questions were raised why another tax levy was needed. That concern has been the major reason that another attempt to pass a tax levy has not been attempted. For the last three years, the CCFD has been maintaining its current level of services, but has not been able to make any significant changes to the operations of the department.

It is apparent for the need for additional revenue and a new fire levy in the near future. The current CCFD administration has recently developed a strategic plan citing seven major areas that need to be addressed. The CCFD administration is in the process of seeking feedback from key internal and external stakeholders about these issues. One of the seven key items listed in the strategic plan is to *improve the way we perform maintenance for both apparatus and facilities.*

In Southwest Ohio, where the CCFD is located there are limited options for apparatus maintenance. Currently, the CCFD is utilizing a private company called Fire Apparatus Repair based out of Xenia, OH. This company provides all maintenance and repair to CCFD apparatus. Fire Apparatus Repair provides apparatus maintenance, diagnosis, and testing of all emergency apparatus on site at all of the CCFD firehouses. Fire Apparatus Repair has a fleet of truck and trailers that can travel to firehouses and perform apparatus maintenance. Fire Apparatus Repair services approximately 50 fire departments and employs 4-6 mechanics at any given time. They have the ability to fix apparatus on site or identify issues that need to be addressed by specialty repair facilities or to satisfy the needs of specific warranties. The staff vehicles are serviced by a local vendor and or the dealership in which they were purchased.

The Southwest Ohio region also has several other companies that provide on-site service similar to Fire Apparatus Repair. These companies are generally dealers of specific apparatus manufacturers that also provide apparatus maintenance with EVT certified mechanics.

Furthermore, there are apparatus maintenance shops that provide service at their facility. This system can be problematic due to needing tow services or utilizing on duty personnel for shuttling apparatus. Coupled with the logistical issues, many of the local mechanic shops do not provide EVT certified mechanics.

The CCFD encounters a multitude of issues that are similar to many other fire departments across the country. When a CCFD apparatus experiences a maintenance issue a reserve apparatus must be placed in service in its place. Furthermore, there is no standard timetable for when the apparatus can be expected to return to service. In correlation to the apparatus being out of service (OOS), the CCFD has minimal bench depth for another apparatus to experience a concurrent maintenance issue. This has a direct impact on the CCFD to maintain levels of service.

The CCFD performs daily and weekly apparatus inspections (See Appendix B). Each apparatus is checked at the beginning of shift and all information is recorded electronically on an iPad. The apparatus check is then sent to the company officer for review. During the review of the daily apparatus check, the company officer fills out and submits any necessary maintenance requests. The request is sent directly to the captain in charge of apparatus maintenance who then coordinates the maintenance requests to the maintenance company. Each day of the week has a corresponding apparatus that receives a weekly apparatus check (See Appendix C). This apparatus check is more in depth and requires the apparatus to be detailed. The same procedure as the daily apparatus check is followed regarding maintenance needs and issues.

The current maintenance system is driven by the company officers. When a maintenance need is discovered it is reported to the company officer. The company officer completes a maintenance request which is then forwarded to the captain in charge of apparatus maintenance

(See Appendix D). This captain is assigned to a 24/48 work schedule so it could be up to two days before the request is received and processed. In the event that the maintenance need renders a unit OOS, the captain can contact the maintenance company to inquire about getting the issue as soon as possible. There are times when the mechanic from the company is available to respond the same day to address the issue, but there are other times it may take a few days to get a mechanic from the company onsite.

The maintenance needs are tracked by the maintenance requests and apparatus daily log. After a review of records for 2016, from the date reported to the date fixed, the mechanic company averaged approximately 20 days. The times were dramatically shorter if the apparatus was OOS (See Appendix F). This is a prime example of the lack of internal control that the CCFD has over ensuring that maintenance issues that are reported get fixed in an efficient and time sensitive manner.

The process in which the CCFD provides maintenance to the fleet of apparatus has become one of the key items in the strategic plan for a multitude of reasons. Primarily, the cost of apparatus and its maintenance is the largest budget item outside of personnel costs. The CCFD spends on average close to $100,000 annually on parts and labor over the last three years (see below chart). The issue with this expenditure is the CCFD has minimal control over such a large budget item.

Year	Labor	Parts	Total
2014	$45,575	$37,437	$83,012
2015	$43,295	$76,694	$119,989
2016	$41,515	$40,557	$82,072

Additionally, the CCFD has undergone tremendous change and growth since the passage of its last fire levy in 2000. Despite the growth of the apparatus fleet, increases in run volume, and increase in number of staffed apparatus the CCFD has not evaluated or changed the practices and procedures of providing apparatus maintenance and service. The cost of the current maintenance practices has continued to be a large budget item. In order for the CCFD to continue to be progressive, the organization must analyze the current apparatus maintenance practices and determine if the cost outweighs the overall efficiency.

LITERATURE REVIEW

One of the largest budget items that many fire departments face is the purchasing and maintenance of emergency apparatus. Additionally, emergency apparatus is a long term investment for any department. Therefore, there a multitude of standards and guidelines aimed at the design, maintenance, inspection, and care for emergency vehicle maintenance. The National Fire Protection Association (NFPA) has designed standards for departments to utilize when outlining the maintenance of emergency apparatus. The NFPA has published standards that cover inspection, maintenance, testing, and retirement of in service apparatus (NFPA 1911). Additionally, the NFPA has a standard for fire apparatus preventative maintenance programs (NFPA 1915) and a standard for emergency vehicle technician (EVT) qualifications (NFPA 1071). The standards designed by the NFPA are considered guidelines that fire departments may utilize regarding the maintenance of emergency apparatus. While these are only guidelines, they are considered to be industry standards. The State of Ohio has adopted the Ohio Administrative Code (OAC) that closely mirrors the NFPA standards. Ohio has designed very specific standards that govern the design, inspection, and maintenance of fire apparatus (OAC, 2016). The standards listed in the OAC are the law in the State of Ohio and require fire departments to

design inspection and maintenance practices that are consistent with State of Ohio Law (OAC, 2016).

There are many things to consider when looking at the CCFD apparatus maintenance practices and how NFPA standards apply to the department. While the NFPA standards are very complex and thorough in their area specific definitions of apparatus maintenance, there are areas that are left to the discretion of the authority having jurisdiction (AHJ). At CCFD, the AHJ is the fire chief. The CCFD follows NFPA 1911 with their apparatus maintenance practices. The department utilizes EVT certified mechanics to perform pump testing and annual safety inspections. According to NFPA 1911, the AHJ shall determine who is qualified to perform the daily/weekly visual and operational checks of the emergency vehicle as required by NFPA 1002 (NFPA 1911). According to Stephen Wilde, a member of the NFPA 1911 technical committee, "Anyone doing any type of fire apparatus preventive maintenance, inspections, etc., should take a look at [NFPA] 1911 because it's a great reference. I also think that there are still many people who are not aware of what NFPA has done with this document." (Avsec, 2013) Wilde, who's also the president of the board for the emergency vehicle technician certification commission, said, "The 2007 edition of NFPA 1911 represented the first NFPA standards document that told the AHJ that they had the option of going above requirements listed in the standard, but it could not delete or ignore requirements in the standard." (Avsec, 2013)

While the apparatus maintenance company that the CCFD utilizes is an EVT certified company, not all of their employed mechanics hold this certification. The mechanics that are not EVT certified operate under the owner of the company EVT certification much like paramedics operating under the direction of a medical director. NFPA further states inspections, maintenance, and testing of emergency vehicles shall be performed by qualified personnel

(NFPA 1911). Additionally, any person performing diagnostic checks, inspections, performance testing, or maintenance of the emergency vehicle shall meet the qualifications of NFPA 1071 or the equivalent (NFPA 1911).

NFPA 1071 Standard for Emergency Vehicle Technician Professional Qualifications defines various levels of this EVT certification. An EVT I is defined as an individual who performs inspection, maintenance, and operational checks on emergency response vehicles and who, by possession of a recognized certificate, professional standing, or skill, has acquired the knowledge, training and experience and has demonstrated the ability to deal with issues related to the subject matter, the work, or the project (NFPA 1071). An EVT II describes the same skills and abilities as an EVT I and adds diagnosis, repair, and performance testing on emergency vehicles (NFPA 1071). The EVT III certification is described as a first-level supervisor responsible for EVT I and EVT II personnel performance, scheduling, quality control of repairs and maintenance work, and the compiling and reviewing of initial documentation (NFPA 1071).

NFPA 1911 Standard for fire apparatus maintenance program standard establishes the minimum requirements for inspection, maintenance, and testing for in-service fire apparatus. The guideline also identifies the systems and items on a fire apparatus that are to be inspected and maintained. While this standard is a guideline for fire departments to use, during my literature review the NFPA reverts back to departments following the manufacturer recommendations. The main purpose of the standard is to provide requirements for an inspection, maintenance, and testing program that will ensure that in-service fire apparatus are serviced, maintained, and kept in a safe operating condition and ready for response at all times. Furthermore, the intent of NFPA 1911 is to establish that safety is a primary concern for the

continued in-service use of a fire apparatus and the ultimate decision to refurbish or retire that fire apparatus (NFPA 1911).

There are a multitude of options that departments utilize for performing apparatus maintenance. Most of the departments center their apparatus maintenance efforts around financial constraints and the ability to find and secure quality mechanics. Fire departments coast to coast are having trouble finding qualified mechanics to work on fire apparatus and do so competently. There is a shortage of heavy equipment mechanics and the few out there often migrate to the private sector for more pay and better benefits. The public sector operates in a considerably different fashion than the private sector. For instance, a mechanic that has 20 years of experience in the private sector may be hired in as a trainee in the public sector. This has a dramatic effect on a mechanics pay and the recruitment efforts of the public sector (Stanton, 1999). If you are a shop manager or a chief officer, that news probably is not surprising as it has been an issue for a few years (Ballam, 2013). The applicant pool for qualified technicians is both real and current. One such case is from George Kassise, who oversees fleet operations for the City of San Antonio, TX, and whose department promotes from the bottom up. Consequently, a mechanic who applies for an opening with 20 years of experience must start out at the trainee level. Few mechanics with bonafide experience want to start over again in life as a trainee, and so such jobs are shunned in favor of more lucrative offers on the private side. (Stanton, 1999)

In 1988, the International Association of Fire Chiefs (IAFC) introduced the Fire Apparatus Mechanics Certification Program. IAFC's goal was to elevate the standards of emergency vehicle maintenance as well as the competencies of the personnel who perform the work. The program also sought to provide those fire mechanics with recognition for their

education, training and experience. Today, those early efforts to raise the level of professionalism within the fire mechanic ranks are carried on by the Emergency Vehicle Technician Certification Commission (EVTCC). The IAFC is no longer directly involved with oversight for the EVT certification program, but does continue to support the program. The EVT Certification Commission is a non-profit corporation dedicated to improving the quality of emergency vehicle service and repair throughout the United States and Canada. EVT is governed by a board of directors that represents emergency response agencies, emergency vehicle maintenance service associations and the educational community. Currently, there are over 7,000 EVT-certified technicians. (Avsec, 2016)

Many departments in the area utilize their jurisdictional public works garage to work on their emergency apparatus alongside of school buses, snow plows, and other ancillary vehicles. While this practice saves money since the mechanics are already in house and compensated, many times they do not hold the applicable certifications to work on emergency apparatus. Too often, the mechanics charged with working on fire apparatus and ambulances, particularly those employed by the local government, are part of the cadre of mechanics who work on many different types of vehicles other than emergency vehicles. Few would argue that there's a world of difference between the maintenance and repair needs of today's fire apparatus and those of, say, a dump truck or trash truck. So what's a better maintenance and repair paradigm for fire departments and their fire apparatus and ambulances? (Avsec. 2016)

Another issue identified with the utilization of public works garages is keeping up with the advancements in apparatus technology. Over the past few decades, significant technological advances made in fire apparatus have placed greater demands on maintenance and repair personnel. In the past, mechanically injected diesel engines with a standard transmission often

drove simple pumps with one pair of master gauges and discharges controlled by manual linkage. Now, electronics have overtaken the entire fire apparatus. Fuel to the diesel engine is now controlled by an electronic computer that communicates to other "brains" that control components such as the electronic transmission and pressure governor. Valves are electrically controlled and electronic meters read flow, engine temperature, oil pressure, voltage, and rpm. Hydraulic brakes were replaced by air brakes controlled by antilock braking system (ABS) sensors and computer. A simple generator or alternator, with an ammeter, to charge the vehicle batteries has the added element of load management to increase engine rpm and reduce unneeded loads during periods of battery discharge. To add to the complexity of these systems, "multiplexing" has been introduced. This allows the various computers to "communicate" with each other over a single pair of wires to control such functions as interlocks and turning electrical accessories "on" and "off." All of these advancements have contributed to a safer apparatus and have decreased the reliance on the human element to operate, but they have also made maintenance and repair functions more complex. It is safe to say that the days of the "shade tree mechanic" repairing apparatus with a test light and a pair of cutting pliers are gone. Diagnosing problems in these systems requires specialized computer readers with the proper software and, more important, a "technician's" approach. In some areas, this has led to a serious problem. (Peters, 2000)

Peters goes on further in describing the three options available to fire departments for apparatus maintenance. He lists the options as an outside repair facility or dealer is paid to care for the apparatus, the fire department maintains a shop facility and addresses some of the routine work, or the municipal garage maintains the apparatus along with other vehicles (Peters, 2000)

Each of these three options can be viewed by their advantages and disadvantages. An outside repair facility or a fire department maintenance shop can be exceedingly expensive and difficult for most fire departments to afford. The advantage is that generally you get mechanics that are familiar with your apparatus and the systems used on emergency apparatus. Conversely, in a municipal garage the fire department apparatus will be competing with other public works vehicles and the mechanics may not be as familiar with emergency apparatus. (Peters, 2000)

The issues surrounding apparatus maintenance are not exclusive to the fire service. There are many large business, corporations, and government entities that have been trying to figure out the most efficient and cost effective system of providing apparatus maintenance. Over the course of this literature review I research how varying agencies and businesses conducted apparatus maintenance and the systems they deployed. I have discovered that apparatus maintenance can be conducted in four different models. The four types of apparatus maintenance models are preventive maintenance, predictive maintenance, reactive maintenance, and a combination of all types (UE Systems, 2014).

There are benefits that exist in each model. Additionally, there are drawbacks or negatives that also exist. Currently, the CCFD utilizes reactive maintenance. Reactive maintenance (also called emergency or breakdown maintenance) is described as unplanned and involves restoring equipment when it fails by replacing or repairing faulty parts. The advantage that reactive maintenance provides is that it's an affordable maintenance model and requires fewer maintenance staff (UE Systems, 2014). The affordability of this maintenance model must also be balanced with the chain reaction of events that must be overcome when an apparatus encounters a breakdown and must be placed out of service (UE Systems, 2014). This is a very hands-off approach to machine maintenance and while it keeps routine maintenance costs low,

such a program can be costly in the long run. The Department of Energy (DOE) Office of Energy Efficiency and Renewable Energy notes that the two major advantages of reactive maintenance are minimal maintenance costs and the need for fewer staff members. However, this is as far as these advantages go (UE Systems. 2014).

The public and private sectors have both deployed reactive maintenance as their chosen models. U-Haul, one of the nation's largest fleet of rental trucks has received criticism for their maintenance practices. U-Haul has approximately 100,000 trucks in its fleet. Many have logged over 100,000 miles. U-Haul relies on a far-flung network of independent dealers to supplement its 1,450 company-owned rental centers. This has added to maintenance problems. Most of the 14,500 dealers have no auto service background. They include storage sites, mini-marts, postal supply shops, even liquor stores and laundromats (Levin, Miller, 2007).

A few of U-Haul's competitors in the moving truck market Penske Truck Leasing and Budget Truck Rental operate in a vastly different manner. Penske Truck Leasing says it replaces up to half its consumer rental fleet every year and that its oldest trucks are about 3 ½ years old. Budge Truck Rental says the average age of its trucks is 2 to 2 ½ years. Among the U-Haul fleet of approximately 100,000 trucks are many aging, high-mileage vehicles. Many have logged more than 100,000 miles (Levin, Miller, 2007).

Reactive maintenance also provides avenues for fire departments and businesses to be subject to liability in the event of a mechanical failure. U-Haul has been involved in litigation over its maintenance practices. The LA Times investigated an incident where a U-Haul truck experienced a brake failure and caused serious life threatening injuries to a customer. During the yearlong investigation, Times journalists surveyed more than 200 U-Haul trucks and trailers in California and other states and found more than half were overdue for a company mandated

“safety certification,” a check of brakes, tires and other parts typically required every 30 days (Levin, Miller 2007).

The Boston Fire Department (BFD) is one of the largest and busiest fire departments in the country. In January of 2009, Boston Ladder 26 was returning from a call when their brakes failed. The truck crashed into a building killing Lieutenant Kevin Kelley. This tragic event prompted the BFD and the Suffolk County District Attorney to examine the incident. The Boston Fire Department hired Mercury Associates Inc. to assess the fire apparatus maintenance practices of the BFD (Lauria, 2009).

During the assessment of the policies and practices of the BFD apparatus maintenance program many deficiencies were exposed. The assessment was very thorough and detailed. While reading the assessment report it was clear that the BFD was only utilizing reactive maintenance procedures even though the standard for the BFD was to include routine maintenance inspections. The BFD Fire Commissioner Joe Finn uncovered that of the 60,000 inspections that were supposed to be completed, less than 500 were actually completed.

In contrast to reactive maintenance, the exact opposite models are defined as preventive and predictive maintenance. Predictive maintenance, as defined by the US Department Of Energy is defined as the actions necessary to monitor, find trends, and analyze parameters, properties and performance characteristics or signatures associated with structures, systems, and components (SSC’s), facilities or pieces of equipment to discern whether or not a state or condition may be approaching which is indicative of deteriorating performance or impending failure, where the intended function of the SSC’s, facilities or pieces of equipment may be compromised. Predictive maintenance activities involve continuous or periodic monitoring and diagnosis in order to forecast component degradation so that "as-needed" planned maintenance

can be initiated prior to failure (U.S. Department of Energy, 2006). One of the goals of predictive maintenance is to reduce the costs and out of service time involved with preventive maintenance. The costs of these models of maintenance are inherently higher and that is why most fire departments utilize reactive maintenance models.

Preventive and predictive maintenance is starting to gain traction in larger metropolitan fire departments as well as very large industries in the private sector. The United Parcel Service (UPS) has one of the largest fleets in service. UPS set out to take the guesswork out of maintenance, reduce environmental impact, and identify trends in their operation to help save time and money. In 2003, UPS completed a three month overhaul of the preventive maintenance process for its 70,000 delivery vehicles. The new procedures were projected to reduce oil use by 330,000 quarts and save an estimated $3 million annually (GreenBiz Editors, 2003).

The redesigned process is built around the individual characteristics of UPS's delivery fleet, essentially giving each vehicle its own fingerprint. Through rigorous part testing, real-time duty cycle analysis and fleet-wide assessments, the Study Group developed a detailed matrix of vehicle characteristics, including engine type, vehicle group, miles driven, days of service and manufacturers' recommendations for oil changes and other types of engine service. It was this process, for example, that allowed UPS to better gauge how frequently a vehicle type needs an oil change. Some vehicles were found to need less frequent oil changes, providing the net savings of 330,000 quarts (GreenBiz Editors, 2003).

The process of preventive maintenance must be constantly monitored to ensure that costs do not soar and out of service or downtime is limited. Ken Eggen at Tango Transport in Shreveport, La., knows that one size doesn't fit all. That is why he has separate preventative maintenance checklists for each of the three engine models his fleet runs. He goes a step further

and sits down with his shop managers quarterly to pick through those checklists and make adjustments. "Over a period of time, a truck changes," said Eggen, Tango's vice president of fleet maintenance. "You build a little bit of data and you learn that the Cummins engine needs different things checked at different times than a Caterpillar engine" (Long, 2009).

Preventive maintenance commonly refers to the practice of regularly servicing equipment on a pre-determined schedule so that it does not develop catastrophic failures and performs better over its useful life cycle (Smith, 2012). One of the important facets of preventive maintenance is performing the maintenance when needed, and not just based on a given interval. Top-notch preventative maintenance programs factor in the types, ages and applications of trucks, consider regional differences and dig deep into owners' manuals to tailor PM checklists (Long, 2009).

The CCFD, as stated earlier in the literature review utilizes reactive maintenance. Although, each apparatus does receive an Annual Safety Inspection (ASI) every year it is in service (GOGL 9.1 Section H, 2016). The maintenance company submits a report of what was discovered during the ASI and CCFD fire department administration and the mechanics decide what needs fixed and what can wait. This is considered preventive and predictive maintenance, but it only transpires once a year. The frequency of these inspections would need to occur on a more regular basis to be considered preventive or predictive maintenance.

The CCFD has policies relating to daily, weekly, and monthly apparatus checks (Appendix C). Per the CCFD General Operating Guidelines (GOGL) each employee through the rank of captain shall be cleared to operate all fire district apparatus during the duration of their employment (GOGL 7.3 section A, 2016). Furthermore, the GOGL states that during the drivers training and qualification policy employees are to be aware of current state and local laws, preventive maintenance, yearly license checks, and daily documentation of driving

logs/apparatus checks GOGL 7.3 section D, 2016). I do not expect fire apparatus drivers to be mechanics, but there is often a fine line between knowing and not knowing the basic mechanics and systems of the vehicle you are charged with operating safely (Dallessandro, 2010). There has been much consideration and thought over the years about how to save money and increase efficiency of apparatus maintenance. The CCFD hired an outside consultant firm in 2015 to assess the operations of the department. One of the recommendations was to leverage maintenance expenditures toward a partnership with an external maintenance provider or entity (Novak Report, 2015). The CCFD has experienced ongoing quality control issues and concerns with the current maintenance contractor, but due to the specialty nature of fire apparatus maintenance, there is a scarcity of other providers who can adequately service these vehicles (Novak Report, 2015). The assessment further recommends that the CCFD would be better served to explore combining resources with the Miami Valley Fire District or other Clearcreek Township entities to share the cost of a full-time mechanic (Novak Report, 2015). Currently, the CCFD and Miami Valley Fire District are both currently utilizing Fire Apparatus Repair for apparatus maintenance.

In summary, there are various ways of performing apparatus maintenance. During my research I was able to uncover that there is not a single approach that is proven to be the most effective for any given fire department, business, or industry. There is a vast array of information ranging from NFPA standards, manufacturer recommendations, and fire department policy and procedure. The type of apparatus maintenance utilized needs to be very user specific. There is no one size fits all model. It is up to each entity to analyze and develop a strategy to perform quality apparatus maintenance while controlling costs and efficiency.

PROCEDURES

The first phase of research involved taking a broad overview of how CCFD performs apparatus maintenance. This included gathering information on what local, state, and national standards govern how apparatus maintenance is performed. I utilized the NFPA website to determine what standards are in placed to assist fire departments with developing and managing their apparatus fleet.

The next phase of research involved utilizing the local library to gather information about how other fire departments, industries, and businesses perform apparatus maintenance. I was able to gather significant information on how the private sector has approached apparatus maintenance. I also utilized the OFE and EFO archived research paper databases to build a foundation of information that assisted me in designing my own descriptive research for apparatus maintenance.

The final phase of research was centered around developing surveys and interview questions. I developed a survey utilizing Survey Monkey to distribute to area fire departments in adjoining counties. The counties consisted of Warren, Butler, Montgomery, Clermont, Hamilton, Clinton, and Greene County. The distribution choices were based on geographic location as well as similarity of size, budget, and run volume in comparison with the CCFD. I was able to obtain contact information by utilizing a fire chief's directory and sent the surveys directly to the contact person by email using Survey Monkey. The area fire department survey was sent to 38 different fire departments in seven different adjoining counties. There were 24 surveys that were completed and returned. The second survey was sent to all 51 internal members of the CCFD. The surveys were distributed by departmental email utilizing Survey Monkey. There were 45 surveys that were completed and returned. Utilizing Survey Monkey

enabled me to determine what the responses were and the total amount of responses. Finally, I developed ten interview questions that I utilized to gather information during a one on one interview with the CCFD fire chief (Appendix H).

The survey and interview data was compiled and utilized to evaluate the CCFD apparatus maintenance practices. The data collected will assisted the author in making recommendations on how to improve the CCFD apparatus maintenance practices.

Definition of Terms

ABS. Antilock Braking System

AHJ. Authority Having Jurisdiction

ASI. Annual Safety Inspection

BFD. Boston Fire Department

CCFD. Clearcreek Fire District

EVT. Emergency Vehicle Technician

EVTCC. Emergency Vehicle Technician Certification Commission

GOGL. General Operating Guidelines

IAFC. International Association of Fire Chiefs

NFPA. National Fire Protection Association

OAC. Ohio Administrative Code

OOS. Out Of Service

PM. Preventive Maintenance

SSC. Structures Systems Components

UPS. United Parcel Service

Limitations of the Study

The surveys that were distributed to all internal members of the CCFD may not have produced the most accurate results due to the rapid growth and hiring of personnel. A large portion of the personnel have been hired fairly recently. Due to this fact, these employees are generally young in age and lack experience with the apparatus maintenance practices of the CCFD. Their lack of involvement with the CCFD apparatus maintenance practices limits their awareness of how effective or ineffective the CCFD maintenance practices may be. These employees may not have possessed the proper amount of experience within the established system to accurately provide usable data to analyze our current apparatus maintenance practices. The author also was directly involved with assisting the Captain in charge of managing the apparatus maintenance program. This involvement provided early access and insight into seeing firsthand some of the issues the CCFD encounters in trying to manage the apparatus maintenance program prior to the completion of this research.

RESULTS

Research Question 1- How is the CCFD currently performing apparatus maintenance?

After a review of the current apparatus maintenance practices, I discovered that there is a Shift Captain that is assigned to a 24 hours on and 48 hours off schedule that is solely responsible for overseeing and tracking the apparatus maintenance. This Captain is the direct link of communication between the CCFD and the private mechanic company. Additionally, the

Captain schedules the maintenance and repair needs and tracks the mileage of each apparatus in the fleet. The other two Shift Captains have the ability to contact the mechanic company if there is a maintenance or repair need, but the primary oversight of the apparatus maintenance program is assigned to one Shift Captain.

The CCFD has policy and procedure in the GOGL detailing the daily, weekly, and monthly apparatus checks. Per the GOGL, all fire and EMS apparatus are to receive a daily apparatus check to ensure operational readiness (GOGL, 2016). Additionally, the apparatus checks are beneficial in determining maintenance needs as well as attempts at preventing maintenance issues (Appendix B). Each piece of apparatus is assigned a detailed check sheet that take occurs on a specific day of the week. The weekly check includes a thorough inspection and cleaning of the entire unit (Appendix C). These checks contribute to ensuring that all apparatus and equipment is clean and in good working order. Each piece of emergency apparatus receives an annual safety inspection (ASI). The goal of the ASI's are to identify potential safety and operational issues that need to be addressed before a potential critical failure could occur. Specialty pieces of equipment such as the pump on an engine or the aerial ladder receive an annual certification test. This annual test certifies that those integral pieces of equipment are in good working order and safe to operate.

There are multiple steps in between the discovery of a maintenance issue and the maintenance issue being repaired. The maintenance requests are processed by completing a fillable form (Appendix D) and submitting the form by email. This email is then received by the Shift Captain that manages the apparatus maintenance. The apparatus maintenance Shift Captain then processes the request, determines the urgency of the request, and either places the request on a master list or contacts the mechanic company to make a site visit in order to fix the issue.

The master list contains specific information about the request including the specific maintenance issue, if the apparatus was rendered OOS, and the date the apparatus was fixed (Appendix E). Referenced in Appendix E, it was discovered that there is a wide range of time frames noted from the reporting of the maintenance need to the date in which it was fixed.

Research Question 2- What local, state, and national mandates govern, and what standards apply to apparatus maintenance?

There are a multitude of standards and guidelines that apply to fire apparatus maintenance. The NFPA has designed standards for fire departments to utilize for apparatus maintenance. The NFPA has published standards that cover inspection, maintenance, testing, and retirement of in service emergency apparatus (NFPA 1911). The NFPA has also designed standards outlining a fire apparatus preventive maintenance program (NFPA 1915) and the qualifications for an EVT (NFPA 1971). While these standards are only guidelines, they are considered to be the industry standard. The State of Ohio has adopted standards in the Ohio Administrative Code (OAC) that directly mirror standards set by NFPA. Local fire departments are required by law to adhere to the specific standards that are defined by the OAC. The OAC clearly defines the minimum requirements for the design, inspection, and maintenance of fire apparatus.

The NFPA standards are very complex and thorough in their specific definitions of apparatus maintenance, but there is discretion left to the AHJ to determine how the NFPA standards are applied to their fire department. The AHJ determines who is qualified to perform apparatus daily/weekly visual and operational checks of emergency vehicles as required by NFPA 1002.

The NFPA has designed a multitude of standards relating to the maintenance of fire apparatus. While the standards are a guideline to follow, during my literature review I found that the NFPA reverts back to departments following specific manufacturer recommendations. The main goal of NFPA 1911 is to establish that safety is the primary concern.

The IAFC established a standard for Fire Apparatus Mechanics Certification Program. The goal of this program was to elevate the standard of emergency vehicle maintenance as well as the competencies of the people performing the work. The IAFC is no longer involved but the ongoing efforts to improve the quality of training and service is carried on by the EVTCC.

Research Question 3- What systems are other departments of like size and budget utilizing for apparatus maintenance?

I distributed an external survey to area fire departments of contiguous counties of the CCFD (Appendix F). Survey question 6 asked how many pieces of fire apparatus is your department responsible for maintaining and the average was 16.54. Survey question 6 asked who provides apparatus maintenance for your fire department? 12 departments responded township/city mechanic, 6 departments responded fire department mechanic, 15 departments responded private mechanic/contractor, and 7 departments responded apparatus vendor. Survey question 7 asked how much your department spends annually on apparatus maintenance? 8.33% responded $0-$25,000, 29.17% responded $25,000-$50,000, 8.33% responded $50,001-$75,000, 16.67% responded $75,001-$100,000, 37.5% responded more than $100,000. Survey question 8 asked how often preventive maintenance checks occur? 13.04% responded daily, 17.39% responded weekly, 17.39% responded monthly, 52.17% responded annually, 0% responded never. Survey question 14 asked, if you could change one thing about your department's apparatus maintenance practices what would it be? 8 responded more mechanics, 8 responded

have their own mechanic, 2 responded better accountability, 2 responded better facilities, 1 responded more preventive maintenance, 1 responded better parts, 1 responded better apparatus, 1 responded nothing.

The results of the external survey show that area fire departments are utilizing apparatus maintenance practices similar to the CCFD. The majority of departments are utilizing a private mechanic company and spending a similar amount of money performing apparatus maintenance. The area fire departments surveyed responded a similar size fleet to the CCFD. Furthermore, the external survey showed area fire departments are utilizing yearly preventive maintenance practices for their fleet similar to the CCFD.

Research Question 4- What can be done to reduce costs and increase efficiency of the apparatus maintenance practices at the CCFD?

The CCFD currently utilizes the reactive maintenance model. The advantage of reactive maintenance is that it is the most affordable model and requires fewer maintenance staff (UE Systems, 2014). In the literature review the author was able to track down how fire departments and the private sector across the country have been performing apparatus maintenance. There are four basic models of performing apparatus maintenance that include preventive, predictive, reactive maintenance, and a combination of using all three types (UE Systems, 2014).

There are three options available to fire departments for apparatus maintenance. The options are an outside repair facility or dealer, a fire department apparatus maintenance shop, and a municipal garage that maintains both fire apparatus and other vehicles (Peters, 2000). Each of the three options can be viewed by their advantages and disadvantages. An outside repair facility or a fire department maintenance shop can be exceedingly expensive and difficult for most fire

departments to afford. The advantage is that you get mechanics that are familiar with your apparatus and the systems used on emergency apparatus. Conversely, in a municipal garage the fire department apparatus will be competing with other public works vehicles and the mechanics will be competing with other public works vehicles and the mechanics may not be as familiar with emergency apparatus (Peters, 2000). The association between costs and efficiency is a pendulum. If you want to increase efficiency it will generally cost more money. Attempts made at saving money will generally swing the pendulum towards decreasing efficiency. When looking to increase efficiency there must be a balance between the costs needed to achieve this. Preventive maintenance commonly refers to the practice of regularly servicing equipment on a pre-determined schedule so that it does not develop catastrophic failures and performs better over its useful life cycle (Smith, 2012). The process of preventive maintenance must be constantly monitored to ensure that costs do not soar and out of service time is limited (Long, 2009).

I conducted a survey with all 51 members of the CCFD (Appendix G). Question 3 asked if the department was to make a change to the apparatus maintenance practices, what would you recommend? 53.33% responded share a mechanic with the rest of the township, 40% responded hire a full time CCFD mechanic, 6.67% share a mechanic with other area fire departments, 0% responded continue with current practices. Question 5 asked if the current maintenance practices are cost effective and efficient? 0% strongly agree, 4.35% agree, 28.26 neutral, 63.04% disagree, and 4.35% strongly disagree.

The CCFD hired an outside consulting firm in 2015 to assess the operations of the department. One of the recommendations was to leverage maintenance expenditures toward a partnership with an external maintenance provider or entity (Novak Report, 2015). The CCFD

has experienced ongoing quality control issues and concerns with the current maintenance contractor, but due to the specialty nature of fire apparatus maintenance, there is a scarcity of other providers who can adequately service those vehicles (Novak Report, 2015).

I also conducted an interview with the CCFD Fire Chief (Appendix H). Question 1 asked what do you think needs changed in our apparatus maintenance program? He responded, "better accountability for what work gets completed/not completed, more consistent and frequent preventive maintenance intervals, and a person on a 40 hour work schedule in charge of apparatus maintenance." Question 2 asked what problems do you see with our current methods and practices of providing apparatus maintenance? He responded, "the CCFD is not a priority and only another department on a list, no consistency on when apparatus gets serviced or how long it is OOS, costly and not very efficient, billing issues, lack of trust and abilities of the mechanics performing the work, and lots of downtime with mechanics traveling to get parts or ordering the wrong parts because they are not familiar with our apparatus." Question 10 asked what is the number one issue that needs addressed with apparatus maintenance? He responded, "accountability, almost impossible to hold current vendor to an acceptable level, who we use as an apparatus maintenance provider and looking into a having a township mechanic work on our apparatus."

The CCFD could hire and train a township wide mechanic to help control costs and improve efficiency. This option would inherently be more expensive, but the cost could be shared with the other departments within the township. One of the advantages is that it will enable the CCFD to have more internal control and oversight of the apparatus maintenance practices for various reasons. The advantage of having a municipal or township repair facility is that you get mechanics that are familiar with the apparatus (Peters, 2000). Additionally, a

township mechanic is an employee of the township and can adhere to township policy and procedure that the CCFD can enforce.

DISCUSSION

The purpose of the descriptive research was to evaluate the current CCFD apparatus maintenance practices with emphasis placed on cost and efficiency. A large amount of time was devoted to determining what the current CCFD maintenance practices are, how other departments are performing apparatus maintenance, and what options are available to the CCFD. The results achieved from this research will assist the CCFD administration in making changes to the CCFD apparatus maintenance practices.

The current system consists of utilizing a private mechanic company for apparatus maintenance. The responsibility for apparatus maintenance was assigned to a Captain working a 24/48 platoon schedule. This has proven to be a system that lacks accountability, control, and communication. The private mechanic company serves over 50 fire departments with only 4-5 mechanics. The logistics of so many fire departments being served by such few mechanics can obviously create issues with efficiency. For the year 2016, the daily logs compiled an average time from a maintenance issue being reported to being fixed was approximately 20 days. This is a clear indication that the apparatus maintenance practices are flawed. The current policy and procedure for the management of apparatus maintenance needs reviewed and overhauled.

During this research, a major component that was identified was cost. I was able to access the CCFD financial record keeping. I also surveyed similar fire departments in the area to ascertain what other fire departments spend on apparatus maintenance. I was surprised to find out that the annual cost of parts and labor spent by the CCFD is on par with the majority of the

fire departments surveyed. Additionally, also in the survey, the majority of the area fire departments are utilizing private mechanics/vendors for their apparatus maintenance. This means that the costs associated with the current CCFD apparatus maintenance practices are not out of balance.

Cost will always be a driving force when considering change. There seems to be consistent link between cost and efficiency. If the goal is to increase efficiency, generally more money will need to be spent. Conversely, if you spend less money, efficiency can be sacrificed. There must be a constant balance. There is an obvious need to examine the options available to the CCFD for apparatus maintenance. As discussed in the literature review, there are various models available. Each model has its advantages and disadvantages. During the research, the author determined the cost of the current maintenance practices to be about average. The surprising aspect was that the money spent on apparatus maintenance equated to minimal or zero control over how the maintenance practices are carried out. As a result, the research conducted indicated that the issues encountered with apparatus maintenance pertained more to efficiency and accountability and not cost.

A major change has occurred during the research process with the assignment of a 40 hour Captain to oversee apparatus maintenance in the year 2018. This Captain works during regular business hours and is directly responsible for communicating maintenance needs to the private mechanic company. This change will be a key component to identify what effect this has on managing and coordinating the apparatus maintenance practices. The consistent oversight of the apparatus maintenance practices may help decrease labor costs by reducing the amount of labor hours needed for a given maintenance need. The consistent variable that continues to be impossible to change is the accountability and control over a non-township employee. Those

variables continue to be the driving force to figure out which maintenance model works best for the CCFD while trying to balance costs and increase efficiency.

The impact of this research for the CCFD is the justification measures needed to transition away from a private mechanic company and explore alternative options for apparatus maintenance. The need to develop policy and procedure before initiating changes will have a direct impact on efficiency, internal controls, and accountability and will ultimately drive what apparatus maintenance options best serve the CCFD. The literature review, surveys, and the Fire Chief interview have provided the necessary information on the current state of the CCFD apparatus maintenance practices and how others perform apparatus maintenance. The shift from primarily reactive maintenance to the incorporation of preventive/predictive maintenance could help control or reduce costs associated with apparatus maintenance. Properly designed and implemented apparatus maintenance practices can promote a safe, full life cycle for all CCFD apparatus.

RECOMMENDATIONS

The problem this study addressed was the lack of internal control and oversight of the current apparatus maintenance practices in regards to efficiency, quality, and cost. The research conducted indicates that the CCFD needs to evaluate their current apparatus maintenance practices and identify possible options to increase efficiency and control costs in order to improve the apparatus maintenance practices.

1. The CCFD should utilize the newly reassigned 40 hour Captain to conduct a comprehensive review of the current apparatus maintenance practices relating to documentation, communication, and accountability in order to determine the most

efficient apparatus maintenance practices. This data can identify best practices in order to minimize out of service time, control costs, and clearly communicate the apparatus maintenance needs to all personnel. The Captain in charge of apparatus maintenance can further apply this data to identify trends in apparatus maintenance and develop more frequent and consistent preventive and predictive maintenance intervals. The comprehensive review will occur during 2018 and will be revisited in 2019 to make needed adjustments/changes. Further reviews will be conducted on an as needed basis as identified by the Captain in charge of apparatus maintenance.

2. The CCFD needs to develop and implement policy and procedure that can be used to manage apparatus maintenance. The policy and procedure will be a direct link to establishing better accountability and internal controls on how apparatus maintenance is performed. All members of the CCFD will be aware of their responsibilities for recognizing, reporting, and ensuring that proper apparatus maintenance is performed. Specific policy regarding the tracking and documentation of apparatus maintenance will need developed to help establish a preventive maintenance program. The current policy regarding the reporting of an apparatus maintenance need will need to be redesigned to coincide with procedures relating to employing a township mechanic.
3. The CCFD needs to utilize all township department heads to develop and design a job description for a township mechanic that can be utilized to hire a township mechanic. The job description will detail the employment requirements and necessary certification requirements. It will be necessary for the township mechanic to already possess diesel mechanic training with preference of having an EVT

certification or the ability to obtain EVT certification. The township mechanic will be responsible for providing maintenance to the CCFD fleet and all other township departments and will be responsible for coordinating specialty repairs that require an outside vendor. Since the CCFD does not have a contract with the current mechanic company, there is no need to sever that professional relationship as the private mechanic company will now operate as an outside vendor when requested.

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Appendix A:

YEAR	CAD ID	MAKE	MODEL
2008	**Chief 22**	Ford	Expedition
2010	**Captain 25**	Chevy	Tahoe
2010	**Battalion 21**	Chevy	Tahoe
2011	**Captain 24**	Chevy	Tahoe
2011	**Chief 21**	Chevy	Tahoe
2012	**Lieutenant 25**	Chevy	Colorado
2012	**Inspector 21**	Chevy	Colorado
2000	**Brush 21**	Ford	F-350
2005	**Utility 21**	Ford	F-250
2006	**MCU 21**	Ford	F-750
2007	**Medic Reserve**	Horton/Freightliner	F-650
2009	**Medic 24**	Horton/Freightliner	Medium 108"
2011	**Medic 23**	Road Rescue/ FL	Ultramedic M2 168"
2013	**Medic 22**	Road Rescue/ Int.	4300 SBA LP
2015	**Medic 21**	Road Rescue/ Int.	4300 SBA LP
1994	**Engine 23**	Pierce	Saber
2002	**Engine 25**	E-One/Freightliner	FL-70
2008	**Engine 22**	E-One	Cyclone II
2015	**Rescue 21**	E-ONE	Rescue
2001	**Ladder 21**	E-One	Ladder

Fire Apparatus: 6

EMS Apparatus: 5

Support Vehicles: 2

Staff Vehicles: **7**

Total Fleet: 20

Appendix B:

Clearcreek Fire District

Apparatus Daily Check

Unit #			Month:						Year:		
Date	Mileage	Fuel Level	Oil Level	Radiator Level	Water Tank Level (Visual)	Brake Function	Tires (Visual)	Lights & Sirens	LP-12 User/Defib Test Pass/Fail	Equipment Inventory	Badge Number
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											
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27											
28											
29											
30											
31											

✓ = Proper working order / fluid levels / inventory, etc.

X = Found inventory or maintenance problem and corrected it.

N = Found inventory or maintenance problem and could not correct it. (Write maintenance request)

FORWARD THIS FORM TO MAINTENANCE LIEUTENANT ON THE 1ST OF FOLLOWING MONTH

Form 620 - ELECTRONIC Medic Weekly Check
Completed by: [redacted]

Medic Weekly Check:

BELTS	Check for tightness, cracking, fraying, damage
RADIATOR FLUID	Check level cold
POWER STEERING FLUID	Check level cold
TRANSMISSION FLUID	Check level at normal operating temperature
WINDSHIELD WASHER FLUID	Check level
BATTERIES	Check fluid level if applicable. Check for terminal tightness/corrosion
UREA FLUID	Check level if applicable
ENGINE HOSES	Check for cracking, fraying, damage, connection tightness
OIL LEAKS	Place in Comments Section
UNDER CARRIAGE	Check for obvious leaks, loose or damaged hardware
BLEED AIR BRAKES	To remove moisture from holding tank(s)
TIRES	Front and Rear 80 PSI - If low, place in Comments Section
CAB INSTRUMENTS	For proper operation
WINDSHIELD WIPERS	For proper operation and Blades signs of wear
HAND TOOLS	Check for tool head tightness, blade sharpness, handle cracks/splinters
AIR PACKS	Correct PSI?, Ensure propertion operation
EXTINGUISHERS	Check for inspection/service date, proper charge on gauge
INVENTORY	Complete Medic Unit Inventory Sheet and Stat Pack Inventory Sheet
DRUG BAG	Check Expiration Dates/ Does Tag Number match the log? - Place in Comments Section
ON BOARD OXYGEN	300 PSI Minimum
GLUCOMETER CHECK	Test with control solution and ensure test strip code # matches monitor
LP12 OR AED USER/DEFIB TEST	Pass?
DECON AND DETAIL	Decontaminate Unit, wash exterior, clean interior and compartments

Form 640 - ELECTRONIC Engine Weekly Check
Completed by: [redacted]

Engine Weekly Check:

BELTS	Check for tightness, cracking, fraying, damage
RADIATOR FLUID	Check level cold
POWER STEERING FLUID	Check level cold
TRANSMISSION FLUID	Check level at normal operating temperature
WINDSHIELD WASHER FLUID	Check level
BATTERIES	Check fluid level if applicable. Check for terminal tightness/corrosion
UREA FLUID	Check level if applicable
ENGINE HOSES	Check for cracking, fraying, damage, connection tightness
OIL LEAKS	Place in Comments Section
UNDER CARRIAGE	Check for obvious leaks, loose or damaged hardware
BLEED AIR BRAKES	To remove moisture from holding tank(s)
TIRES	If low, place in Comments Section
CAB INSTRUMENTS	For proper operation
WINDSHIELD WIPERS	For proper operation and Blades signs of wear
TOOL BOX	Check invnetory per tool box inventrory sheet
HAND TOOLS	Check for tool head tightness, blade sharpness, handle cracks/splinters
AIR PACKS	Correct PSI?, Ensure propertion operation
EXTINGUISHERS	Check for inspection/service date, proper charge on gauge
GENERATOR	Check fluids/proper operation
HYDRAULIC OIL LEVEL	Check per manufacturer directions
HYDRAULIC RESCUE TOOLS	Check fluids/proper operation; Check hoses for leakis, cuts, abrasions
ELECTRIC LIGHTS/TOOLS	For proper operation
PPV FAN	Check fluids, proper operation
PRIMING PUMP	Check oil level(if applicable)
PUMP, VALVES AND GAUGES	Check for proper operation, lubricate valves as needed
DRAINS, CONNECTIONS	Operate and lubricate drains,tighten connections as needed
RELIEF VALVE	Check for proper operation
DECK GUN OPERATION	Check for proper operation and clean/lubricate as needed
HOSE/NOZZLE INSPECTION	Ensure serviceability
LADDERS	Inspect, clean, and lubricate as needed
DRUG BAG	Check expirations dates/Does tag number match log book?
FIRST IN BAG W/OXYGEN	Check inventory per EMS Inventory Control policy, Oxygen 1200 PSI Min
GLUCOMETER CHECK	Test with control solution and ensure test strip code # matches monitor
LP12 OR AED USER/DEFIB TEST	Pass?
INVENTORY AND DETAIL	Ensure proper unit inventory, wash exterior, clean interior and cmpartments

Appendix C:

J. All suppression and EMS apparatus shall be detailed, inspected, and thoroughly cleaned (equipment removed and inspected, tools and compartments cleaned) according to the Daily and Weekly Duties list distributed by an Assistant Chief and in accordance with the following:

Sunday- Medics

Monday- Engines

Tuesday- Ladder

Wednesday- Staff Vehicles

Friday- Utility, Brush and Rescue

Appendix D:

Clearcreek Fire District

Fire Protection and Paramedic Service

Vehicle / Equipment Maintenance Request

From:

Date: Nov 2, 2014

Unit Number:

Description of Problem:

Submit by Email

Description of Repairs Made:

Repaired By: _____ Date: _____

Comments:

Form 602 Rev 07/2014

Appendix E:

Unit number	Maintenance issue	Date reported	Date fixed	Days to fix
Medic 305	cab seal	5/14/2017	5/21/17	35
	dead battery	3/29/2016	3/30/2016	1
	AC not working	5/27/2016	6/21/2016	21
	AC not working	6/25/2016	6/29/2016	4
	AC not working	7/5/2016	7/9/2016	4
	Rear suspension	7/12/2016	7/13/2016	1
	Module controls	7/12/2016	10/19/2016	91
	Back up siren	8/13/2016	9/19/2016	35
	Trash bin	8/13/2016	11/3/2016	80
				Avg: 30
				Days OOS: 0
Medic 306	Shoreline	3/15/2016	3/25/2016	10
	Oil leak	1/9/2016	3/4/2016	55
	Oil leak	6/17/2016	6/25/2016	8
	Grease on wheel	7/14/2016	7/18/2016	4
	AC not working	8/18/2016	10/19/2016	61
	ECU	9/13/2016	9/28/2016	15
	Air leak	10/12/2016	1/23/2017	101
				Avg: 36
				Days OOS: 15
Medic 307	Battery	1/9/2016	1/10/2016	1
	Check engine light	1/30/2016	2/6/2017	7
	Battery	4/30/2016	5/5/2016	6
	Air leak	7/4/2016	7/9/2016	5
	Check engine light	8/9/2016	8/20/2016	11
	AC not working	9/2/2016	10/4/2016	32
	No battery power	10/6/2016	10/11/2016	5
				Avg: 9
				Days OOS: 22
Medic 308	Tire pressure	8/10/2016	8/16/2016	6
				Avg: 6

				Days OOS: 0
Brush 202	Engine idle	1/8/2016	1/28/2016	20
				Avg: 20
				Days OOS: 0
Engine 402	Air brake	1/23/2016	4/4/2016	71
	Brake problems	2/15/2016	3/11/2016	26
	Exhaust welds	3/1/2016	3/19/2016	18
	Discharge gauge	2/26/2016	3/19/2016	23
				Avg: 34
				Days OOS: 0
Engine 404	Auto charger	7/24/2016	8/5/2016	12
				Avg: 12
				Days OOS: 0
Engine 405	Shoreline	1/10/2016	6-Feb	26
	Compressor	6/9/2016	7/9/2016	30
	Brake lines	6/25/2016	8/1/2016	36
	Check engine light	8/26/2016	8/29/2016	3
	Power steering	8/29/2016	9/30/2016	31
	Suspension	9/4/2016	11/12/2016	52
	Auto charger	12/17/2016	12/31/2016	14
				Avg: 27
				Days OOS: 17
Ladder 601	Outrigger sensor	1/13/2016	1/23/2016	10
	Leaf springs	5/26/2016	6/4/2016	9
				Avg: 9
				Days OOS: 0

Appendix F:

External Survey

1. What type of fire department are you?

- All Full Time **20.83%**
- All Part Time **4.17%**
- Combination of Full Time and Part Time **75%**
- Volunteer **0%**

2. How many pieces of apparatus (fire apparatus, medics, staff vehicles) is your department responsible for maintaining?

16.54 AVG

3. What is your yearly EMS run volume?

3,642 AVG

4. What is your yearly fire run volume?

1,152 AVG

5. What county is your department located in?

Warren- 6	Clermont- 2
Hamilton- 8	Montgomery- 3
Butler- 4	Greene- 2

6. Who provides apparatus maintenance for your department? (Check all that apply)

- Township/City mechanic **12 respondents**
- Fire department mechanic **6 respondents**
- Private company/contractor **15 respondents**
- Apparatus vendor **7 respondents**
- Other (please specify)

7. How much does your department spend annually on apparatus maintenance?

- $0-$25,000 **8.33%**
- $25,000-$50,000 **29.17%**
- $50,001-$75,000 **8.33%**
- $75,001-$100,000 **16.67%**
- More than $100,000 **37.50%**

8. Preventive maintenance is performed while the apparatus is still in service. The preventive maintenance is performed to lessen the likelihood of a mechanical failure. Does your department perform any maintenance similar to checks of brake pads, air filters, belts, batteries, tires, etc. If so, how often do these preventive maintenance checks occur?

- Daily **13.04%**
- Weekly **17.39%**
- Monthly **17.39%**
- Annually **52.17%**
- Never **0%**

9. How would you rate your apparatus maintenance practices?

- Excellent **41.67%**
- Good **41.67%**
- Fair **8.33%**
- Poor **8.33%**

10. Your department apparatus is kept in good condition and is safe for operation?

- All the time **91.67%**
- Sometimes **8.33%**
- Rarely **0%**
- Never **0%**

11. How often is a piece of apparatus taken out of service due to a mechanical issue?

- Daily **6.25%**
- Weekly **37.50%**
- Monthly **56.25%**

Other (please specify)

12. Is your department currently, or have they in the past looked at changing how apparatus maintenance is performed?

Yes **54.17%**

No **45.83%**

13. Do you feel your apparatus maintenance practices are cost effective and efficient?

Strongly agree **29.17%**

Agree **33.33%**

Neutral **12.50%**

Disagree **0%**

Strongly Disagree **4.17%**

14. If you could change one thing about your department's apparatus maintenance practices, what would it be?

More mechanics-8 Own mechanic-8
Accountablilty-2 More PM- 1 Better Apparatus-1
Better facilities-2 Better parts-1 Nothing-1

15. Are your apparatus maintenance practices extending the service life of your apparatus?

Strongly Agree **50%**

Agree **33.33%**

Neutral **12.50%**

Disagree **0%**

Strongly Disagree **4.17%**

Appendix G:

Internal Survey

1. The CCFD apparatus is maintained with high quality maintenance?

- Strongly agree **0%**
- Agree **17.39%**
- Neutral **34.70%**
- Disagree **45.65%**
- Strongly Disagree **2.17%**

2. There are no issues with the CCFD apparatus maintenance?

- Strongly agree **0%**
- Agree **0%**
- Neutral **15.22%**
- Disagree **78.26%**
- Strongly Disagree **6.52%**

3. If the department was going to make a change to the apparatus maintenance practices, what change would you recommend?

- Hire a full time CCFD mechanic **40%**
- Share a mechanic with the rest of Clearcreek Township **53.33%**
- Share a mechanic with other area fire departments **6.67%**
- No changes needed, continue with current practices **0%**
- Other (please specify)

4. The CCFD apparatus is maintained in a manner that makes them unsafe?

- Strongly Agree **0%**
- Agree **4.35%**
- Neutral **28.26%**
- Disagree **63.04%**
- Strongly disagree **6.52%**

5. The CCFD maintenance practices are cost effective and efficient?

- Strongly agree **0%**
- Agree **2.17%**
- Neutral **41.30%**
- Disagree **50%**
- Strongly disagree **6.52%**

6. The current apparatus maintenance practices allow the CCFD to get a full service life out of each piece of apparatus?

- Strongly agree **2.17%**
- Agree **30.43%**
- Neutral **36.96%**
- Disagree **28.26%**
- Strongly disagree **2.17%**

7. Have you ever been on an emergency run where a piece of apparatus experienced a mechanical failure that caused it to be taken out of service?

- Yes **76.09%**
- No **23.91%**

8. Have you ever discovered a mechanical issue during daily or weekly apparatus checks that resulted in the apparatus to be taken out of service?

- Yes **89.13%**
- No **10.87%**

Appendix H:

Fire Chief Interview Questions

1. What do you think needs changed in our apparatus maintenance program?
    - Better accountability for what work gets completed/not completed
    - More consistent and frequent preventive maintenance intervals
    - Person on 40 hours in charge of apparatus maintenance

2. What problems do you see with our current methods and practices of providing apparatus maintenance?
    - CCFD is not a priority, only another department on the list
    - There is no consistency on when apparatus get serviced, how long a piece might remain OOS
    - Costly and not very efficient
    - Billing issues, not following township policy
    - Trustworthiness of the person performing the work. There are multiple different mechanics working on our apparatus, all with different skill levels and dedication to their work.
    - There is a lot of down time with mechanics traveling to get parts or ordering the wrong parts because they are not as familiar with the apparatus as they should be.

3. What is the expected life span of the CCFD apparatus (Ladder, Engines, Medics, Staff Cars)?
    - Ladders / Engines 20 years
    - Medics 10 years
    - Staff cars 10 years

4. Can the CCFD afford to make changes to the apparatus maintenance program?
    - Yes, depending on the change and organizational priorities. (i.e. shared mechanic, township mechanic)

5. Will apparatus maintenance be a priority item for future strategic planning?
    - Yes, was an action item during the recent strategic planning process and in the Novak Consulting Report.

6. Do you think the administrator/elected officials will be open to approving different ways of providing apparatus maintenance and the associated costs?
    - Yes, as long as we show that the investment can be affordable and better our service delivery.

7. Do you think that the fire department has enough work to be covered by a full time mechanic?
    - No, not for just a mechanic. However, if we hired someone and put them in charge of both apparatus and facilities maintenance, there would be enough work for one person to do both jobs.

8. Currently, we share a private mechanic, are you open to the idea of sharing a mechanic with other township divisions or other area fire departments?
    - Yes. There would be some down sides to this but I think done correctly, sharing a mechanic could be a good transition between what we do now and having our own mechanic.

9. Do you think our facilities are adequate for providing apparatus maintenance? If not, what changes would you like to make?
    - All of our facilities are tight, and lacking space in their current state. Adding equipment and services will only make increase this issue.
    - In the future, if we are going to make changes to our apparatus maintenance program our facilities will need to be part of the overall change/plan.
    - The facilities are average, and have supported our maintenance needs up to this point.

10. In your opinion, what is the number one issue that needs addressed with apparatus maintenance?
    - Accountability. It is almost impossible to hold the current vendor to an acceptable level of accountability due to our lack of systems and controls.
    - Who we use as an apparatus maintenance provider and looking into having a township mechanic work on fire apparatus.