

## **Emergency Vehicle Maintenance at Ashland Fire Department**

By: Dan Raudebaugh  
Assistant Chief  
Ashland Fire Department  
274 Cleveland Ave.  
Ashland, Ohio 44805

A proposed research project submitted to the Ohio Fire Executive Program

February 17, 2014

## CERTIFICATION STATEMENT

I hereby certify that the following statements are true:

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

2. I have affirmed the use of proper spelling and grammar in this document by using the spell and grammar check functions of a word processing software program and correcting the errors as suggested by the program.

Signed: \_\_\_\_\_

Printed Name: \_\_\_\_\_

## ABSTRACT

The problem this study addressed was finding the best option for emergency vehicle maintenance. The purpose of this study is to recommend the method of vehicle and equipment maintenance that would be most beneficial to the Ashland Fire Department, with emphasis geared towards cost and method.

Descriptive research was used to answer the following questions: 1. What are the current expenses in relation to the total cost of emergency vehicle technician's (EVT's) wages and vehicle maintenance and can the benefits of the current program be measured? 2. What are other departments doing for vehicle maintenance that compare to Ashland Fire Department in reference to run volume and number of apparatus? 3. What are the qualifications for an EVT and how are they obtained? 4. Based on qualifications for an EVT, are any employees eligible and interested in the position?

A review of literature and two surveys were undertaken. The literature review of National Fire Protection Association (NFPA) standards, National Institute for Occupational Safety and Health (NIOSH) reports, Ohio Association of Emergency Vehicle Technicians (OAEVT), and Emergency Vehicle Technician Certification Commission (EVTCC) were used. Two surveys were used. One was sent out to thirty career fire departments. The other was given to all members of the Ashland Fire Department.

The recommendations include continuing the current program of a firefighter/paramedic serving as an EVT be continued with four main areas of improvement. The four areas of improvement are education and certification, the use of a software program, parts inventory, and the development of a formal job description.

**TABLE OF CONTENTS**

CERTIFICATION STATEMENT ..... 2

ABSTRACT..... 2

TABLE OF CONTENTS..... 3

INTRODUCTION ..... 4

    Statement of the Problem..... 4

    Purpose of the Study ..... 4

    Research Questions..... 4

BACKGROUND AND SIGNIFICANCE..... 5

LITERATURE REVIEW ..... 9

PROCEDURES.....18

    Definition of Terms..... 20

    Limitations of the Study..... 20

RESULTS ..... 21

DISCUSSION..... 29

RECOMMENDATIONS ..... 32

REFERENCES ..... 40

APPENDIX 1 – Survey Cover Letter ..... 41

APPENDIX 2 – Survey ..... 42

APPENDIX 3 – Survey results ..... 46

APPENDIX 4 - Employee Survey .....63

APPENDIX 5 - Employee Survey results .....64

## INTRODUCTION

### **Statement of the Problem**

*The problem this study will address is to find the best option for adequate emergency vehicle maintenance. Currently, the department has one emergency vehicle technician (EVT) that also serves as a firefighter/paramedic and works a 24/48 traditional firefighter schedule. That schedule entails working for twenty four hours and then being off duty for forty eight hours. In September 2014, the EVT will have the option to retire and to date, the Ashland Fire Department does not have a plan in place to insure emergency vehicle maintenance after his retirement. This author will define the problem and propose a solution to the problem by using descriptive research.*

### **Purpose of the Study**

*The purpose of this study is to recommend the method of vehicle and equipment maintenance that would be most beneficial to the Ashland Fire Department, with emphasis geared towards cost and method.*

### **Research Questions**

*The research questions this study will investigate are:*

1. What are the current expenses in relation to the total cost of EVT's wages and vehicle maintenance and can the benefits of the current program be measured?
2. What are other departments doing for vehicle maintenance that compare to Ashland Fire Department in reference to run volume and number of apparatus?
3. What are the qualifications for an EVT and how are they obtained?

4. Based on qualifications for an EVT, are any employees eligible and interested in the position?

### **BACKGROUND AND SIGNIFICANCE**

The Ashland Fire Department (AFD) is a thirty member career department. AFD is the only career department in Ashland County and handles all traditional fire department activities including fire suppression, prevention, and emergency medical service (EMS). All members are crossed-trained for fire and EMS. EMS functions include 911 emergency calls for the City of Ashland and two contractual townships, Milton and Montgomery. AFD provides fire and EMS services to the City of Ashland which is 11.17 square miles and has a population of 20,362 (US Census Bureau, 2010). The two contractual townships total 51.2 square miles and have a combined population of 4,843 (US Census Bureau, 2010). They provide mutual aid and paramedic intercepts for all Ashland County Volunteer Fire Departments and surrounding counties. AFD also provides special rescue services including, but not limited, to hazardous material, ice, trench, and rope rescues. AFD responded to 3,847 runs in 2011 in which all responses came from one centrally located station.

In that one station twenty pieces of apparatus, which include emergency response apparatus and administrative vehicles are housed. All of these pieces of apparatus need preventive maintenance and repairs. With twenty pieces of apparatus at a mean age of 8 years, this gives the current EVT plenty to maintain. With a lean budget, we are trying to extend their life expectancy; which could possibly cause an increase in maintenance costs.

The AFD is funded out of the general fund for the City of Ashland. The 2013 total budget for the fire department is \$2,903,420.52. The majority of AFD's budget or 90.7% is used on employee wages and benefits. The current EVT's wages is part of the 90.7%. The line item of equipment maintenance in the budget is \$40,000.00. The equipment maintenance line is used to pay the outsourced vendors and for the cost of parts. The equipment maintenance line is not used for the wages of the current EVT.

Our current EVT has been with the department for 23 years as a firefighter/paramedic, out of those, he has been serving as both the EVT and firefighter/paramedic role for 17 years. The EVT is paid the same contractual wages as other firefighter/paramedics plus a stipend dictated by the collective bargaining agreement of \$750.00 per year. The EVT works a traditional shift of 24/48; all shift personnel start and end the shift at 06:30 each day. On his duty days, he works 06:30 in the morning until 16:00 as the EVT, after 16:00 the EVT role ends and the firefighter/paramedic role begins. The EVT will work past the 16:00 if the need is present to finish a repair. The EVT does not perform maintenance duties on Sundays or holidays, but does on all other duty days. Also, the EVT will attempt to respond to fire type emergencies, this depends on his ability to stop his maintenance duties at the time of the call.

This author was unable to find documentation of the exact date that the Ashland Fire Department started the current method of vehicle maintenance. It is known to have been started sometime in the 1969 by Chief Bernard Johnson. Chief Johnson had a firefighter by the name of Allen Gebhart who had previously worked as a mechanic at a car dealership. Firefighter Gebhart would make needed repairs and do preventive maintenance as needed. Since Gebhart, AFD has had three other firefighters who have also served as the department mechanic. The current

mechanic is the only one to hold any formal certification, even though he has allowed those certifications to expire.

The AFD does not have any formal job description for the EVT position. In the past, the position was filled by interest in the position which led to being appointed to the position. The current EVT performs the following duties of preventive maintenance, annual pump tests, and performs most of the repairs on the department's apparatus. If a task is beyond the EVT's expertise he will schedule the repairs to be completed by outsourcing to a vendor or the city's garage. Some example of a repairs that the current EVT does not complete are, brake repairs on the larger pieces of apparatus and injector maintenance on the diesel engines.

The EVT's supervisor is the assistant chief in charge of logistics. He directly reports to him for all maintenance duties. The logistics assistant chief and the EVT work on the same shift.

The EVT has to wait on phone calls about parts and service; at times this task can take more time than expected. While the EVT is completing his maintenance duties, the other shift members cover the emergency runs and take care of housekeeping tasks. Due to the change of duties, tension among the members is typical. The perception that the EVT is not working hard enough occurs, this usually is when he is waiting on phone calls, rather than being under a piece of apparatus.

The current EVT has not kept his automotive service excellence (ASE) or his EVT certification. The current EVT has not completed any continuing education for two years. The AFD has no policies or job requirements that require the EVT to maintain a certification or accomplish any continuing education.

The budget line for apparatus and equipment maintenance has been decreased by 25% in the past two years, from \$40,000 in 2010 to \$30,000 in 2012. In 2010 the department spent



73.3% of the budgeted \$40,000; in 2011, 80.3% of \$35,000 was spent. As of September 5, 2012, 100.2% of the \$30,000 has been spent on apparatus and equipment maintenance

To date, the administration of The Ashland Fire Department has not explored any options to the current system of vehicle maintenance. The EVT stipend is part of the collective bargaining agreement and the administration has not consulted with the union on this matter. The collective bargaining agreement expired at the end of 2012.

*The potential impact this study could have on the Ashland Fire Department is the most beneficial and fiscally responsible option for performing apparatus and equipment maintenance will be known.*

## Literature review

Many reliable resources about emergency vehicle maintenance were located during my review of literature. The resources included the National Fire Protection Association (NFPA), the National Fire Academy (NFA), Executive Fire Officer (EFO) research papers, Fire Engineering magazine, Government Fleet, and the National Institute for Occupational Safety and Health (NIOSH) reports, Ohio Association of Emergency Vehicle Technicians (OAEVT), and Emergency Vehicle Technician Certification Commission (EVTCC).

The current expenses in relation to the total cost of EVT's wages and vehicle maintenance are best measured by using the researched data from the department's financial records. These financial records included payroll records, department budget, and department invoices. Payroll records were used from 2010 until September 2012 to find the total wages, overtime, and stipend totals for the current EVT. It was interesting to note, that the department was over budget for 2012 for apparatus and equipment maintenance, and that this line item has been decreased in the budget by 25% or \$10,000.00 since 2010. The only thing that has not fluctuated by more than \$2,000.00 is the EVT's total wages, which includes overtime and stipend. The EVT's wages, stipend, and overtime are not part of the vehicle maintenance line in the budget, but come from the wages for firefighter's line. The EVT's total wages, including overtime and stipend in 2010 was \$56,601.76, and in 2011 it was \$56,270.59. In 2012, the EVT's total wages were \$57,585.41, which is an increase of \$1,314.82 from 2011. That increase is partially due to contractual wage increase. The total wages were reported from the City of Ashland's finance department records.

It was also noted, that the department does not track the number of hours in which maintenance is being performed. The only information logged into Firehouse software (FH), is when preventive maintenance (PM) such as oil changes and pump test have been completed. No information is currently logged on major or minor repairs including cost or time taken to complete those repairs in FH. We do have some expenditure records which are comprised of receipts that the department secretary scans and puts in a folder on the server. No hours of labor are attached to those repairs or PM. The department has not required the EVT to record hours of labor or documentation of repairs that were made. The department's budget line for vehicle maintenance is not differentiated between which expenditures are for parts and what is spent on other types of maintenance, like labor from outsourced repairs. All these costs are lumped together and paid out of the vehicle maintenance line in the budget. Also, no out of service time is recorded for in-house or outsourced repairs.

In reference to the cost benefits of the current program, the total number of hours that maintenance was being completed had to be calculated. This calculating was started by interviewing the current EVT, Rob McClaran. Rob was interviewed (personal interview, September 23, 2012) in reference to how many hours he spends performing maintenance per duty day. Rob advised that on an average, four hours of his day is spent performing maintenance. He stated that those four hours, in his opinion, is what a service centers would charge for labor. This author in trying to measure the benefits of the current program took the EVT's total number of duty days per year and subtracted the days that he would not be working as an EVT. The total number of duty days per year was 122. From that 122 duty days, nine kelly, ten vacation, one personal, three holidays, and seventeen Sundays were subtracted. The total number of days that maintenance was being performed is 82 days. Those 82 days were then

multiplied by the number four, which represents the number of hours spent per day doing maintenance. The total number of hours spent per year performing maintenance is 328. This does not include the over-time hours that the EVT works. This was done to figure out how much of the EVT's wages went towards working on apparatus and equipment. The EVT's hourly rate of \$18.13 was then multiplied by the 328 hours, that figure comes to \$5,946.64. Then the EVT's \$750 stipend was added to the \$5,946.64 for a total cost of \$6,696.64.

This author then researched how much service centers charge for labor and if their technicians are EVT certified. A Google search was done for emergency vehicle service. Not all the service centers that the Google search revealed are being used. Ohio Cat, Finley, W.W.Williams, and All American are service centers located in Ohio. An over the phone interview was completed with the four service centers (personal communications, October 2, 2012). They each were asked what are their labor charges per hour, and do the mechanics have an EVT certification? The results revealed that the average labor rate for the four vendors is \$84.50 per hour and all four have certified EVTs performing the work.

The four vendors offer service for an average rate of \$84.50/hour, that rate was then taken and multiplied by the 328 hours that the EVT works per year, that figure comes to \$27,716. That is the amount it would cost the Ashland Fire Department per year for labor charges by an outside vendor. Then the \$6,696.64 that the department spends on the EVT's wages was subtracted from the labor charges from vendors and the savings comes to \$21,019.36 per year.

This author used five main sources for information in reference to qualification of an EVT and how the qualifications are obtained. These sources are The Emergency Vehicle Technician Certification Commission (EVTCC), the Ohio Association of Emergency Vehicle

Technicians (OAEVT), National Institute for Automotive Service Excellence (ASE), Fire Chief Magazine, and the National Fire Protection Association (NFPA).

OAEVT's website ([www.oaevt.org](http://www.oaevt.org)) stated that their purpose was to encourage, support, and promote the profession of emergency vehicle technicians in concert with recognized safety standards, through education and training. The OAEVT's website stated that the Emergency Vehicle Technician Certification Commission is a third party that administers EVT tests. Its primary function is to test and certify emergency vehicle technicians. OAEVT trains technicians, while the EVTCC tests and certifies the technicians. Each September, the OAEVT sponsors a one week all-encompassing symposium at the Ohio Fire Academy. This symposium offers preparation for the EVT certification program testing. Also, the symposium offers the invaluable opportunity to network, problem solve, and share information with others in the field.

The EVTCC (2012) began as The Fire Apparatus Mechanics Certification Program, sponsored by the International Association of Fire Chiefs (IAFC). In 1988, the IAFC introduced this certification program in an effort to elevate the standards of emergency vehicle maintenance and the personnel who perform the work. In addition, the IAFC sought to provide technicians recognition for the education, training, and experience they have in the field of service and repair of emergency vehicles. While the IAFC no longer directly oversees the EVT Certification Program, the IAFC continues to support the continued development and operation of the EVT Certification Program (p.2).

The EVTCC booklet (2012) states that five different tracks are available that individuals can be certified in, each of those tracks contain different sections of certifications. The five different tracks are: Fire Apparatus Technician, Ambulance Technician, Airport Rescue and Firefighting Technician, Law enforcement Vehicle Technician, and Management Certification

Track (pp.5-8). As an example, the Fire Apparatus Technician Track has eight different sections to test on. Those sections include: F1- Inspection, maintenance, testing of fire apparatus; F2- Design and performance standards of fire apparatus; F3- Fire pumps and accessories; F4- Fire apparatus electrical systems; F5- Aerial fire apparatus; F6- Allison automatic transmissions; F7- Foam systems; and F8- Hydraulic systems (p.5). Also, three different levels certification is available in each track. As an example, the Fire Apparatus Technician Level I would require the person to pass the F-1 and F-2 exams along with exams from the ASE in T-4 Heavy-Duty truck brakes and T-5 Suspension and steering. To be a Level II technician, a person would need to pass F-3 and F-4 EVT exams along with ASE exams in T-2 Diesel engines, T-3 Drive train, and T-6 Electrical systems. To be a Master Level III technician a person would need to pass EVT exams F-5 and F-6 along with ASE exams in T-1 Gasoline engines and T-7 Heating and air-conditioning (p.5).

EVTCC booklet (2012) informs that EVT exams are offered twice a year at sites across the country. In addition, many mechanic seminars, workshops, and schools which offer training in various fields of maintenance have made testing sites available during their activities.

Anyone may register to take the exams and no prerequisites are required to register. The test dates and sites can be found on the EVTCC's website ([www.evtcc.org](http://www.evtcc.org)) or by calling 847-426-4075 (p.2). Each exam has 85-110 multiple-choice questions. The questions are written by a panel of technical experts from the emergency apparatus and ambulance industry, certified EVTs, components systems experts, and vocational educators. A time limit of two hours is allowed for each regular exam (p.3).

An EVTCC (2012) certification expires after five years, resulting in the need for a re-certification exam. Each re-certification exam has 25-35 multiple-choice questions. A time limit of 40 minutes is allowed for each re-certification exam (p.3).

The ASE guide (2012) states that to be ASE certified, a person would need to pass one or more exams and have at least two years of relevant hands-on work experience to be certified (p.3). The ASE (2012) exams are 50-65 questions with an hour to an hour and half to complete, depending on which exam is being taken (p.5).

ASE (2012) recertification is completed by taking recertification exams that are 20-28 questions with 30-45 minutes to complete. Recertification exams need to be taken every five years (p.5).

Steffens (2000, October) described that the impact of NFPA 1071 is to require that emergency service agencies ensure that only qualified people perform the various inspections, diagnoses, testing, maintenance, and repairs on emergency vehicles. This includes not only the personnel in a public fire department or fleet maintenance facilities, but also the personnel in private maintenance facilities, such as apparatus dealerships and other outside contractors who perform many of these important functions.

NFPA 1915 (2000) is the *Standard for Fire Apparatus Preventative Maintenance Programs*. The standard defines a fire apparatus as “any vehicle used for fire suppression or support by a fire department, fire brigade, or other agency responsible for fire protection” (p.4). The standard further defines maintenance as “the act of servicing fire apparatus and equipment within a time frame prescribed by the authority having jurisdiction. Servicing of apparatus is based on manufacturers’ recommendation, local experience, and operating conditions in order to maintain the vehicle and its components in proper operating condition” (p.4). In describing

preventive maintenance (PM), NFPA 1915 makes reference to the act or work of keeping equipment in working order by performing necessary preventive actions in a routine manner with the goal of preventing failure or breakdown.

Generally, NFPA 1915 (2000) contends that it is the responsibility of the fire protection authority to develop and implement a schedule of service and maintenance for fire apparatus, systems, and components. Fire apparatus component and system inspections are integral to the PM process. They should also be structured in response to recommendations from the original equipment manufacturer (OEM), local experience, and operating condition. Written documentation of maintenance activities, apparatus problems, and other critical data is also required under the standard (p.5).

NFPA 1915 (2000) is a comprehensive standard that addresses general inspection and maintenance issues for all types and varieties of fire apparatus, pumping systems, aerial device systems, line voltage electrical systems, air systems, and etc. The standard also maintains that any individual performing inspections or maintenance should meet the qualifications of NFPA 1002, *Standard for Fire Apparatus Driver/Operator* (p.18). Also, NFPA 1915 (2000) recognizes that additional qualifications can be obtained by schooling, training, and recognized certification programs such as the ASE and the EVT agencies (p.18).

In July 1995, the NFPA standards council, after receipt of a request from the International Association of Fire Chiefs (IAFC), developed a standard for the qualifications of an EVT. An EVT is identified by NFPA 1071, *Standard for Emergency Vehicle Technician Professional Qualifications* (2011) as “an individual possessing a recognizable certificate, professional standing, or documented skill who has acquired the knowledge, training, and experience needed to deal with maintenance of fire apparatus" (p.6). NFPA 1071 (2011) developed standards for



three different levels of an EVT. EVT-I is an individual who performs inspections, maintenance, and operational checks on emergency response vehicles. An EVT-I must have a recognized certificate, professional standing, or skill, and has acquired the knowledge, training, and experience to perform inspections, maintenance, and operational checks (p.6).

According to NFPA 1071 (2011), an EVT-II is an individual who performs the same functions as an EVT-I, but can also diagnose, repair, and do performance testing on emergency response vehicles. The EVT-II also holds a certificate from a recognized program (p.6).

According to NFPA 1071 (2011), an EVT-III is an individual who is the first-level supervisory for the EVT-I and EVT-II's personnel performance, scheduling, quality control of repairs and maintenance work. The EVT-III also compiles and reviews documentation of the work being performed (p.6).

NFPA 1500 (2002) the *Standard on Fire Department Occupational Safety and Health Program* affirms that fire departments shall consider safety and health as primary concerns in the specification, design, operation, maintenance, inspection, and repair of all fire department apparatus (p.14).

On February 26, 2010, NIOSH made public an investigative report (F2009-05) about the death of a career lieutenant and the injury of three other firefighters. The report stated that brake failure was the cause of the crash involving a ladder truck in Massachusetts (p. 10). NIOSH's first recommendation was for fire departments to ensure that PM programs are developed and implemented for fire apparatus, according to manufacturer guidelines/specifications and national consensus standards (p. 11). The second recommendation was for fire departments to ensure that PM on fire apparatus be performed and/or overseen by qualified personnel, who meet the certification requirements outlined in NFPA 1071 (p. 12).

In that NIOSH report, it referenced NFPA1911 (2012) *Standard for the Inspection, Maintenance, Testing, and Retirement of In-Service Automotive Fire Apparatus* this standard addresses when apparatus should be taken out of service and that only a qualified EVT should be making that determination (p.14).

This author, after completing the literature review, found it intriguing how much emphasis and work has been put into developing standards for maintenance on emergency vehicles. The literature review revealed that PM and repairs has been a problem in the fire service for an extended period of time. The literature review, after reading many NIOSH reports, led this author to search for what is being done to prevent firefighter death and injury due to poorly maintained apparatus. NFPA, IAFC, EVTCC, and many other organizations have developed standards and certification processes to directly affect positive change in the fire service.

## PROCEDURES

Descriptive research consisting of literature review and two surveys was used in preparing this paper. The research began in June 2012 with a search on topics such as emergency vehicle maintenance, apparatus maintenance, and emergency vehicle technicians. Then the searches were narrowed to the National Institute for Occupational Safety and Health, Ohio Association of Emergency Vehicle Technicians, Emergency Vehicle Technician Certification Commission, National Fire Protection Association, National Fire Academy Research papers, and Fire Chief Magazine.

In finding answers to the research questions, the above resources were used to gather factual information. The current expenses in relation to the total cost of EVT's wages and vehicle maintenance are best measured by using the researched data from the department's financial records. The lack of documentation of hours spent on maintenance, and the amount spent on parts for each repair made it difficult to measure benefits. This author did use the information that was available such as budget and payroll printed sheets that were obtained from the finance department. Over the phone interviews with apparatus service centers was used. The goal of these interviews was to gain knowledge on what the four service centers charged for labor per hour and whether or not their mechanics are certified EVTs. This information was used to compare to the current Ashland Fire department's EVT's wages and certification.

To determine what are other departments are doing for vehicle maintenance. This author used a 20 question survey to answer this. The goal of the survey was to gain input from other fire departments regarding their current methods of vehicle maintenance. Whether a certified EVT is doing the work, if maintenance is done in-house or outsourced, out of service times, if an

in-house parts inventory is used, what information is logged or tracked, and if feedback is given to the person reporting the needed repair are all examples of expected feedback. This information will be used to help determine what method of accomplishing vehicle maintenance for the Ashland Fire Department is best. The survey (Appendix 2) was distributed through e-mailing career fire departments asking them to complete the survey by following the link to Survey Monkey. The e-mail (Appendix 1) was sent to thirty chief officers of career departments in Ohio that was randomly selected by this author. Not all the career departments in Ohio were e-mailed. These departments were selected by considering size of department, run volume, number of apparatus, and budget. Fourteen departments responded by completing the survey. The information received from the survey (Appendix 3) was used to better understand how other departments are performing vehicle maintenance and how they compare to AFD.

A six question survey (Appendix 4) was given to the 30 employees to determine if anyone is qualified and interested in the current position. Out of the thirty employees given the survey, twenty-five returned the survey with results. The survey was in paper form and was directly distributed by the author. The results of the survey (Appendix-5) show if employees have an EVT certification, if they desire to be an EVT, and if not, why. Also, they were asked if they think the current method is best in reference to cost and if maintenance should be done in-house or outsourced. These questions were used to have better understanding of the needs of the department in reference to training, certification, and opinion of the members. Also, these questions were used to determine if anyone has interest for the EVT position.

### **Definition of Terms**

EVT. “A certification established by the Emergency Vehicle Technician Certification Commission for personnel maintaining emergency vehicles” (Emergency Vehicle Technician Certification Commission [EVTCC] booklet, 2012, page 2).

ASE. “works to improve the quality of vehicle repair and service by testing and certifying automotive professionals” (Automotive Service Excellence [ASE] guide, 2012, page 3).

NIOSH. “The mission of NIOSH is to generate new knowledge in the field of occupational safety and health and to transfer that knowledge into practice for the betterment of workers. To accomplish this mission, NIOSH conducts scientific research, develops guidance and authoritative recommendations, disseminates information, and responds to requests for workplace health hazard evaluations” (National Institute for Occupational Safety and Health [NIOSH] fact sheet, 2013, page 1).

NFPA. “The world's leading advocate of fire prevention and an authoritative source on public safety, NFPA develops, publishes, and disseminates more than 300 consensus codes and standards intended to minimize the possibility and effects of fire and other risks” (National Fire Protection Association [NFPA], 2013).

### **Limitations of the Study**

The research population only included thirty career departments in Ohio, with only fourteen responding, and did not include departments from other areas of the country. Therefore, the study did not represent the entire fire service. Also, the survey did not include a way to track which departments responded to the survey. Therefore, no additional questions or information was able to be obtained.

## RESULTS

In conducting this research project, two surveys and literature review were completed to answer the research questions. Research questions #1 was answered by literature review. The current expenses in relation to the total cost of EVT's wages and vehicle maintenance are best measured by using the researched data from the department's financial records. Those records include payroll and time sheets. The benefits of the current program versus having an outside vendor were an estimated \$21,019.36 per year on labor expenses. To determine an average labor rate that could be effectively used, I selected four outside vendors that have certified EVTs performing the work. This rate was then used compare to the AFD EVT's pay rate. This benefit estimation was not without limitations due to lack of accurate record keeping of time spent on each repair or maintenance procedure within the department.

So to answer research question number one, the total cost of the current program in relation to the current mechanic's wages is \$6,696.64. The second part of research question number one asked if any benefit exists and as noted above a cost savings of \$21,019.36 per year is noted in relation to labor charges. This cost savings is a comparison of the outside vendor's labor cost of \$27,716.00 and the current EVT's wages of \$6,696.64.

Also, research question #3 was answered by literature review. The qualifications for an EVT and how those qualifications are obtained were answered by reviewing the standards that have been set in place by the EVTCC, ASE, and NFPA. These three organizations have set criteria for the qualifications of an EVT and how they are obtained. The EVTCC and ASE do the testing through exams for each level of certification. Also, the EVTCC and ASE require EVTs to take recertification exams every five years to keep their certification. The NFPA has set standards for fire departments to follow. Those NFPA standards are reflected in what the

EVTCC and ASE are doing for testing. In others words, if a mechanic passes the EVTCC and ASE exams, they will be accomplishing the standards set by NFPA.

What are other departments doing for vehicle maintenance, was answered through a twenty question survey. That survey was sent to thirty career departments in Ohio, with only fourteen departments responding. The entire results of the responses from the fourteen departments are listed in Appendix 3. In survey question one, the departments were asked if a certified EVT performs their vehicle maintenance. Five reported that all maintenance was done by a certified EVT. Six reported that only major repairs were completed by an EVT while three reported that they did not use a certified EVT for any maintenance.

Question two asked if maintenance was completed in-house or outsourced. Two reported that all maintenance was completed in-house. While three departments reported that all their maintenance was completed by an outsource vendor. Nine reported that their maintenance was completed by both in-house and outsourced mechanics.

Question three asked whether the maintenance was completed in-house or outsourced and if the work was performed by certified EVTs. Two reported that in-house and outsourced mechanics are EVT certified. Five reported that the outsourced mechanics were the only certified EVTs. Three reported that the in-house mechanics are the only certified EVTs. Two reported that none of the mechanics used were certified EVTs. Two others reported that they did not know if any of the mechanics were certified EVTs.

Question four asked if vehicle maintenance was completed in-house by a certified EVT and what percent also served as firefighter/paramedics. Two reported that their EVTs also serve as firefighter/paramedics. One reported that half of their EVTs also served as firefighter/paramedics. Six reported that none of their EVTs served as firefighter paramedics.

Five reported that this question was non-applicable.

Question five was an opinion question asking how important it was for certified EVT's to perform the maintenance on their apparatus. Seven reported that it was very important to have a certified EVT perform the maintenance. Three felt that it was somewhat important. Another three felt neutral on the subject. One reported that it was somewhat unimportant to have certified EVT's perform the work.

Question six asked the departments that had their maintenance completed in-house and outsourced, what percentage of that maintenance was completed in-house. Three reported that up to 20% of their maintenance was completed in-house. One reported that 21% to 40% of maintenance was completed in-house. Two reported that 41% to 60% of maintenance was completed in-house. Five reported that 61% to 80% of maintenance was completed in-house. One department reported that 81% to 100% of their maintenance was completed in-house.

Question nine asked if the departments that have EVT's that serve as firefighter/paramedics, if their pay was different from the other firefighter/paramedics. One department reported that the pay was more for the EVT. Three reported that there was no difference in pay for their EVT's. Nine departments reported that the question was non-applicable to them.

Question eleven asked how long the out of service time was for maintenance that was outsourced. Two departments reported that out of service times for their maintenance was up to one day. Four reported that their out of service time was from one to two days. Three reported that their out of service time was from two to three days. One reported that their out of service time was from four to five days. Two reported that their out of service time was six days or greater. Two other departments reported that the question was non-applicable to them.



Question twelve asked how long the out of service time was for those departments that had their maintenance completed in-house. Five departments reported that out of service time for their maintenance was up to one day. Five other departments reported that their out of service time was from one to two days. Two reported that their out of service time was from two to three days. Two other departments reported that the question was no-applicable to them.

Question thirteen asked the departments that complete their maintenance in-house if they maintained a parts inventory. Four departments reported that they maintained an extensive parts inventory. Six reported that they maintained a limited parts inventory. Two reported that they maintained only a parts inventory of disposable parts. One reported that they maintained no parts inventory.

Question fourteen asked how repairs were reported. Eight departments reported that an official maintenance form was filled out, which is in paper form. Five reported that a computer software program was used to report needed repairs. Eight reported that face to face communication was used to report needed repairs.

Question fifteen asked who schedules repair work to outsourced vendors. Nine reported that an officer did the scheduling of repairs to outsourced vendors. Three reported that their EVT did the scheduling. The other three departments reported that their chief, chief officer or firefighter did the scheduling of outsourced maintenance.

Question sixteen asked if maintenance records were maintained. All fourteen departments reported that they maintained maintenance records.

Question seventeen asked the departments that had their maintenance completed in-house, what kind of maintenance was recorded. Thirteen departments reported that all routine maintenance was recorded. Eleven reported that they recorded parts costs. Eight reported that

they recorded hours of labor spent on maintenance. Seven reported that they recorded the labor costs to each repair. Eleven reported that they recorded the type of repair. Eleven reported that they recorded who reported the needed repair. Six recorded the out of service time. Ten reported that they recorded who performed the maintenance.

Question eighteen asked if feedback was given to the person who reported the needed repair. Ten departments reported that they give feedback to those persons making the report. While four reported that they did not give any feedback to those making the report.

Question nineteen asked how important a preventive maintenance program was to their department. Thirteen departments reported that a preventive maintenance program was very important to their department, while only one reported that it was somewhat important to theirs.

Question twenty asked what determining factor was used to determine when preventive maintenance (PM) is to be done. Eight departments reported that the hours determined when PM was to be completed. Four reported that mileage was used to determine when PM is to be completed. Two reported that they used a monthly schedule for determining when PM needed to be completed. Three reported that a quarterly schedule was used for determining PM. Five reported that once per year PM was completed. Three departments reported that they did PM on an as needed basis for determining when to complete PM.

In analyzing the survey, departments accomplish emergency vehicle maintenance in three methods. The three methods of completing maintenance are: completing all maintenance in-house, outsourcing all maintenance, and a combination of some maintenance being completed in-house with the rest being completed by an outsource vendor.

The departments that had all of their maintenance completed in-house used certified EVT's to perform the work with two of the departments having EVT's that also served as

firefighter paramedics. These departments reported a decrease in out of service time when compared to those that had maintenance completed by an outsource vendor. The departments that have certified EVT's on staff that also served as firefighters paramedics reported that they were either were paid the same or an increase in pay was given. The majority reported that they had at least a limited parts inventory while four departments reported that they had an extensive parts inventory. All departments that had their maintenance completed in-house reported that maintenance records were kept. The amount of records varied from routine maintenance to hours of labor, cost of parts, out of service time, who performed the work, and who reported the needed repair.

The three departments that reported that all maintenance was completed by an outsource vendor had an increase in out of service time when compared to those having maintenance completed in-house. These departments that used outsource vendors only, were not asked if certified EVT's perform the work.

Nine of the fourteen departments reported that maintenance is completed by both in-house and outsourced vendors. Of those nine departments the majority had their maintenance completed in-house.

In summary of the twenty question survey, half of the departments felt that it was very important to have all maintenance completed by certified EVT's while three more felt that it was somewhat important. Out of service time was increased for the majority of the departments when maintenance was completed by outsourced vendors. A parts inventory was maintained by the majority of the departments whether it was only disposable items or an extensive parts inventory. For reporting needed repairs eight of the departments use an official paper form while five use a computer software program. When a repair is needed to be completed by an

outsourced vendor the majority of the departments had an officer do the scheduling, while some have their EVT do the scheduling. All of the departments reported that they kept maintenance records. Ten of the departments give feedback to their employee, who reported the needed repair, while four of the departments give no feedback. Majority of the departments use the hour meter to determine when preventive maintenance (PM) should be completed while the others use mileage, monthly, quarterly, yearly time frames, and others completed their PM on an as needed basis.

Based on the qualifications for an EVT, are any current employees eligible and interested in the position of being the departmental EVT, was answered through a survey. That survey had six questions and was directly distributed to all thirty Ashland Fire Department employees. Twenty-five employees returned the completed surveys. The entire survey can be viewed in appendix 5.

Question one asked the employees if they hold any current certifications for being an EVT. All twenty five responders reported that they do not hold any EVT certifications. The current departmental mechanic was one of the twenty five responders.

Question two asked if anyone wanted to be an EVT for AFD. Only one responder reported that they were interested in the EVT position for AFD.

Question three asked if they were interested in being the EVT would they be willing to go to training courses and take certification exams. Four responders reported that they would be willing to take training and take certification exams. While five responded that they would not be willing and sixteen responded as non-applicable to them.

Question four asked the department employees why they were not interested in being the departmental EVT. Two reported that not enough pay was the prime factor for not being

interested in the EVT position. Twenty two reported that they just don't have any interest in the position. One reported that they do not like the hours of the position.

Question five asked the department employees if they felt the current method of maintenance was the best option for AFD. Twenty employees reported "yes" that the current method was the best option. While five employees reported that "no" that the current method was not the best option.

Question six asked if maintenance should be completed in-house, outsourced or both. Five employees reported that they felt maintenance should be completed in-house. Only one employee felt that all maintenance should be completed by an outsourced vendor. Nineteen employees reported that maintenance should be completed by outsourcing and in-house.

In answering research question number four of based on the qualifications of an EVT are any employees eligible and interested in the position. No employees are eligible not even the current mechanic who allowed his EVT certification to expire. According to the six question employee survey only one employee reported to wanting to be the department EVT, even though four reported to be willing to go to training and take certification exams. When asked why they were not interested in the position, the majority of the employees reported they just don't have any interest in the position while the rest of the employees reported that either pay or work schedule as their reasons. Questions five and six were opinion questions dealing with method of completing maintenance. The majority of employees reported, in their opinion, that current method of having a firefighter paramedic also serving as the EVT to be the best method. Also, they reported that having some maintenance completed in-house and the rest completed by an outsourced vendor as being the best option for completing maintenance.

## DISCUSSION

The research conducted provides insight into issues related to emergency vehicle maintenance. It is clear that vehicle maintenance is an important function for any fire department that wants to follow NFPA standards. Even though the survey results indicate that departments are not following the NFPA standards or NIOSH recommendations, the knowledge and information gained through the literature review has made it very clear that certified personnel need to be performing the apparatus maintenance. The NIOSH reports, that this author read, have made it very clear how firefighter's lives are on the line while responding in apparatus that may or maybe not in good working order. The apparatus needs to be in good working order for those firefighters to make it to the scenes of the emergency. One of the many recommendations that the NIOSH reports made, was that good documentation of repairs and the need of repairs was essential to a good maintenance program. Many of the departments that this recommendation was made too did not have adequate record keeping of repairs and documentation of who performed the work. NFPA standards have set guidelines on how daily inspections and preventive maintenance (PM) programs are to be completed. Yet, it is seen that those standards are not being followed by many departments through the many NIOSH reports. When departments start following the NFPA standards for apparatus maintenance, we could see a decrease in NOISH reports dealing with apparatus failures due to improper maintenance.

Literature review has made it clear that the current method of vehicle maintenance at the Ashland Fire Department is beneficial in relation to cost. This was solely based on labor rates of outsource vendors compared to current expenses of the AFD mechanic. Also, the employee survey results revealed, that in reference to cost, 80% of the employees felt that the current method was the best option. The employee survey did reveal that at least one individual was

interested in the position. Since the survey, that individual has become a certified EVT and has taken some continuing education courses. AFD has paid for his EVT exams and the continuing education courses including time off and paying for his room and board.

The literature review revealed that the Ashland Fire Department is deficient in the areas of tracking hours spent on repairs, tracking of parts inventory and the cost of repairs to each piece of apparatus. The tracking and recording of information for vehicle maintenance is one area that AFD can make substantial improvement. AFD currently has software that can be used to track all the maintenance details, but the software is not being used. The tracking of a parts inventory could decrease the out of service time, by having needed parts in-stock. Also, by tracking parts, it could determine which parts are in greater need of being in-stock. The tracking of maintenance would increase the number of hours the mechanic would spend on each repair even though this is a much needed task. The tracking of repair cost and other maintenance would help management make informed decisions on the life expectancies of each piece of apparatus. This type of documentation could be used to demonstrate the need for apparatus replacement to the mayor and city council.

Currently, AFD does not have a job description for the position of EVT. The current EVT answers to the Logistics Assistant Chief, but with no documentation, it is random at best on how or when duties are to be completed. AFD will need to come along side human resources (HR) to develop a job description for the EVT position. The job description will need to detail what level of certification and continuing education requirements that will need to be maintained. The job description would need to include the maintaining and tracking of a parts inventory and the documentation of all maintenance. This documentation would include all repairs, out of service times, parts cost, and the number of hours spent on the repair. The EVT position is very

important to the safety of all who either operate or ride in the apparatus. All fire department chief officers need to view apparatus maintenance as a very important part of operating a fire department. The most important resource for all fire departments is its people. If we cannot provide a safe piece of apparatus for them to respond in, we as chief officers are dropping the ball.

An area that was not researched in this paper is the benefits of having the same EVT performing all maintenance. Is there a benefit of knowing the history of a piece of apparatus, and can that knowledge of the history be measured? This is an area that could be developed in the future by other researchers.

The current method does come with some negative effects. At certain times, the EVT/ firefighter is unable to respond, which reduces the manpower for that response. Also, the shift that the EVT serves on has more daily chores due to the EVT not have the time to perform daily station chores. This creates strife at times between the shift members.



## RECOMMENDATIONS

The reason this subject was selected as a research topic is because in September 2014, the current mechanic will have the option to retire, and to date, the Ashland Fire Department (AFD) does not have a plan in place to assure emergency vehicle maintenance after his retirement.

The Ashland Fire Department is going to be at an organization crossroads regarding the vehicle maintenance program. This author recommends that the current program of a firefighter/paramedic serving as an EVT be continued. That being stated, five areas of improvement need to be made. Those areas are education and certification, the use of a software program, parts inventory, the development of a formal job description, and tool management.

The first area of improvement is the education and certification of the AFD mechanic. The AFD mechanic needs to be certified as an EVT. This recommendation is due to the research and surveys that have been completed. The area of education and certification is supported from the facts found in the literature review and the standards that have been set in place by the Emergency Vehicle Technician Certification Commission (EVTCC), Automotive Service Excellence (ASE), and the National Fire Protection Association (NFPA). Also, the survey results revealed that it was “very important” to have a certified EVT perform the maintenance. These standards of education and certifications should be achieved to the Level 1 Fire Apparatus Technician. Also, EVTs should be encouraged to achieve further education by paying for their training, room and board while away, and pay overtime to attend the training. This increase in education should include a level 2 Fire Apparatus Technician and other specific training such as Allison Transmission repair and Detroit Diesel repair. Having a mechanic with the education and certification is like having an insurance policy. Having a mechanic that has no certification performing maintenance on apparatus that costs hundreds of thousands of dollars is

a risk not worth taking. It was noted in the National Institute of Occupational Safety and Health (NIOSH) reports that having a certified EVT performing the maintenance is a “must do”. The literature review of the NIOSH reports, show time and time again the importance of following NFPA standards which recommend education and certification; this is not only to increase firefighter safety while using the apparatus, but to decrease liability. The apparatus of today is much different than the apparatus of the past. The apparatus of today requires not only a greater knowledge base, but an increase in technology. The recommendation of having a certified EVT to complete all the maintenance may not only save money, but decrease the liability to the AFD. Having an individual who knows what they are doing and also knowing when to have the work performed elsewhere is invaluable. This will ensure that the work is completed correctly the first time; therefore, requiring less repeat repairs and providing high level of quality control. The facts from the survey side revealed that the out of service time is decreased when departments have their maintenance completed in-house. This further exemplifies the importance of having a certified EVT performing the maintenance in-house due to the fact that the AFD does not have any backup apparatus. AFD cannot afford to have apparatus out of service for long periods of time.

The second area of improvement would be for the EVT to fully utilize our Firehouse software program. The department already uses this program for EMS and fire reporting. This same software can be used to not only report a needed repair, but track all maintenance. The computer software can be used by the EVT to log and track hours spent on repairs, cost of parts, out of service times, and preventive maintenance (PM) schedule. The survey revealed that having a method to report and track all maintenance was done by all departments. The current mechanic and all current members of the department are capable and are using the Firehouse

software for the reporting of EMS and fire reports. It is this author's recommendation that training needs to be completed so that all personnel can use the Firehouse software to its full capabilities.

The third area of improvement would be to find and use a software program that would be used to track and record parts inventory. While our current program can effectively record EMS and fire reports, it is not capable of being used for parts inventory. That being said, I inquired with our current software program, and they reported that they are in the process of developing a parts inventory system using barcodes. The time frame on this project by the software company is unknown at the time of this project. Other software programs used for parts inventory tracking are available with monthly fees. The survey results revealed that the majority of the departments have and maintain a parts inventory. That being said, the survey did not detail how the departments tracked and recorded their parts inventory.

The fourth area of improvement would be to develop a formal job description for the position of EVT. This would include defining the duties and responsibilities for the EVT and the certification Level 1 Fire Apparatus Technician to be secured and maintained. The duties would include performing PM and general repairs with the ability to have an outsourced vendor complete any maintenance outside of the EVT's scope of practice or certification level. The EVT would be encouraged to increase their certification level if so desired. Also, it would be the EVT's responsibility to enter all data into the computer software along with giving feedback to the individual who reported the needed repair.

The fifth area of improvement would be a tool management program. This would include replacement of tools, repair software or the acquisition of needed tools or software. As hand tools are being used they become damaged or worn, so they need to be replaced or updated.

This goes along with computer software that would be used to diagnosis problems or to the making of adjustments to the equipment. Most current fire apparatus use onboard computers to operate at the levels they are designed to function. As new apparatus is purchased, also new or updated software may need to be purchased.

The costs associated with the four areas of improvement are as follows: The first recommendation will cost the AFD to pay a current employee to complete the exams to be certified as a Fire Apparatus Technician Level 1. This would cost the department \$198 in fees for the initial testing with another \$120 every five years for recertification testing. The cost of fuel for transportation and possible overtime could cost as much as \$400 depending on how far the testing site is and if the employee is on duty or off duty on the date of testing. The Level 1 technician would need to pass two exams from the EVTCC and two tests from the ASE. Each of these organizations requires recertification exams every five years. Also, the EVT should attend the Ohio Association of Emergency Vehicle Technicians (OAEVT) symposium every year in September at the Ohio Fire Academy. The cost of registering to attend the week long symposium is \$400. That being said, the cost of meals and the hotel room for the current EVT to attend the 2012 symposium was an additional cost of \$596. At this symposium the EVT will attend workshops and special topics of interest all related to emergency vehicle maintenance.

The second area of improvement would not cost the department any new fees. With the department already having a computer software program that is being utilized for EMS and Fire reporting, there will be no new costs associated with this area for the tracking of maintenance.

The third area of improvement would have additional cost associated with it. Whether it is decided to purchase the additional upgrade to the current Firehouse software or purchase a new software program for the tracking and recording of the parts inventory, this will increase the

cost of the program. If it is decided to buy a new software program, they have monthly fees that range from \$25 to \$120 to track and record the parts inventory. The current Firehouse software program used for EMS and fire reports is not capable of being used for a parts inventory, but is being developed to do such. The price of the upgrade to the current software is not yet been advertised.

The fourth area of improvement would not have any costs associated with it. The development of a formal job description can be completed by this author along with the human resources director.

The fifth area of improvement would have additional costs associated with it. An amount of \$500 per year for tool replacement or update should be budgeted. Also, an additional \$1200 for computer software used for repairs or adjustments should be budgeted. That being said there may be years where no new tools or software will need to be purchased. This area of improvement will need to remain flexible, due to some years more may need to be spent than what is budgeted while other years less may need to be spent on tools and software.

The reason that this author recommends continuing the current maintenance program is due to the research revealing the current program had a cost saving of \$21,019.36 in 2012. This was a comparison between having maintenance completed by an outsourced vendor and the department's mechanic completing the maintenance. This saving is only in the area of labor costs. The fact that the department has its maintenance completed by a firefighter, which would be getting paid whether he performs any maintenance or not, is seen as a benefit. That firefighter EVT receives a \$750 stipend per year plus some overtime. The savings was determined through the comparison of outside vendor's labor cost compared to the labor costs of the current EVT. The total number of duty days per year was 122. From that 122 duty days, nine Kelly days, ten

vacations, one personal, three holidays, and seventeen Sundays were subtracted. The total number of days that maintenance was being performed is 82 days. Those 82 days were then multiplied by the number four, which represents the number of hours spent per day doing maintenance. The total number of hours spent per year performing maintenance is 328. This does not include the over-time hours that the EVT works. This was done to figure out how much of the EVT's wages went towards working on apparatus and equipment. The EVT's hourly rate of \$18.13 was then multiplied by the 328 hours; that figure comes to \$5,946.64. In addition the EVT's \$750 stipend was added to the \$5,946.64 for a total cost of \$6,696.64.

This author then researched how much service centers charge for labor and if their technicians are EVT certified. A Google search was done for emergency vehicle service. Not all of the service centers that the Google search revealed are being used. Ohio Cat, Finley, W.W.Williams, and All American are service centers located in Ohio. An over the phone interview was completed with the four service centers (personal communications, October 2, 2012). They each were asked what their labor charges were per hour, and if the mechanics had an EVT certification? The results revealed that the average labor rate for the four vendors was \$84.50 per hour and all four had certified EVTs performing the work.

The four vendors offer service for an average rate of \$84.50/hour. That rate was then multiplied by the 328 hours that the EVT works per year and came to the grand total of \$27,716. That is the amount it would cost the Ashland Fire Department per year for labor charges by an outside vendor. The \$6,696.64 that the department spends on the EVT's wages was then subtracted from the labor charges from vendors and the savings comes to \$21,019.36 per year. The estimated cost savings for 2012 was \$21,019.36. This estimate needs to be monitored as better tracking of the cost of the current program will also need to improve. By improving the

tracking of costs of the current program, a better determination can be made to the cost effectiveness.

The fact that the AFD does not currently have a certified EVT completing the vehicle maintenance could be increasing its liability due to apparatus failure. The employee survey revealed that the majority of the department does not have any interest in the position. Only one employee was interested in becoming the AFD's EVT. This interest should be developed through the department paying for exams and training. Also, this individual should be allowed to shadow the current EVT to develop his knowledge base. This "shadowing" may also help that individual determine if they are truly interested in the position. The recommendation of trying to increase interest in the EVT position should be accomplished through incentives. This may encourage other members to be interested in the position. This can be done by addressing the issues that were identified in the employee survey as reasons that employees did not have interest in the position. The two main reasons given for lack of interest in the EVT position, was reported as: not enough pay and working hours. The area of pay should be increased by increasing the stipend to \$2000 the first year and with increases of \$500 every year till a maximum of \$5000 is reached. This increase in stipend is a small payment for the knowledge and benefit being provided. The working hours need to remain flexible for the sake of repairs needing completed. The other area that may encourage members to be interested is by management speaking positively about the position and the benefit of having the EVT. By presenting the position in a positive manner it gives power to the position.

In summary, this authors recommendation of continuing the current program with the improvements noted above would be a cost savings of an estimated \$14,000.00 compared to having outsourced vendors complete the maintenance. This is a reflection of the savings

estimated in 2012 minus the cost of a mechanic taking tests, attending the OAEVT symposium, the increased stipend, and the cost of parts inventory software. The savings of \$14,000.00 is a benefit that should not be overlooked. The benefit of having the same individual performing the maintenance was not measured, but through literature review it was noted in National Fire Academy (NFA) research projects as a benefit. That benefit comes from an EVT knowing the history and the current state of the apparatus. This can be used to determine when a piece of apparatus should be replaced. This determination of replacement by an EVT is recommended by the NFPA. The NFPA has determined that an EVT as the best person to determine when a piece of apparatus needs to be replaced.

A recommendation for future readers or researchers is to expand the number of surveys to a larger portion of the fire service. This topic is significant to the fire service across the country and they could benefit from this knowledge. By expanding the number of surveys, a better determination of what other departments are doing for vehicle maintenance will be developed. Also, expand the survey to organizations outside of the fire service and into not only the private sector, but other governmental agencies.



## REFERENCES

- Ashland Fire Department. (2011-2013). *Monthly budget reports*. Ashland, Ohio: City of Ashland Fire Department.
- Automotive Service Excellence (2012). (ASE) *Medium/heavy truck test study guide*. [Booklet]. Leesburg, Virginia: National Institute for Automotive Service Excellence.
- Emergency Vehicle Technician Certification Commission (2012). *Emergency vehicle technician certification program*. [Booklet]. Dundee, Illinois
- National Fire Protection Association (2000). *Standard for fire apparatus preventative maintenance programs* (NFPA 1915). Quincy, MA: National Fire Protection Agency.
- National Fire Protection Association (2011). *Standard for emergency vehicle technician professional qualifications* (NFPA 1071). Quincy, MA: National Fire Protection Agency.
- National Fire Protection Association (2002). *Standard on fire department occupational safety and health program* (NFPA 1500). Quincy, MA: National Fire Protection Agency.
- National Fire Protection Association (2012). *Standard for the inspection, maintenance, testing, and retirement of in-service automotive fire apparatus* (NFPA 1911). Quincy, MA: National Fire Protection Agency.
- National Institute for Occupational Safety and Health (February 26, 2010). *Fire fighter fatality investigation report* (Report F2009-05). Cincinnati, Ohio: Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health.
- Ohio Association of Emergency Vehicle Technicians (2012). Retrieved December 15, 2012 from [www.oevt.org](http://www.oevt.org)
- Steffens, J.T. (2000). *NFPA new and improved*. Fire Chief In Service, October, 1-5

**APPENDIX 1 – SURVEY COVER LETTER**

Dear Chief Officers,

My Name is Dan Raudebaugh and I'm an Assistant Chief with the Ashland Fire Department. I'm currently enrolled in OFE class 12, my research project is based on emergency vehicle maintenance. If you are a chief officer of a career department, I would greatly appreciate you taking a few moments to fill out the survey. The link below will take you to the survey. If you would like a copy of my research paper upon completion, I will gladly send you a copy.

<https://www.surveymonkey.com/s/FG6W5WK>

Thanks for your time and effort,

AC Raudebaugh

**APPENDIX 2 – SURVEY**

1. Do certified emergency vehicle technicians (EVT) perform your vehicle maintenance?
  - a. All maintenance is performed by certified EVT's
  - b. Major repairs only are done by certified EVT's
  - c. Preventive maintenance only is done by certified EVT's
  - d. None
  
2. Is your vehicle maintenance completed in-house or outsourced?
  - a. In House
  - b. Outsourced
  - c. both
  
3. Whether your vehicle maintenance is completed in-house or outsourced, are the mechanics EVT certified?
  - a. Both in-house and outsourced are certified EVT's
  - b. Outsourced only are certified
  - c. Only in-house are certified
  - d. None are certified
  - e. Unknown if certified
  
4. If your vehicle maintenance is completed in-house by certified EVTs, what percent of the EVTs serve as FF/paramedics?
  - a. 100%
  - b. 75%
  - c. 50%
  - d. 25%
  - e. 0%
  - f. N/A
  
5. How important is the use of a certified EVT to work on your apparatus?
  - a. Very important
  - b. Somewhat important
  - c. Neutral
  - d. Somewhat unimportant
  - e. Not important
  
6. If you have your vehicle maintenance completed in-house and outsourced, what percentage is done in-house?
  - a. 0%
  - b. 1-20%
  - c. 21-40%
  - d. 41-60%
  - e. 61-80%
  - f. 81-100%

7. How many pieces of apparatus does your department have?
  - a. 0-5
  - b. 6-10
  - c. 11-15
  - d. 16-20
  - e. 21-25
  - f. 26-30
  - g. 31 and up
  
8. On average, how many runs does your department respond to in a year?
  - a. 0-1000
  - b. 1001-2000
  - c. 2001-3000
  - d. 3001-4000
  - e. 4001-5000
  - f. 5001- and up
  
9. If you have certified EVT's that are FF/Medics on your department, is their pay different from the other FF/Medics?
  - a. Yes more
  - b. Yes less
  - c. No
  - d. N/A
  
10. How much is budgeted for vehicle maintenance?
  - a. \$0-\$10,000
  - b. \$10,001-\$20,000
  - c. \$20,001-\$30,000
  - d. \$30,001-\$40,000
  - e. \$40,001-\$50,000
  - f. \$50,001-\$60,000
  - g. \$60,001-\$70,000
  - h. \$70,001-\$80,000
  - i. \$80,001-\$90,000
  - j. \$90,001-\$100,000
  - k. \$100,001- and up
  
11. If your vehicle maintenance is outsourced, what is the average out of service time?
  - a. 1hr-1day
  - b. 1day-2days
  - c. 2days-3days

- d. 3days-4days
  - e. 4days-5days
  - f. 6days- and up
  - g. N/A
12. If your vehicle maintenance is completed in-house, what is the average out of service time?
- a. 1hr-1day
  - b. 1day-2days
  - c. 2days-3days
  - d. 3days-4days
  - e. 4days-5days
  - f. 6days- and up
  - g. N/A
13. If your vehicle maintenance is completed in-house, do you have a parts inventory?
- a. Yes, extensive parts inventory
  - b. Yes, limited parts inventory
  - c. Yes, only disposables (wiper blades, filters, etc.)
  - d. None
14. If a vehicle is in need of repair, how is the process started to report the needed repair? (circle all that apply)
- a. Official maintenance form (paper)
  - b. Computer software program
  - c. Face to face communication
15. If your vehicle maintenance is outsourced, who does the scheduling of the repairs?
- a. Chief
  - b. Chief Officer
  - c. Officer
  - d. Firefighter
  - e. EVT
16. If your vehicle maintenance is completed in-house or outsourced, is the maintenance recorded?
- a. Yes, all maintenance is recorded
  - b. Yes, in-house only
  - c. Yes, outsourced only
  - d. No, maintenance is recorded
17. If your vehicle maintenance is completed in-house and recorded, what is recorded? (circle all that apply)
- a. Routine maintenance
  - b. Parts cost
  - c. Hours of labor

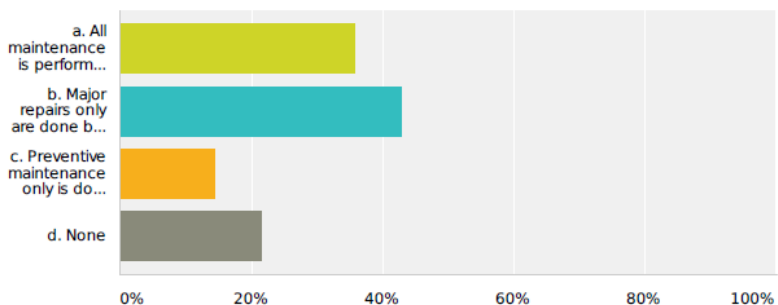
- d. Labor cost
  - a. Repair type
  - b. Who reported the needed repair
  - c. Time out of service
  - d. Who performed the needed work
18. If a vehicle is reported to be in need of repair, is feedback given to the person who made the report?
- a. Yes
  - b. No
19. How important is a preventive maintenance program to your department?
- a. Very important
  - b. Somewhat important
  - c. Neutral
  - d. Somewhat unimportant
  - e. Not important
20. If a preventive maintenance (PM) program is in place, what method determines when PM is done?
- a. Hours
  - b. Mileage
  - c. Monthly
  - d. Quarterly
  - e. Yearly
  - f. As needed

### APPENDIX 3 – SURVEY RESULTS

What is the best option for vehicle maintenance?

#### Q1 Do certified emergency vehicle technicians (EVT) perform your vehicle maintenance?

Answered: 14 Skipped: 0

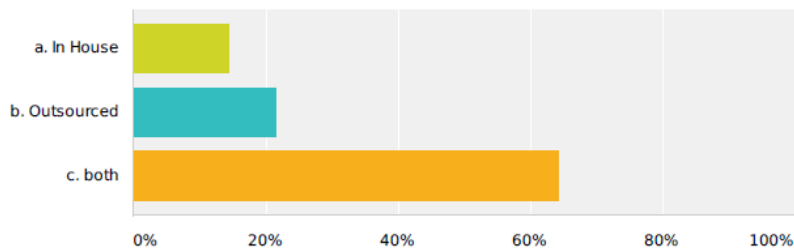


Answer Choices	Responses
<b>a. All maintenance is performed by certified EVT's</b>	<b>35.71%</b> 5
<b>b. Major repairs only are done by certified EVT's</b>	<b>42.86%</b> 6
<b>c. Preventive maintenance only is done by certified EVT's</b>	<b>14.29%</b> 2
<b>d. None</b>	<b>21.43%</b> 3
Total Respondents: 14	

What is the best option for vehicle maintenance?

#### Q2 Is your vehicle maintenance completed in-house or outsourced?

Answered: 14 Skipped: 0

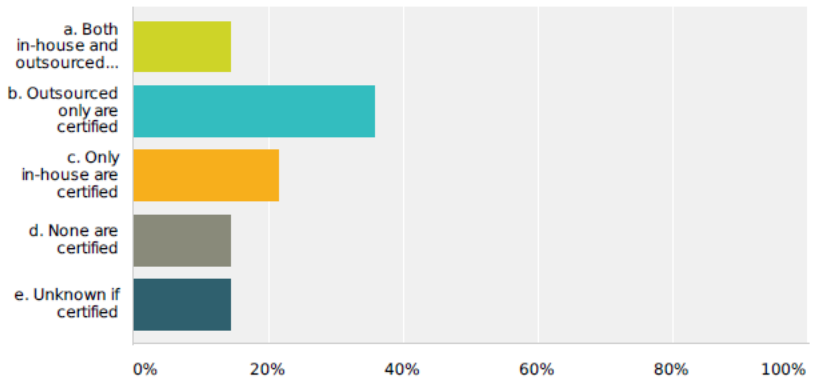


Answer Choices	Responses
<b>a. In House</b>	<b>14.29%</b> 2
<b>b. Outsourced</b>	<b>21.43%</b> 3
<b>c. both</b>	<b>64.29%</b> 9
Total Respondents: 14	

What is the best option for vehicle maintenance?

### Q3 Whether your vehicle maintenance is completed in-house or outsourced, are the mechanics EVT certified?

Answered: 14 Skipped: 0



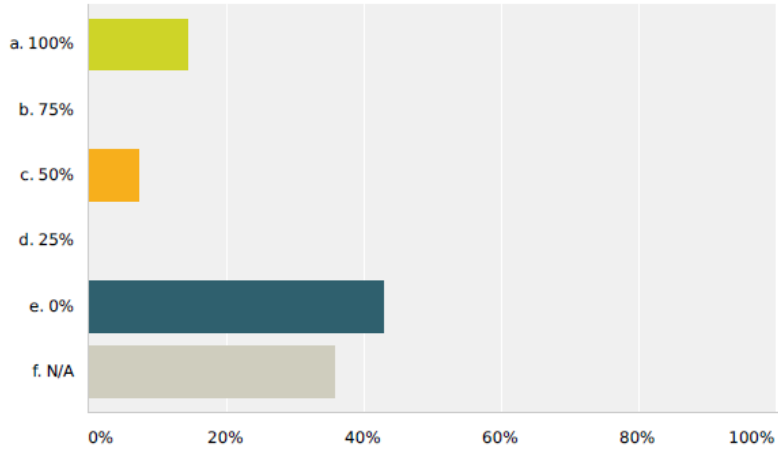
Answer Choices	Responses
<b>a. Both in-house and outsourced are certified EVT's</b>	<b>14.29%</b> 2
<b>b. Outsourced only are certified</b>	<b>35.71%</b> 5
<b>c. Only in-house are certified</b>	<b>21.43%</b> 3
<b>d. None are certified</b>	<b>14.29%</b> 2
<b>e. Unknown if certified</b>	<b>14.29%</b> 2
Total Respondents: 14	



What is the best option for vehicle maintenance?

**Q4 If your vehicle maintenance is completed in-house by certified EVT's, what percent of the EVT's serve as FF/paramedics?**

Answered: 14 Skipped: 0

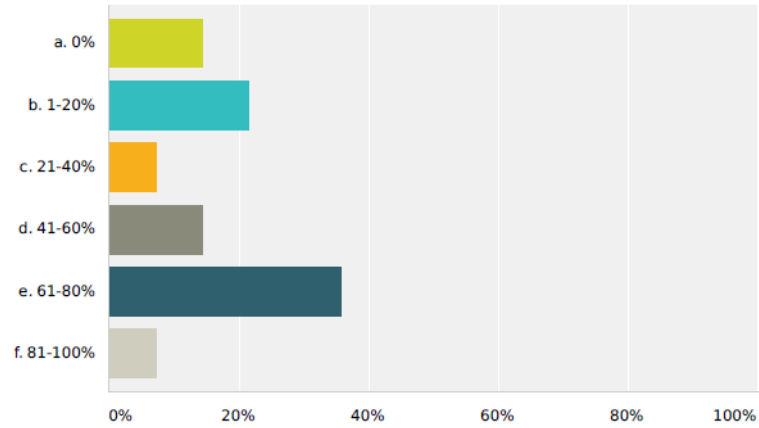


Answer Choices	Responses
<b>a. 100%</b>	<b>14.29%</b> 2
<b>b. 75%</b>	<b>0%</b> 0
<b>c. 50%</b>	<b>7.14%</b> 1
<b>d. 25%</b>	<b>0%</b> 0
<b>e. 0%</b>	<b>42.86%</b> 6
<b>f. N/A</b>	<b>35.71%</b> 5
Total Respondents: 14	

What is the best option for vehicle maintenance?

**Q6 If you have your vehicle maintenance completed in-house and outsourced, what percentage is done in-house?**

Answered: 14 Skipped: 0

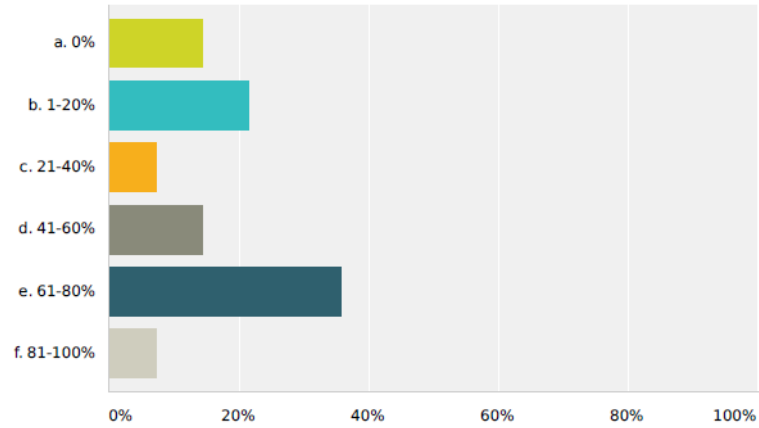


Answer Choices	Responses
<b>a. 0%</b>	<b>14.29%</b> 2
<b>b. 1-20%</b>	<b>21.43%</b> 3
<b>c. 21-40%</b>	<b>7.14%</b> 1
<b>d. 41-60%</b>	<b>14.29%</b> 2
<b>e. 61-80%</b>	<b>35.71%</b> 5
<b>f. 81-100%</b>	<b>7.14%</b> 1
Total Respondents: 14	

What is the best option for vehicle maintenance?

**Q6 If you have your vehicle maintenance completed in-house and outsourced, what percentage is done in-house?**

Answered: 14 Skipped: 0

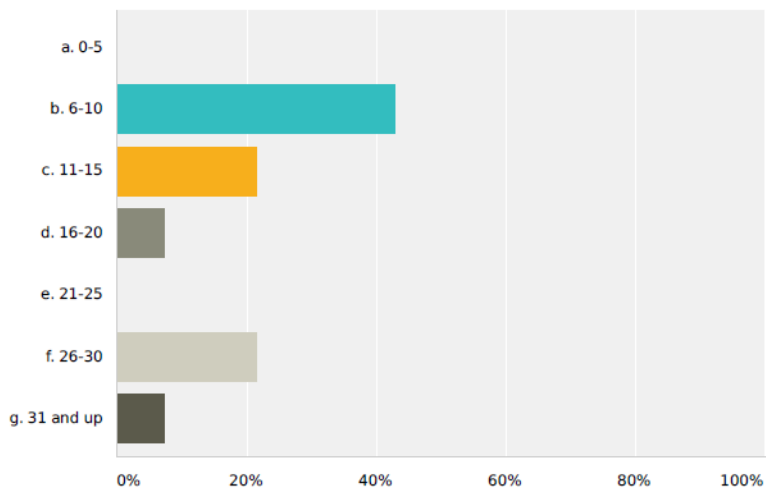


Answer Choices	Responses
<b>a. 0%</b>	<b>14.29%</b> 2
<b>b. 1-20%</b>	<b>21.43%</b> 3
<b>c. 21-40%</b>	<b>7.14%</b> 1
<b>d. 41-60%</b>	<b>14.29%</b> 2
<b>e. 61-80%</b>	<b>35.71%</b> 5
<b>f. 81-100%</b>	<b>7.14%</b> 1
Total Respondents: 14	

What is the best option for vehicle maintenance?

### Q7 How many pieces of apparatus does your department have?

Answered: 14 Skipped: 0

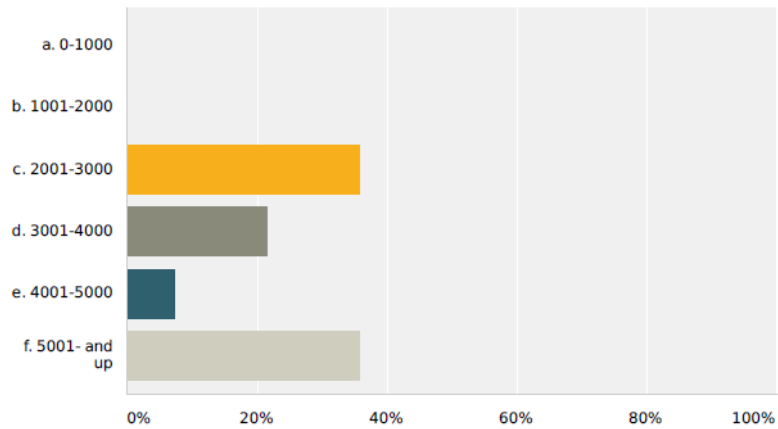


Answer Choices	Responses
<b>a. 0-5</b>	<b>0%</b> 0
<b>b. 6-10</b>	<b>42.86%</b> 6
<b>c. 11-15</b>	<b>21.43%</b> 3
<b>d. 16-20</b>	<b>7.14%</b> 1
<b>e. 21-25</b>	<b>0%</b> 0
<b>f. 26-30</b>	<b>21.43%</b> 3
<b>g. 31 and up</b>	<b>7.14%</b> 1
Total Respondents: 14	

What is the best option for vehicle maintenance?

**Q8 On average, how many runs does your department respond to in a year?**

Answered: 14 Skipped: 0

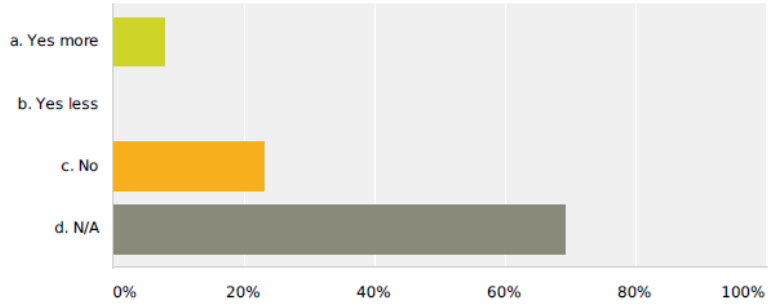


Answer Choices	Responses	
<b>a. 0-1000</b>	<b>0%</b>	0
<b>b. 1001-2000</b>	<b>0%</b>	0
<b>c. 2001-3000</b>	<b>35.71%</b>	5
<b>d. 3001-4000</b>	<b>21.43%</b>	3
<b>e. 4001-5000</b>	<b>7.14%</b>	1
<b>f. 5001- and up</b>	<b>35.71%</b>	5
Total Respondents: 14		

What is the best option for vehicle maintenance?

**Q9 If you have certified EVT's that are FF/Medics on your department, is their pay different from the other FF/Medics?**

Answered: 13 Skipped: 1

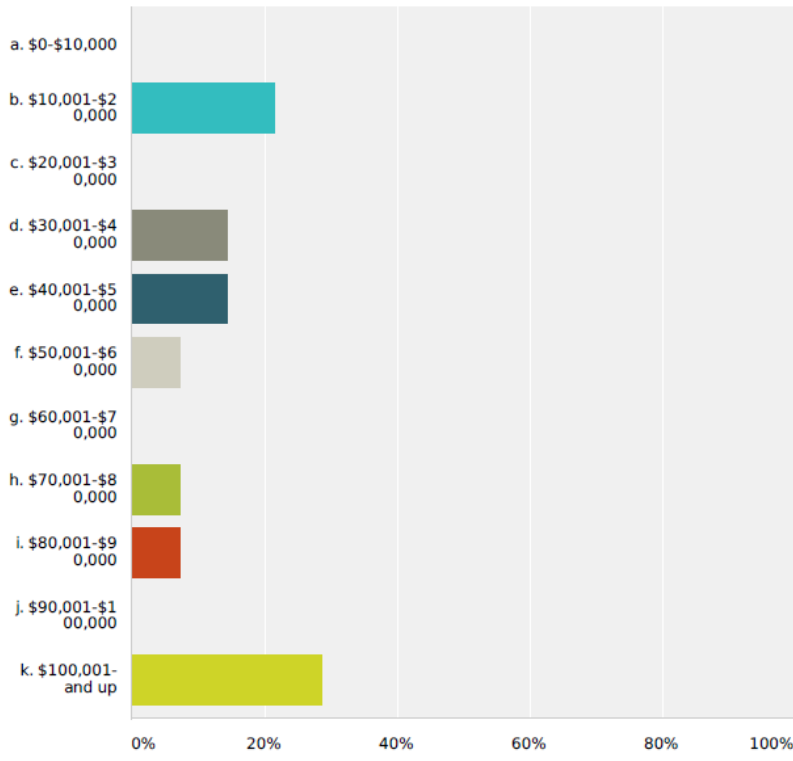


Answer Choices	Responses
<b>a. Yes more</b>	<b>7.69%</b> 1
<b>b. Yes less</b>	<b>0%</b> 0
<b>c. No</b>	<b>23.08%</b> 3
<b>d. N/A</b>	<b>69.23%</b> 9
Total Respondents: 13	

What is the best option for vehicle maintenance?

### Q10 How much is budgeted for vehicle maintenance?

Answered: 14 Skipped: 0

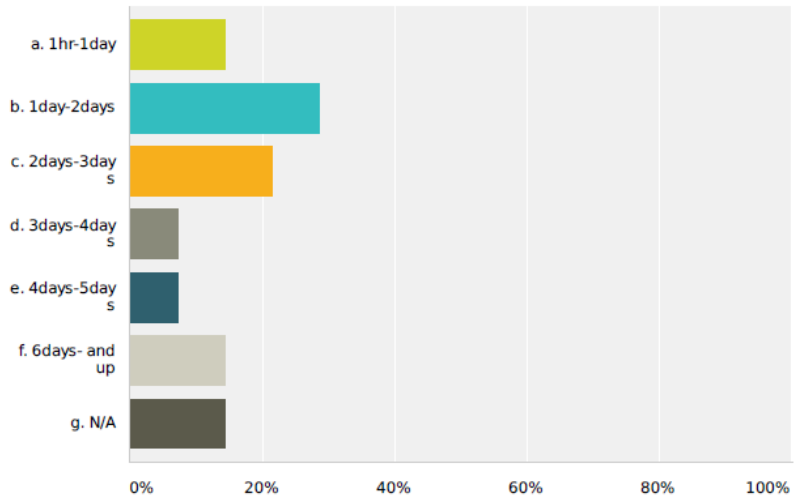


Answer Choices	Responses
<b>a. \$0-\$10,000</b>	<b>0%</b> 0
<b>b. \$10,001-\$20,000</b>	<b>21.43%</b> 3
<b>c. \$20,001-\$30,000</b>	<b>0%</b> 0
<b>d. \$30,001-\$40,000</b>	<b>14.29%</b> 2
<b>e. \$40,001-\$50,000</b>	<b>14.29%</b> 2
<b>f. \$50,001-\$60,000</b>	<b>7.14%</b> 1
<b>g. \$60,001-\$70,000</b>	<b>0%</b> 0
<b>h. \$70,001-\$80,000</b>	<b>7.14%</b> 1
<b>i. \$80,001-\$90,000</b>	<b>7.14%</b> 1
<b>j. \$90,001-\$100,000</b>	<b>0%</b> 0
<b>k. \$100,001- and up</b>	<b>28.57%</b> 4
Total Respondents: 14	

What is the best option for vehicle maintenance?

### Q11 If your vehicle maintenance is outsourced, what is the average out of service time?

Answered: 14 Skipped: 0



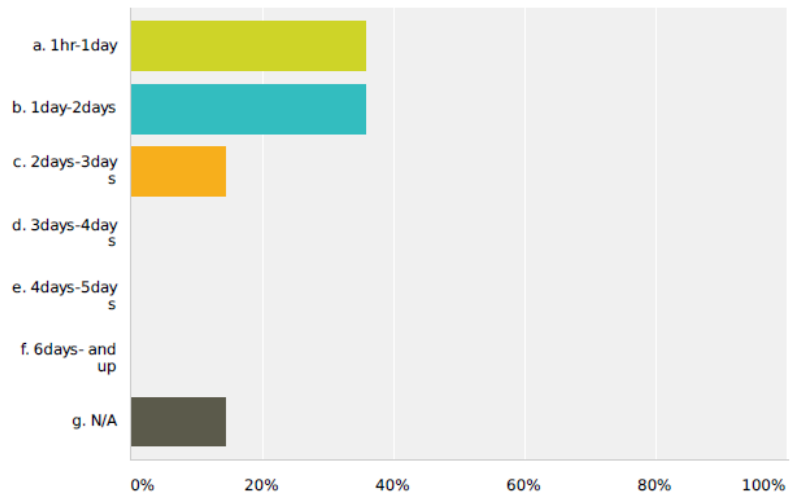
Answer Choices	Responses
<b>a. 1hr-1day</b>	<b>14.29%</b> 2
<b>b. 1day-2days</b>	<b>28.57%</b> 4
<b>c. 2days-3days</b>	<b>21.43%</b> 3
<b>d. 3days-4days</b>	<b>7.14%</b> 1
<b>e. 4days-5days</b>	<b>7.14%</b> 1
<b>f. 6days- and up</b>	<b>14.29%</b> 2
<b>g. N/A</b>	<b>14.29%</b> 2
Total Respondents: 14	



What is the best option for vehicle maintenance?

**Q12 If your vehicle maintenance is completed in-house, what is the average out of service time?**

Answered: 14 Skipped: 0

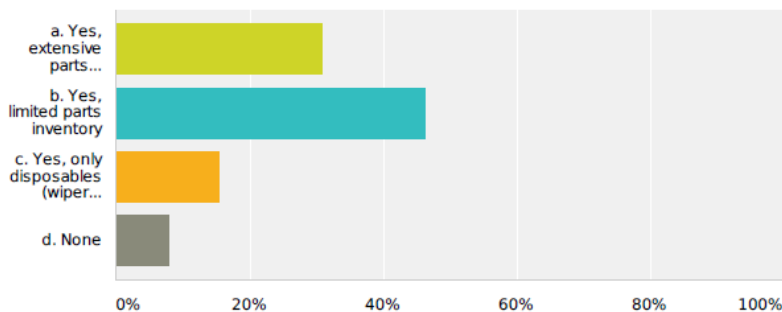


Answer Choices	Responses
<b>a. 1hr-1day</b>	<b>35.71%</b> 5
<b>b. 1day-2days</b>	<b>35.71%</b> 5
<b>c. 2days-3days</b>	<b>14.29%</b> 2
<b>d. 3days-4days</b>	<b>0%</b> 0
<b>e. 4days-5days</b>	<b>0%</b> 0
<b>f. 6days- and up</b>	<b>0%</b> 0
<b>g. N/A</b>	<b>14.29%</b> 2
Total Respondents: 14	

What is the best option for vehicle maintenance?

### Q13 If your vehicle maintenance is completed in-house, do you have a parts inventory?

Answered: 13 Skipped: 1

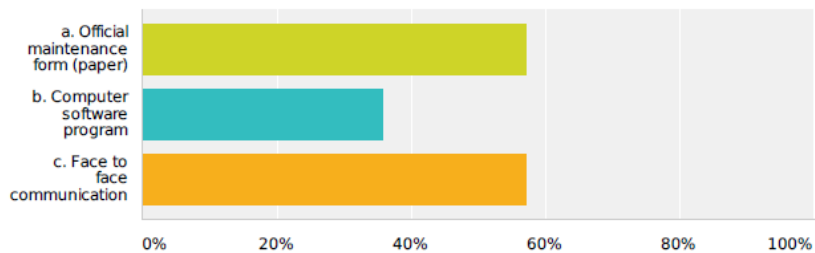


Answer Choices	Responses
<b>a. Yes, extensive parts inventory</b>	30.77% 4
<b>b. Yes, limited parts inventory</b>	46.15% 6
<b>c. Yes, only disposables (wiper blades, filters, etc.)</b>	15.38% 2
<b>d. None</b>	7.69% 1
Total Respondents: 13	

What is the best option for vehicle maintenance?

### Q14 If a vehicle is in need of repair, how is the process started to report the needed repair? (check all that apply)

Answered: 14 Skipped: 0

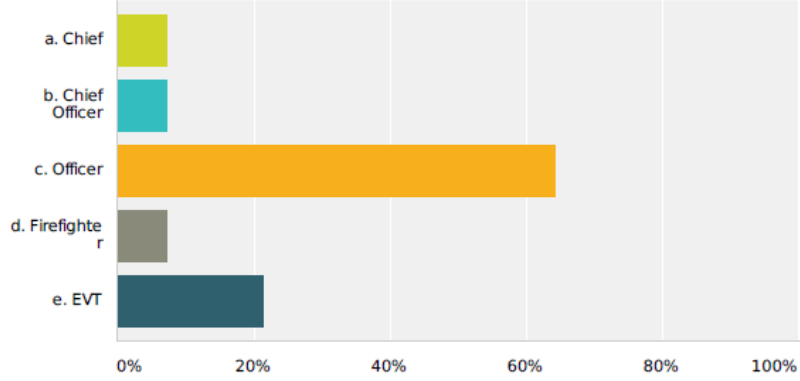


Answer Choices	Responses
<b>a. Official maintenance form (paper)</b>	57.14% 8
<b>b. Computer software program</b>	35.71% 5
<b>c. Face to face communication</b>	57.14% 8
Total Respondents: 14	

What is the best option for vehicle maintenance?

### Q15 If your vehicle maintenance is outsourced, who does the scheduling of the repairs?

Answered: 14 Skipped: 0

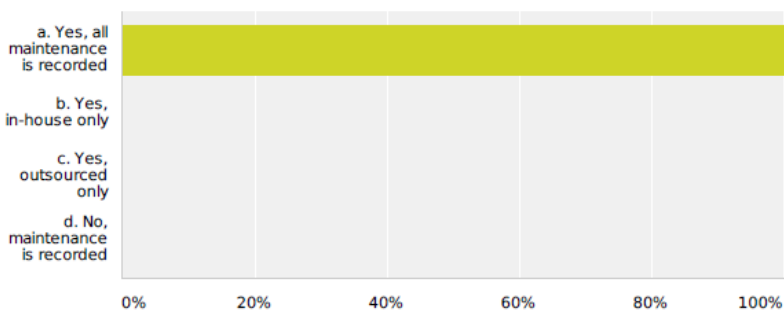


Answer Choices	Responses
<b>a. Chief</b>	<b>7.14%</b> 1
<b>b. Chief Officer</b>	<b>7.14%</b> 1
<b>c. Officer</b>	<b>64.29%</b> 9
<b>d. Firefighter</b>	<b>7.14%</b> 1
<b>e. EVT</b>	<b>21.43%</b> 3
Total Respondents: 14	

What is the best option for vehicle maintenance?

### Q16 If your vehicle maintenance is completed in-house or outsourced, is the maintenance recorded?

Answered: 14 Skipped: 0

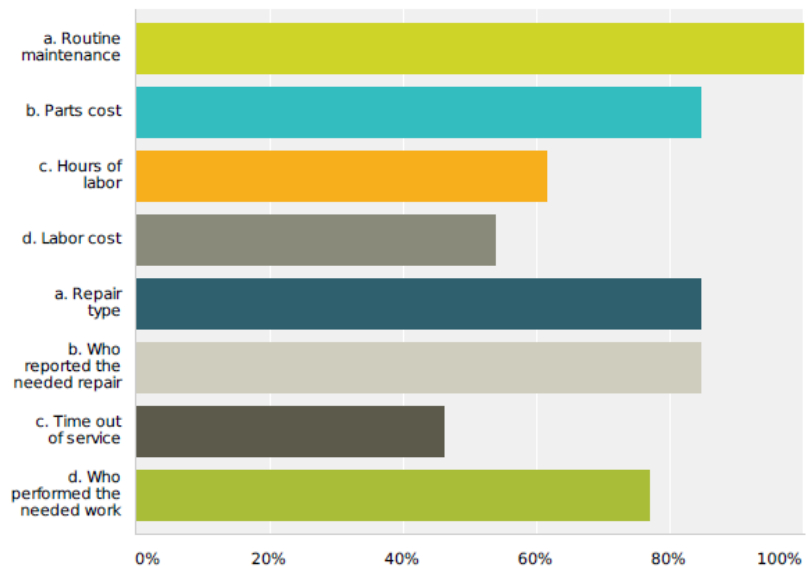


Answer Choices	Responses
<b>a. Yes, all maintenance is recorded</b>	<b>100%</b> 14
<b>b. Yes, in-house only</b>	<b>0%</b> 0
<b>c. Yes, outsourced only</b>	<b>0%</b> 0
<b>d. No, maintenance is recorded</b>	<b>0%</b> 0
Total Respondents: 14	

What is the best option for vehicle maintenance?

**Q17 If your vehicle maintenance is completed in-house and recorded, what is recorded? (circle all that apply)**

Answered: 13 Skipped: 1

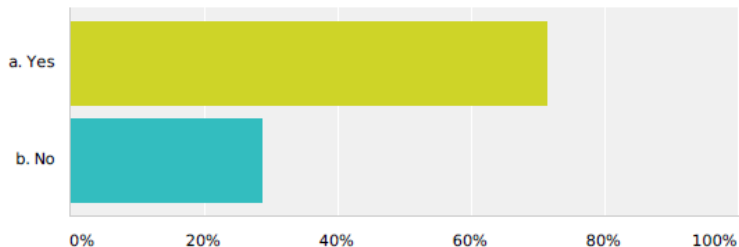


Answer Choices	Responses	
<b>a. Routine maintenance</b>	<b>100%</b>	13
<b>b. Parts cost</b>	<b>84.62%</b>	11
<b>c. Hours of labor</b>	<b>61.54%</b>	8
<b>d. Labor cost</b>	<b>53.85%</b>	7
<b>a. Repair type</b>	<b>84.62%</b>	11
<b>b. Who reported the needed repair</b>	<b>84.62%</b>	11
<b>c. Time out of service</b>	<b>46.15%</b>	6
<b>d. Who performed the needed work</b>	<b>76.92%</b>	10
Total Respondents: 13		

What is the best option for vehicle maintenance?

### Q18 If a vehicle is reported to be in need of repair, is feedback given to the person who made the report?

Answered: 14 Skipped: 0

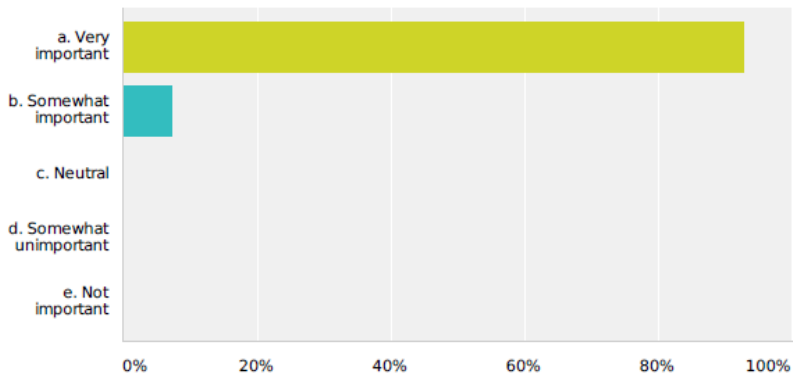


Answer Choices	Responses
<b>a. Yes</b>	<b>71.43%</b> 10
<b>b. No</b>	<b>28.57%</b> 4
Total Respondents: 14	

What is the best option for vehicle maintenance?

### Q19 How important is a preventive maintenance program to your department?

Answered: 14 Skipped: 0

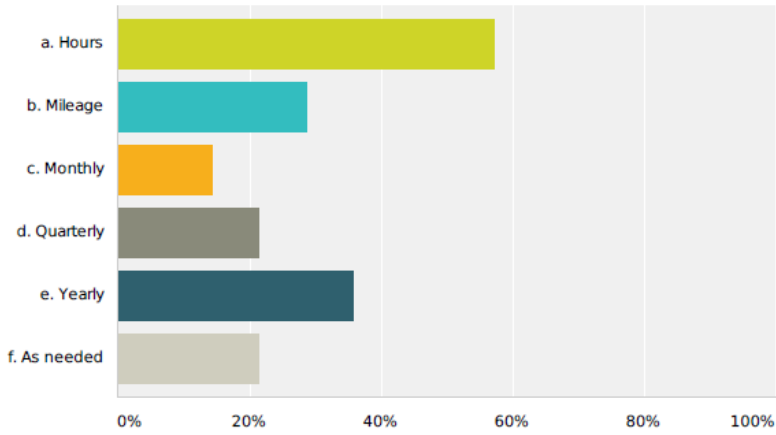


Answer Choices	Responses
<b>a. Very important</b>	<b>92.86%</b> 13
<b>b. Somewhat important</b>	<b>7.14%</b> 1
<b>c. Neutral</b>	<b>0%</b> 0
<b>d. Somewhat unimportant</b>	<b>0%</b> 0
<b>e. Not important</b>	<b>0%</b> 0
Total Respondents: 14	

What is the best option for vehicle maintenance?

### Q20 If a preventive maintenance (PM) program is in place, what method determines when PM is done

Answered: 14 Skipped: 0



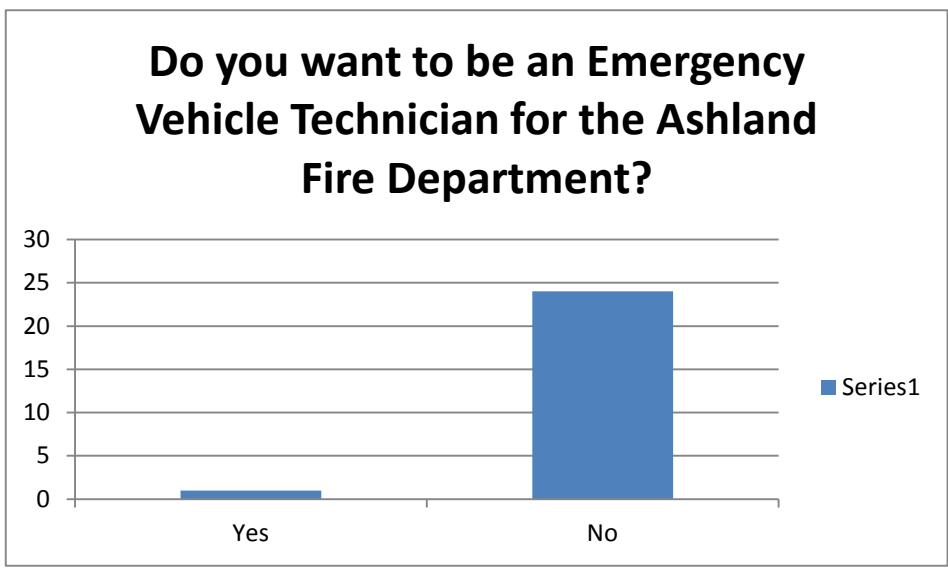
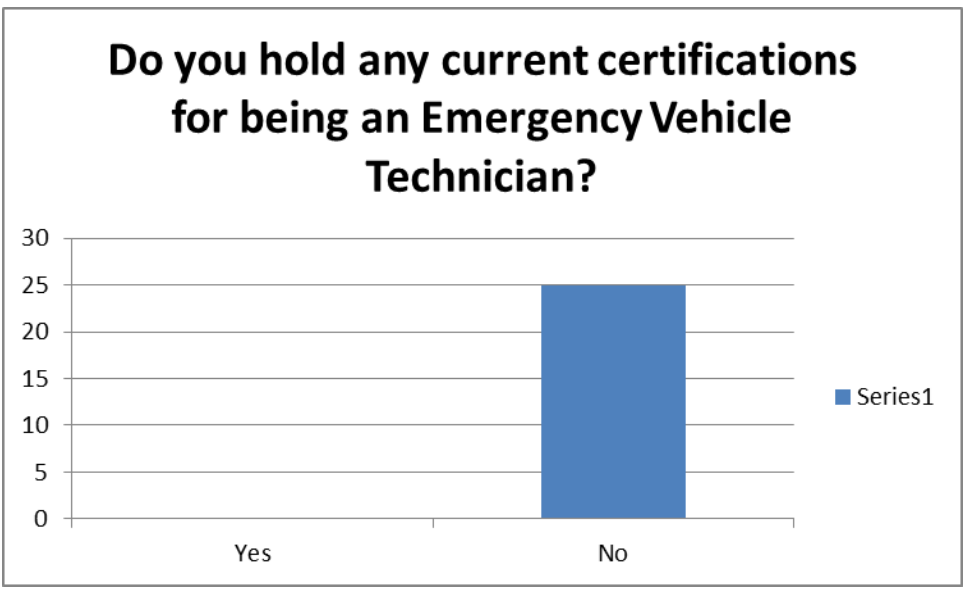
Answer Choices	Responses
<b>a. Hours</b>	<b>57.14%</b> 8
<b>b. Mileage</b>	<b>28.57%</b> 4
<b>c. Monthly</b>	<b>14.29%</b> 2
<b>d. Quarterly</b>	<b>21.43%</b> 3
<b>e. Yearly</b>	<b>35.71%</b> 5
<b>f. As needed</b>	<b>21.43%</b> 3
Total Respondents: 14	

**APPENDIX 4 – EMPLOYEE SURVEY**

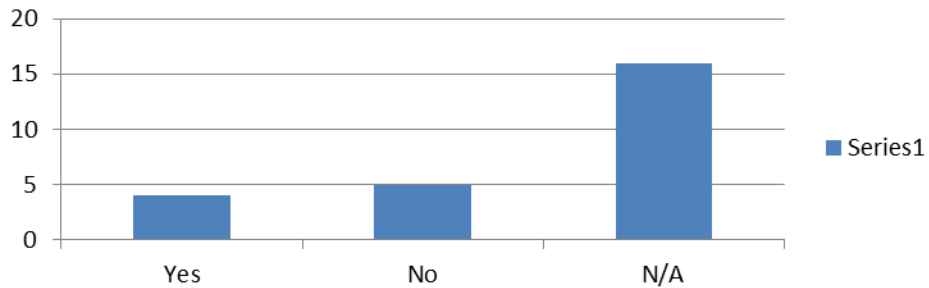
1. Do you hold any current certifications for being an Emergency Vehicle Technician?
  - a. Yes
  - b. No
  
2. Do you want to be an Emergency Vehicle Technician for the Ashland Fire Department?
  - a. Yes
  - b. No
  
3. If you are interested in being the Emergency Vehicle Technician, would you be willing to go to training courses and take certification exams?
  - a. Yes
  - b. No
  - c. N/A
  
4. If you are not interested in being an Emergency Vehicle Technician, why? (circle all that apply)
  - a. Not enough pay
  - b. Have no interest in vehicle maintenance
  - c. Don't like the hours
  - d. Don't want to the responsibility
  - e. Don't want to go to training
  - f. Don't want to take tests to be certified
  
5. Do you feel that the current method of emergency vehicle maintenance is the best option for Ashland Fire Department in reference to cost?
  - a. Yes
  - b. No
  
6. Do you think that vehicle maintenance should be done in-house, outsourced or both?
  - a. All maintenance should be done in-house
  - b. All maintenance should be outsourced
  - c. Maintenance should be done in-house and outsourced



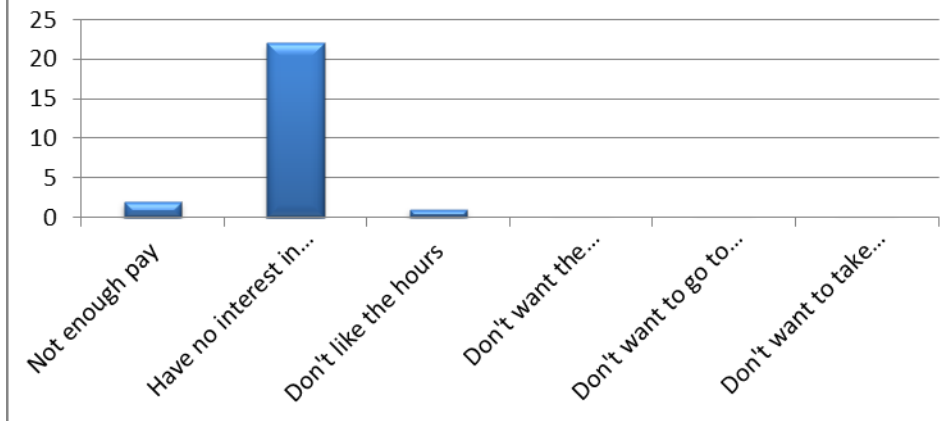
**APPENDIX 5 – EMPLOYEE SURVEY RESULTS**



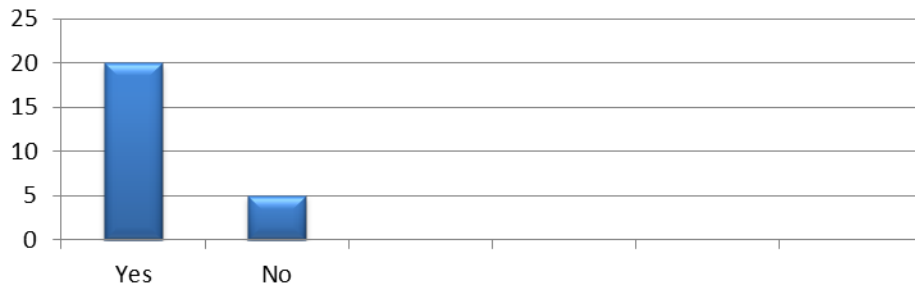
**If you are interested in being the  
Emergency Vehicle Technician, would  
you be willing to go to training  
courses and take certification exams?**



**If you are not interested in being an  
Emergency Vehicle Technician, why?**



**Do you feel that the current method of emergency vehicle maintenance is the best option for Ashland Fire Department in reference to cost?**



**Do you think that emergency vehicle maintenance should be done in-house, outsourced or both?**

