

Using Preventative Maintenance to Reduce Costs for the  
Miami Valley Fire District

By: Tim Shafer  
Lieutenant  
Miami Valley Fire District  
2710 Lyons Rd.  
Miamisburg Oh.45342

A proposed research project submitted to the Ohio Fire Executive Program

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**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.

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## **ABSTRACT**

The Miami Valley Fire District was created to eliminate redundancies in service and provide a cost savings for the citizens Miami Township and the City of Miamisburg.

The problem this research paper addressed was the how to reduce costs in maintenance from an aging fleet. The purpose of the study was to recommend different methods such as preventive maintenance to help achieve a better maintained apparatus and create a system to save the Miami Valley Fire District funding on apparatus repairs.

Descriptive research was conducted to answer the following questions:

1. How will using preventative maintenance save the MVFD money?
2. What operating methods need to change to decrease out of service time amongst the aging fleet?
3. Do other departments similar in size and run volume use preventative maintenance?
4. Would predictive maintenance be more suitable for the MVFD?

The procedures used were descriptive external and internal surveys and a literature review.

Results compiled from this research paper indicate that other fleet maintenance repair services or combination of should be considered to reduce out of service time. Better use of a data collection management tool to help track costs and create a vehicle service history.

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## INTRODUCTION

### **Statement of the problem**

In 2012 the City of Miamisburg (MFD) and The Miami Township Fire Department (MTFD) after four years of long discussions and study's consolidated resources by merging the two fire departments into one department creating the Miami Valley Fire District (MVFD) in hopes of saving both communities money and eliminating redundancy's in the fire and EMS service for both communities. Due to an aging fleet and the lack of regular performance maintenance the Fire district was in the process of having to do reactive maintenance causing high maintenance costs, long out of service times and in some cases complete failure of equipment.

### **Purpose of the Study**

*The purpose of this study will be to recommend the use predictive maintenance to help reduce costs of fleet repairs and also help reduce out of service time for the Miami Valley Fire District.*

### **Research Questions**

*The Research questions this study will investigate by a descriptive research were:*

1. How will using preventative maintenance save the MVFD money?
2. What operating methods need to change to decrease out of service time amongst the aging fleet?
3. Do other departments similar in size and run volume use preventative maintenance?
4. Would predictive maintenance be more suitable for the MVFD?

## **BACKGROUND AND SIGNIFICANCE**

The City of Miamisburg resides in Montgomery County Ohio and is a southern suburb of Dayton Ohio. Miamisburg was known nationally for its nuclear mound facility which was operational during World War II and helped create parts for the atomic bomb. The Mound facility which is named after the largest conical Indian mound in Ohio rests directly across from where this facility was once the major employer of the city. It has since been decommissioned and now has been turned into a developing business park which also now houses the Regional Dispatch Center for Montgomery County. The city consisted of 20,181 residents from the 2010 census. The residential makeup is 7,948 households and 5,570 families with the average household size was 2.50 and average family size was 2.98. The median age was 40.2 years. 25% of the residents were under the age of 18. Fifty eight percent were between the ages of 18 to 64 and 16.2% were 65 and older, (US Census Bureau, 2010).

The Miamisburg Fire Department was established in 1843 was actually called the “The Young America Fire Company” and originally made up of all volunteers until 1928 when it hired its first full time firefighters. In 1948 the City of Miamisburg and the Miami Township trustees combined on a contract that permitted the township to house a fire truck in the City fire station and assigned dispatching duties to the Miamisburg Fire Department. Prior to the merger in 2012 the Miamisburg Fire Department (MFD) consisted of two stations, manned with 5 fulltime Firefighter/paramedics who were supervised by a station officer with one on duty Lieutenant and Captain, working a 24/48 hr shift. One fulltime Fire Chief, one 40 hr daytime Captain, one 40 hr daytime Lieutenant/Inspector/Fire Marshall and a 40hr Administrative Assistant, The Miamisburg Fire Department (MFD) has an average of 3200 calls a year with the majority of those calls being requests for emergency medical services. The fleet consisted of two frontline

Ford Medics 5 and 8 years old with one back up that was 12 years old, One frontline E-One engine 22 years old and one frontline E-One Quint 13 years old and two back up apparatus engines over 25 years old. The department had several other support vehicles such as a brush truck (24yrs), Air Unit (16yrs).

Miami Township (Montgomery County, Oh) geographically surrounds the City of Miamisburg consisting of 21 unincorporated square miles while bordering two other cities from the north, West Carrollton and Moraine respectfully. Population for the township according to the 2010 census was 50,735 (Us Census Bureau). Two major highways dissect the township, the average household income \$52,042 with several major employers such as LexisNexis, PNC Bank, and MetLife along with a large shopping mall.

MTFD prior to the merger had four stations and was a combination department of full and part time employees with one fulltime chief, a 40 hr Lieutenant/Inspector, three 24/48 shift supervisors of the rank of Battalion Chief, two station shift Lieutenants, 3 firefighters/paramedics and shift part time who held certifications of paramedic or basic emergency medical technician (EMT). The department averaged 4400 calls per year with the majority of those responses for emergency medical services. There fleet consisted of 1 front line Pierce Ladder Truck (7yrs), 1 Pierce Engine (9yrs) 2 KME Engines (16 and 18yrs), 5 Ford Medium duty medics (4, 7, 8, 10,12yrs) and assortment of other support vehicles.

The City of Miamisburg created their own service garage to help maintain its fleet of trash trucks, police cars, road trucks, and of course fire equipment as most municipal agencies have to keep all equipment in working and operating order. The problem with the cities particular service garage was that fire department equipment wasn't always a priority to get fixed

immediately and if certain types of repairs were needed such as when it came to pumps the piece would then be outsourced to the City of Dayton Fire apparatus garage that specializes in fire apparatus. This created equipment being out of service for longer periods than necessary to due having to wait when the other garage could fit our equipment in. Moving forward the state was restricting local government funds, along with a sluggish economy, a decrease in tax revenues created a negative increase in funding for the fire department thus creating a lack of replacement of outdated fire equipment.

A committee was formed by local government officials to look at the feasibility of merging departments to help alleviate the rising cost public services such as the duplication of fire and EMS services in the surrounding township and how those services could be meshed into one fire department. After a four year study the merger took place as of June of 2012. Since that time the merging of the two departments has created the need to look for help in maintaining the diversities of the fleets of the two communities. Merging of the two fire departments was intended to save tax payers dollars but maintaining the fleet has not been cost effective at this point due to age and daily wear and tear.

Prior to the merger an administrative sub committee was formed and identified these issues. Miami township uses there service garage for routine maintenance and also has a mechanic in that shop for some pump maintenance. Other repairs and services are performed by outside sources like Finley Fire, Dayton FD Garage, or Fire Apparatus and repair. The annual budget is \$ 236,240 for repairs and fuel. Miamisburg would also use their service garage for diesel engine tune-ups, brake repair and standard oil changes but would out source all pump and aerial repairs with an annual budget of \$112,912.

Possible solutions that risen from the sub-committee was:

Fire apparatus repair that provides certified EVT service for all minor and major services including the fire pump @ \$60/hr flat rate which repairs are done at your station.

Finley Fire which also provides EVT certified technicians at a flat rate of \$70/hr.

Dayton Fire Services provides EVT techs only at their facility in Dayton at \$80/hr.

The fleet itself is an aging one, with 67% of the Miami Valley Fire District (MVFD) engines, are past there replacement dates. The average age of the fleet is 15.16 yrs. To replace four engines would cost the district \$1,692,000. The medic fleet has 71% of its vehicles at 5 years and older with two approaching their replacement dates at a cost of, \$404,000. In the next couple of years, to establish greater compatibility and increase safety and lower maintenance costs, the district will have to spend \$2,096,000. In the first 8 months of 2013 the Miami Valley Fire District (MVFD) has spent \$159,512.24 in fleet maintenance costs. This is only going to increase as the year goes on and the fleet continues to age.

By creating a study on how a preventive maintenance program could possibly affect the budget of the MVFD, taking the time to analyze how we are taking care of our equipment along one of the outcomes of this research is the recognition of a standardized fleet. This would help eliminate having to learn all the differences between each apparatus along with creating a matching service plan for all equipment, but will take time and of course significant funding.

William Peters wrote in Fire Engineering that “fire departments need to establish and follow a structured preventive maintenance program because of the critical nature of the service

so apparatus can perform at a moment's notice. The safety of the crew and the general public relies on equipment that is maintained to factory specifications at all times, the high cost of modern fire equipment be maintained in the best possible condition to protect their capital investment, and prevent legal action and financial judgments from improperly maintained vehicles.”

## **Literature Review**

A roundtable of qualified fleet managers from across the country discussed the challenges of maintaining fleet maintenance. Many felt that having qualified mechanics on hand to meet the requirements of federal regulations and standards was the correct approach. Others felt standardization of the fleets made life somewhat easier due to having the ability of interchangeability between fire apparatus. But the biggest item that came to hand was ways to save money without compromising safety. (Ballam, 2013)

This source looked at performing a fleet audit to help maintain fleet awareness when it came to purchasing new equipment in the future, along with cost analysis of what's has already been spent. He felt being proactive with preventive maintenance helps reduce apparatus downtime and increasing availability. Essentially looking at fleet maintenance as a business and reducing or taking shortcuts in a department's fleet would constitute a recipe for disaster. (Brown, 2013)

This author described The National Fire Protection agency (NFPA 1911) will help your department save money and extend the life of your apparatus. NFPA 1911 helps define exactly what type of preventive maintenance program shall consist of. It states specifically what needs to be checked along with how to look for when taking an apparatus out of service. It also gives departments backing if any type of accident would ensue enabling them to fall back on a national standard. (Wilde, 2001)

This article focused on the high profile accidents in Boston and Houston and how each department fleet maintenance program was basically nonexistent, what changes were made to help correct deficiencies in each department. Both are major metropolitan city's which lacked

any type of preventive maintenance program. Because of this each department suffered fatal accidents from equipment that was improperly kept. (Wilmoth, 2009)

This report focused more on the responsibilities associated with the operator of the fire apparatus and how to conduct proper preventive maintenance. He cited several areas that operators should concentrate on when checking in a piece of fire apparatus from lights being in working order to proper pressure for the braking system to checking fluids on a daily basis. He also cited works from NFPA 1915 which is the standard for Apparatus Preventive Maintenance which states that the fire department should develop and implement a type of your department's fleet maintenance. Each answer gave the reader an explanation on what would work best for your particular department. He also listed several NFPA publications to help cover all the areas of apparatus and equipment maintenance. (Peters W. C., 2004)

In the Apparatus Architect looked at justifying purchasing new fire apparatus in tight economy and focused somewhat on how preventive maintenance programs can help save a department money along with coming up with schedules on replacement to help ease the burden of making major purchases when it comes time to replace apparatus. He goes on to state other methods to look into such as purchasing software packages to help provide information on when to replace older apparatus and even looking at refurbished pieces to help save money rather than purchasing new. (Wilbur, 2010)

In The Apparatus Engineers Duties more focused on driving safely, but was the operator's duty to properly check in their particular apparatus and having consistent policies and procedures so uniformly all equipment gets inspected and maintained. He goes on to state that any piece of fire apparatus that breaks down compromises the safety of the crew who rely on that

apparatus to support their roles in the operation. He also cited the some criteria in when to take a piece out of service due to defects which would be consistent with NFPA (Peters W. 2011).

## Procedures

My research started by using the learning resource center at Sinclair Community College using categorized online periodicals and key words such as preventive maintenance. A data collection survey was used to gain insight from local fire departments on how they maintain their fleets, what costs they incur, how much time their front line equipment is out of service and the effects on efficiency in their respective departments.

A data collection survey was developed to gather information on how other fire departments conduct vehicle maintenance. The survey was developed, distributed and the results were tabulated by SurveyMonkey. Ten questions ranging from demographic to budget items relating to fleet maintenance, along with frequency of maintenance in the department. The survey was sent to 96 individuals using a distribution list from the Ohio Fire Chiefs membership sort values of members to non members, Lieutenants and above, Southwest departments in Ohio. Out of the ninety six (96) only twenty three (23) responded which was approximately a 24% return. Some limitations affecting this research is that maintenance records have been incomplete from both departments (MTFD and MFD). However a new online record keeping procedure has been developed using Emergency Reporting Service (ERS) a web based company to track Incidents, Inspections, Personnel, Maintenance, and Training costs. A second internal survey was conducted within the MVFD officer core. Twelve officers were surveyed with the ranks of Battalion Chief to Lieutenant. Six surveys were returned with a 50% return rate.

## Results

A survey this section was developed and distributed through SurveyMonkey. Question 1 Asked how often fire departments apparatus is out of service. Of the 21 responses, just over 50% have fire apparatus out of service for more than 1-2 days a week.

Question 2 asked how much do you spend on repairs each month. The Miami Valley Fire District (MVFD) spent \$6000 per month in comparison to \$13,500 that departments of similar size have spent.

Question 3 was a frequency question asking how often preventive maintenance is performed. Fifty percent responded at least once a month. Question 4 and over 90% had budgeted for over \$5000 in repairs.

“ Question 5 asked” if having a preventive maintenance program would benefit their department with close to 80% responses saying extremely likely which corresponds to Question 6 and 7 was demographic question in relation to what type of department is responding and if they out source there repairs which reflects what the MVFD does. Question 8 relates to having SOGs in place which is also part of this researchers request to answer one of the problems of the MVFD.

Question 10 asked if you could hire a certified mechanic to do apparatus maintenance less than 90% said yes, which maybe a proposed solution to one of the research questions that part of this project.

The results of the internal survey was tabulated and intended to gauge what actions needed to be addressed to make changes to our current maintenance issues of equipment downtime.

Question 1 asked “How do you feel about our current maintenance of our apparatus?” with 100% responding that our current maintenance program is behind and was unsatisfactory. Due to the merging of the two departments, we now have to play catch up to many issues that went unattended and the issues that were taken care of by the previous form of fleet maintenance for both merged departments was less than adequate.

Question 2 was what changes could be made to help prevent or reduce maintenance to our fleet? There were varying opinions to this question but majority felt that a more solid P.M. program and better training on each piece of equipment would help reduce wear and tear on the fleet.

Question 3 Asked, should some sort of maintenance SOG be developed? Only one response felt that this would not help in any way.

Question 4 Asked, “Do you believe our personnel are qualified to recognize when to take apparatus out of service for maintenance issues?” 100% felt that all were qualified but improvement could take place such as training or a driver’s check list that would be in line with NFPA 1002 Inspection and service form.

Question 5 Asked, what would be better for the MVFD, preventive maintenance or predictive maintenance. 100% responded that Predictive maintenance would be better and could be a cost savings for the MVFD but more information was needed and there were no local departments to compare to see who does it that way.

Question 6 Asked do you think that a better system of daily checks would help reduce vehicle downtime? All were in agreement that better checks could help reduce vehicle downtime by

catching maintenance issues earlier before they become a major problem later that could increase costs of repairs.

Question 7 Should the MVFD explore other options for fleet repair? Answers to this question had various opinions which ranged from modifying our current fleet repair provider and outsourcing smaller jobs such as oil changes and wiper replacement, light bulb replacement and using our current fleet manager for the larger jobs such as pump repair and also hold them accountable and placed on some sort of time table on when a job should be completed.

Question 8 Asked, do you know what other departments in our area use for fleet maintenance? From all of the responses only two knew of other repair services, some used a combination of services. Fleet maintenance repair for fire apparatus in this area has very limited resources to choose from.

Question 9 Asked, Do you feel that Emergency Reporting (ERS) is being utilized correctly. Responses indicated that personnel was using it correctly to report service issues but more consistencies was needed to help create a complete history of service requests and service completions which hadn't been done pre merge of the two departments

## **Discussion**

The exceptional amount of time that equipment was out of service for repairs along with regular scheduled preventative maintenance and the lack of a preventative maintenance program was the driving factor for this research project.

Because of the lack of a preventative maintenance program at either fire department prior to the merge led to reactionary maintenance on equipment causing increase out of service times and the playing of catch-up on repairs that should have been kept up on. Since that time preventative maintenance has been established but service has been lacking and other processes need to be put in place to help provide a more adequate operation to help in the decrease of out of service time and the wear and tear on equipment along with reducing costs.

Insight was gained on the importance of establishing some sort of preventative maintenance program from the literature review. Departments that responded to the survey also noted that on average most had equipment out of service at least two days out of the week at a cost of \$3000 a month. In comparison to the MVFD whose average monthly budget for repairs is approximately \$20,000 a month.

Data needs to be collected on individual apparatus and cost comparison should be done to establish a baseline on what future repairs will be needed so a better understanding of what type of preventative maintenance program should be put in place such as using predictive maintenance to help reduce costs.

## **Recommendations**

The problem this research project addresses was how to reduce costs by creating a preventive maintenance program for the Miami Valley Fire District. Through observation and research these recommendations for future considerations would be a blue print to help reduce vehicle downtime, increase safety and awareness which would boost morale, along with reducing vehicle maintenance.

1. Create a preventative maintenance guideline which would consist of a fire apparatus quick check sheet that would be in compliance with NFPA 1002 and train personnel on what operational deficiencies that would be a safety concern to place apparatus out of service or be able to be rendered in house without the use of a service vendor.

2. Since the beginning of 2014 MVFD lost a 40 hour daytime Administration Chief due to retirement, this position originally would not be replaced due to attrition. Replacement of this position would allow better efficiency in the tracking, follow up, and accountability of our fleet maintenance. This position would also be able to dictate policy and procedures on how and when maintenance would be performed, be liaison to the vendors, obtain pricing, search for parts, prioritize repairs. The responsibilities of this position currently reside with a shift Battalion Chief which on occasion results in delay when apparatus needs to be followed up on or critical repairs need to be pushed through to completion.

3. Continued standardization of the fleet. Since January of 2013 the MVFD has purchased one new KME Engine and one new medium chassis Freightliner medic. In 2014, another purchase of a medic and another new engine at the end of this year. Beginning of 2015 specs will be put in place for a new ladder to replace our other Quint that was totaled in 2014 due to an accident. This would decrease the age of our fleet, medics would be on average 3.5 years

old and the engines would be 6.3 years old. This is a 1.5 year difference to our current frontline medics and 6.5 year difference to our frontline engines. This would increase safety margin on responding in older equipment along with less breakdowns and replacing older or harder to obtain parts.

## References

- (2012,2013). Retrieved from Emergency Reporting Serices: [www.Emergencyreporting.com](http://www.Emergencyreporting.com)
- (2013, December). Retrieved from Factfider2.census.gov: [www.Factfinder2.census.gov](http://www.Factfinder2.census.gov)
- (2013, November). Retrieved from SurveyMonkey: [www.surveymonkey.com](http://www.surveymonkey.com)
- Ballam, E. (2013, Janauary). Maintenance Roundtable. *Firehouse*, pp. 58-62.
- Brown, B. (2013). Performing a Fleet Audit. *Fire Apparatus Emergency Equipment*.
- Cavette, C. (2005, August). Rate Your Shop. *Fire Chief*, pp. 102-107.
- Firefighters, I. A. (2002,2010). *Improving appartus response and roadway safety in the carreer fire service*. Division of occupational health, safety and medicine IAFF, AFL-CIO.
- Hesketh, R. A. (1999, January). Miamisburg Fire Department dates back to 1843. *Dayton Daily News*.
- Lowman, C. J. (2009, October 27). Two Level Maintenance. *DoD Maintenance Alignment in the 21st Century: Cross Boundry Maintenance*. US Army Logistics.
- Mcgreal, M. A. (n.d.). Developing a Fire Apparatus Maintenance program for the Wilmette Fire Department. 59.
- McLoone, C. (2011). Maintaining Your Fleet in a Down Economy. *Fire Apparatus Emergency Equipment*.
- Miami Township, OH*. (2013). Retrieved from [www.miamitownship.com](http://www.miamitownship.com)
- network, F. E. (2000, October 1). *Fire Engineering*. Retrieved from Fire Engineering: [www.Fireengineering.com](http://www.Fireengineering.com)
- Niosh. (2011). *Career Lieutenant Dies from Injuries received after vehicle undergoing maintenance crushes him*. NIOSH.

Peters, W. (2011, June). The Apparatus Engineer's Primary Duties: Maintenance and Safe Operation. *Fire Engineering*, pp. 36-42.

Peters, W. C. (2004, June). Fire Apparatus Operator Preventive Maintenance. *Fire Engineering*, pp. 42-48.

Queen, C. M. (08-15-2013). *Detail Expense Transactions*. Miami Valley Fire Distict.

Rolli, J. W. (December 2004). Developing an Apparatus Maintenance program for the Stoneham, Massachusetts Fire Dept. 29.

Shaw, C. (2010). Mastering Military Maintenance. *McKinsey on Government*, 28-33.

Stevenson, M. G. (2002, September). *Army Maintencance Transformation*. Retrieved from [www.almc.army.mil/alog/sepoct02](http://www.almc.army.mil/alog/sepoct02).

Wilbur, T. S. (2010, July). The Apparatus Architect-How Do You Justify a New Apparatus during these Tight Economic Times. *Firehouse*, pp. 100-104.

Wilde, S. (2001, December). An Apple a Day. *Fire Chief*, pp. 44-48.

Wilmoth, J. (2009, October). Vicious Cycle. *Fire Chief*, pp. 55-60.

## **Appendix 1 – Internal Survey**

- 1. How do you feel about our current maintenance of apparatus?**
- 2. What changes could be made to help prevent or reduce maintenance to our fleet?**
- 3. Should some sort of maintenance SOG be developed?**
- 4. Do you believe our personnel are qualified to recognize when to take apparatus out of service?**
- 5. Do you think Predictive maintenance would better suited over Preventative Maintenance for the MVFD?**
- 6. Do you think that a better system of daily checks would help reduce vehicle down time?**
- 7. Should MVFD explore other options for fleet repair and what do you think they should be?**
- 8. Do you know what other departments in our area use for fleet maintenance?**
- 9. Do you feel that Emergency Services Reporting (ERS) maintenance section is being utilized correctly?**