JUSTIFYING THE PURCHASE OF NEW FIRE APPARATUS

EXECUTIVE DEVELOPMENT

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Abstract

The problem was justifying the purchase of new fire apparatus to the governing body of the Washington Township Fire Department so that funding could be obtained. The purpose of the research was to determine if strategies or methods exist for justifying the replacement of dated fire apparatus. The research method used for the study was evaluative. Three research questions were answered in this study.

1. What comprehensive studies on the life expectancy of fire apparatus exist?
2. Are there common guidelines for replacing older fire apparatus with new equipment?
3. Can these guidelines be shaped into an applicable strategy for justifying the replacement of dated fire apparatus?

The research procedure used in the preparation of this paper began with a literature review. Fire engine manufacturers were contacted and the Internet was utilized by posting a request for information in the I-Chiefs mailbox. The National Fire Protection Association, National Association of Emergency Vehicle Technicians, and the International Association of Fire Chiefs offices were also contacted. National Fire Protection Association Standards were also consulted.

No standards or surveys were located that provided definitive information on the life expectancy of fire apparatus. There was literature with recommended time frames for the replacement of fire apparatus based on the experiences of the authors. Guidelines that could be used as a strategy for justifying the replacement of dated apparatus were also identified and applied to the replacement of apparatus at the Washington Township Fire Department.
The conclusions drawn from this study were that more research is needed on the life expectancy of fire apparatus. In the absence of definitive studies and surveys there are several areas that when strategically applied can provide documentation justifying the replacement of older fire trucks.
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Introduction

The problem is justifying the purchase of new fire apparatus to the governing authority of the Washington Township Fire Department so that funding can be obtained. The Fire Chief of the Washington Township Fire Department wishes to modernize the department’s fleet of fire apparatus by replacing two 1985-fire engines before the year 2001. In order to accomplish this he must convince the Township Board to supply the necessary funding. The purpose of this research project is to determine if strategies or methods exist for justifying the replacement of dated fire apparatus. The research method used for the study is evaluative. Three research questions are answered in this study:

1. What comprehensive studies on the life expectancy of fire apparatus exist?
2. Are there common guidelines for replacing older fire apparatus with new equipment?
3. Can these guidelines be shaped into an applicable strategy for justifying the replacement of dated fire apparatus?

Background and Significance

To complete its mission effectively, the fire service must have dependable and efficient fire apparatus. Fire service administrators must be prepared to replace outmoded fire equipment on a timely basis. The purchase price for a customized fire engine can be as much as $250,000. Economic pressures exist at all levels of government; the decision to allocate funding for the replacement of fire apparatus must be supported by a sound, cost-effective analysis. Whether they are in charge of a large metropolitan department or a small village department, the fire chief must be prepared to justify such a large capital expenditure.
The Washington Township Fire Department is a 134-member, combination department, located on the north side of Indianapolis in Marion County, Indiana. The department provides fire prevention, fire protection, rescue, hazardous materials, and emergency medical services to a 35 square-mile suburban jurisdiction with a population of more than 150,000 residents. These services are provided from five fire stations located throughout the township. Its fleet of fire apparatus includes six fire engines. The oldest of these fire engines is a 1981-model currently utilized as a reserve engine. Two of the remaining five primary engines were made in 1985.

Chief Tim Whitaker would like to purchase two new engines in the next three years. He would like to replace the 1981 reserve piece of equipment. The 1985 engine in the best condition would be placed into reserve status and the other traded in. The two new fire engines would take their place as primary engines. Chief Whitaker feels a sense of urgency to secure a commitment to fund these purchases, as it can take as long as three years to specify, build, and take delivery of a new fire engine. This sense of urgency is heightened by the possibility that a sixth station may be opened in the next several years, and the reserve engine may need to be temporarily utilized at that station. Budget dollars are derived from a percentage of property taxes collected in the township. An elected trustee and seven-member advisory board approve the fire department’s budget. In order to secure funding for the new fire engines they will have to be convinced that the expenditure is warranted.

The author of this report is the Deputy Chief of Operations for the Washington Township Fire Department and a student in the Executive Fire Officer Program. He has been asked by the Chief of the Department to prepare a report to justify the expenditure
for two new fire engines. In the Executive Development Course of the Executive Fire Officer Program, students are taught the importance of research beneficial to the fire service and how to conduct such research. This research project is significant because it will assist the Washington Township Fire Department in meeting its goal of purchasing two new fire engines and may serve as a model for other fire officers seeking to justify capital purchases of fire apparatus.

Literature Review

An extensive review of available literature found no comprehensive studies on apparatus life expectancy or clear-cut time frames for replacement. There were no definitive answers for how long a fire truck lasts. E-mail postings in a post office box for fire service personnel to share information via the Internet (the I-Chiefs web-site), also yielded no data on apparatus service life. Regional differences are one factor cited for the absence of these studies. Variables such as weather, road conditions, run loads, and maintenance are listed as reasons for the inadequacy of any clear-cut information in this area (Peterson, 1994). Age in itself should not be the sole criterion for deciding to replace a fire apparatus. The vehicle’s routine workload, its physical condition, and the degree of preventative maintenance it received are usually more accurate indications of whether the apparatus is still reliable for first-line duty (Peters, 1994).

There was, however, anecdotal information found in the literature based on antecedent, experiential, or “on average” data. These estimates ranged from 10 to 15 years, to 15 to 20 years. Life expectancy varies greatly from one location to another. Generally, a 10 to 15 year life expectancy is normal for engines used daily in heavy to moderate response areas (Peters, 1994). For fire apparatus approaching or exceeding 15
to 20 years of age, corrosion, metal fatigue and crystallization in concealed areas can result in serious consequences (Freitag, 1984). Perhaps the most reliable of these resources in reference to life service of fire apparatus is the National Fire Protection Association (NFPA) Handbook, 17th Edition which states, “In general, a 10 to 15 year life expectancy is considered normal for first line pumping engines. In some types of service, including areas of high fire frequency, a limit of only 10 years may be reasonable for first line service” (Peterson, 1994).

Other factors should be considered in addition to the age of the fire truck, in order to make the best decision as to whether the truck should be replaced. These other factors include:

1. Personnel Safety
Many of the changes in the new standards deal with safety items such as fully enclosed cabs, higher visibility, cab noise abatement and various interlocks. You must determine if you are willing to delay the availability of certain safety features until the new unit is purchased (Peters, 1992).

2. Obsolescence
Number of miles traveled and hours of pumping operation do not normally provide a basis for determining the need for replacement. There are other factors that limit the effective and economical life of apparatus, making replacement desirable. These include obsolescence due to inadequate braking, slow pick-up and acceleration resulting in a tendency not to slow up at intersections, inadequate protection of driver and men, and structurally weakened chassis due to overloading (Freitag, 1984).

3. Condition of Major Components
An examination of the major components of an apparatus must be made including the drive train, transmission, engine, pump, chassis, and body (Peters, 1994).

4. Availability of Replacement Parts

As apparatus get older, replacement parts may become more difficult to obtain, leading to longer periods of “down time” (Peterson, 1994).

5. Changes in National Standards or Federal Mandates


6. Maintenance Costs and Performance

All apparatus should be tested annually. These tests, together with your records of maintenance, should be used to determine the cost trend in maintaining the apparatus. As costs increase and the value of the apparatus decreases, you will reach a point where it is no longer economical to continue investing in repairs (Peterson, 1994).

7. Mission

Is the present unit adequate to complete the mission now as well as five to ten years from now? Often, changing demographics require new needs such as paramedic, haz-mat, or foam capabilities on your basic fire suppression unit to be addressed (Peters, 1992).

In summary, the literature review found no definitive studies on the service life of fire apparatus. There were no NFPA standards that stated fire engines should be replaced at a
certain age. There were no surveys located that provided information on average life expectancy, such as; a 1985 Pierce engine responding to 500 incidents per year will provide fifteen years of service in the Midwest given proper maintenance. Several authors offered opinions based on their experiences as to when apparatus should be replaced. These opinions varied from a low of 10 years to a high of 25 years of service. Most of the literature indicated a range of 10 to 15 or 15 to 20 years of service for fire engines.

The literature suggested that age alone is not the best barometer for purchasing new apparatus, but that each case must be considered on its own merits and several factors should be considered. Those factors are: personnel safety, obsolescence, condition of major components, availability of replacement parts, changes in national standards or federal mandates, maintenance costs and performance, and changes in the department’s mission. These guidelines were used to see if they could be applied to justify the purchase of two new fire engines for Washington Township.

Procedures

The purpose of this research project was to justify the purchase of new fire apparatus so that funding could be obtained. The research procedure used in the preparation of this paper began with a literature review at the Learning Resource Center at the National Emergency Training Center at the National Emergency Training Center, Emmitsburg, Maryland. Additional research of literature was conducted at the Indianapolis Public Library in Indianapolis, Indiana. In order to answer the first research question, the initial focus of the review was an effort to locate definitive studies, surveys, standards, or other documentation on the life expectancy of fire apparatus. The review was broadened when no surveys or standards of this type
could be located. Fire engine manufacturers were contacted but could provide only warranty information. The Internet was utilized by posting a request for information in the I-Chiefs mailbox. No information was received. The National Fire Protection Association, National Association of Emergency Vehicle Technicians and the International Association of Fire Chiefs offices were contacted by telephone but they were unable to provide any information on surveys or studies that exist on apparatus life expectancy.

If the literature review failed to find any specific data documenting the service life of fire apparatus, how then did chief officers corroborate the need to replace aged vehicles by purchasing new ones? This led to the second research question. Are there common guidelines for replacing older fire apparatus with new equipment? The literature review was repeated in an effort to locate universal guidelines to justify the purchase of new fire apparatus. This review was more successful as several articles were found. The guidelines in these articles were examined to see if a pattern could be identified. Seven common guidelines were found. These guidelines were used to create a strategy justifying the replacement of dated fire apparatus with new fire trucks.

The next procedure was to see if the strategy could be utilized to justify the replacement of Washington Township’s two 1985-fire engines. If the strategy was applicable at Washington Township, it could be considered as a model to be used by other fire departments. Each of the seven guidelines identified was applied. Two of the guidelines led to additional research procedures. First, the literature mentioned changes in national standards as one method to corroborate replacement of fire apparatus. NFPA 1500, Standard on Fire Service Occupational Safety and Health Program and the 1979,
1991, and 1996 editions of *NFPA 1901 Standards for Automotive Fire Apparatus* were reviewed to see how present standards had changed since 1985 when the engines were built.

Secondly, examination of maintenance costs was another method mentioned. Escalation in costs may indicate the need to replace aged apparatus. So 1997 and 1998 maintenance records for the 1985 engines were examined and compared against the rest of Washington Township’s fleet.

Washington Township’s Chief Mechanic, Cliff McCartney was interviewed to ascertain whether it was difficult to obtain parts for the 1985 model engines. The interview also provided information on improvements made to current model engines versus those built in 1985.

This research was limited by the absence of previous definitive studies, surveys, standards, or other documentation on the life expectancy of fire apparatus. It was also limited by the fact that the literature on successful strategies for justifying the purchase of fire apparatus was dated. The most current article cited was published in 1994.

**Results**

No comprehensive studies on the life expectancy of fire apparatus existed. No extensive surveys on the service life of fire apparatus could be located through the literature review. There were no factual data such as definitive standards or other documentation that answered the question “How long does a fire truck last?” Fire engine manufacturers provided only warranty information. The Internet was utilized by posting a request for information in the I-Chiefs mailbox. No information was received. The National Fire Protection Association, National Association of Emergency Vehicle
Technicians, and the International Association of Fire Chiefs offices were unable to provide any information on surveys or studies that exist on apparatus life expectancy. Literature was found that contained approximate service life for fire trucks based on the author’s experiences. These estimates generally fell into timeframes of 10 to 15 years or from 15 to 20 years of expected service life. The articles suggested that regional differences are a factor in the absence of more comprehensive studies. Weather, road conditions, run loads, and maintenance are some of the reasons cited for the inadequacy of any clear-cut information in this area. The vehicle’s routine workload, its physical condition, and the degree of preventative maintenance are all factors that will affect a fire trucks life expectancy.

Research of the second question, whether guidelines exist on when to replace older fire apparatus with new equipment, was more successful. The literature review revealed several articles with guidelines for determining when fire engines need to be replaced. The articles suggested an examination of several areas. The identified areas were personnel safety, obsolescence, condition of major components, availability of replacement parts, changes in national standards or federal mandates, maintenance costs and performance, and changes in the department’s mission.

Manufacturers continue to make improvements on personnel safety features of fire engines. The literature suggests that fire departments examine differences in the personnel safety features of their old apparatus and those of newer fire engines. Safety features mentioned include fully enclosed cabs, higher visibility, cab noise abatement, and various interlocks.
Another factor, which limits the effective and economical life of fire apparatus and makes replacement desirable, is obsolescence. This includes obsolescence due to inadequate braking, slow pick-up and acceleration resulting in a tendency not to slow up at intersections, inadequate protection of driver and men, and structurally weakened chassis due to overloading.

The condition of major components of an apparatus must be examined. The soundness of the fire truck’s drive train, transmission, engine, pump, chassis, and body must each be considered to determine if the apparatus should be replaced. Another related factor that must be considered is the availability of replacement parts. As apparatus get older, replacement parts may become more difficult to obtain, leading to longer periods of “down time.” Depending on the age of the truck, parts may no longer be manufactured at all.

Changing national standards are perhaps the most important consideration for determining whether to replace an apparatus. The NFPA published *NFPA 1901 Standards for Automotive Fire Apparatus* in 1979, 1991 and 1996. In each edition the industry standards were upgraded, so older fire engines may no longer meet current national standards. The third edition of *NFPA 1500, the Standard on Fire Service Occupational Safety and Health Program* was published by the NFPA in 1997. The standard recommended that fire apparatus have certain safety features, such as enclosed cabs. Fire trucks built prior to the publication of the standard may not have these safety features.

There is a point where the cost of maintaining an apparatus is increasing, while the value of the truck is decreasing, and it is no longer economically feasible to continue
spending money on repair. Comparing the performance of an engine against its annual maintenance costs is another guideline to consider when replacing a fire truck.

The last recommended guideline is an analysis of the Fire Department’s mission. Changes in the mission of the department can result in fire apparatus being used for functions that were not necessary when it was originally purchased. An apparatus originally purchased to meet basic fire suppression needs may now be required to function in a paramedic, hazardous materials, or heavy rescue capacity. Is the present unit adequate to complete the mission now as well as five to ten years from now?

An effort was made to see if these guidelines could be shaped into a common strategy to justify the replacement of dated fire apparatus? The common guidelines outlined above were applied to justify the replacement of the Washington Township Fire Department’s two 1985 Pierce engines.

Examining the 1985 fire engines from the perspective of personnel safety raised several concerns. The apparatus do not have fully enclosed cabs. The jump seat area (the seating area for two rearward facing fire fighters located just behind the driver’s compartment) is open on the sides. This exposes fire fighters to the elements and creates a greater danger of their being ejected if the truck is involved in an accident. All current models are built with fully enclosed cabs. Current cabs are also more resistant to crushing in the event of a truck rollover. Manufacturers have continually made improvements in cab resistance to crushing since 1985. The older engines do not have three-point seatbelts that include shoulder harnesses, only lap belts. Newer engines also come equipped with anti-lock brakes. These brakes allow the engine to safely stop under emergency braking conditions. The 1985 engines do not have this feature.
Manufacturers have also added interlock systems to their new engines. These prevent the accidental movement of the fire engine during pumping operations. Other areas where personnel safety has been enhanced since 1985 include additional perimeter lighting and noise abatement.

The area of obsolescence did not yield any compelling reasons for replacement of the older engines. Although the engines do not have anti-lock brakes, the brakes are adequate for slowing and stopping the vehicles. Their pick up and acceleration are normal, and the chassis is not structurally weakened or overloaded (Cliff McCartney, personal interview, June 17, 1998).

An inspection of the 1985 engines’ major components found that the drive train, chassis, transmission, and pump are in good shape. The engines in both trucks needed extensive work. As a result of an undersized radiator, the engines were exposed to persistent overheating. This led to irreparable damage to their motors, which required complete overhauls. The stainless steel water tanks in both trucks will also need to be replaced. Water tanks in new fire apparatus are made of high tech plastics that have lifetime warranties. Because they are lighter in weight they can be designed to hold more water. The 1985 models have water tanks that hold 500 gallons of water. Newer engines in the fleet have tanks that hold 750 gallons of water. Replacement parts for the 1985 models are not as readily available as are parts for newer fire trucks, but no significant delays or down time have resulted from an inability to find parts (Cliff McCartney, personal interview, June 17, 1998).

A comparison of current standards and the standards in place in 1985, found many new requirements and improvements for fire engines. The 1979 edition of *NFPA 1901*
Standards for Automotive Fire Apparatus was in effect when the 1985 engines were built. Since 1985 this standard has been updated twice. The first revision was published in 1991 and the second in 1996.

The 1991 edition of NFPA 1901 was renamed from Standard for Automotive Fire Apparatus to Standard for Engine Fire Apparatus. The document was totally rewritten and reorganized to include requirements for engine apparatus only. New safety requirements were added, including total enclosure of the fire fighter seating area, maximum step heights, a provision for handrails, and additional warning lights and reflective striping. The requirement for minimum fire pump size was increased to 750 gallons per minute. The newer pumps were required to have slow closing valves on larger intake valves, an intake relief system, and interlocks to prevent accidental movement during pumping operations, and more accurate gauges. Other changes were made to auxiliary systems such as foam application, 120/240-volt electrical systems, booster reels, and auxiliary pumps.

The 1996 edition of NFPA 1901 again grouped all types of fire fighting apparatus into one document titled Standard for Automotive Fire Apparatus. New requirements were added to the document. As with the 1991 version, many of the new requirements focus on safety issues. The height of controls is limited to 72 inches above the standing position of the operator. Equipment in the driving and crew areas must be securely fastened or in a compartment. There are requirements for increased work lighting around the vehicle and better grouping of pump controls to keep the operator away from the intake and discharge outlets. The requirements for warning lights were rewritten to provide for different lighting when “calling for right-of-way” versus “blocking right-of-
way.” Requirements for warning lights were increased so that greater visibility of the fire apparatus is provided. Additional requirements were written for storage of self-contained breathing apparatus (SCBA) and cylinders, pump and plumbing access, and powered equipment racks. None of the many requirements listed from the 1991 and 1996 revisions of NFPA 1901 applied at the time the two 1985 fire engines were manufactured.

In addition to the changes in NFPA 1901 *Standard for Automotive Fire Apparatus*, there are also changes in the 1997 third edition of NFPA 1500, *the Standard on Fire Service Occupational Safety and Health Program*. This standard also contains safety requirements pertaining to fire apparatus. In fact, the standard considers safety as one of the highest priorities. “The fire department shall consider safety and health as primary concerns in the specification, design, construction, acquisition, operation, maintenance, inspection, and repair of all fire department vehicles” (NFPA 1500, 1997). The 1985 engines fail to meet the safety standard in at least one important way. As stated earlier the 1985 engines are not fully enclosed.

All new fire apparatus shall be specified and ordered in accordance with the appropriate fire apparatus standard specified in Section 4-1 of this chapter with a sufficient number of seats in a fully enclosed personnel area for the maximum number of persons expected to ride on the vehicle at one time. The fully enclosed personnel area shall consist of a roof, a floor, and four sides, with positive latching doors that provide total enclosure (NFPA 1500, 1997, p12).

Maintenance records for Washington Township’s five primary fire engines were compared. A comparison was made for 1997 and for the first six months of 1998. In
1997 the cost of maintaining Engine 224, one of the 1985 Pierce fire trucks, was slightly more than $20,000. The next highest maintenance cost was $2,300. Engine 224 cost almost ten times more to maintain than any other engine. In fact, Engine 224 cost more to maintain than the combined cost to maintain all of the other engines. The majority of this cost ($9,000) was for the overhaul of its motor.

The maintenance reports for the first six months of 1998 show a similar discrepancy. This time it is the maintenance cost of the other 1985 Pierce engine, Engine 225, which is six times greater than any other engine. Once again it is the expense of the engine overhaul that drove the cost up.
Price estimates have been obtained on the cost to enclose the cab areas of Engine 224 and Engine 225. They are the only apparatus that are not fully enclosed. The cost to refurbish one engine is $30,000. This would significantly add to the cost of retaining the 1985 fire engines.

The last area examined was whether the apparatus are still suitable to meet the fire department’s present mission. Has the department’s mission changed since the original purchase of the engines in 1985? The most significant change in mission affecting the trucks is the addition of emergency medical services (EMS) responses, including paramedic responses. At the time the engines were purchased they were used primarily for fire suppression activities and responded to EMS calls in a limited capacity. Now nearly 80 percent of their run loads are for EMS calls. In 1992 the engines began answering paramedic or advanced life support emergencies. This requires the apparatus to carry EMS equipment and limits available compartment space. Engine 224 has also been added to tactical rope rescue responses and is required to carry necessary rope rescue equipment. Engine 224 has no compartment space available for any other equipment.

To summarize the results, no comprehensive studies on the life expectancy of fire trucks were found. Several common guidelines on replacing older fire apparatus with new equipment were identified. The guidelines were: personnel safety, obsolescence, condition of major components, availability of replacement parts, changes in national standards or federal mandates, maintenance costs and performance, and changes in the department’s mission. The guidelines can be utilized as a strategy to justify the
replacement of dated fire apparatus, as was the case when applied to Washington Township’s specific need to replace two 1985 fire engines.

Discussion

Fire Departments throughout the country are faced with justifying the purchase of new fire trucks to governmental authorities so that funding can be appropriated. How is this accomplished? The task would be simplified if clear-cut criteria existed. However determining when to replace fire apparatus, like trying to decide whether to replace the family car, is an inexact science. Do fire engines need to be replaced every 15 years, or after 100,000 miles, or 10,000 responses, or 30,000 hours of pump operation? It depends on a variety of conditions such as climate, routine workload, the truck’s physical condition, and the degree of preventative maintenance it receives.

The National Fire Protection Association, the National Association of Emergency Vehicle Technicians, and the International Association of Fire Chiefs do not have standards nor do they make recommendations concerning the replacement of fire trucks. Fire Chiefs would be in a stronger position when appearing before the funding agency if they could state that “our fire engine is 15 years old and according to NFPA standards should be replaced.” Or to tell them, “according to the National Association of Emergency Vehicle Technicians our engine has over 100,000 miles on it and should be replaced,” or even “according to a survey taken by the International Association of Fire Chiefs most fire apparatus are replaced after 20 years of service.” But no such survey, data, or information exists.

How then, do we warrant spending $250,000 for a new fire truck? There is literature in which the authors advise a time frame for fire apparatus replacement. These time
frames are based on the authors’ experiences and range from 10 to 15 years and 15 to 20 years. All of the literature suggests that there are fire apparatus that may need to be replaced sooner and others that still work well after 25 years of service. This is why the literature states that age is not the best determination for replacing dated equipment.

A variety of other factors should be considered according to the articles cited. The articles suggest gathering information on the vehicle’s safety and the condition of major components such as pumps and drive trains. Find out if replacement parts are readily available. See what changes in national standards or federal mandates have occurred since the truck’s purchase. Consider whether rising maintenance costs are providing diminishing returns. Determine if the apparatus still meets the needs of the department’s current mission. This information can then be used to make a compelling argument to keep or replace an apparatus.

In applying this strategy to the Washington Township Fire Department, the author of this report found that not all of the factors must be taken together to justify replacement of an apparatus. Some factors may be more compelling than others may. You would not replace a fire truck simply because replacement parts are not easily located; but you certainly would consider replacement if personnel safety were at risk, even if all of the other factors were not pertinent. The value in using these guidelines as the basis for an overall strategic plan is that at least some of the guidelines should be pertinent to each situation. As each guideline is applied to an individual case, two or three of them should emerge as reasonable arguments for replacing a dated apparatus. Those guidelines can then be used to form a rationale for your replacement policy.
In the Washington Township Fire Department illustration, personnel safety, changing national standards, and rising maintenance costs are compelling factors. The condition of major components, the availability to locate replacement parts and changes in the department’s mission are less compelling reasons. If the same guidelines were applied to the fire engines at some other department, just the opposite could be true.

The implication of this research for the Washington Township Fire Department is that justification for the replacement of the 1985 Pierce engines exists. It is not accessible in the form of a readily available study on fire apparatus life expectancy or a national survey but must be prepared by the organization itself. Available literature suggests that the 13-year old engines fall within the time frame when consideration should be given to their eventual replacement. By examining personnel safety factors and researching changes in national standards and departmental maintenance records, the department can prepare documentation justifying the replacement of the 1985 fire engines.

Recommendations

The complete absence of definitive studies, surveys, standards, or other documentation on the life expectancy of fire apparatus indicates that further research in this area is needed. A survey to determine when fire trucks are replaced would be a good follow up to this research project. The survey should be formulated to account for as many factors as possible. These factors would include not only the age of the truck at the time it was replaced but also the mileage and hours of service. Other variables could be accounted for such as regional differences, climate, run load, and routine maintenance. This sample questionnaire would be used to gather as much data as possible. An
examination of the data would reveal trends or other pertinent information that might provide additional insight into how decisions are made on replacing fire apparatus.

Even without survey data or recommended time frames for replacement found in national standards, chief officers can still arm themselves with documentation advocating the replacement of older fire apparatus. Fire departments should use the seven guidelines identified in this research as a strategy for developing the needed documentation.

First, document how personnel safety is affected by the continued use of an outdated fire engine. Is the absence of antilock brakes or a fully enclosed cab unnecessarily putting fire fighters at risk? If so, are there cases where fire fighters have been injured on apparatus lacking these safety features? This information should be collected.

Written reports from the company officers staffing an older engine can be used to show that it may be obsolete. If the officers or drivers complain that the brakes are inadequate for slowing or stopping the vehicle or that the truck has inadequate acceleration, then they should submit a written report.

Reports from the department’s mechanics on the condition of major components should be compiled. Maintenance records should also be compiled to examine the maintenance costs and the availability of replacement parts.

Records can be gathered to show how changes in the department’s mission are affecting the use of an older apparatus. If an engine that was originally purchased to use for fire suppression only, is now also used for paramedic responses, then run response records should reflect this increase in usage.

A review of the changes in National Standards such as NFPA 1901, *Standards for Automotive Fire Apparatus* and NFPA 1500, *Standard on Fire Service Occupational
Safety and Health Program will provide further documentation. A written report that details the differences in the standards in effect when the engine was manufactured and current standards can be a powerful argument warranting the replacement of older fire trucks.

Once information has been gathered in the seven areas identified, they should be examined to see which ones provide the most compelling reasons to replace the old fire engine with a new one. The documentation gathered in those areas can be presented to the governing authority as justification for the funding of new apparatus.

To justify the replacement of its two 1985 Pierce engines the Washington Township Fire Department should present documentation to their governing board in three areas. These areas are personnel safety, changing national standards, and rising maintenance costs. Impressive grounds for replacing the 1985 engines can be found in each of these categories.

The manufacturers of fire trucks have improved the safety features of their apparatus in several ways since 1985 when Washington Township Engine 224 and 225 were built. Apparatus built in 1998 have fully enclosed cabs and are more resistant to crushing in the event of a truck rollover. They have three-point seatbelts that include shoulder harnesses and come equipped with anti-lock brakes and interlock systems to prevent the accidental movement of the fire engine during pumping. New trucks also have additional perimeter lighting and noise abatement.

Several well-publicized vehicle accidents involving fire engines have occurred in the Indianapolis area over the last few years. In one of these accidents a fire fighter was killed and another permanently paralyzed. The fire truck was involved in a rollover type
of accident and was manufactured prior to the requirements for enclosed cabs and improvements in crush resistance. In two other fire truck incidents involving rollover accidents the passengers received only minor injuries. These trucks were built with fully enclosed crush resistant cabs. While other factors may have influenced the extent of the injuries received in these accidents, a forceful statement can still be made that all fire engines should have fully enclosed crush resistant cabs.

In fact, the current editions of NFPA 1500 and NFPA 1901 make fully enclosed cabs the standard for current fire truck manufacturers. Many other provisions that impact personnel safety are included in the current standards that were not in effect when the 1985 Pierce engines were manufactured. Maximum step heights, a provision for handrails, and additional warning lights and reflective striping, as well as controls limited to 72 inches above the standing position of the pump operator are current standards. Equipment in the driving and crew areas must be securely fastened or in a compartment. There are requirements for increased work lighting around the vehicle and better grouping of pump controls to keep the operator away from the intake and discharge outlets. The requirements for warning lights were rewritten to provide for different lighting when “calling for right-of-way” versus “blocking right-of-way.” Requirements for warning lights were increased so that greater visibility of the fire apparatus is provided. These changes in national standards are the second area that can be documented and presented as justification for replacement of Washington Township’s older fire engines.

The last compelling argument that can be documented and presented to the Township Board to justify the replacement of the 1985 Pierce engines is rising maintenance costs.
Figures for 1997 show that one of the 1985 Pierce engines, Engine 224, cost ten times more to maintain than any other engine. Records for the first six months of 1998 show that the other 1985 engine, Engine 225, cost six times as much to maintain as any other engine. To bring these engines into compliance with current NFPA standards by fully enclosing the cabs will cost another $30,000 per apparatus, driving their maintenance costs even higher.

The Chief of the Washington Township Fire Department has asked for documentation that will justify the purchase of two new fire engines. The 13-year old fire engines that the new engines would replace fall within the time frame when they should be considered for replacement. By presenting detailed information in the areas of personnel safety, changing national standards, and rising maintenance costs, the Chief can justify these purchases. Documentation on each of the other identified guidelines: obsolescence, availability of replacement parts, condition of major components, and change in mission, can also be used as secondary arguments to support his position.

There is one other factor that must be considered if funding cannot be secured for new fire engines. The issues raised concerning the 1985 Pierce engines must still be addressed. The department would be negligent in its responsibility to provide a safe working environment for its employees if it did not deal with the safety concerns and changes in national standards. At the very least, funding must be secured to refurbish the engines so that the cabs are strengthened and fully enclosed. Making the apparatus safer is the best argument for refurbishment but not the only reason it would be a wise investment. Money has already been spent to rebuild the engines in both trucks. The Chief has indicated that they may still be used in a reserve capacity or at a new station
when replaced as primary response vehicles. For these reasons, refurbishment is recommended if the fire engines are not replaced.
References


