Vehicle Replacement Plan for the City of Watertown Fire Department

Dale C. Herman

City of Watertown Fire Department

Watertown, New York

Certification Statement

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

Signed: _____

Abstract

The problem facing the Watertown Fire Department (WFD) is that the organization does not have a vehicle replacement plan. The purpose of this applied research project is to develop a draft vehicle replacement plan for the organization. This project utilized an action research methodology to answer the following questions: a) What are some components within standards or laws that can be utilized in a vehicle replacement plan; b) What criteria do other fire departments use to determine when to replace a vehicle; c) What criteria should be included in the WFD department vehicle replacement plan.

A survey form was developed utilizing information gathered from reference material and sent to New York State Career Fire Chiefs, in late December 2013, through an e-mail group. Sixteen respondents participated, equating to a return rate of nearly 22%, by sending in their replies to the survey questions and their responses were analyzed by this researcher. The results of this project indicated that there is no one particular item used by respondents or in laws or standards that indicates when a vehicle be replaced, but rather a combination of items, such as; mileage, age of the vehicle, downtime, maintenance cost, (all direct cost factors) that provide insight as to when a vehicle needs replacement as opposed to the consideration of possible indirect cost factors. The conclusions of the research for this project were supported by Bibona (2003) theory and were converted into recommendations for a vehicle replacement plan.

These recommendations included; annual safety and operations inspections and testing of all department apparatus; record keeping of maintenance cost; tracking of mileage, engine hours and down time; as well as provide an annual comparison of maintenance cost to the original vehicle price.

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Introduction

Kevin Roche (2012) writing in the *Managing Fire and Emergency Services*, states that the decision of "when" to replace a vehicle is more difficult than the need to purchase a new vehicle for a new fire station (p. 372). It is highly unlikely that the City of Watertown will construct a new fire station in the future; however there is still a need to replace existing response and staff vehicles in order to continue to deliver services to the community.

The problem is that the City of Watertown Fire Department (WFD) does not have a vehicle replacement plan for response apparatus or the staff fleet consisting of utility and command vehicles. The purpose of this research is to develop a draft vehicle replacement plan for the organization. This research project will utilize an action research method to address the problem statement using the following questions: a) What are some of the components within standards or laws that can be utilized by the fire department to develop a vehicle replacement plan; b) What criteria do other fire departments within New York State use to determine if a vehicle is due for replacement; c) What criteria should be included in our department plan for replacing a fire apparatus or staff type vehicle. Utilizing resources available to this researcher, it is the goal of this project to gather sufficient information to develop a draft vehicle replacement plan for our organization. The lack of a plan is making forecasting when a vehicle should be replaced difficult at best. The need to replace response and staff vehicles will continue to be a responsibility of the management team of the WFD, but are there currently methods in place by other fire departments that can aid our organization in meeting that responsibility. This researcher is optimistic that by addressing the problem of not having a vehicle replacement plan is a worthy endeavor and the development of such a plan can only improve our ability to foresee

when vehicles will need to be replaced and be able to provide incite in defending the decision to replace said fire apparatus or staff vehicle.

Background and Significance

The City of Watertown is located at the eastern end of Lake Ontario and has had an organized fire department since the City was incorporated in 1863. The Watertown Fire Department (WFD) consists of a seventy-nine person career staff and protects this mid sized municipality which encompasses 9.3 square miles and is home to approximately 27,900 citizens (US Census Bureau, 2012). The City is also in close proximity to Fort Drum, home of the 10th Mountain Division, which has provided the community with a stable economy and a slow but steady population growth.

The fire department has also undertaken a steady increase of the services that our citizens expect, but has had a steady decline in the number of personnel employed. The department not only provides the essential fire, hazardous material and EMS responses, but has acquired training and equipment for technical rescue responses in swift water, confined space, trench and rope rescue as well as structural collapse capabilities within the last ten years. A recent visit to the Syracuse area by President Obama had our organization placed on notice that in the event of a technical rescue incident, that we would be getting a call to respond to the incident some seventy miles to the south of our community through the New York State Fire Mobilization Plan. These new resources have required the fire department to purchase enclosed trailers to store and move the cadre of equipment associated with providing these services. In undertaking these new responsibilities, the department call volume to incidents has more than doubled when comparing the 1990's incidents numbers of 1589 to those of 2013 at 4149 incidents.

The department's first line pumpers range in model year from 2001, an E-One custom to 2007 Pierce having current service life spans ranging from six to thirteen years of usage. The ladder truck, a 2004 Pierce with a 2000 gpm pump, has been in service for nine years. The reserve apparatus are much older with both a pumper and ladder being built in 1986 and the second reserve engine having been built in 1996 which was refurbished in 2008 by a local fire apparatus dealer. The wild card of the response fleet is the department's heavy rescue truck that was delivered in 2005 by American LaFrance, but this vehicle has no reserve back up if it goes out of service. In 2012, this rescue apparatus responded to 2803 calls, which are approximately 1700 more calls that our busiest engine for the same period of time. When this vehicle is out of service for repairs or inspection, the crew and equipment are transferred to a utility truck that is utilized to tow the technical rescue trailers.

Our staff fleet of vehicles is a mix bag of pick-up trucks and SUVs that are used to move personnel and equipment to incidents, as well as, support prevention and training functions. These vehicles range in date of manufacture from 2001 to 2008, with a service life between five to twelve years. As we are in a snow region, our pick-up trucks are outfitted with snow plow attachments to move snow accumulations at our three fire stations and are equipped to pull the fire safety trailer and other technical response trailers.

Not knowing when to place a vehicle on the City's five year capital budget plan for replacement may adversely affect the delivery of essential services to the community as well as present potential financial issues, as the City has additional priorities other than just those of the fire department. Attempts over the past three years to replace vehicles in the staff fleet have not been successful as City Council has eliminated them from the proposed budget due to their

perceived goals for the City. Having a vehicle replacement plan as to how best to determine when a vehicle should be replaced has merit and defendable qualities.

Attending the Executive Leadership course at the National Fire Academy during the end of September of 2013, has provided this researcher with knowledge that the current approach to replace fire department vehicles may be better accomplished by exercising adaptive leadership and trying to change the hearts and minds of the final decision makers, City Council with regards to funding vehicle replacements for our organization. This project aligns mostly with strategic goal number three of the United States Fire Administration, (USFA Strategic Plan for Fiscal Years 2010-2014), in trying to improve the fire and emergency services capabilities by ensuring that the WFD has a fire apparatus replacement plan and by providing reliable and safe apparatus for use by our members in order to protect our community.

Literature Review

In preparing for this applied research project, information was obtained by this researcher through the Learning Resource Center, located at the National Emergency Training Center at Emmitsburg Maryland, available subject related books and magazines at our main fire station here in Watertown, as well as sources found on the world wide web utilizing search engines such as Google and Bing. The goal was to find material that either can be directly utilized in a vehicle replacement plan for the WFD or information that may be used to develop survey questions to be sent to other NYS Fire Chiefs.

The Federal Motor Carrier Safety Administration (FMCSA), a division of the United States Department of Transportation (2013), has requirements that all “commercial motor vehicles” must have an annual inspection. Failure to have an annual inspection performed may

cause the owner of such vehicle to be penalized under provisions of 49 U.S.C. 521(b) (US DOT Regulation 396.17). Any vehicle that passes a roadside or periodic inspection performed under the direction of any State Government will be considered as to having met the minimum requirements of the FMCSA inspection guidelines.

The National Fire Protection Association (NFPA) Standard for the Inspection, Maintenance, Testing and Retirement of In-Service Automotive Fire Apparatus (Standard 1911) 2012 edition has a section that addresses inspection and maintenance of fire apparatus. Specifically 4.5.1 states that "fire apparatus shall meet all federal, state or provincial and local laws for motor vehicle inspection" (p.1911-13). Later in the section on inspections, there is language that if deficiencies are found during the inspection process, those deficiencies shall be repaired or corrected.

Chapter 6 of NFPA 1911 gives a list of deficiencies that would render a fire apparatus out of service. The list includes inoperable safety systems, issues with the electrical, cooling and braking systems, as well as, issues that may make independent components of the vehicle, such as the fire pump or aerial device inoperable. Sections 6.1.4 of the standard provides that an apparatus shall be returned to service only when the defect or deficiencies has been corrected and the component that caused the unit to be placed out of service has been tested.

NFPA 1911 also has a Chapter titled "Retirement of Fire Apparatus" which comprises of two sentences. The first, 5.1.1, states that "The fire department shall consider safety as the primary concern in the replacement of apparatus" (p. 199-14). The second, 5.1.2, states that "Retired fire apparatus shall not be used for emergency operations" (p. 1911-14).

The Volunteer Fireman's Insurance Services (VFIS) bulletin entitled "Vehicle Preventive Maintenance" (2011), states that regular inspection of emergency vehicles is necessary for safe operations of them. Their communiqué lists two types of inspections of fire apparatus, a pre-trip and post trip inspection. This bulletin goes on to include statements that both types of inspection, as well as maintenance efforts done on the vehicle should be documented and kept on file during the life span of the emergency vehicle.

The New York State Department of Transportation's Heavy Duty Vehicle Inspection of Commercial Vehicles (2013), meets the requirements of the annual inspection of such a vehicle. If a defect is found during this inspection, depending on the seriousness of the defect, the vehicle will either be placed out of service or cannot be assigned to another hauling assignment until the necessary repairs have been completed. There is also a requirement, in the inspection program, that the driver of the vehicle conduct a post trip inspection of the vehicle. A vehicle that has been placed out of service cannot be operated until repairs are satisfactorily completed.

The NYS Vehicle and Traffic Law, Section 310 states that the Commission of Motor Vehicles shall require every registered vehicle in New York State to be inspected once a year for safety. Section 307 of the V&T addresses the voluntary inspections of motor vehicles, as fire service vehicles are exempted from commercial vehicle inspections and are not registered with the NYS Department of Motor Vehicles.

The International Association of Fire Chiefs (IAFC) Vehicle and Maintenance Section recommended that agencies that have emergency response vehicles implement NFPA Standard 1911 for their organization. It is stated that if the standard is fully implemented, it will provide a comprehensive vehicle maintenance, inspection, testing and replacement program for the

organization that adopts the standard. The IAFC white paper on NFPA 1911 recommends that "Emergency response vehicles that cannot pass the requirements of NFPA 1911, must be repaired, refurbished or removed from active service" (January 2012).

Alan Saulsbury (2004) wrote an article for the IAFC entitled *Refurbish or Replace?* He highlights NFPA 1901, particularly Annex D that explains that each fire department has a responsibility to provide safe apparatus and equipment for their communities so that personnel can safely perform their duties. The apparatus should comply with applicable standards, and must adhere to state and local requirements which would include vehicle inspections where required.

Chris Cavette (2006) wrote an article entitled *Out with the Old*, for Fire Chief's web site. He list ten reasons for replacing fire apparatus. This list consist of items such as improved safety, easier operations, better ride and handling, space for more equipment and other items were mentioned. He also lists that new vehicles will have a longer life than older steel bodied apparatus because of the newer materials, such as aluminum, have less of a corrosion issue than those fire apparatus constructed of steel body components.

The NYS Comptroller's Office has written a Fleet Management System Brochures entitled *Establishing an Effective Fleet Management System* (2013) to aid local governments and school districts with providing cost saving ideas. The brochure states that as vehicle usage is unique to each municipality, a universal management guide does not exist that can be utilized for every community. A police cruiser needs to be replaced more frequently than a utility vehicle for a public works department. This brochure states that an effective fleet management program should address guidelines for the acquisition, maintenance, replacement and disposal of vehicles.

With regards to replacement, the brochure identified that replacing a vehicle to soon or too late is not an efficient use of municipal funds. The goal of a vehicle replacement plan is to develop a cost analysis that identifies a point when a vehicle has reasonable depreciations but not yet incurring high maintenance cost.

Sal Bibona (2003) wrote an article entitled *Establishing a Cost Effective Fleet Replacement Program* where he writes that most vehicle replacement plans use a combination of vehicle age, mileage and current condition. As vehicles become older, maintenance cost tend to increase while depreciation tends to decrease. Bibona also indicates that downtime and obsolescence can also impact as to how long a vehicle should be kept in service. Having a dedicated vehicle replacement fund aides in acquisition of vehicles as opposed to capital budget process where by many entities of a community are competing for the same scarce resources.

The General Services Administration (GSA) fleet minimum vehicle replacement standards for fiscal year 2012 places a heavy truck with a diesel motor for replacement after twelve years of service or 250,000 miles. A light truck with a diesel motor has a replacement age minimum of eight years and 150,000 miles. The same light truck with a gasoline motor has a replacement cycle of seven years of usage and 100,000 miles. The South Carolina Budget Control Board utilizes solely mileage in consideration of their replacement of vehicles in their fleet.

The City of Bozeman Montana in 2010 established an administrative vehicle/equipment policy for all municipal vehicles. Age and mileage were criteria by which vehicle replacement was based on. The replacement of Fire Department vehicles for the City of Bozeman was

exempted from following the policy. There was no explanation given for this exemption within the policy.

In 2003, Automotive Fleet had a whiter paper written by Peter Klopchic entitled *Vehicle Lifecycle Cost Analysis.* The paper pointed at two direct cost factors, depreciation and maintenance, as well as four indirect cost factors to be considered; perk value, corporate image, downtime and feature upgrades as additional factors when considering vehicle replacement. Klopchic indicated that the best time to replace a vehicle is just prior to a major breakdown.

Richard Upham' (2007) Executive Fire Officer (EFO) project entitled *Develop an Apparatus Replacement Plan for the Scottsdale Fire Department* indicated that he found no specific reference to the life span of a vehicle in neither US DOT or State of Arizona regulations. His research found that 100% of respondents to his survey indicated that age is a criterion for vehicle replacement. When evaluating repair cost, his research showed an excessive amount to be greater than twenty per cent of vehicle resale value. Scott Sorenson (2000) found in his EFO project that age and mileage are universal benchmarks in vehicle replacement for the fire service.

The County of Alberarle, Virginia, Department of Fire And Rescue, 2005 Apparatus Replacement Guidelines goal is to have fire trucks replaced between seventeen and twenty years of age and staff type vehicles replaced between 100,000 and 120,000 miles. The Town of Windsor Colorado's 2009 Budget reflects a vehicle replacement comparison between their vehicle fleet and the American Public Works Association (APWA) standard life cycle. APWA lists light trucks as having usage rate of approximately six years and heavy duty vehicles between seven and sixteen years of service.

Appendix D of NFPA 1911 (2012) recommends that vehicles manufactured prior to 1991 and less that twenty five years of age be placed in reserve statues. It continues that most vehicles over twelve years of age have little or no trade in value toward a new vehicle purchase. The Appendix goes on to reflect that old and poorly maintained apparatus has no place in emergency services.

Floyd Schiller, (2014), head of the Denver Fire Department's fleet states that his City's policy is to replace an apparatus every twenty years. He is quoted in *Firehouse Roundtable: Apparatus Maintenance*, "When we retire apparatus, its pretty beat up", (p. 71, Firehouse, January 2014).

The review of resources found during the initial phases of this project has provided possible criteria that could be utilized in a vehicle replacement plan for the WFD. Of most interest is Klopchic' (2003) view of direct and indirect cost factors as well as Bibona's (2003) view of a combination of vehicle age, mileage and current condition. Their perspectives on vehicle replacement will be considered when developing a questionnaire for this project.

Procedure

The literature review for this project produced some interesting concepts and ideas as to what should be considered when replacing a vehicle. As the goal of this project was to develop a vehicle replacement plan for the WFD, this researcher utilized the information found to create a survey questionnaire to be sent out to New York State Career Fire Chiefs through the use of a group e-mail address, career-fire-chiefs-of-new-york-state@googlegroups.com. This group represents approximately seventy-three communities in New York State that have a career fire chief. As most of the communities in New York State have the same weather conditions and

road clearing techniques, it is assumed by this researcher that this target group would need to replace fire apparatus on a cycle that could be representative of what the WFD should be doing.

The survey questionnaire, (Appendix B) was developed by using Klopchic (2003) direct and indirect cost factors when considering vehicle replacement, as well as Bibona's (2003) view of a combination of vehicle age, mileage and current condition, and the knowledge gained by this research project that any vehicle that cannot pass a motor vehicle inspection nor has components that do not function needs to be taken out of service. The survey consisted of eleven questions, with the respondents making choices of answers that were provided to them. There was no question that required a written response by those participants.

Question 1 was intended to determine the type of municipality the respondent works for. Different municipality types, like fire districts, have a sole purpose of providing for only fire protection, where as a village or city has to provide for a variety of services to meet their communities need.

Question 2 was intended to identify how vehicle replacement was funded by each respondent. The City of Watertown utilizes a capital funding plan to replace its fire apparatus and its operating budget to replace command and utility vehicles.

Question 3 through 5; ask the respondent to check an age range of the useable life expectancy of a frontline fire engine, truck and heavy rescue units within their departments. WFD doesn't have an ambulance, but does have vehicles similar to the ones that are inquired about in Questions 3 through 5. A list of our current vehicle inventory is listed as Appendix C.

Question 6 inquires as to the respondents opinion as to what age a fire apparatus should no longer be considered in use. The WFD currently has two vehicles that were manufactured in

1986. (See Appendix C) One is a pumper that has had no major rebuild to it during its time with the WFD. The second vehicle is a ladder truck that had a major accident affecting the cab and ladder and during repairs, major work was done on enclosing the cab. These damaged components of the truck were repaired and tested so that the vehicle could be placed back into service.

Question 7 uses the direct and indirect cost functions mentioned by Klopchic (2003), and Bibona's (2003) factors of age, mileage and current condition, as well as additional factors of Insurance Services Organization (ISO) recommendations and vehicle failure to reflect NFPA 1911 out of service parameters. Respondents were asked to give a value of 1 to their highest factor and 8 to the lowest consideration. The results should show the leading factor as the lowest overall score when the values provided by respondents were totaled.

Question 8 shifts attention to staff, utility, and command vehicles and the factors used when considering when to replace these types of vehicles. Factors such as age and mileage were cited in the literature review as items used my many municipal governments for replacement of vehicles.

Question 9 through 11, breaks down further into specific measurable increments for age, mileage and maintenance cost for comparison and the potential of building a template for replacement of WFD staff, utility and command vehicles.

As the survey was distributed on December 30, 2013, this researcher understands that many recipients of the survey may be on vacation, so a two week window was set as the opportunity for the researcher to handle inquires and record findings of the survey. As the survey was sent out to seventy-three potential respondents, this researcher would be happy with a

20% return rate of the surveys. This group was used by this researcher for another research project that had a return survey rate of 20%. When attending the group's bi-monthly meeting, approximately fifteen to twenty chiefs are in attendance.

On January 20th, 2014, this researcher started tabulation of the results into a useable format for comparison of respondent replies with other respondents as well as further study of each respondent's individual replies to the questions asked within the survey questionnaire.

Results

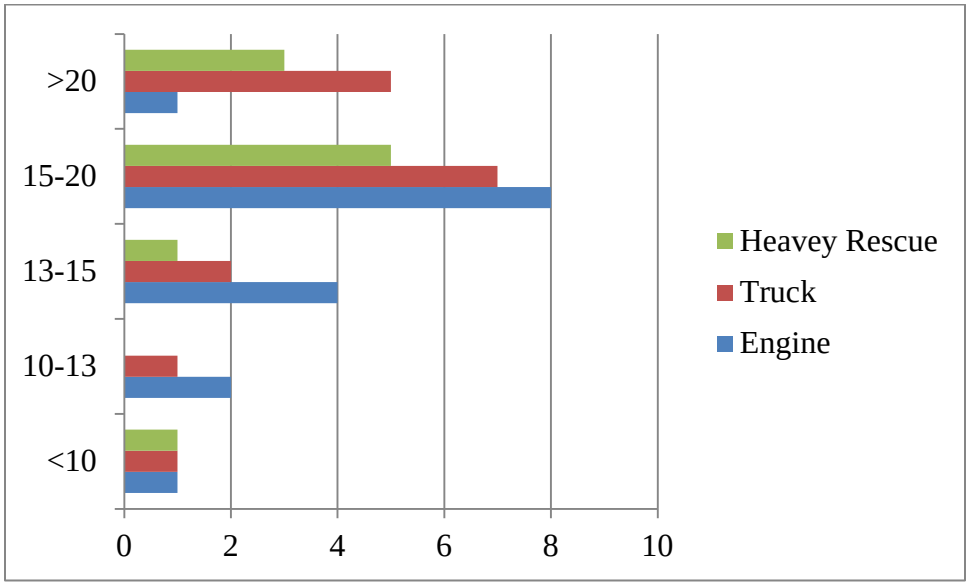
This researcher received sixteen responses to the request to New York State Career Chiefs asking for their participation in answering a questionnaire on the subject of vehicle replacement. This is a return rate of 21.9%, slightly higher than the expectation of return and this researcher is confident that the number of returns makes this project valid. The survey summary of results can be found as Appendix D, and a table of the raw data collected can be found in Appendix E.

Of the sixteen respondents for question 1, twelve represent cities, one represents a village and there are three representing fire districts. Respondent 1 is a former Fire Chief from Johnson City, New York and now is an Assistant Chief for Gwinnet County Georgia. His responses reflect his current position in the state of Georgia and not his previous role as Fire Chief of Johnson City.

The results of Question 2 indicates three of the respondents having a dedicated fund for vehicle replacement, twelve utilizing a capital budget process and only one utilizing their operating budget. Those respondents, 1, 9 and 14 who utilize a dedicated fund represent two fire districts and one city. Respondent 1 is the gentleman from Georgia.

The chart below reflect the results of question 3 through 5 and show the age breakdown for the useable life expectancy of front line fire engine, truck and heavy rescue. Only ten of sixteen respondents indicated an age for heavy rescue, leading this researcher to believe that the other six respondents do not have such a vehicle. Respondent 1's answers to Question 3 through 5 were for less than ten years of front line service. All of the other respondents chose an answer greater than ten years of service.

Chart 1 Results of survey Questions 3 through 5

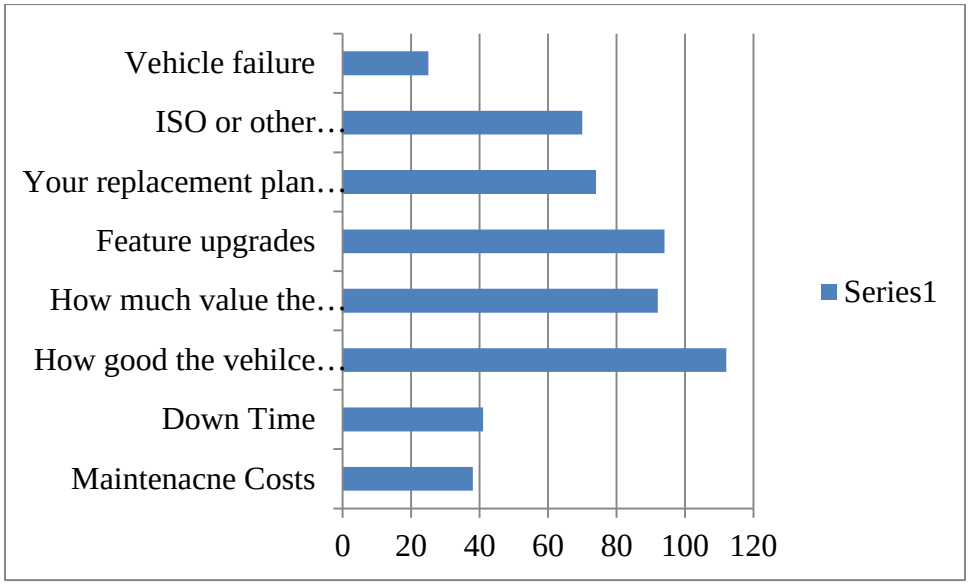


The results of survey Question 6 indicate that two respondents believe that a drop dead age for vehicle replacement is less than fifteen years. Two respondents selected an age between fifteen and twenty, eight respondents between the age of twenty and twenty-five and four respondents selected an age of greater than twenty five years of overall service of fire apparatus. Respondent 1 again selected the lowest age criteria for vehicle replacement.

Question 7 asked respondents to rank from the highest to lowest (with the number 1 indicating the highest selected) the items considered when replacing a piece of fire apparatus.

This researcher totaled the values of each respondent in each category to develop the following chart.

Chart 2 Results of survey Question 7

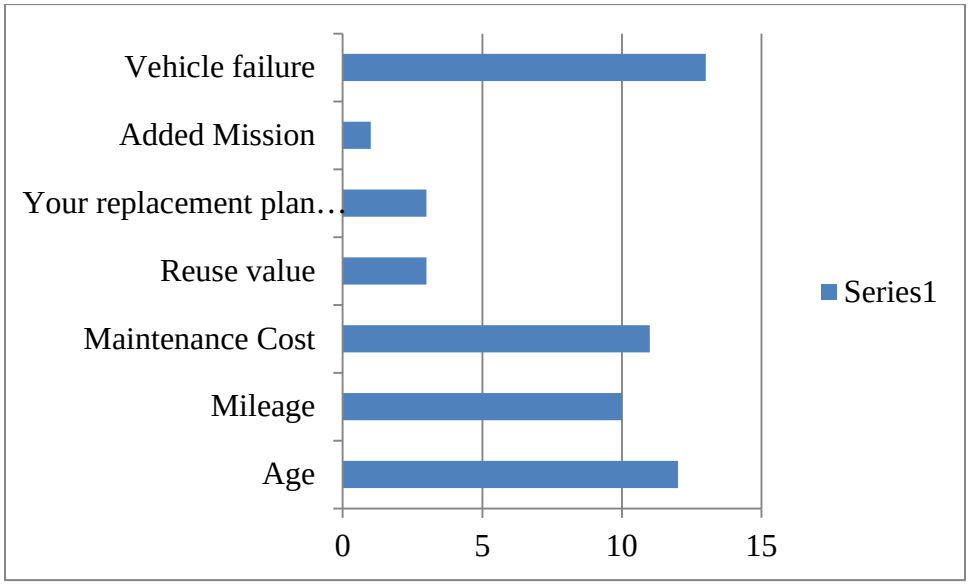


It should be noted that respondent 4 only rated his top three choices (see Appendix E), leaving the other items blank. This researcher recorded these non answers as a value of zero. Vehicle failure was the highest selected response with a value of 25. Maintenance cost and down time received rating of 38 and 41 respectfully. The item that received the lowest score was for the category of "How good the vehicle looks" as a reason to replace a vehicle was given a value of 112.

Question 8 asked respondents to check the criteria they would use to replace staff, utility, command or smaller medic units. Respondent 12 rated the elements of Question 8 *a* through *g* by placing a numerical value to his response similar to what was asked in question 7. As the directions for this question was to choose all that apply, this researcher did not utilize his responses for this question. Of the other fifteen respondents, thirteen respondents chose vehicle

failure as a reason for vehicle replacement, and only one respondent made a selection of an added mission. The chart below indicates the selections made by the fifteen respondents.

Chart 3 Results of survey question 8

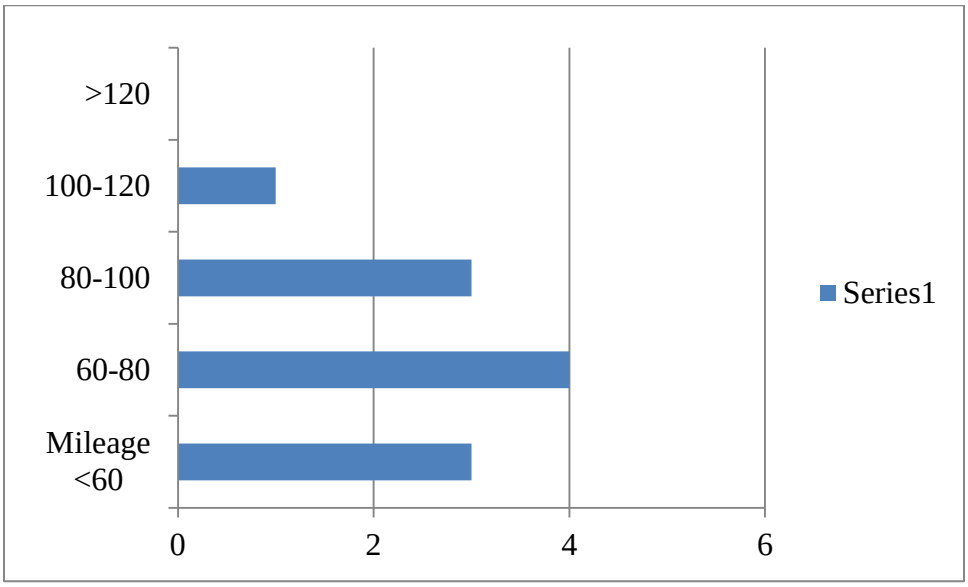


After vehicle failure, age, maintenance cost and mileage were the selections made most by respondents. Only three respondents chose the response of "your replacement plan says it is time to replace the vehicle."

Question 9 asked respondents to indicate the expected life usage of staff type vehicles. Fifteen of sixteen respondents selected a value for this question with nine selecting an age between seven and ten years of service. There were no responses to the value of greater than fifteen years of service and three responded with a selection of less than seven years.

Question 10 asked the expected mileage of staff type vehicle with a total of eleven respondents making this selection. The chart below indicates the respondent's choices with the most frequent response being between 60 and 80 thousand miles on a vehicle.

Chart 4 Results of survey Question 10



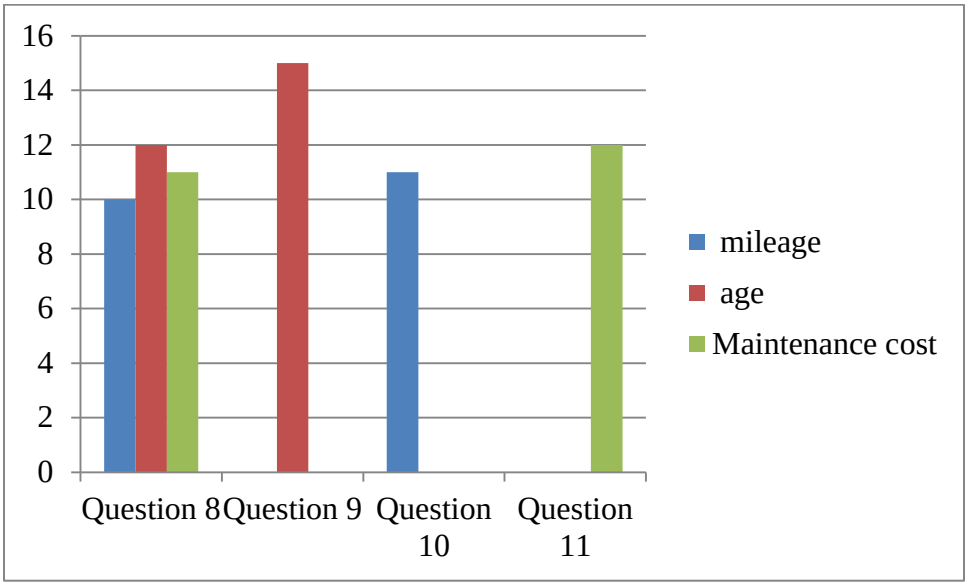
No respondent chose the selection of greater than 120,000 miles and only one respondent chose a mileage between 100 and 120 thousand miles. It was identified that Respondent 2 selected both the highest age of thirteen to fifteen years in Question 9 as well as the highest mileage in Question 10 (Appendix E).

The final survey question, number 11, related to maintenance cost in which six respondents selected the annual maintenance cost of 10-25% compared to a new vehicle and six chose a percentage between 25-40% of the cost of a new vehicle.

The responses to Question 9 through 11 were to be based on the respondent's answers to Question 8. As Respondent 12's reply was not utilized for analysis in Question 8, his responses to Questions 9 through 11 were utilized as he had selected all answers in question 8. There were a total of fifteen responses to Question 9 where only twelve respondents chose the age selection in Question 8. With similar results for the other two questions, eleven respondents answered Question 10, but only ten replied to the mileage selection in Question 8 and twelve answered

Question 11, but only eleven answered the maintenance selection in Question 8. The chart below indicates that there were more respondents to the Questions 9 through 11 then were intended to be.

Chart 5 Comparison of responses between Question 8 and 9 through 11



Appendix E shows that Respondent 2 only selected mileage in Question 8, but supplied an answer for Question 9, 10 and 11. Respondent 9 chose maintenance cost as a selection in Question 8 but did not make a selection in Question 11 as how the maintenance cost should be related to a percentage of new vehicle cost.

It appears that either the respondents did not understand how Question 8 related to Question 9 through 11 or the researcher did not phrase the questions properly to get the intended results. In either case, the results to question 9 through 11 did provide some insight as to how Fire Chiefs that replied to this researcher's request to respond to this survey do make selections as when to replace a vehicle within their organization.

A couple of respondents supplied comments with their survey returns. Respondent 13, from the Village of Scarsdale, added in response to Question 7 that his highest selection would have been *f* (your replacement plan says that it is time to replace the vehicle, but he writes “my 5 year replacement plan looks good on paper but is rarely funded by my village.” (Personal Communication T. Cain, January 13, 2014)

Respondent 12, from the City of Tonawanda, New York, comments included that if his organization had a vehicle replacement plan, he would have given it a higher ranking in Question 8. His vision of a vehicle replacement plan would involve the City Mechanic, City Treasurer and each City Department Head; He states “The main benefit would be that each department would maintain a dependable vehicle fleet with the ability to budget for such.” (Personal Communication C. Stuart January 2, 2014).

Based on the finding of this survey questionnaire, this researcher has produced a chart indicating the year of manufacturer and current mileage of all vehicles that the WFD has and the fiscal year that the vehicle should be replaced in utilizing a replacement of not more than twenty-five years of service to the department for fire apparatus and fifteen years of service for staff and utility vehicles. This chart can be found as Appendix A. Of note within the chart is that two of the fire apparatus are past due for replacement of an age of twenty-five years of service and two staff vehicles are past a ten year replacement plan cycle.

Discussion

Similar to researcher Richard Upham (2007) results of his project, this researcher could not find a specific reference to the life span of a vehicle in any law of US Department of Transportation or New York State laws and codes. The closest reference to when a vehicle has

to be replaces was that a vehicle could not be utilized if it did not pass the annual commercial inspection. According to Douglas Horton, Service Manager for Jerome Fire Equipment, by NYS law, all vehicle inspections are to be done at a registered garage facility, (Personal Communication, D. Horton, January 31, 2014). This annual inspection does not apply to fire vehicles in New York State, however, the WFD does have their vehicles inspected by a registered motor vehicle garage, but does not have a written policy to perform this annual inspection. NFPA 1911 (2012) does not specify a given age, or mileage for the retirement of fire apparatus, but prioritizes the safety of the vehicle as a primary factor for the consideration of vehicle replacement.

Cavette's (2006) ten reasons for replacing fire apparatus are similar to the indirect cost factors that Klopchic (2003) lists of perk value, feature upgrades and corporate image. However, when these items were listed for consideration for vehicle replacement for NYS Fire Chiefs e-mail group as Question 7, of the survey, these indirect cost factors received the lowest of considerations when compared with other choices listed as vehicle failure, down time and maintenance costs which are displayed in Chart 2 of this project.

The results of survey Questions 3 through 5, (Chart 1), using vehicle replacement based strictly on age, indicates that fire engines need replacement sooner than ladder truck or heavy rescue apparatus. If age has a direct correlation to response numbers, based on this researcher's knowledge, then engines will generally have more responses than truck companies due to the type of incidents each style of vehicle responds on during any given year. The WFD rescue responses to more calls a year than our busiest pumper. So should this vehicle be replaced sooner than the pumpers in our existing fleet based solely on age? Using Bibona's (2003)

combination theory, of age, mileage and circumstances, would suggest that replacement of our existing rescue truck should be done more frequently than some of our pumpers.

The results of Question 6 indicated that a fire apparatus should last at least twenty years with eight respondents, 50%, choosing the selection of 20-25 years of service and an additional four respondents, 25% of responses, choosing selection of greater than 25 years. The total number of respondents that selected the response of twenty years or greater are 75% of the total respondents. Using this data, a fire apparatus replacement plan should incorporate vehicle being used a minimum of twenty years. This twenty year age is supported by Schiller (2014) who represents Denver's Fire Department Fleet Maintenance position as well as the vehicle replacement plan for the County of Alberarle, Virginia (2005).

This researcher was a little confused by how the GSA and APWA differentiated between the life span of light trucks with diesel and those with gasoline engines. According to those references, trucks that have gasoline engines have a reduced life span when compared to the life span of a truck with a diesel engine. Only one of the WFD staff/utility vehicles has a diesel engine compared to the six that have gasoline engines. Gas engines have been purchases for many of our staff and command vehicles due to the fact that they are stored outside in the freezing elements. If diesel power vehicles have a longer life span, the WFD vehicle replacement plan may want to pursue more usage of diesel powered utility/staff vehicles within our fleet. In a conversation with Peter Monaco, who is in charge of the City of Watertown maintenance garage, informed this researcher that the initial cost of a pick-up with a diesel motor is more than the cost of one with a gasoline engine. The annual maintenance cost comparison between gas and diesel motors is that maintaining a diesel motor is more costly (Personal Communication, P. Monaco, February 12, 2014).

The NYS Comptroller's view (2013) that each municipality's vehicle usage is unique is supported by the City of Bozeman, Montana (2010) vehicle equipment policy in which the vehicles for the fire department were exempted from having to follow that community's vehicle replacement policy.

NFPA 1911 (2012) makes reference to cost as a factor that a vehicle older than twelve years has little or no trade-in value toward a newer purchase. When looking at the WFD vehicle 8-15, a 2001 Chevy Tahoe, the current replacement cost is approximately $38,000. When the vehicle was first purchased, the WFD paid a total of $26,200 to the vendor who provided the vehicle under state contract pricing. The maintenance cost associated with this vehicle since its delivery is $4672, not including routine items such as bulb replacement and oil changes. The maintenance cost as a percentage of the original cost for this vehicle is 17.8%, but when compared to the replacement cost, the comparison is only 12.3%. According to Kelley Blue Book, the trade in value of this vehicle is $3,889, which is of lesser value than the total maintenance cost associated with the vehicle. The trade in value is also only 10% of the replacement value, thus indicating that the reference made by NFPA in which vehicles older than twelve years in age has little or not trade is value is valid.

Survey Question 11, the comparison of annual maintenance cost compared to new vehicle replacement may have been poorly written. One would reach a higher percentage when comparing overall maintenance cost to the original purchase price as opposed to replacement cost. The industry standard for inflation of fire apparatus is 6% per year. If a pumper was purchased in 2006 at a price of $375,000, as the WFD has done, the replacement value in twenty years would have increased 120% or a cost of $825,000 in the year 2026. What community can afford that type of cost for one piece of fire apparatus?

This research project has proven that there appears to be no one factor that can be considered when forecasting the replacement of a fire apparatus vehicle. Replacement costs, usage, down time and age seem to be indicators that need to be continually evaluated as a vehicle is utilized by a fire department in order to determine when the vehicle should be replace. The input of respondents has aided this researcher in making a vehicle replacement plan.

Recommendations

This researcher had an awakening during this project in that the vehicles that we currently have were purchased by individuals who are no longer with the organization. Fire apparatus are supposedly built to last a long time, but the need for improved safety features and new technologies are small factors when considering vehicle replacement compared to vehicle age, mileage and maintenance cost.

Having a vehicle replacement plan by which certain aspects of the vehicle are evaluated on a routine basis and the ability to document maintenance costs will help project and demonstrate the need for a vehicle to be replaced.

Based on this applied research project, the following are recommendations that should be part of a vehicle replacement plan for the WFD:

The first recommendation is to have all vehicles owned by the WFD to be inspected for safety, per NYS commercial vehicle regulations, and pump and aerial components inspected and tested on an annual basis or more frequently if the unit was out of service for major repairs. This will ensure that the vehicles are examined by a competent inspector that will verify the vehicles future dependability and that the vehicle is safe to operate.

The second recommendation is to have all maintenance cost recorded and kept current for each vehicle owned by the WFD. This tracking of cost will aid the organization in determining what maintenance has been done on a particular vehicle and indicated if the same type of maintenance has been previously performed on that vehicle.

The third recommendation is to implement a procedure for tracking mileage, engine hours and down time for each of the vehicles owned by the WFD. The department currently tracks mileage and engine hours but does not track down time. By combining these three measures, we can determine why a vehicle may have a low annual mileage and engine hours if it has been down for a considerable period of the year. Also, considerable down time may indicated a decrease in dependability and be an indicator of the need for replacement.

The fourth recommendation is to annually compare total maintenance cost to the original purchase price of the vehicle. This will be done in order to demonstrate to the elected officials of our City the need for a vehicle to be replaced based on cost. Most elected officials look solely at the cost factor and nothing else.

Kevin Roch (2012) was correct when he stated that the decision of “when” to replace a vehicle is more difficult that the need to purchase a vehicle for a new station in that you yourself know that a vehicle is nearing time for replacement, but when exactly eludes us. This organization cannot rely on any one item to make a vehicle replacement determination, but must be able to demonstrate to others that the time for a vehicle replacement is best done through a plan and not a hunch.

As only three of sixteen respondents indicated that they had a designated fund for vehicle replacement, this researcher did not look at whether developing a vehicle replacement fund

would make it easier to plan for fire apparatus replacement. A second area of future research would be to do a cost comparison between purchasing a new vehicle and refurbishing an existing apparatus. At a projected replacement cost of $800,000 in twenty years for a 2006 fire pumper, there may be cost savings and other benefits to refurbishing that vehicle that could extend its life beyond twenty or twenty-five years of age that were found to be milestones in this research project.

The goal of this applied research project was to develop a draft vehicle replacement plan for the WFD. By utilizing available resources and a questionnaire to NYS Career Fire Chiefs, this researchers has developed such a vehicle replacement plan and is Appendix A of this paper.

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Appendix A

Draft Vehicle Replacement Plan

Vehicle Number	Type	Year of Manufacter	Mileage current	10 Year Replacement Fiscal Year	15 Year Replacement Fiscal Year	20 Year Replacement Fiscal Year	25 Year Replacement Fiscal Year	Current location 5 yr. Budget plan	Total Maintenance Cost	Down Time
8-1	Pumper	2000	60891		2015-16	2020-21	2025-26			
8-5	Pumper	1986	70742		2001-02	2006-07	2011-12	2014-15		
8-2	Pumper	2006	30755		2021-22	2026-27	2031-32			
8-3	Pumper	2007	33124		2022-23	2027-28	2032-33			
8-4	Pumper	1996	6894*		2011-12	2016-17	2021-22			
8-5	Truck	2004	6561		2019-20	2024-25	2029-30			
8-6	Truck	1986	17443		2001-02	2006-07	2011-12	2016-17		
8-7	Rescue	2004	44978		2019-20	2024-25	2029-30	2018-19		
8-8	Pick-up	2001	34501	2011-12	2016-17			2014-15		
8-12	Command	2008	29422	2018-19	2023-24					
8-13	Pick-up	2006	47110	2016-17	2021-22			2017-18		
8-14	staff car	2006	82295	2016-17	2021-22					
8-15	Command	2001	89358	2011-12	2016-17			2014-15		
8-16	Command	2006	30625	2016-17	2021-22			2017-18		
8-17	Squad	2008	7335	2018-19	2023-24					

Appendix B

Survey Questionnaire

December 30, 2013

Dear Fire Chief;

I am currently working on an applied research project to complete my Executive Fire Officer program at the National Fire Academy. My topic for this project is to create a vehicle replacement plan. In order to get a sense of what other fire departments are doing with regards to vehicle replacement, could you answer the following survey questions, and return them to my e-mail address dherman@watertown-ny.gov.

Thank you

Dale

1) Which type of municipal fire department are you considered;
    a. _____ City
    b. _____ Village
    c. _____ Fire District
    d. _____ Fire Protection District
2) How does your municipality fund vehicle acquisitions;
    a. _____ Designated vehicle fund
    b. _____ Capital project budget (borrow monies)
    c. _____ Operating budget
3) What do you consider the useable life expectancy of your department's front line engine;
    a. ____ < 10 yrs. ____ 10-13 ____ 13-15 ____ 15-20 _____> 20 yrs.
4) What do you consider the useable life expectancy of your department's front line truck;
    a. ____ < 10 yrs. ____ 10-13 ____ 13-15 ____ 15-20 _____ > 20 yrs.
5) What do you consider the useable life expectancy of your department's front line Heavy Rescue;
    a. ____ < 10 yrs. ____ 10-13 ____ 13-15 ____ 15-20 _____ > 20 yrs.
6) What do you consider a drop dead age for replacing a fire apparatus;
    a. ____ < 15 yrs. ____ 15-20 ____ 20-25 ____ > 25 yrs.
7) Please rank, (with 1 being your highest choice) the following when considering replacement of a piece of fire apparatus;
    a. _____ Maintenance costs
    b. _____ Down time
    c. _____ How good the vehicle looks

d. _____ How much value the vehicle has for trade in
e. _____ Feature upgrades
f. _____ Your replacement plan says that it is time to replace the vehicle
g. _____ ISO or other recommendations for needed fire flow
h. _____ Vehicle failure

8) Check the criteria you use to replace staff, utility, command or smaller medic units; (Choose all that apply)
   a. _____ Age
   b. _____ Mileage
   c. _____ Maintenance cost
   d. _____ Reuse value
   e. _____ Your replacement plan says it is time to replace the vehicle
   f. _____ Added mission
   g. _____ Vehicle failure
9) If you selected age, what is the expected life usage of this type of staff, utility, command or smaller medic units;
   a. ____ < 7 yrs. ____ 7-10 _____ 10-13 ____ 13-15 ____ > 15 yrs.
10) If you selected mileage, the expected mileage a vehicle should have before replacement;
   a. ___ < 60,000 miles ___ 60-80 ____ 80-100 ____ 100-120____ > 120,000 miles
11) If you selected maintenance cost, the expected annual cost of maintenance compared to a new vehicle to replace it with is;
   a. ___ < 10% ___ 10-25% ___ 25-40% ___ 40-60% ___ > 60%

Thank you again for your participation.

Appendix C

List of WFD Apparatus

Vehicle Number	Type	Year of Manufacter
8-1	Pumper	2000
8-5	Pumper	1986
8-2	Pumper	2006
8-3	Pumper	2007
8-4	Pumper	1996
8-5	Truck	2004
8-6	Truck	1986
8-7	Rescue	2004
8-8	Pick-up	2001
8-12	Command	2008
8-13	Pick-up	2006
8-14	staff car	2006
8-15	Command	2001
8-16	Command	2006
8-17	Squad	2008

Appendix D

Survey Results

1) Which type of municipal fire department are you considered;
    a. __12___ City
    b. __1___ Village
    c. ___3__ Fire District
    d. _____ Fire Protection District
2) How does your municipality fund vehicle acquisitions;
    a. __3___ Designated vehicle fund
    b. __12___ Capital project budget (borrow monies)
    c. __1__ Operating budget
3) What do you consider the useable life expectancy of your department's front line engine;
    a. __1__ < 10 yrs. __2__ 10-13 __4__ 13-15 __8__ 15-20 __1___> 20 yrs.
4) What do you consider the useable life expectancy of your department's front line truck;
    a. __1__ < 10 yrs. __1__ 10-13 ___2_ 13-15 __7__ 15-20 __5___ > 20 yrs.
5) What do you consider the useable life expectancy of your department's front line Heavy Rescue;
    a. __1__ < 10 yrs. __0__ 10-13 __1__ 13-15 __5__ 15-20 __3___ > 20 yrs.
6) What do you consider a drop dead age for replacing a fire apparatus;
    a. __2__ < 15 yrs. __2__ 15-20 __8__ 20-25 __4__ > 25 yrs.
7) Please rank, (with 1 being your highest choice) the following when considering replacement of a piece of fire apparatus;
    a. __38___ Maintenance costs
    b. __41___ Down time
    c. __112__ How good the vehicle looks
    d. __92 __ How much value the vehicle has for trade in
    e. __94___ Feature upgrades
    f. __74___ Your replacement plan says that it is time to replace the vehicle
    g. __70___ ISO or other recommendations for needed fire flow
    h. __25___ Vehicle failure
8) Check the criteria you use to replace staff, utility, command or smaller medic units; (Choose all that apply)
    a. _12____ Age
    b. _10___ Mileage
    c. _11____ Maintenance cost
    d. __3__ Reuse value
    e. __3___ Your replacement plan says it is time to replace the vehicle
    f. __1___ Added mission
    g. _13___ Vehicle failure

9) If you selected age, what is the expected life usage of this type of staff, utility, command or smaller medic units;
    a. __3__ < 7 yrs. __9__ 7-10 __1___ 10-13 __2__ 13-15 __0__ > 15 yrs.
10) If you selected mileage, the expected mileage a vehicle should have before replacement;
    a. _3__ < 60,000 miles _4__ 60-80 _3___ 80-100 __1__ 100-120__0__ > 120,000 miles
11) If you selected maintenance cost, the expected annual cost of maintenance compared to a new vehicle to replace it with is;
    a. _0__ < 10% _6__ 10-25% _6__ 25-40% _0__ 40-60% _0__ > 60%

Appendix E

Table of Survey Results

Respondents	Total	1	2	3	4	5	6	7	8	9	10	11	13	14	15	16	12
Question 1		C	A	A	A	C	A	A	A	A	A	A	B	C	A	A	A
Question 2		A	B	B	B	C	B	B	B	A	B	B	B	A	B	B	B
Question 3																	
<10	1	1															
10-13	2									1		1					
13-15	4						1	1			1		1				
15-20	8		1	1	1	1			1					1	1		1
>20	1															1	
Total	16																
Question 4																	
<10	1	1															
10-13	1									1							
13-15	2						1				1						
15-20	7		1	1				1	1				1		1	1	
>20	5				1	1						1		1			1
Question 5																	
<10	1	1															
10-13	0																
13-15	1										1						
15-20	5		1				1		1					1		1	
>20	3											1			1		1
Question 6																	
<15	2	1								1							
15-20	2						1				1						
20-25	8				1	1		1	1			1	1		1	1	
>25	4		1	1										1			1
Question 7a	38	3	1	1	1	3	2	3	1	3	2	3	4	3	3	2	3
7b	41	2	2	3	2	2	3	6	3	2	3	2	2	2	2	3	2
7c	112	7	8	6		8	8	7	8	8	7	8	8	8	6	8	7
7d	92	8	6	8		4	5	5	6	5	8	5	6	7	7	6	6
7e	94	5	3	7		7	6	8	7	6	6	7	7	5	8	7	5
7f	74	4	5	4		5	7	2	5	7	4	6	1	6	5	5	8
7g	70	6	7	5		6	4	4	4	4	5	4	5	4	4	4	4
7h	25	1	4	2	3	1	1	1	2	1	1	1	3	1	1	1	1
Question 8a	12	1		1	1	1	1	1		1	1	1	1		1	1	4

8b	10	1	1			1	1	1	1		1		1		1	1	3
8c	11	1		1	1		1		1	1	1	1	1	1	1		2
8d	3								1			1		1			5
8e	3	1											1	1			7
8f	1															1	6
8g	13	1		1	1	1	1	1	1	1	1		1	1	1	1	1
Question 9																	
<7	3	1								1							1
7-10	9			1	1	1	1	1			1	1	1			1	
10-13	1								1								
13-15	2		1												1		
>15	0																
Question 10																	
<60	3							1			1						1
60-80	4								1				1		1	1	
80-100	3	1				1	1										
100-120	1		1														
>120	0																
Question 11																	
<10%	0																
10-25%	6	1			1		1				1	1		1			
25-40%	6		1	1					1				1		1	1	
40-60%	0																
> 60%	0																