

**“CUSTOM VERSUS COMMERCIAL CHASSIS APPARATUS”**  
**AN ANALYSIS FOR THE TULSA FIRE DEPARTMENT**

Executive Leadership

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## ABSTRACT

The Tulsa Fire Department had purchased both custom and commercial chassis apparatus since 1994. The problem was no thorough analysis had been conducted to determine which type of apparatus chassis best fits the needs of the department. The purpose of this research was to analyze features of both types of chassis to see which apparatus best fits the needs of the Tulsa Fire Department. The study used descriptive research methodology as well as historical techniques. The research questions were:

1. What are the basic differences between a custom chassis and a commercial chassis apparatus?
2. What is the difference in the purchase price of a custom versus commercial chassis apparatus?
3. What are the historical maintenance costs associated with the different types of chassis on the Tulsa Fire Department?
4. What are the opinions of Tulsa Fire Department mechanics who work on the different apparatus?
5. How do Tulsa Fire Department members rate the apparatus now in use on the department?

The procedures included research performed at the National Fire Academy Learning Resource Center, a survey of department members, interviews with department mechanics, and research of historical purchase prices and maintenance costs of the apparatus.

The results were that those basic differences between custom and commercial apparatus were identified and reported. The survey of department members as well as interviews with department mechanics showed a preference for the custom apparatus over the commercial

chassis apparatus. Historical data showed that the maintenance costs were lower for custom chassis versus the costs for commercial apparatus. Finally, the difference in the initial purchase price for custom trucks was approximately \$20,000 more than for the commercial chassis trucks produced from like specifications.

The recommendations included using this study to analyze future apparatus purchases, taking into account that the difference in initial purchase price of a custom apparatus may be offset by the increased maintenance cost of a commercial apparatus. Additionally, the preferences by the members who daily use the trucks as well as the mechanics who perform maintenance and repairs should be given a higher priority in the selection process. A more descriptive survey should be distributed to the members to further analyze what features they feel are important and needed for the apparatus to best fit their needs and the needs of the department. Finally, if funding sources remain consistent in the future, custom chassis apparatus should be the preference for future apparatus purchases for the Tulsa Fire Department.

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## INTRODUCTION

In 1994 the Tulsa Fire Department (TFD) made the first commercial chassis apparatus purchases. Prior to that year the apparatus purchased had been custom chassis apparatus made exclusively for the TFD. In a genuine effort to show prudence in the use of public funds, commercial chassis apparatus were introduced into the fleet. The initial purchase price of a commercial truck is less than their counterpart custom truck built from like specifications. The problem is no thorough analysis has been conducted to determine which type of apparatus chassis best fits the needs of the department. The purpose of this research is to analyze features of both types of chassis to see which apparatus best fits the needs of the TFD. The study uses descriptive research methodology as well as historical techniques. The research questions are:

1. What are the basic differences between a custom chassis and a commercial chassis apparatus?
2. What is the difference in the purchase price of a custom versus commercial chassis apparatus?
3. What are the historical maintenance costs associated with the different types of chassis on the Tulsa Fire Department?
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## **BACKGROUND AND SIGNIFICANCE**

### **Apparatus**

The TFD currently has 30 fire stations that house a total of 47 apparatus. Current resources include 29 engines, 11 ladders, 2 truck units, 2 haz-mat units, and 3 ARFF units. The breakdown of custom and commercial vehicles is that 31 are custom chassis apparatus and 16 are commercial chassis apparatus. The first commercial chassis units were purchased beginning in 1994. In 1999, eight commercial pumpers were purchased but many problems were identified shortly after placing them into service. Turning radius, braking distance, brake replacement, and maneuverability were just some of the problem areas identified by members and by the Safety and Engineering Division.

### **Apparatus Replacement**

The TFD has the good fortune to have an aggressive apparatus replacement program supported by data from the City of Tulsa Equipment Management Division (EMD). EMD recommends replacing engines on a 10-year cycle for front line apparatus and replacing ladders and trucks on a 20-year cycle for front line use.

### **Funding**

The funding for this program is provided for by a 1994 general obligation bond and a 1996 one-cent sales tax. This allows for funding to continue each year without having to fund apparatus purchases through the city's regular general fund. The current program is funded through 2003, and the request for the extension to 2008 has already been placed before the Mayor and City Council. The amount of monies for apparatus purchases from these sources is around 2.2 million dollars per year.

### **Maintenance Division**

The City of Tulsa provides an in-house maintenance division with mechanics dedicated to repairing all fire department apparatus and vehicles. Maintenance records are kept on each individual apparatus and costs are calculated on a per mile basis.

### **Executive Leadership Course**

This research project is related to the Executive Leadership Course, Module 9, relating to Persuasion. One aspect of persuasion is to provide compelling positions and evidence to support one's issues or ideas.

## **LITERATURE REVIEW**

According to John Lee Cook (1989), the first motorized fire apparatus delivery was a 300 gallon per minute, dual gasoline engine pumping unit manufactured by the Waterous Company. It was purchased by the Radnor Fire Company of Wayne, Pennsylvania in 1906. The acceptance of motorized fire apparatus, like so many technological advances, was neither immediate nor overwhelmingly enthusiastic. Many departments continued to use the traditional horse-drawn fire apparatus until the 1920's. Since those very humble beginnings, apparatus have undergone many dramatic modifications and improvements. More choices, options and features are available today than ever before. Cook points out that one of the major decisions is which type of chassis should be specified. This is an age-old question that has yet to be resolved.

Both commercial and custom chassis are available in a wide range of sizes, shapes, and price tags. Generally, all major types of engines, transmissions, rear ends, and so on are also available in both style of chassis. The choice is

usually a matter of individual preference. (p. 83)

Cook points to several advantages for both commercial and custom chassis apparatus. Some of the main advantages of the commercial vehicles are:

1. Lower initial cost.
2. Local availability of parts and service.
3. Easier access to engine compartments.
4. More economical to re-chassis.
5. Improved visibility and handling.
6. Manufacturer's successful track record with chassis model type.

The advantages he lists for custom chassis apparatus are:

1. Heavy-duty chassis and components.
2. Maximum flexibility for design and function.
3. Longer life expectancy.
4. Specifically built for the fire service.
5. More appropriate for aerial application.
6. Appearance.

Along with the advantages, he discusses some of the disadvantages of each chassis.

The disadvantages of the commercial chassis as listed by Cook are:

1. Limited seating capacity.
2. Limited visibility.
3. Limited turning radius.
4. Not conducive to aerial applications.
5. Height and overall length less desirable.



Among the disadvantages he lists for the custom chassis are:

1. Higher initial costs.
2. Higher repair costs.
3. Past history of manufacturers going out of business.
4. Unavailability of local parts and service.

In his final analysis, Cook does not recommend one chassis type over the other, but recommends buyers explore the various alternatives available and select the chassis type that is appropriate to the task and affords the maximum safety and comfort to the personnel who will use the apparatus.

Chris Cavette (1999) states that when a department is building an apparatus from the ground up, your choices start at the bottom with the type of chassis. The department should look at what they need the apparatus to do before they decide on the chassis. It really depends upon the mission for which the apparatus is to be used. In this article he points to the advantages of custom chassis vehicles and the features that make them desirable. Maneuverability, tighter curb-to-curb turning radius, ride, handling, and ease of entry and exit are just a few of the reasons to buy a custom apparatus. Another major factor pointed out as an advantage for the custom chassis apparatus was that all the systems are built into the chassis rather than being added on, the way they are with commercial chassis. This results in better reliability and cuts down on modification costs. Finally, he observes that some custom chassis have more attractive standard warranties in certain areas such as cab structure, cab corrosion, frame rails.

Chris Cavette (2000) points out that the debate pitting custom against commercial chassis has been going on since the first Model T Ford was adapted for the fire service. He states that

both custom and commercial chassis can be excellent choices for fire apparatus. The real issue is what you need. Commercial trucks usually have a lower initial purchase price, which may appeal to departments with restricted budgets. The proven durability and reliability of the product was cited as the number-one reason to buy commercial. Additionally, commercial chassis manufacturers have a larger dealer network, which can mean better parts and service availability. In conclusion he states that some departments may find a custom chassis better for them and other may find a commercial chassis is better. The choice is theirs.

“Most people believe fires are extinguished with water. Actually, they are extinguished with money” (Rosenhan, 1987, p. 45). The question of custom versus commercial chassis is one issue that may never be completely resolved, but there are several things to consider when making that decision. Many things go into making the choice of which chassis to buy. Some of those are local custom, personal preference, politics, and a host of other rationale. The decision should be based upon facts and figures based on local conditions and be made in a professional and organized manner. Rosenhan points out the classic argument that commercial chassis last about 15 years and custom chassis can be expected to last about 20 years. He further points out that the power train options and engines as well as transmissions, pumps, and axles of either custom or commercial are basically the same. A real problem arises with commercial units when there is a problem as to who will fix the chassis. The local dealer, who has the parts and expertise, probably did not sell the chassis and has no interest in fixing the problem. The manufacturer doesn't have the local resources and parts to do it at all. Salvage and trade-in cost should be another consideration in the final cost analysis for any type of apparatus.

Glenn Usdin (2000), a used apparatus broker in Landisville, Pennsylvania, discusses the retained value of custom and commercial chassis and points out that custom cabs and chassis retain their value up to 50% of their initial value over five years.

Jim Wilkins (2000), in his article on chassis selection criteria, includes a quote from Jim Hebe, President and CEO of the Freightliner Corporation. Mr. Hebe refers to the cab and chassis as the foundation on which everything else depends. He further states that the chassis gets the hardest workout of any truck component and has been willfully ignored as the key component of a fire truck. Wilkins continues to emphasize the importance of the chassis and the problems that historically plagued fire apparatus when they failed. It is not uncommon for fire apparatus of all types to experience a chassis problem or failure of some type at some point in its service life. He also states that weak chassis can be credited for many failures of other fire apparatus components. These types of problems can be avoided by fire departments gaining some very basic knowledge.

John Horton and Danny Tiller (personal communication, September 13, 2000) confirmed many of the listed advantages and disadvantages that were stated in the above articles. Both men have been employed by EMD for many years and perform the majority of maintenance and repairs on the TFD apparatus. The one main advantage they pointed out for the commercial trucks was the availability of parts. They can find items like windshields, doors, windows, and body parts readily available in Tulsa through a local vendor and can receive the part in a short period of time. However, that is where the advantages ended from their point of view. They both confirm that the custom trucks are easier to work on and that less time is required to perform the work. This is due to all systems being integrated together and built by one source. The wiring, electrical and electronic systems are color-coded and consistent throughout the entire

vehicle. The heating and air conditioning systems are built to handle the size of the cab efficiently. The structures of custom trucks are built to withstand the rigorous use of the fire service. As Tiller pointed out, commercial trucks are built more for over-the-road type of uses, but not for the needs and harsh use encountered as a fire apparatus. Horton stated that although commercial trucks have a purpose for some departments, Tulsa really benefits from using the custom trucks. In his opinion, if a department only makes a few runs a year, the commercial apparatus would probably be the best choice. However, some of our trucks make 1800 or more runs per year and the TFD will be better served by the custom chassis variety of apparatus.

The information gained through the literature was very consistent among the sources, with very few conflicts. One begins to realize the many different issues involved in making sound purchasing decisions. There is certainly more than just initial purchase price of an apparatus that should be looked at when evaluating a department's apparatus needs. As all the authors pointed out, it is really up to the individual department to decide which chassis type to purchase. Both commercial and custom apparatus have a place in the fire service. Now it is up to the TFD to look at these choices in a more informed manner and make sound financial and safety decisions relating to fire apparatus. The information shared by the TFD mechanics would certainly lead one to believe that for the TFD a custom chassis apparatus is the choice that makes sense.

## **PROCEDURES**

### **Research Methodology**

The desired outcome of the research project was to develop information that would assist the department administration in future apparatus purchases. There should be more than just the consideration of initial purchase price that determines the type of apparatus that best fit the needs of the department. The research methodology was descriptive based, supported by historical methods.

### **Literature Review**

The review of literature was conducted at the Learning Resource Center (LRC) at the National Fire Academy (NFA) in Emmitsburg, Maryland. The search was conducted on the subjects of custom and commercial fire apparatus.

### **Personal Communications**

Personal interviews were conducted with two fire department mechanics who perform the majority of the work on the TFD's apparatus. Both mechanics have been with the City of Tulsa for several years and also have been a part of the specification and inspection process for new apparatus purchases.

### **Survey Description**

A survey was distributed to all Relief Fire Equipment Operators (RFEO), Fire Equipment Operators (FEO), and Fire Captains (FC) on the TFD. This was a total of 575 surveys. Of the total number of surveys distributed, 322 were returned for a response rate of 56%. The survey was conducted in such a manner that the participants did not know that the study was a comparison of custom versus commercial apparatus, rather they were asked only to rate the

apparatus to which they are currently assigned. View Appendix A, page 22, for a copy of this survey.

### **Assumptions and Limitations**

Information relating specifically to custom and commercial chassis apparatus comparisons was limited to a few magazine articles. However, though the quantity was limited the subject matter directly related to the subject of this research and proved helpful.

The survey was conducted only within the TFD and a survey of other fire departments was not conducted. An outside survey could have given a broader perspective on the subject. The survey also did not reveal that the data would be used to compare custom against commercial apparatus, as the author believed this information could influence the respondents and prejudice their answers.

Maintenance cost comparisons and purchase price comparisons were limited to engine apparatus since no ladder or truck apparatus in the TFD fleet were of the commercial type. Maintenance cost comparisons were based upon a cost per mile basis and did not take into account the age of the apparatus. In the four-year comparison of engine apparatus purchase prices, the years were not the same four years. The custom chassis four-year average was for years 1995 through 1998 and the commercial chassis four-year average were for years 1996 through 1999. This was the closest comparison that could be conducted due to the purchase dates of the different types of chassis.

### **Definitions**

Custom Chassis Apparatus – A fire apparatus built from a department's specifications exclusively for the fire service for fire suppression or other related fire and rescue activities. A single manufacturer generally builds all components, features, and systems of the custom

apparatus. However, in some cases they can be built by more than one manufacturer but all are fire apparatus manufacturers.

Commercial Chassis Apparatus – A fire apparatus built from a department's specifications whose cab and chassis portion is built by a manufacturer that builds chassis for a number of different uses. The cab and chassis are then sent to other manufacturers to modify and add fire suppression or other related fire and rescue equipment for use as a fire apparatus.

## RESULTS

### Chassis Comparisons

All authors cited in the review of literature stressed the importance of the chassis in the overall makeup of a fire apparatus. Jim Wilkins (2000) called it the foundation on which everything else depends. Cavette (1999) gave an enlightening list of advantages of the custom chassis apparatus that compared to the same advantages for custom chassis as given by Cook (1989). They both also agreed very closely on the advantages for commercial chassis apparatus. Cook (1989) did go a step further and pointed out the disadvantages for both types of chassis. The fact that a custom chassis can retain more value over a commercial apparatus was given as a main point in the article by Glenn Usdin. (2000)

The main differences in the discovered advantages in the above articles were:

<u>Custom Chassis</u>	<u>Commercial Chassis</u>
All systems built into chassis	Lower purchase price
Better maneuverability	Better engine access
Better Ride	Proven durability
Better turning radius	Larger dealer networks

Ease of exit and entry	Local parts and service availability
Better appearance	More economical to re-chassis
More interior space for seating	
Better standard warranties	

The main differences in the discovered disadvantages in the above articles are:

<u>Custom Chassis</u>	<u>Commercial Chassis</u>
Higher initial purchase price	Limited seating
Local parts and service unavailable	Limited visibility
Higher repair costs	Overall height and length less desirable
	Lighter duty chassis will not hold up
	System must be modified

### **Purchase Price**

The initial purchase prices of the custom apparatus bought by the TFD are higher than those of commercial chassis apparatus. Three different comparisons were made between custom engine apparatus and commercial engine apparatus. First, initial purchase prices of all custom engines were compared to all commercial engines. The average purchase price for custom was \$220,652 compared to \$217,057 for commercial, a difference of only \$3595. Secondly, the oldest custom engines purchased in 1998 were taken out of the comparison. This compared custom engines purchased from 1992 to 1998 against commercial engines purchased from 1994 to 1999. The average purchase price for custom was \$237,211 compared to \$217,057 for commercial, a difference of \$20,154. Finally, a four-year comparison was conducted comparing



custom engine apparatus purchased from 1995 to 1998 with commercial engine apparatus purchased from 1996 to 1999. The average purchase price for custom in this case was \$254,550 and for commercial \$234,562, a difference of \$19,988. See Appendix B, page 24 for charts comparing the purchase price data.

### **Maintenance Cost**

Two different maintenance cost comparisons were conducted, both based upon a cost per mile basis. First, all custom chassis engine apparatus were compared to all commercial chassis engine apparatus. The results were that the per mile maintenance cost for custom apparatus was \$1.11 compared to commercial apparatus at \$2.63, a difference of \$1.52 per mile. Secondly, the highest and lowest apparatus maintenance cost was eliminated from the average for the comparison due to one commercial apparatus having an extremely high cost record. The adjusted average showed that the cost for custom was \$0.78 compared to commercial of \$1.00, a difference of \$0.22 per mile. See Appendix C, page 26 for chart comparing the maintenance cost per mile.

### **Mechanic's Opinion**

John Horton and Danny Tiller (personal communication, September 13, 2000) confirmed much of the information gained from the literature review. Only one main advantage was recognized from a maintenance standpoint for the commercial apparatus and that was the availability of parts and service. Many advantages were cited by both men for the custom apparatus. The fact that all components are built by one source and integrated together made

them easier to work on and the time required for repairs reduced. When asked, both agreed they would rather work on a custom chassis truck over a commercial chassis truck.

### **Member's Rating**

The results of the member survey revealed an overall preference or satisfaction with the custom chassis apparatus over the commercial chassis apparatus. In all but two categories the custom apparatus rated higher than the commercial apparatus. These two categories were Accessibility of Tools, and Equipment and Storage Capacity for Tools and Equipment. Two other points of interest were the categories of Engine Power and Pumping Capabilities. In these two categories the commercial engine apparatus rated relatively equal with the custom apparatus. This adds some validity to the survey since the power supply in both these apparatus is the same. See Appendix D, page 28- 29 for data and chart comparing the results.

## **DISCUSSION**

One of the major advantages of purchasing commercial chassis apparatus is that the initial purchase price is lower compared to custom chassis apparatus. In fact, most all of the sources (Cavette, 1999; Cavette 2000; Cook, 1989; Rosenhan, 1987) agreed to this fact. When the TFD historical data developed from this research was calculated, the difference in the average purchase price of a custom apparatus compared to a commercial apparatus was around \$20,000 more for a custom chassis.

When maintenance costs are taken into account the advantage falls to the custom chassis apparatus. The TFD average maintenance cost per mile for a custom truck was \$ .078 compared to \$1.00 per mile for a commercial truck. Over a life span of 100,000 miles this would be a saving of \$22,000 which offsets the \$20,000 difference in the initial purchase price cited above.

The TFD apparatus survey showed a preference for the custom apparatus over the commercial apparatus. The most telling categories were road handling, maneuverability, and turning radius. These were issues that were also brought out as advantages for the custom apparatus by the articles (Cavette, 1999; Cook 1989) studied as a part of this research.

John Horton and Danny Tiller (personal communication, September 13, 2000) confirmed many of the basic advantages as discussed above, but concentrated their responses relating to the maintenance and repair of the vehicles. Both favor working on custom apparatus over the commercial vehicle for a number of reasons, but it comes down to convenience, cost, and time.

The purpose of this research was to analyze features of both types of chassis to see which apparatus best fits the needs of the Tulsa Fire Department. In the final analysis, it is up to the individual departments which apparatus should be purchased. In the TFD situation, several factors pointed out in this research should be weighed. The higher initial purchase price of a custom chassis apparatus seems to be offset by the increased maintenance cost for a commercial vehicle. The personal comfort, ride, handling, and overall performance of the custom vehicles seem to be favored by the TFD membership that participated in the survey. The mechanics who perform the daily maintenance on the apparatus also favor the custom apparatus over the commercial type. Taking these factors into account one begins to see that the pendulum begins to swing in favor of purchasing custom chassis fire apparatus for the TFD.

## RECOMMENDATIONS

The recommendations include using this study to analyze future apparatus purchases, taking into account that the difference in initial purchase price of a custom apparatus may be offset by the increased maintenance cost of a commercial apparatus. Additionally, the preferences by the members who daily use the trucks as well as the mechanics who perform maintenance and repairs should be given a higher priority in the selection process. A more descriptive survey should be distributed to the members to further analyze what features they feel are important and needed for the apparatus to best fit their needs and the needs of the department. Finally, if funding sources remain consistent in the future, custom chassis apparatus should be the preference for future apparatus purchases for the TFD.

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*Appendices Not Included. Please visit the Learning Resource Center on the Web at <http://www.lrc.fema.gov/> to learn how to obtain this report in its entirety through Interlibrary Loan.*