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DATA BASE DEVELOPMENT OF AUTOMOBILE AND LIGHT TRUCK MAINTENANCE

VOLUME I - Text and Appendixes A-D

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AUGUST 1978

FINAL REPORT

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16. Abstract

This volume describes the development of the life cycle maintenance costs for 212 sales-leading 1970 through 1975 passenger cars and light trucks. These costs provide a data base for the Department of Transportation, which describes the costs for parts and labor for performing both the scheduled (manufacturers recommended) and typical unscheduled (replacement of worn out parts) maintenance for each of these 212 vehicles. The actual data base is contained in Appendices E and F which are bound separately in Volumes II and III. This report also describes where the service work is performed during the vehicle life cycle.

In addition, the automotive service industry has been characterized. This characterization includes the facility (building) costs, land requirements, tools and equipment requirements, inventories investment costs and operating capital required to operate a service establishment. The major types of service facilities which perform most of the commercially done repair work were characterized. These establishments are representative of the 29,600 new car dealers, 86,200 gasoline service stations, 30,650 independent repair garages, and 12,280 specialty shops in existence in 1975.

The policies used by the service industry in pricing replacement parts are also presented. The report details the price discounting policies of the industry parts suppliers, including the automobile manufacturers and aftermarket parts manufacturers, as well as those of the parts distribution system (jobbers, new car dealers, oil companies, and specialty shops).

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PREFACE

This development and analysis of the Repair and Service Maintenance Data Base was performed for the U.S. Department of Transportation, Transportation Systems Center by the Automotive Technology Group at Arthur D. Little, Inc., under Contract Number DOT-TSC-1047. The work was done under the guidance of Mr. Sanuel F. Powel, Ms. J. H. DeBlois, and Mr. James Kakatsakis, Technical Monitors at DOT/TSC. The Program Manager was Mr. Donald A. Hurter, assisted by Mrs. Nancy Gardella and Mr. Philip G. Gott.

We would like to thank the Chilton Publishing Company, and in particular, Mr. James Milne, as well as many others in the automotive industry for their contribution to the development of the vehicle maintenance data base.

This is a three-volume report - Volume I presents a data base of the automobile and light truck service and repair industry and the current maintenance requirements of 212 domestic and foreign cars and light trucks through the years 1970-1975. Volume II includes the total cost summaries of Scheduled and Unscheduled Maintenance and Appendix E, Scheduled Maintenance Data Sheets. Volume III includes Appendix F, Unscheduled Maintenance Data Sheets.

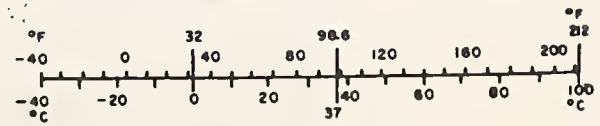
METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
in	inches	2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
		AREA		
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
	acres	0.4	hectares	ha
		MASS (weight)		
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
		VOLUME		
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
		TEMPERATURE (exact)		
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
		AREA		
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
ha	hectares (10,000 m^2)	2.5	acres	
		MASS (weight)		
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
		VOLUME		
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m^3	cubic meters	35	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
		TEMPERATURE (exact)		
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F



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1. EXECUTIVE SUMMARY

1.1 INTRODUCTION

A data base has been developed which contains complete scheduled and unscheduled maintenance costs for 212 automobiles and light duty trucks. The actual compilation of the data base was done in 1976-1977 for model years 1971-1975. In order to continue the real time analysis of effect of the technological innovations currently being incorporated in production vehicles, the maintenance requirements, frequencies and costs should now be updated to include the 1976-78 model years as part of a continual effort.

This report presents not only the actual maintenance data but the assumptions, conditions and constraints which were necessary to develop a comprehensive set of data. In addition detailed information on the facilities, tooling, capital investment, labor and materials which are required to perform this maintenance has been presented. In order to complete the maintenance description, an extensive analysis of the repair and service industry's pricing policies has been done.

a. The commercial automotive repair and service industry consists of new car dealers, gasoline service stations, independent repair garages, and specialty service shops. Each of these types of establishments has been characterized by facility costs, land requirements, tools and equipment required, inventory investment, and the required operating capital.

b. In 1975, the total number of service establishments has been determined to be approximately 29,600 new car dealers, 86,200 gasoline service stations, 30,650 independent repair garages and 12,280 specialty service shops.

c. The total replacement cost of these establishments would be $25.3 billion (includes facility, land, tools and equipment). An additional $4.3 billion would be required for inventory and operating capital. This brings the total investment that would be necessary to replace all of these service establishments to $29.6 billion.

1.2 REPAIR AND SERVICE INDUSTRY PRICING POLICIES

Parts

a. In order to analyze the service industry's pricing policies, four representative vehicles manufactured domestically and two foreign vehicles were chosen. Prices of 10 non-proprietary parts such as spark plugs and mufflers and 10 proprietary parts such as grill and fuel tank were examined for each of the 6 vehicles at various service facilities and distribution levels.

b. For a non-proprietary part the dealer list price would be comparable to the jobber list price. For proprietary parts the dealer discount level would be slightly lower than that on non-proprietary parts.

c. List prices for parts sold by the new car dealers are reasonably competitive with parts supplied to other service facilities by jobbers. One cost comparison shows a variation between dealer and jobber of $1.79 on $829.49 worth of parts.

d. The most common discount for both domestic and foreign new car dealers is 40%.

e. Discounts for slower moving proprietary parts are generally below average, similarly an increased discount is applied to the faster moving non-proprietary parts. Engine assemblies and automatic transmission assemblies generally carry a reduced discount.

f. The automobile manufacturers often offer additional allowances to the new car dealer. These are the stocking allowance, an incentive to provide minimum orders of specific parts at specific times and the redistribution allowance on parts sold to the trade where the dealer is acting as a distributor. The effect of these allowances is to increase the car dealer percent gross profit.

g. Jobbers have four or five different price levels from highest to lowest - first price, net user price, service trade and stocking trade price. Jobber gross profit ranges from 40-53% to walk in level and from 31-38% to the trade.

h. Many rebuildable parts such as front brake shoes and starters are traditionally supplied as rebuilt by the jobbers at a lesser price than dealer list price.

i. A foreign car parts jobber earns a gross profit of approximately 22%, if he serves as a distributor his costs carry a greater discount and his gross profit is about 30%.

j. In general, specialty shops purchase their parts from their parent company or franchising company.

Labor Rates

a. Labor charges are normally computed as an hourly rate multiplied by a standard time specific to the particular vehicles. This standard time is not necessarily the actual time spent on a particular repair.

b. Standard times are listed in Flat Rate manuals

c. Labor charges for common repair operations are often quoted as a constant "job" price by service stations, not accounting for actual time differences between vehicles.

d. Specialty shop profitability is based on larger parts discounts and reduced labor time due to the efficiencies of specialization. The facility must operate near maximum capacity to be profitable due to the large equipment investment.

e. Although the car dealers labor rate varies by type of dealership and demographic factors, an estimate of a reasonable national average was used, with consideration of a typically higher rate for luxury car dealers.

f. Most independent repair shops and service stations do not charge for labor for scheduled maintenance when a parts sale is made.

g. In general the car dealer labor rate is highest followed by the independent repair garage and then the gasoline service station. In addition, luxury car dealers rates are higher than those of standard size car dealers.

1.3 VEHICLE MAINTENANCE DATA BASE

a. Scheduled Maintenance

1. Scheduled maintenance costs are based on manufacturers recommended maintenance schedules

2. The total life cycle scheduled maintenance costs averaged across all vehicles examined is approximately $1100, if performed. With a few minor exceptions, the recommended scheduled maintenance for all vehicle models of one manufacturer are basically the same.

b. Unscheduled Maintenance

Nineteen potential sources of detailed unscheduled maintenance data were reviewed. It was concluded in each case that either the data was not credible, or not typical of normal usage. Therefore common wear factor frequencies were developed for the unscheduled maintenance items in lieu of actual vehicle data.

1.4 WHERE MAINTENANCE IS PERFORMED

a. During the life cycle of a typical vehicle, the establishment where maintenance is performed charges as a result of the vehicle's age. In the beginning the average car is serviced at a car dealer - primarily scheduled maintenance. In the second and third years the average vehicle is serviced more often at the other three establishment types. By the end of the third year unscheduled maintenance is becoming a factor. The fourth year, the average vehicle changes hands so service is again done at the dealer - both scheduled and unscheduled. For major items the car returns to the dealer during the fifth and sixth year, but other maintenance is done either by the owner or at the other less expensive establishments. In the seventh thru tenth year, much maintenance is done by the owner, tires and batteries by TBA dealer or mass merchandisers and the remaining maintenance divided equally among the four establishments.

b. After the first two years the do-it-yourself market is the single most dominant service facility outside the car dealership.

c. The total 1974 aftermarket sales percentage are compared at 12.7% for car dealers, 38% for service stations, 8.3% for independent repair and specialty shops and 19.1% for TBA, mass merchandisers and D-I-Y.

1.5 GENERAL TRENDS IN THE POPULATION OF SERVICE ESTABLISHMENTS

a. More sophisticated equipment (pollution controls, electronic ignition, etc.) and the growing population of import cars, will tend to increase the amount of service being performed by car dealers. "Factory trained" and certified mechanics, expensive equipment and availability of parts will be a necessity to compete in the market.

b. Periodic Motor Vehicle Inspection (PMVI) programs could also influence the maintenance market. Currently, all but 17 of the 50 states have a PMVI program. Three of these states have state owned and operated systems. The other 31 states operate through licensed, private inspection stations such as service stations, car dealers, independent repair shops.

c. The TBA dealers and mass merchandisers service centers are expected to continue increasing their share of the maintenance market through aggressive merchanidising. High costs of maintenance under current economic conditions will continue to encourage the do-it-yourself market.

d. A shift of maintenance being performed by D-I-Y contigent to conventional service establishments would require major investments in service facilities.

e. Service stations are the only establishment failing to show sales gain.

f. The interest of major oil companies to operate high volume "gas only" service stations may continue. Of the 226,459 stations reported in the 1972 Census, only 145,268 reported sales of TBA and parts and only 97,440 indicated service labor sales. If this trend continued, establishments other than service stations will be utilized for maintenance.

2. INTRODUCTION

2.1 BACKGROUND

Since the mid 1960's, the automotive industry has had to equip its automobiles with an ever increasing amount of hardware and equipment in order to meet regulatory standards for safety and emissions. This trend towards increasingly complex light duty motor vehicles is expected to continue until at least the mid 1980's, and probably beyond, due to the impact of regulatory requirements such as more stringent emission standards, improved fuel economy, and increased crashworthiness and accident avoidance.

The associated hardware and equipment necessary to meet the regulatory requirements has undoubtedly increased the first cost as well as the life-cycle costs of automobiles.

2.2 PURPOSE

In order to assess just what the impact of future regulatory requirements will be upon vehicle life cycle maintenance costs, the United States Department of Transportation desired to establish a data base of current (1970-1975) vehicle repair and service costs, and to determine just how the introduction of technological innovation can impact these costs. For this reason, the Transportation Systems Center engaged Arthur D. Little to prepare a data base examining the typical life-cycle (100,000 mile) costs of servicing and repairing each of 212 different sales leading cars and light duty pickup trucks. Excluded from the scope of this study were body, paint, top, glass and upholstery shops.

Arthur D. Little was also requested to estimate the impact of various technological innovations upon these costs in order to establish future trends in maintenance costs. For undefined innovations not covered in this program, Arthur D. Little developed a plan by which their impact upon life cycle maintenance costs may be qualitatively assessed. This information can be used by the Department of Transportation to assess the impact of future regulatory requirements upon the owner's costs of servicing and repairing his cars.*

2.3 SCOPE

The maintenance costs of automobiles was found to be dependent upon:

a. The Type of Repair Establishment
   - Dealer
   - Gasoline service station
   - Independent repair garage
   - Specialty shop

---

*See Report No. DOT-TSC-NHTSA-78-39.

b. Labor hours required to inspect, repair, or replace vehicle components

c. Source of parts as it influences parts prices
   - Dealer
   - Jobber
   - Specialty shop

d. Frequency and extent of manufacturers recommended maintenance operations (scheduled maintenance)

In order to determine the costs typical of each establishment type, "typical" establishments were characterized by type and cost of:

a. Buildings

b. Land

c. Tools and equipment

d. Investment
   - Inventory
   - Operating capital

Parts sources used by each establishment type were characterized by their discount and stocking and redistribution allowance practices.

The manufacturers recommended maintenance schedules (scheduled maintenance) for each make, model, and year of vehicle were studied. The assumption that vehicle owners follow this scheduled maintenance, the labor times required to perform the recommended service, the type of service establishment and the parts supplier (which determines parts prices) were combined to determine the costs for the performance of the scheduled maintenance for each make, model, and year vehicle in the data base. These costs were established for the life of the vehicle (100,000 miles).

The costs for the replacement of components, which may wear out (unscheduled maintenance) at some point during a vehicle's lifetime were determined. The fundamental assumption underlying the determination of these costs is that all similar components wear out at the same rate which is independent of the make, model, or year or usage of a vehicle. The costs for unscheduled maintenance in this data base are therefore only a function of the labor hours required to replace the failed components, the service establishment performing the maintenance and the parts supplier. For unscheduled maintenance then, the costs for labor and the cost of the part

are a function of the vehicle make, model, and year. The frequency with which unscheduled maintenance operations must be performed is the same for all vehicles.

Using these methodologies, the life cycle maintenance costs were determined for each of 212 different makes, models, and years of passenger cars and light duty pickup trucks were determined. A list of all the vehicles studied is presented in Appendix C.

In a typical life-cycle, the various owners of a given car will most likely have the maintenance work performed at different types of establishments. This report therefore describes the types of establishments which service the various types of cars throughout their useful life.

3. OVERVIEW OF THE REPAIR AND SERVICE INDUSTRY

The automotive repair and service industry is primarily made up of new car dealers, service stations, independent repair garages, and specialty shps. Do-it-yourselfers (D-I-Y) are also a significant factor in the repair and service of the nation's fleet, but are an unorganized, non-commercial factor and we therefore do not consider them a part of the industry, per se. Throughout its normal life, a typical motor vehicle will be serviced by all of these repair and service establishments at some time or another.

As the name implies, new car dealers are primarily in the business of selling specific makes and models of new cars. These dealers also have a service department which is capable of preparing new cars for sale and delivery, performing warranty work, and also servicing a limited number of out of warranty cars. New car dealers also maintain a more or less complete stock of parts which fit only the makes and models of cars they sell. As such, the dealers serve as a source of parts manufactured by or for the original vehicle manufacturer (OEM). These dealers therefore sell parts not only to their own service customers, but are a source of those proprietary parts which are not available through any other source.

Service stations, for the purpose of this report, are defined as those members of the industry which sell a major brand of gasoline and are therefor connected with major oil company, and which also perform repair and service work on automobiles. These establishments perform a wide variety of repairs and carry a slected inventory of fast moving parts.

Many of their parts are supplied to them by their parent oil company who supply a so-called tire, battery and accessory (TBA) line of parts. The TBA line usually includes tires, batteries, radiator hoses, fan belts, shock absorbers, universal joints, tune-up parts, light bulbs and filters.

Other parts are usually obtained on demand from local auto parts stores (jobbers) or dealers. The service stations will recieve a discount from the parts they buy, and then charge the customer list price.

Independent repair garages are those establishments which do general repairs only, and are not in the business of selling a major brand of gasoline. These shops may also carry a limited selection of fast-moving parts on hand. Unlike the service stations, however, these shops depend entirely upon jobbers and dealers for their parts which they purchase at a discount and sell for list price. Because these shops depend upon service and repairs as their sole source of income, these shops may also be better equipped to do a broader range of repairs than the gasoline service station.

Specialty shops, of course, specialize in a specific type of repair, such as mufflers or transmissions, or they may service an area of the car, such as the undercarriage, for which they might service exhaust systems, shock absorbers, and brakes. These shops generally carry a complete supply of their own parts. Because such shops are usually run on a franchise basis, they carry their own branded parts, only, and are supplied by their own national supply system.

With a few exceptions when the owner takes his car to one of these commercial establishments, he will pay for parts and labor, itemized separately on his bill. The price he pays for his parts is normally the list or retail price recommended by the manufacturer of the part. The labor charge is normally computed as an hourly rate multiplied by a standard, accepted time for performing the particular repair on that particular car.

These standard times are listed in so-called Flat Rate Manuals published by Chilton, Hearst, and others. These manuals are developed by obtaining from the vehicle manufacturers the time which the manufacturer has determined is required for performing a given repair on a new car. The publisher of the flat rate manual usually increases this time somewhat to allow for increased difficulty due to the accumulation of rust and dirt on a car which has been in service for some time.

It is important to note that the labor charges customarily reflect the repair time established by the flat rate manuals rather than the actual time spent on each repair. Regardless of the time a mechanic spends on a specific job, the customer is charged for the time indicated by the flat rate manual.

There are a few exceptions to this. The most common exception being oil filter and oil changes for which the customer pays only for the list price of the oil and filter. The labor involved in the oil change appears to be uncharged or 'free'. In actual practice, with items such as these, the repair establishment considers that the labor is paid for out of the profit made in selling the oil and filter.

Another exception to itemized and/or flat rate charging is the shop which specializes in one type of repair, such as installing new brakes. These specialty shops generally have one price for a specific job on a wide variety of vehicles. For the various vehicles specified, there is a fixed price for a given job regardless of the actual time required and the cost of the part. These shops may also charge a fixed, total price for a given job on a given car, and not charge separately for labor and materials.

4. REPAIR AND SERVICE ESTABLISHMENT CHARACTERISTICS

A large number of commercial service establishments are required to maintain the entire automobile and light truck fleet. These establishments are in the form of new car dealerships, gasoline service stations, independent repair garages and specialty service shops.

This section of the report will characterize these establishments by their replacement costs,(the costs of replacing the land, the buildings and other facilities, and the tools and equipment) their investments in parts inventory and operating capital, and their portion of the total repair and service market. The categorical characterizations of cost and investment also include characterization of the type of facilities and tools typical of each establishment.

The total cost of a repair and service establishment is the sum of the replacement costs and the necessary investment as presented in the following portions of this Section.

4.1 REPLACEMENT COSTS OF EACH ESTABLISHMENT TYPE

Service facilities for the entire automobile and light truck represent a considerable investment. The 1975 total replacement cost of these establishments is just over $25 billion as shown in Table 4.1 Using a representative establishment from each of four types, the replacement cost of each representative establishment is shown in terms of facility costs, land costs, and tools and equipment costs.

4.1.1 Facility Costs

Facility costs include the cost of making site improvements constructing the necessary building, providing necessary furnishings and the cost of specialized, built-in equipment such as lifts and compressors.

4.1.1.1

New Car Dealership. Facility costs for new car dealerships were established by combining new car manufacturer's recommended specifications for various planning volumes (PV). These specifications were applied to various construction cost factors to determine actual construction costs based on July 1975 values.

TABLE 4.1 REPLACEMENT COSTS OF SERVICE ESTABLISHMENTS
(Dollars)

	New Car Dealer 300 PV (15 Bays)		Service Station (3 Bays)	Independent Repair Garage (5 Bays)	Specialty Shop (4 Bays)
	New and Used Car Sales	Repair and Service			
Facility	146,000	203,000	128,000	70,000	79,000
Land	12,000	12,000	11,000	10,000	10,000
Tools and Equipment	-	70,000	4,590	25,180	17,300
Total 1975 Replacement Cost	158,000	285,000	143,600	105,200	106,300

Total Replacement Costs all Service Establishments

	Number Facilities		Cost/Facility		$ Billions
Car Dealers	29,600	x	285,000	=	8.4
Service Stations	86,200	x	143,600	=	12.4
Independent Repair	30,650	x	105,200	=	3.2
Specialty Shops	12,280	x	106,300	=	1.3
				TOTAL	$25.3

Sources: References 17-43, 46,70,52-87, 140

TABLE 4.2 SPECIALTY SHOP REPLACEMENT COSTS ($)

	Muffler Brakes Shocks 5 Bays	Transmission Repairs 6 Bays	Diagnostic and Tune-Up 2 Bays	Radiator and Air Conditioning 2 Bays	Tune-Up Brakes Air Conditioning 5 Bays	Alignment Brakes Shocks 3 Bays	Average 4 Bays
Facility*	121,000	101,000	52,000	56,000	77,000	67,000	79,000
Land*	10,000	10,000	10,000	10,000	10,000	10,000	10,000
Tools and Equipment**	14,760	10,660	28,530	8,190	21,630	20,100	17,300
Total 1975 Replacement Cost	145,760	121,660	90,530	74,190	108,630	97,100	106,300

*Sources: References 21,28,35-41,46,86,87
**Sources: References 55-61,63-71,73,74,75,77,79-87,140,141,146

The 300 annual planning volume (PV) new car dealership facility was considered to be the average facility for the sake of establishing a total replacement cost figure. The sales and service requirements for the 1974 and 1975 market was provided by 29,600 dealers selling an average of 300 cars per year[1,10,32,142,147]. The replacement cost of the repair and service portion of the new car dealership was used to establish the total cost of the new car dealer's repair and service operation.

4.1.1.2

Gasoline Service Station. Facility costs for service stations were established using gasoline company engineering department figures for size, configuration and cost. The average facility was determined from Motor Age surveys to be a three-bay station.

4.1.1.3

Independent Repair Garage. Independent repair garage costs were developed for a three-mechanic, five-bay shop providing complete mechanical services ranging from wheel alignment to all other general mechanical repairs such as drivelines, suspensions, electrical systems, and fuel systems. Construction cost factors were applied to the specifications to determine the replacement cost. Motor Age surveys indicate that the average shop employs 2.6 mechanics and has approximately five bays.

4.1.1.4

Specialty Service Shops. Specifications and costs were developed for six different franchised specialty shops which altogether would provide a variety of different services. Actual franchise operation literature,[21,44,46] as well as conversations with franchise personnel[49] and Chilton's knowledge of service facility requirements were used to determine typical facility specifications. These shop costs were averaged and multiplied by the number of shops for a total replacement value. Table 4.2 shows the variety of specialty shops studied and their individual sizes and costs used to determine a representative shop.

4.1.2 Land Costs

Since land values are affected by many factors, establishing a fixed land value for this study was necessary. Land value, which varies greatly between locations, was established at $20,000 per acre. This is the approximate 1975 cost of an acre of commercial property fronting on a state highway in Delaware and Chester countries west of Philadelphia, Pa. This area is in the process of development with a large percentage of the land undeveloped, but with business clustered along the route - including some new car dealerships. Much of the open land is or was farm land.

The minimum service facility site was considered to be one-half acre[17-27,31,35,37,40,41,42] at a $10,000 cost. This area is the minimum specified by the major oil companies, [36-40] for service stations with two and three-bay facilities. The automobile manufacturers recommend a minimum area of 51,000 ft^2 [18,19,22-32,42,43] on the average for the entire facility, and we allocated one-half that for the service operation. Likewise, we allocated approximately one-half use for each of the other establishments, based on a review of various facility specifications for specialty shop franchises.

4.1.3 Tools and Equipment Costs

Tools and equipment lists were established for each facility considered and the lists were priced and totaled to give the entire cost. The lists included shop tools, machinery and equipment and inventory stocking bins.

Mechanic tool requirements were developed from catalog lists and dealership requirement lists. These were divided into several groups of tools based on quantity, quality and specific tool items which were applied to each facility as the mechanic's job requirements dictated. Good quality, but not highest quality, tool prices were obtained from the NAPA-Balkamp catalog[67,68] and the Sears Roebuck tool catalog.[61]

A detailed listing of tools and equipment costs by facility is shown in Appendix D. A summary of the shop tools and the equipment costs by facility is shown in Table 4.3.

4.1.3.1

New Car Dealership. The tools and equipment cost is far greater for new car dealerships than for the other service facilities considered in this study. This cost is due largely to the greater number and variety of tools and equipment required to supply the complete range of automotive service, and partially to heavier duty equipment at a greater cost.

4.1.3.2

Gasoline Service Station. The gasoline service station has the lowest tools and equipment cost of the facilities studied.[5-10,142,147] As seen in Table 4.3, the representative service station lacks the high cost tools and equipment that a new car dealership, independent garage or specialty shop has to perform major scheduled or unscheduled maintenance, such as front end alignment. Instead, the service station has a good low cost assortment of tools and equipment enabling it to perform most common scheduled and unscheduled maintenance, such as tune-ups and brake jobs.

4.1.3.3

Independent Repair Garage. The tools and equipment cost for the independent repair garage ranks next to and is less than half that of the new car dealership. The tools and equipment cost for the independent garage slightly

TABLE 4.3 TOOLS AND EQUIPMENT COST SUMMARY
BY ESTABLISHMENT TYPE

Tools and Equipment Categories	New Car Dealer (15 Bays)	Service Station (3 Bays)	Independent Garage (5 Bays)	Specialty Shops (Av. 4 Bays) Tune-Up A/C Brakes (5 Bays)	Radiator & A/C (2 Bays)	Diagnostic Tune-Up (2 Bays)	Transmission (6 Bays)	Muffler (5 Bays)	Alignment (3 Bays)
General	15,145	1,059	5,060	3,205	1,714	907	4,843	5,891	2,929
Cleaning	690	135	190	190	190	190	190	190	190
A/C-Cooling	1,036	35	998	998	4,505		10		
Alignment/Suspension	6,044	38	3,987						9,987
Brake	4,106	162	4,100	4,165	24		24	4,165	4,100
Clutch/Transmission Axle	1,586		1,354				2,679		
Tune-Up Diagnosis	5,898	265	2,088	10,646		26,648			
Electrical	1,561	290	274	200	240	258	200	200	200
Engine Repairs	2,579		2,120						
Lubrication	1,326	203	758				238		
Tire Service	1,883	665	1,633					8	1,067
Other	4,500								
Subtotal	46,400	2,850	22,560	19,400	6,700	28,000	8,200	10,500	18,500
Mechanics' Tools	10,900	1,740	2,620	2,230	890	530	2,460	1,760	1,600
Storage Equipment	12,700	Incl.	Incl.	Incl.	600	Incl.	Incl.	2,500	Incl.
TOTAL	70,000	4,590	25,180	21,630	8,190	28,530	10,660	14,760	20,100
Cost Per Bay	4,670	1,530	5,000	4,300	4,100	14,200	1,800	2,900	6,700

Sources: References 20,24,41,46,52-87,140

exceeds that of the new car dealership on a per bay basis.

4.1.3.4

Specialty Shop. As shown in Table 4.3, the tools and equipment cost for specialty shops vary from one specialty to another, but the average cost is comparable to that of the independent repair garage. The major tool and equipment cost is for diagnostic tune-up equipment (where applicable).

4.1.4 Establishment Count

The number of establishments in a given category was determined using NADA (National Automobile Dealers Association) information and 1972 Census [145] [147] numbers as projected by Chilton Research for 1974.

4.1.4.1

New Car Dealership. The number of new car dealers at the end of 1974 was established by NADA at 29,600[1]. By December 1977 this had changed to 24,250.

4.1.4.2

Gasoline Service Station. Only service stations that had payrolls and reported service labor were considered for this study. This is because only those reporting service labor are considered to perform maintenance. The others only sell fuel. The 1972 Census figures were updated to 1974 by adjusting the number of stations reporting service labor by the change in overall number of service stations. In 1972 there were 226,000 service stations of which only 97,400 reported service labor and had a payroll[5-10] [142] [147]. The total number of service stations projected by Chilton for 1974 is 200,000. Following a proportionate reduction, the number of stations with a payroll and reporting service labor for 1974 is 86,200.

4.1.4.3

Independent Repair Garage. Independent repair shops with a payroll were considered for this study. Of the 127,200 total number of independent repair shops listed in the 1972 Census, 65,500 were shops with a payroll and these 65,500 shops conducted a full 87% of the independent repair garage business. General repair shops accounted for 30,650 of these and this number was applied to the established independent garage cost to determine the total replacement cost.

4.1.4.4

Specialty Shop. Specialty shops considered for this study were chosen using data described in paragraph 4.1.4.3. Subtracting the 30,650 independent repair garages from the 65,500 shops with a payroll leaves 34,850 specialty shops. Top and body shops, paint shops, and glass shops were not considered in determining the total number of specialty shops applicable to this study since their functions are normally to repair crash damage, not to perform maintenance. Eliminating from these specialty shops 18,300 top and body shops, 2,460 paint shops and 1,810 glass shops, leaves 12,280 specialty shops which have payrolls and supply automobile and light truck maintenance services.

Although the total number of independent repair shops (including specialty shops) increased from 1972 to 1974,[72] [73] [74] Chilton projected that most of the increase would be attributed to top and body shops. Therefore, the 1972 Census numbers are used as described to define the number of facilities considered in this study under independent repair garages and specialty shops.

4.2 SERVICE ESTABLISHMENT INVESTMENT COSTS BY FACILITY TYPE

The service establishment replacement costs described previously establish the cost of providing fully equipped service facilities capable of handling the service work necessary to maintain the entire car and light truck fleet. However, in order to function normally as a business, two other investment categories must be considered. A service business must have an inventory and operating capital.

The investments required of each establishment are discussed below and summarized in Table 4.4.

4.2.1 Inventory

Inventory values were determined by applying dealership parts investment tables and formulas, service station investment lists, recommendations of service shop operators, and franchised service shop requirements. These values represent average inventory requirements for the size and type of service facility studied. Inventory requirements for individual facilities within a type grouping may vary greatly depending on the needs of the individual market being served and the proximity of the service shop to their sources of supply. The service shop must carry an inventory sufficient to carry on normal service business between restocking cycles. If the supplier is next door, the restocking cycle can be frequent, without disrupting business, and only a small inventory is required. If the supplier is 100 miles away, restocking cycles

TABLE 4.4 TOTAL INVESTMENT COSTS OF SERVICE FACILITIES

Car Dealer, 300 Planning Volume

	New and Used Car Sales	Repair and Service	Service Station 3-Bay	Independent Repair Garage	Specialty Shop
Total 1975 Replacement Cost	$158,000	$285,000	$143,600	$105,200	$106,300
Inventory	--	40,000	6,100	2,500	5,700
Operating Capital	42,000	38,000	10,000	8,300	10,100
Total Investment	$200,000	$363,000	$159,700	$116,000	$122,100
		$563,000			

TOTAL INVESTMENT COSTS ALL SERVICE FACILITIES

					Billions
Car Dealers	29,600	x	$363,000	=	$10.7
Service Stations	86,200	x	159,700	=	13.8
Independent Repair	30,650	x	116,000	=	3.6
Specialty Shops	12,300	x	122,100	=	1.5
Total*					$29.6

Source: Refs 1 through 10, 17 through 87, 140, 142, 147

*Does not include shops devoted solely to body repair

will be longer and larger inventories will be required, assuming the volume of business is the same.

4.2.1.1

New Car Dealership. New car dealerships must carry a much larger parts inventory than the normal service shop because the dealership parts department must supply his own service department, which for the average dealer is 2.5 to 3 times as large as the other types of service shops shown. The dealer must also provide for walk-in customers and be a wholesale supplier for many service shops.

4.2.1.2

Gasoline Service Station. Service station inventory consists primarily of gasoline and oil supplemented with TBA (tire-battery accessory) stock. These businesses generally depend heavily on parts supply sources for service parts required beyond belts, hoses, tune-up and electrical parts.

4.2.1.3

Independent Repair Garage. Independent repair garages with a good parts supplier nearby can work adequately with an inventory of small parts including belts, hoses, points, plugs, wipers, flashers, wire, fuses, bulbs, etc. Additional items may be carried to meet the needs of an individual market area.

4.2.1.4

Specialty Shops. Specialty shops in general carry more inventory than independent repair shops. However, a shop that specializes in tune-up work would carry an inventory similar in value to the independent shop because the parts serviced are small, less expensive parts. Conversely, a shop specializing in mufflers and shocks or in transmission repairs must stock a large dollar amount of inventory. Specialty shops exist on the premise that they will do a high volume of work in a limited service area. Those servicing more expensive components require more expensive inventories. The inventory value for specialty shops was established by averaging the inventory requirement for the six specialty shops studied. Table 4.5 shows this input.

4.2.2 Operating Capital

Operating capital requirements were determined by totaling operating expenses for a 60-day period for each establishment type. This is the amount of money recommended by lending institutions for a beginning business. This investment is necessary to allow a business a period of time to develop customers and generate a sustaining cash flow. The expenses shown do not

TABLE 4.5 SPECIALTY SHOP INVESTMENT COSTS

	Specialty Shops						
	Muffler, Brakes, Shocks 5-Bays	Transmission Repair 6-Bays	Diagnostic and Tune-up 2-Bays	Radiator and Air Conditioning 2-Bays	Tune-up, Brakes, Air Conditioning 5-Bays	Alignment, Brakes, Shocks 3-Bays	Average 4-Bays
Total 1975 Replacement Cost	$145,760	$121,660	$90,530	$74,190	$108,630	$ 97,100	$106,300
Inventory	10,000	6,000	2,500	10,000	2,500	3,000	5,700
Operating Capital	13,200	15,100	5,700	5,750	12,650	8,050	10,000
Total Investment	$169,000	$142,800	$98,700	$89,900	$123,800	$108,150	$122,100

Source: Refs 21, 28, 35 through 41, 44 through 49, 55 through 61, 63 through 71, 73, 74, 75, 77, 79 through 87, 140

include a rent or mortgage payment or payments on any capital loans. For new car dealers the floor plan interest for new car inventory is included. (The floor plan interest is the monthly interest expense a dealer incurs on the money borrowed to pay the manufacturer for the unsold cars in the dealer's inventory.) The costs are presented in this manner so that actual investment may be shown. Real world situations normally would have the owners borrowing from a bank as much as possible. This would reduce the owner's investment, create a lending institution investment and add to the operating expenses by the amount of real estate loan repayments of principle and interest and by any capital loan payments amounts. In addition a new car dealer would normally have an initial used car inventory to finance by cash or loan. This amount is not considered in this study. Table 4.6 outlines the operating capital requirements of the various service facilities.

4.3 TOTAL SERVICE ESTABLISHMENT COSTS

The total cost of a service establishment consists, of replacement costs for the facility, land, tools, and equipment, as well as investment costs for inventory and operating capital. These requirements are outlined for the four categories of service establishments in Table 4.4. The total investment shown for each establishment is the summation of total replacement cost, inventory, and operating capital required. The total costs for all service establishments including replacement costs, inventory and operating capital is shown to be 29.6 billion dollars. This is computed by multiplying the total investment per service establishment by the number of establishments in each group and totaling the cost for car dealers, service stations, independent repair garages and specialty shops.

4.4 OTHER CONSIDERATIONS

Thorough consideration has been given to the wide variety of service establishments currently supplying the entire automobile and light truck fleet maintenance. One segment not considered in this study is the large Do-It-Yourself (D-I-Y) market. This segment represents a large part of the TBA Dealers and Mass Merchants sales and Car Dealer Parts Department counter sales.

This segment of the entire TBA Parts and Service market for TBA Dealers and Mass Merchants and others (not including car dealers, service stations, independent and specialty repair shops) has increased from $3.4 billion in 1967 to $19.1 billion in 1974. This is an increase of 462%. During this time car dealer parts and service business rose 76% independent repair and specialty shops together rose 102% and service stations decreased by 2.5% after showing an increase of 5% in 1972[1-10 141 143 145 146 147]

TABLE 4.6 OPERATING CAPITAL REQUIREMENTS

	$ - 60 Day Fixed Expenses				
	Car Dealer 300 Planning Volume		Service Station 3 Bay	Independent Repair Garage	Specialty Shop Average
	New & Used Car Sales	Service Repair			
Payroll	18,580	28,410	7,000	5,500	7,219
Insurance	200	70	50	30	37
Floor Plan Interest	18,000	-	-	-	-
Utilities	1,600	1,500	450	500	503
Telephone	400	200	50	100	135
Travel & Entertainment	400	-	-	-	-
Supplies-Uniforms	-	900	300	300	300
Advertising	1,600	200	100	200	500
Taxes	720	720	550	316	352
Receivables & Misc.	500	6,000	1,500	1,340	1,000
Total	42,000	38,000	10,000	8,300	10,000

Sources: Ref. 21, 44 thru 51

These values are in terms of real sales dollars without considering inflation. It is seen that the segment responsible for supplying the D-I-Y customer had a significantly larger increase than other service segments.

Car dealer parts counter sales contributed 10.8% of the dollar volume of total dealer parts sales in 1974. This represents a dollar increase of 18% over 1973 and accounted for 6% of the total car dealer parts and service sales.

Conditions that would shift a portion of the fleet maintenance from the D-I-Y contingent to conventional service establishments could cause the need for additional major investments in service facilities. This would also add significantly to the overall cost of maintenance service since the amount performed by D-I-Y does not reflect a labor cost which the D-I-Y person provides at no cost. Parts costs would probably remain the same or increase and the once free labor would be charged at conventional rates. These changes, depending on their direction and magnitude, could also change the distribution of maintenance service work among type of establishments (see Chapter 7). A change in conditions that would limit D-I-Y service capability will affect the whole service industry facility and investment requirement.

4.5 SUMMARY

The establishments which normally perform normal automotive maintenance have been characterized as to:

- Facility Costs
- Land Costs
- Tools and Equipment Costs
- Number of Establishments
- Inventory Investment
- Operating Capital

Each of these characteristics is unique for each type of repair facility considered. Facilities which were considered are:

- New car dealerships
- Gasoline service stations
- Independent repair garages
- Specialty service shops

5. REPAIR AND SERVICE INDUSTRY PRICING POLICIES

5.1 INTRODUCTION

Pricing policies of the various repair and service establishments were studied to determine any differences in the cost of parts and labor by establishment type.

New car dealers' pricing policies were studied to determine any differences in markup between proprietary and non-proprietary parts supplied by the new car dealer.

5.2 METHODOLOGY

5.2.1 Parts Selection

A workable number of parts from a car representing each of four domestic, and two major foreign auto manufacturers were selected. Ten new car dealer proprietary and ten non-proprietary parts were defined and selected to give a wide representation of various vehicle systems.

Prices from new car dealer sources, aftermarket supply sources, service station sources, and related cost discount structures were procured and studied for each of the ten non-proprietary parts for each of the six vehicles. Dealer list prices and the applicable discount price structures were also studied for the ten proprietary parts for each of the six vehicles.

5.2.1.1

Proprietary Parts. Proprietary parts are limited to the body area parts which normally are not serviced in the scheduled or unscheduled maintenance of an automobile. These parts all would require a substantial expenditure for manufacturing tooling (special dies, fixtures, etc.) if made by an aftermarket supplier for aftermarket sales only. Since the auto manufacturer has already partially amortized the tooling costs in the production of his automobiles and has produced spare parts in the normal production runs, the charges for these parts are minimized. And since the market for such pieces is unpredictable (and already covered by the auto manufacturer) there is little incentive for aftermarket suppliers to provide these parts in competition with the manufacturers. Thus, parts in this category are considered proprietary parts.

The proprietary parts selected for study are:

Grille	Front Bumper
Fuel Tank	Rear Bumper
Right Front Fender	Roof Panel Assembly
Hood Panel Assembly	Front Door
Trunk Lid Assembly	Front Seat Bottom Pad

5.2.1.2

Non-Proprietary Parts. Non-proprietary parts include parts normally serviced during the life of the vehicle as part of scheduled or unscheduled maintenance or parts of enough universal application to warrant aftermarket production. Even though the production of some of these parts may involve some fairly substantial tooling expenditures, the market is known to exist because the vehicle quantity to be serviced is known and an excellent service history for most of these items is available.

The non-proprietary parts selected for examination are:

Starter	Master Cylinder
Shock Absorber	Water Pump
Muffler	Air Filter
Voltage Regulator	Oil Filter
Spark Plugs	Front Brake Shoes

These items fall into many categories and vary greatly in such characteristics as: number of pieces per car; car system affected; normal service frequency; safety related; non-safety related, but necessary to operate the vehicle; not safety related or necessary, but desirable to extend the useful car life. These factors all have some effect on the market for an individual replacement part. Because of these forces, some items are fast-moving, commonly and frequently used, while others have a slower replacement rate. Competition, however, is strong in every segment and affects the price levels.

These non-proprietary parts come from a wide variety of sources:

a. Spark plugs are supplied by parts manufacturers, who supply O.E.M. parts to the auto manufacturers, or in some cases by independent manufacturers. All major spark plug manufacturers have O.E.M. accounts and make plugs for almost all cars.

b. Shock absorbers are sold by O.E.M. producers who make different product lines that vary in cost, quality and brand name. Auto manufacturers often make their own shock absorbers and market these through their dealers and through conventional aftermarket outlets.

c. Air, oil and fuel filters are produced by large companies who supply the aftermarket outlets and, in some cases, supply auto manufacturers. Some auto manufacturers have divisions that produce filters for their own cars and for distribution through their dealers and conventional aftermarket outlets.

d. Exhaust system components may be supplied as aftermarket parts by the vehicle manufacturers through their dealer sales outlets and by many independent manufacturers who supply the aftermarket only. Some aftermarket suppliers are also O.E.M. suppliers. A single parts manufacturer may make various quality level exhaust system components under a multitude of brand names for sale through different types of outlets, or as original equipment parts.

e. Brake service parts may be supplied to the aftermarket by: auto manufacturer's divisions that supply the assembly line, the dealer, and independent aftermarket channels; independent O.E.M. suppliers, independent aftermarket suppliers; or by companies that reline used brake shoes.

f. Items such as starters and generators, are available as new original equipment items from dealers and other outlets. It is more common for these electrical parts to be sold as rebuilt components both through major aftermarket distribution channels and new car dealers. Numerous large rebuilding factories exist to fulfill these requirements. Large cities usually have smaller local rebuilders that do quality work.

5.2.2 Vehicle Selection

A representative vehicle was selected from each of the four major domestic automobile manufacturers and the two most popular foreign importers. Since pricing policies were found to be consistent within a given auto manufacturing corporation, it was decided to choose for study a popular full-size vehicle from each selected domestic auto manufacturer and a popular 1975 vehicle from the two foreign manufacturers. The 1973 VW Beetle was used to gather data from parts warehouses and distributors (jobbers) for discount structure studies because 1975 Rabbit parts were not yet generally available from parts jobbers. The selected parts for each of these vehicles were investigated to determined their prices at various levels of distribution and from various aftermarket sources (dealers, jobbers, oil companies, etc.). The vehicles selected for study are:

Manufacturer	Model	Engine
General Motors	1975 Chevrolet Impala	350 V8
Ford Motors	1975 Ford Galaxie	400 V8
Chrysler Motors	1975 Chrysler Newport	360 V8
American Motors	1975 AMC Matador	360 V8
Volkswagen of U.S.	1973 VW Beetle	90 Flat 4
Toyota Motors	1975 Toyota Corolla	97 L4

5.3 RESULTS AND ANALYSIS

5.3.1 Parts

Dealer cost numbers are real numbers, stocking allowances and redistribution allowances are real, but trade prices and list prices are only recommended prices and, although usually followed, may be varied by individual dealers or service shops.

5.3.1.1 List Prices

5.3.1.1.1

Results. List prices for non-proprietary parts sold by new car dealers are reasonably comparable to list prices of similar parts supplied by jobber outlets to other automobile repair facilities.

Table 5.1 illustrates this through a comparison of prices from the dealers and jobbers for parts for a representative car from each domestic auto manufacturer and two foreign auto manufacturers.

List prices of some fast-moving items, specifically hoses, belts, filters, and shock absorbers sold by service stations and supplied by the parent oil company are less than comparable jobber or dealer supplied parts.

5.3.1.1.2

Analysis of List Price Variations. List prices for parts as sold by new car dealers are reasonably competitive with parts supplied to other repair shops by parts jobbers. An analysis of the non-proprietary parts prices (Table 5.1) showed a total dealer list price for eight parts for each of the six cars except for Ford and Toyota (seven parts), and VW (five parts), to be $829.49 with only a $1.79 variation between the dealer list prices and repair shop (jobber) list prices.

Front brake shoes and starters, on the list of non-proprietary parts, were not compared for any of the cars because they are traditionally supplied as rebuilt starters and relined brakes from the parts jobbers at a lesser cost than that shown in the dealer price books. Dealers often use rebuilt starters instead of new starters for dealer service work because of the lower prices. When rebuilt units are sold to customers as part of a repair job, the list price is the same from the dealer or from a service garage since both are supplied from a jobber or rebuilder. Dealers also supply relined brakes and jobbers supply new shoes and linings. Comparable materials have a comparable list price from both sources.

The Ford and Toyota mufflers were dropped from the comparison because the jobber-supplied part and the dealer part were not the same item. The Toyota front shock absorber was also not included because the new car part is a complete shock strut and the jobber part is a shock cartridge only and therefore not comparable.

Shock absorber list prices are common for a given source to avoid confusion in pricing a wide variety of similar items.

The air-cooled 1973 VW Beetle referenced for the study does not have a water pump or a replaceable, throw-away type oil filter or air cleaner element. Thus, these items were eliminated from the comparisons.

TABLE 5.1 LIST PRICES - DEALER VS. JOBBER TO OTHER REPAIR FACILITIES

(For Selected List of Non-Proprietary Parts

for Selected Cases)

Manufacturer	Model	Dealer List Price	Jobber List Price
GM	Chevy Impala	$163.98	$162.36
Ford	Ford Galaxie	146.04*	135.08*
Chrysler	Newport	161.20	154.81
AMC	Matador	134.40	144.65
VW	Beetle	112.53*	114.75*
Toyota	Corolla	111.34*	116.05*
Total List Price		$829.49	$827.40

Parts Priced: Shock absorber, muffler, voltage regulator, spark plug, master cylinder, water pump, air filter, oil filter (*except Ford and Toyota muffler and VW water pump, air filter and oil filter).

Source: Refs 88 through 115

Price comparisons made were between new car dealer prices in effect October 1975 and jobber prices in effect June 1976. To adjust these to a comparative level the dealer list prices were adjusted upward by 4%.

Although the prices studied were essentially the same for the dealer and jobber supplied group representing six car lines, individual differences do occur.

a. Shock Absorbers

1) With few exceptions, shock absorbers have the same price throughout a given auto manufacturer's car lines. The price does vary somewhat between auto manufacturers.

2) Jobber list prices for all normal configuration shock absorber (tubular with various ends and lengths) are also the same, with few exceptions, across all domestic car lines for a given quality level.

3) Service station list prices for shock absorbers supplied by the parent oil company are usually slightly lower than jobber list prices. Jobber list prices are 75-85% of dealer list prices.

4) Domestic manufactured shocks for foreign cars carry a lower list price than foreign made units of equal quality.

5) Most jobbers and service stations carry three quality levels of shock absorbers: standard-budget; deluxe-original equipment; and master-heavy duty. Each quality level carries a constant list price for all make and model car applications. The constant line list price increases as quality increases.

6) For foreign models that have a MacPherson strut front suspension a replacement cartridge is available and has a common list price across applicable car lines.

b. Voltage Regulators

Voltage regulators often have identical list prices from the dealer or jobber.

c. Spark Plugs

Spark plugs generally have universal list prices from dealer or jobber across all car lines, heat ranges and sizes, but vary if a resistor or non-resistor plug and if smaller than normal plug. Therefore, most plugs will carry one of three list prices which is not dependent on the part manufacturer.

d. Water Pumps

Water pumps tend to carry a higher list price from the jobber than from the dealer, especially for slower moving models.

e. Air and Oil Filters

1) Air and oil filter list prices are reasonably comparable from a dealer or jobber for the higher volume filters. Filters for lower volume domestic and foreign cars tend to have a higher list price from the jobber than the dealer.

2) Filters sold by service stations and supplied by the parent oil company usually carry a lower list price than those same pieces supplied by a jobber or dealer. Belts and hoses fall into this same categoy.

3) Service stations have a predominant share of the repair market* in hoses, belts, and filters. These items are high volume items. The parent oil companies can make large volume, cost reducing purchases and distribute through an existing system directly to the service stations, with a resultant price reduction to generate more petroleum product sales. The service station operator enjoys an adequate profit in terms of dollars, from these sales because the cost from the parent oil company is based on a larger discount than the same items he might procure from a jobber or dealer.

f. Master Cylinders and Mufflers

Master cylinders varied from being the same, 10% higher and 10% lower at domestic dealers compared to aftermarket and from being 8% to 25% less at the dealer for the foreign cars. Slower moving parts carry higher aftermarket list price.

Mufflers (except for Ford and Toyota which were not included in the totals, as noted) were generally priced slightly lower at the dealer by from 1% to 10% on an approximately $25 item.

In general, with respect to the average the aftermarket prices were lower for General Motors, Ford, and Chrysler by 1.0%, 7.5%, and 4.0% respectively and higher by 7.1% for American Motor parts. VW and Toyota aftermarket prices for the total list were 2% and 4.2% higher.

*Table 7.4 "Where Automotive Service Work is Done"

5.3.1.2 Parts Discount

5.3.1.2.1

Dealers. The dealer discount (from list to dealer cost) for proprietary parts is slightly less than for non-proprietary parts for all auto manufacturers surveyed except for Volkswagen (where it is essentially the same). The proprietary parts are generally slower moving and, even though they are captive parts, the dealers do not extract an excessive gross profit in relation to non-captive parts which must be sold in competition with other aftermarket suppliers.

Table 5.2 shows parts discounts for the various auto manufacturers. The average discounts for the groups of the proprietary parts range from 35.9% to 40.2% for the six different auto makers. The average discounts for the six groups of non-proprietary parts range from 39.9% to 43.2%. These discount percentages illustrate the dealer gross profit on the parts group when these parts are installed on a customer's car in the dealer's shop or are sold by the dealer over the counter at list price to a customer for his own installation. These discounts do not consider stocking allowances or allowances for wholesaling to the service trade.

Discounts for individual items within the proprietary and non-proprietary categories vary somewhat by part and by manufacturer. Table 5.3 shows discount variations by indicating the range of variations by category and manufacturer, by showing the most frequent discount in each case, and by showing the range of discounts and frequency of high and low percentages. Domestic car manufacturers exhibit a large degree of sophistication in the application of slightly varying discount rates to specific parts. Foreign dealers generally have a fixed discount rate for all parts. The 40% discount is the most common observed for both domestic and foreign cars, however.

The price survey[88-115] indicates that discounts for certain parts vary from an auto manufacturer's average discount for the proprietary or non-proprietary category. For example, the roof panel discount is lower than the average discount for parts on General Motors and American Motors cars, but by different amounts. Spark plugs carried a higher discount on Chrysler, Volkswagen, and Toyota. Oil filters showed higher discounts on all but Volkswagen and air filters were discounted more than the average by Toyota and American Motors. In general, it is noted that among the proprietary parts the ones with discounts below the average were slower moving items. Of the non-proprietary parts the faster moving ones carried the increased discounts, reflecting reaction to normal competitive forces from the aftermarket suppliers. Complete or partial engine assemblies and automatic transmission assemblies carry a reduced discount from most manufacturers'

TABLE 5.2 PROPRIETARY VERSUS NON-PROPRIETARY PARTS DISCOUNT
(From New Car Dealers - Average of 10 Parts Each)

	Discount - % List to Cost	
Manufacturer	Proprietary	Non-Proprietary
American Motors	38.3	42.1
Ford	40.2	41.4
General Motors	38.0	41.75
Chrysler	35.0	41.4
Volkswagen	40.0	39.9
Toyota	40.0	43.2
Average	38.6	41.6

Source: References 88-115

TABLE 5.3 AUTO MANUFACTURERS DEALER PART DISCOUNTS RANGE
(Proprietary and Non-Proprietary Parts)

Manufacturer	Proprietary			Non-Proprietary		
	Average of Ten Items (%)	Range	Most Common	Average of Ten Items (%)	Range	Most Common
American Motors	38.3	35-40 (3) (6)	40	42.1 (7) (2)	40-50	40
Ford Motor	40.2	40-42 (3) (6)	40	41.4	39-48 (2) (1)	40
General Motors	38.0	30-40 (1) (7)	40	41.75	40-45 (6) (3)	40
Chrysler Corporation	35.0	35-35 (10)	35	41.4	40-49 (8) (1)	40
Volkswagen	40.0	40-40 (10)	40	39.9	30-49 (1) (1)	40
Toyota	40.0	40-40 (10)	40	43.2	40-56 (7) (1)	40

Numbers in parenthesis () indicate frequency among the 10 parts sampled

Sources: References 88-115

normal proprietary parts discounts, as shown in Table 5.4.

Engine assemblies or partial engine assemblies are supplied by the automobile manufacturers through dealer parts departments. These items are slow moving and require a large area to stock. Except for Chrysler and Ford, these engine assemblies carry a smaller discount to the dealer than the average discount for proprietary parts. Chrysler maintains their normal 35% proprietary part discount for partial engines and Ford applies their normal 40% rate. However, American Motors reduces the discount to 30% from 38%; General Motors reduces to 30% for most engines from 38% (Cadillac engines are discounted 25% and the V-6 engine is discounted 33%); Volkswagen reduces to 20% from 40%; Toyota engines carry a 15% discount, down from the normal 40%.

Automatic transmission assemblies are also subjected to a reduction in discount. Standard transmissions carry normal dealer discounts for domestic cars, but some foreign manufacturers also reduce the discounts on their standard transmissions. Toyota varies with a discount of either 27% or 40% depending on volume of production. Datsun discounts transmissions 40%, but Volkswagen discounts only 20% on their transaxle assemblies (a transmission and final drive gears combined).

In general, major assemblies such as engines and transmissions carry a lower dealer discount than other proprietary parts. This is because these parts sell slowly compared to normal maintenance items, are more difficult to handle, and occupy greater storage space. Note that most repairs to these items are accomplished by rebuilding the original assemblies, and the parts required to do so are discounted at normal rates.

5.3.1.2.2

Jobbers. Jobbers represent the primary source of parts supply for the independent service trade including service stations. Jobbers also supply many dealers and all other types of service facilities with some of their service parts supply needs. Jobbers offer a substantial inventory of parts at competitive prices and rapid access to their supply warehouses for additional parts needed. Jobbers have a multi-level price structure to sell to different classifications of customers.

Table 5.5 illustrates some of the following observations regarding the jobber discount structure.

a. Jobbers' price levels may include four or five price levels: list price, net user price (or walk-in price), service trade price (sometimes two levels), and stocking trade price. Each price level is successively lower.

TABLE 5.4 DEALER DISCOUNTS FOR MAJOR ASSEMBLIES
(Percent List to Cost)

Manufacturer	Average Proprietary Part Discount (%)	Engine Assemblies (%)	Automatic Transmission Assemblies (%)
American Motors	38	30	25
Ford Motor	40	40	25
General Motors	38	30	25
Chrysler Corporation	35	35	28
Volkswagen	40	20	20*
Toyota	40	15	27-40*

*Standard Transmission (other standard transmissions at normal proprietary parts discount)

Source: References 88-115

b. Jobbers almost never sell at list prices.

c. The trade firm (service shop) that buys parts from the jobber sells the parts to the customer, as part of a service job, at list price.

d. The net user or walk-in price is the price level at which the man on the street (the do-it-yourselfer) buys from a jobber. This price is usually 15 to 25% off list for domestic parts and 10 to 20% off list for foreign parts.

e. Service shops normally buy at the service trade price level. Some jobbers have a trade level slighly higher than the normal level on some lines, but this level is used only for special situations. Normal trade discount varies from 30 to 50% on domestic parts and from 20 to 50% on foreign parts.

f. The stocking trade price offers an additional discount to service garages or fleets that carry a certain minimum stock of parts. These generally offer an additional 3 to 10% discount depending on the part. Sometimes jobbers offer an automatic restocking service whereby a certain inventory is maintained in the service garage and restocked periodically by the jobber as a service for those receiving the stocking discount.

g. All levels in the pricing structure do not carry through to all parts.

h. The discount levels vary by type of part.

i. Discounts are affected by such factors as frequency of sale, original source of parts, amount of space required for stock, degree of competition, variety of vehicles serviced with a common part. Usually a blend of factors will determine the levels.

j. Foreign car parts generally carry a lower discount than domestic car part lines.

k. Gasoline service stations may buy certain fast moving items, such as hoses, belts and filters, from their parent oil company at a greater discount than from jobbers. Since this discount represents their gross profit on those items, the parent oil company is their usual source. The service stations sell these parts at a lower list price than similar jobber supplied items but with the higher discount the actual dollar amount of profit per item is still greater than for the jobber part.

l. Jobber cost discounts vary from 50 to 64% of list price. Since jobbers do not sell at list price the jobber gross profit is less than this cost discount. The jobber gross profit range is from 40 to 53% when selling at walk-in level and from 31 to 38% when selling to the trade. A successful jobber will expect to average around 35-36% gross profit on all sales.

TABLE 5.5 JOBBER DISCOUNT STRUCTURES AND GROSS PROFITS

-EXAMPLES FOR 10 REPRESENTATIVE PARTS-

AVERAGED FROM DOMESTIC AND FOREIGN CARS

	Representative Discounts From List Price For Jobber Sales Of					Jobber Gross Profit On Sale of				
	Domestic Car Parts					Foreign Car Parts		Domestic Parts to:		Foreign Parts to:
	To Walk In (%)	To Service Trade (%)	To Stocking Trade (%)	Cost to Jobber as % of List (%)	Cost to Service Station as % of List (%)	To Service Trade (%)	Cost to Jobber as % of List (%)	Walk In (%)	Service Trade (%)	Service Trade (%)
Starter	15	30	33	55	30*	20	38	47	36	23
Shock Absorber	26	40	-	57	40*	37	51	42	38	22
Muffler	20	30	-	52	30*	22	39	40	31	22
Voltage Regulator	25	40	45	60	40*	20	38	47	33	23
Spark Plug	40	47	55	64	47*	47	58	40	32	21
Master Cylinder	25	30	33	56	30*	22	39	41	37	22
Water Pump	15	30	36	55	30*	22	39	47	36	22
Air Filter	25	35	40	58	49**	33	48	44	35	21
Oil Filter	25	35	45	58	50**	33	48	44	35	21
Brake Shoes	15	40	43	60	40*	22	39	53	33	22

Sources: References 118,122,123,125,127
128,130-139

*Supplied from Jobber
**Supplied from Parent Company

m. A foreign car parts jobber earns a gross profit of approximately 22%. If the jobber also serves as a distributor, his costs will be 5-6% (of list) less and his gross profit will average around 30% on sales to the trade and 39% on sales to the walk-in type customer.

n. These conclusions are based on policies of large national jobber chains. Smaller independent jobbers can buy at greater discounts and offer larger discounts on sales.

Jobbers provide parts to all segments of the service industry, but primarily to independent service garages and service stations. Jobbers also sell parts over the counter to the walk-in or do-it-yourself trade. This category of buyer buys at a net price level which may range from a 10-40% discount from list price. The common level is 15-25% for domestic car parts and 10-20% for foreign car parts. If the walk-in customer has the repairs performed at a service garage he would pay list price for the parts.

Service shops of all types as well as certain volume fleet accounts and large farm accounts buy parts from the jobber at a service trade price level. This is usually called a resale price level 3 by the jobber. Some accounts or occasional buyers receive a level 2 or slightly higher price due to some unfavorable aspect of the account (bill paying practices, purchasing frequency, personalities, etc.).

Accounts that maintain certain specified inventory levels can buy at a level 4 - a stocking trade price level. This represents a 3 to 20% greater discount and is beneficial to the trade shop that qualifies. Jobbers often promote this type of business (and hence their own) by offering a regular inventory checking service and automatic reordering or by providing special lists of service parts that should be stocked to service specific vehicles in a fleet. The jobbers are supported in these efforts by the parts suppliers.

Some parts do not carry price sheets for all levels of distribution. An example of this is shown in Table 5.5 where no "stocking trade" price is listed for shock absorbers or mufflers. In this case the item is purchased for stock at the same price as if purchased for each job. In the case of shock absorbers a sale to the trade in sets would be made at the service trade price, but a single purchase would be made at a premium trade (level 2) price, at a lesser discount. In all probability, a service garage that wished to make a volume purchase of shock absorbers could negotiate an additional discount even though there were no published prices between service trade and jobber cost.

Faster moving, easily stocked parts that service a broad range of applications carry higher discount levels.

Foreign car parts usually carry a lower discount level than domestic car parts. This is because of the more specialized nature of the part, the fact that many must support overseas shipping costs, and the lower volume of cars to service. This results in an increased number of slower moving parts lines. With import volumes rising, levels have recently been achieved to make it worthwhile for domestic manufacturers to enter production of many parts. This will make some parts available at lower prices and with greater discounts. The shock absorber is a good example of this. One VW shock absorber lists for $18.00 in the foreign-made version, but only $13.00 in the domestic version. In making evaluations of this nature it is important to compare parts of the same quality level.

Gas stations can sell belts, hoses and filters at a lower price than jobber list when their supply comes from their parent oil company. These items are fast moving, serviced most commonly by gas stations and do not require much space to stock. Gas station owners generally turn to a jobber for most other parts because of convenience and resultant reduction in inventory requirements. Some large stations may have a substantial inventory beyond the belts, hoses and filters level if their business activity warrants this.

The fast moving parts mentioned, while carrying a lower list price, also carry a higher discount to the service station operator. Because of this, the cash profit per item is greater than the jobber supplied part. Hence, the service station usually acquired these parts from the oil company, but uses the jobber to supplement this source in times of shortage.

Since the jobber does not sell at list price, his gross profit level is less than his jobber cost discount level. Jobber cost discounts range from 52 to 64% for domestic parts and from 38 to 58% for foreign parts. However, gross profits on sales to the trade are from 31 to 38% for domestic and approximately 22% for foreign. Sale to walk-in customers yields a gross profit of 40 to 53% for domestic parts and about 32% for foreign parts.

If the foreign parts jobber is large, and also serves as a distributor, his costs might carry a 5 or 6% greater discount and his gross profit on sales to the trade would be about 30%, and on sales to walk-in customers, 39%.

Various jobbers offer a variety of discounts. The jobbers investigated for this study have nationwide coverage and are high quality, highly respected organizations. These numbers represent those used by sound operations dealing in high quality parts. Other reputable jobbers exist that may give various quality parts and various discount levels. Jobbers may make purchasing arrangements with suppliers of individual lines for the purpose of achieving greater discounts and lower prices. Indeed many

jobbers buy most of their product lines from separate suppliers. Jobbers associated with national parts distributions may purchase from any source and usually do carry some outside lines that extend their parts coverage or have more favorable prices than the national distributor's prices.

5.3.1.2.3

Summary of Parts Discount Structure. Various automobile service facilities purchase parts for repair work from various sources which supply parts at a variety of discount levels. Figure 5.1 shows the variety of parts costs as a percent of list price.

New car dealers buy from their own companies at approximately the same cost as from a jobber (40% discount). Stocking discounts give additional compensation for maintaining a supply of parts for sale. If a dealer requires parts supplied from another manufacturer he receives substantially less discount, even as little as 10-15% from some foreign car dealers.

Service stations buy normally at the jobber discount level (40%), and can get better discounts on certain items from their parent oil companies. However, if parts must come from dealers, costs are increased.

Independent repair garages have the same normal sources except for the specialized parent company supplied parts.

Specialty shops normally purchase from their franchising or parent company, bypassing a warehouse stop in the supply chain and receiving larger discounts. Franchise fees reduce some of this "extra" profit however. If parts are needed from other sources the jobber or dealer supplies these at the normal costs.

In addition to these conventional sources of supply, there are many other people selling parts in less formally structured ways. Wagon peddlers, who sell various supplies and parts from route trucks; and expediters who buy from anyone and sell to anyone. Single line distributors handle items such as tires or filters. All these fill the gaps in the supply structure that continues to move the necessary parts from the parts manufacturer to the service shop, and hence, to the customer.

5.3.1.3

Stocking and Redistribution Allowances. Two additional factors influencing the actual cost of parts that the dealer pays are stocking and redistribution allowances. The discounts discussed previously determine the normal or maximum price that a dealer pays for parts. Under certain circumstances some parts may be eligible for additional discounts.

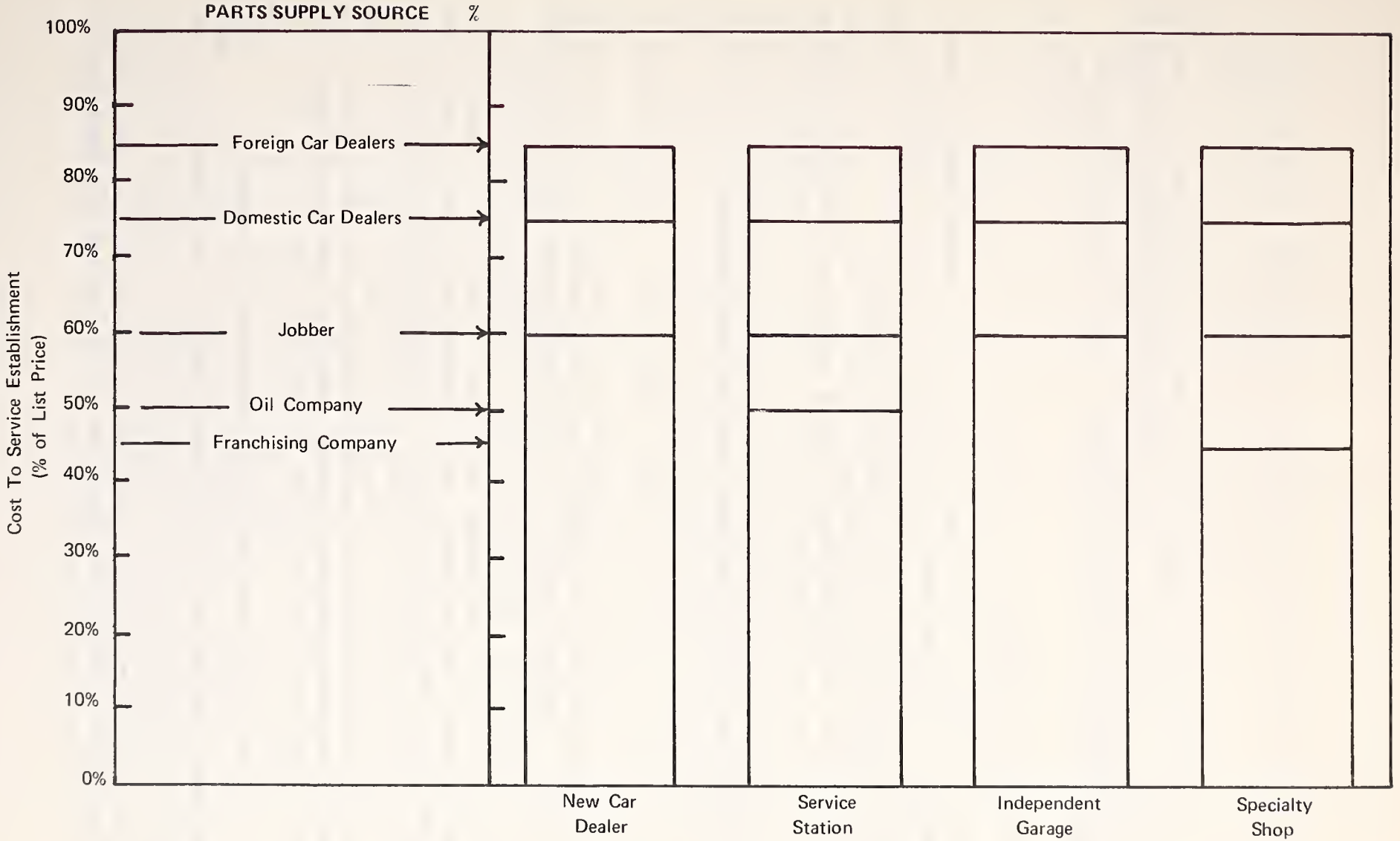


FIGURE 5.1 NORMAL AFTERMARKET PARTS COSTS TO VARIOUS SERVICE ESTABLISHMENTS EXPRESSED AS % OF LIST PRICE

Incentives exist, usually in the form of an additional discount on a stock order, to entice the dealer to stock parts which are not always the fastest moving items and/or to order parts on specific infrequent order dates for large order processing efficiency. This incentive is called a stocking allowance.

a. These stocking allowances are usually 5%, but may vary (some are 0%, some Chrysler are 15%).

b. Stocking allowances usually apply only to parts ordered under certain guidelines. Parts may have to be ordered on a specific form, at a specific time, limited to a specific frequency, in excess of a specific minimum amount or meet other standards to qualify.

c. General Motors, Ford, and Chrysler offer stocking allowances. American Motors, Toyota, and Volkswagen and other foreign car importers do not.

d. American Motors and Toyota allow discounts for minimum-volume purchases of certain very fast moving items such as ignition parts.

e. Stocking allowances, where applicable, usually result in a gross profit increase of 3% for the dealer (some Chrysler non-proprietary parts, 12%)

Compensation from the manufacturer to the dealer exists, usually in the form of a periodic rebate, to allow the dealer to sell parts to the service trade industry. This compensation, called the redistribution allowance, makes up for the dealer's efforts in serving as a parts distributor as well as a parts storeroom, and allows a trade service shop to buy at reduced prices so he can resell at the dealer list price and still make a reasonable gross profit on the parts. This redistribution allowance is sometimes called a wholesale allowance or wholesale incentive.

a. Redistribution allowances are only applicable on parts sold to the trade for resale to customers of the trade firm. The dealer must supply proper documentation before the rebate is made.

b. Redistribution allowances vary between companies and parts.

c. Redistribution allowances usually do not apply to the slowest moving parts groups.

d. General Motors, Ford, and Chrysler offer redistribution allowances. American Motors, Toyota, Volkswagen and other foreign car importers do not offer redistribution allowances.

e. Redistribution allowances o not directly increase gross profit but parts with a redistribution allowance show a 5 to 7% better dealer gross profit for Ford and General Motors parts and a 4 to 12% better gross profit for applicable Chrysler parts.

Tables 5.7 and 5.8 help to illustrate the above conclusions concerning stocking and redistribution allowances.

Because each manufacturer treats these allowances differently, the following analysis of stocking and redistribtuion allowances is addressed separately by car manufacturers.

5.3.1.3.1 General Motors (References 88-92, 102, 106)

a. Stocking Allowance

In the list of proprietary parts observed, General Motors allows a stocking allowance of 4%, except for the two parts which are the slowest moving and are stocked only in the "factory" class warehouse in Michigan. These items, the roof panel and seat bottom pad, are seldom sold.

Of the non-proprietary parts, the stocking allowance does not exist for the faster moving parts such as shocks, voltage regulators, spark plugs, air and oil filters and for starters, which dealers may service mostly with rebuilt pieces not acquired through the General Motors parts system. Exhaust system parts, brake parts, and engine oil pumps carry the 5% stocked allowance.

General Motors' requirements for qualifying for the 5% is that the order be placed on a specified order day, occurring once every two weeks, and is considered a basic stock order.

b. Redistribution Allowance

For the proprietary parts studied, most qualified for a redistribution allowance or "wholesale incentive": of 25% of the base dealer cost. To qualify for this allowance, the dealer must sell the parts to a legitimate body shop or auto repair shop. The selling price to the trade for parts which qualified for the redistribution allowance is dealer cost, the cost the dealer himself pays for the part. This allows the trade shop to sell the part at list price and make the same 40% gross profit the dealer would make on the part if he were to perform the repair work. For serving as a warehouse or jobber to the trade, the dealer realizes a gross profit of 25% on these items which qualify for the redistribution allowance. This allowance is made in the form of a monthly parts order credit of the allowances incurred during the month, when requested and verified on the proper form. It should be noted that a 25% gross profit is considerably less than a parts jobbers' average expected gross profit of 34-36% (average for over-the-counter and trade sales).

TABLE 5.7 NEW CAR DEALER PARTS ALLOWANCES

	STOCKING ALLOWANCE		REDISTRIBUTION ALLOWANCE		
	ALLOWANCE % OF DEALER COST	FREQUENCY IN SAMPLE	ALLOWANCE % OF DEALER COST	FREQUENCY IN SAMPLE	RANGE % HI-LOW
GENERAL MOTORS					
PROPRIETARY	5%	8 of 10	25.0%	6 of 10	25-25
NON-PROPRIETARY	5%	4 of 10	27.6%	7 of 10	25-30
FORD					
PROPRIETARY	5%	10 of 10	25.0%	6 of 10	25-25
NON-PROPRIETARY	5%	10 of 10	26.3%	10 of 10	17-35
AMERICAN MOTORS					
PROPRIETARY	0	10 of 10	0	10 of 10	0-0
NON-PROPRIETARY	0	10 of 10	0	10 of 10	0-0
CHRYSLER					
PROPRIETARY	5%	10 of 10	25.0%	7 of 10	25-25
NON-PROPRIETARY	15%	10 of 10	Avg.10.3%	7 of 10	6-15
TOYOTA					
PROPRIETARY	0	10 of 10	0	10 of 10	0-0
NON-PROPRIETARY	0	10 of 10	0	10 of 10	0-0
VOLKSWAGEN					
PROPRIETARY	0	10 of 10	0	10 of 10	0-0
NON-PROPRIETARY	0	10 of 10	0	10 of 10	0-0

Source: References 88 thru 115.

TABLE 5.8 DEALER AND TRADE GROSS PROFITS

	DEALER GROSS PROFIT				TRADE GROSS PROFIT
	% OF LIST PRICE		% OF TRADE PRICE		% OF LIST
	SALE TO CUSTOMER NO ALLOWANCES	SALE TO CUSTOMER INCL. STOCK ALLOWANCES	SALE TO TRADE INCLUDING REDISTRIBUTION ALLOWANCES	SALE TO TRADE INCL. STOCK & REDISTRIBUTION ALLOWANCES	SALE TO CUSTOMER
GENERAL MOTORS					
PROPRIETARY	38.0%	40.4%	22.6%	26.4%	32.0%
NON-PROPRIETARY	41.8%	43/0%	24.8%	26.8%	37.8%
FORD					
PROPRIETARY	40.2%	43.2%	22.3%	26.9%	34.9%
NON-PROPRIETARY	41.4%	44.4%	26.3%	31.3%	41.4%
AMERICAN MOTORS					
PROPRIETARY	38.3%	38.3%	20.4%	20.4%	22.5%
NON-PROPRIETARY	42.1%	42.1%	20.1%	20.1%	27.8%
CHRYSLER					
PROPRIETARY	35.0%	38.0%	21.4%	26.4%	32.0%
NON-PROPRIETARY	41.4%	48.6%	25.4%	37.4%	27.1%
TOYOTA					
PROPRIETARY	40.0%	40.0%	29.0%	29.0%	15.0%
NON-PROPRIETARY	43.2%	43.2%	29.0%	29.0%	15.0%
VOLKSWAGEN					
PROPRIETARY	40.0%	40.0%	33.0%	33.0%	10.0%
NON-PROPRIETARY	39.9%	39.9%	32.9%	32.9%	10.0%

Source: References 88 thru 115

NOTE: Figures are average of 10 parts studies with and without allowances

Some proprietary parts have no redistribution allowance. The parts are sold to the trade by the dealer at a cost somewhere between dealer cost and list, typically with a 22-25% markup from dealer cost. This results in a dealer gross profit of 18-20% of the selling price to the trade. The trade resells the part at list price and realizes a gross profit of 15-25%.

The selection of parts which qualify for the redistribution allowance is based on turnover. The faster moving proprietary parts qualify for the allowance and include body parts from the front, rear, and corners which have the greatest repair volume. The parts for the center of the car and fuel tank are not damaged as frequently and do not qualify for the allowance. These parts are not normally damaged by themselves, so a repair job involving the center body parts would usually involve some front and rear parts. Thus the trade establishment's overall gross parts profit would probably be closer to 40% than 25%. General Motors' parts distribution to their dealers for the slower moving parts is less than the normal 40% also. On some of these, even stocking allowances are not given.

For non-proprietary parts General Motors allows a wholesale incentive of 25-30% of the dealer cost for most parts observed. The 30% incentive were for shocks and electrical parts, while brake system parts received 25%. Items which are not normally supplied to the trade for resale by car dealers (filters and water pumps) offer no redistribution allowance.

The parts enjoying the allowance will return 25-30% to the dealer. The trade sells these at list for a gross profit of 40-45%, the same as the dealer would get if he sold the parts at retail. Parts without an allowance give the dealer a 14-20% gross profit on the sale to the trade firm. The trade firm realizes a gross profit of 25-30% of the list price sale to this customer.

5.3.1.3.2 Ford Motor Company (References 93,107)

a. Stocking Allowance

An allowance of 5% of the dealer cost is made on all proprietary and non-proprietary parts studied (and nearly all parts in the parts book). To qualify for this allowance, the dealer must order at specifically designated times on an appropriate form.

b. Redistribution Allowance

For proprietary parts the redistribution allowance is 25% of the dealer cost on applicable parts. Parts applicable, from the sample observed, are the same as for General Motors with the allowance not applying to the roof panel, door, front seat bottom pad and fuel tank for the same reasons as General Motors. Qualifying conditions are the same as for General Motors. The trade grosses 40% on parts with the allowance, and 25-31% on parts without the allowance. Dealer gross profits on sales to the trade are 25% on parts with the allowance and from 13-20% on parts without the allowance.

For the non-proprietary parts studied the redistribution allowance ranges from 17-35% of the dealer cost. All parts surveyed were applicable for the allowance. The maximum 35% allowance applies to shock absorbers, a 30% factor is applicable to electrical items and filters. Mufflers and water pumps qualify for a 17% rebate. The average redistribution allowance is 25% for the non-proprietary parts. The trade grosses the same as a dealer would on a retail sale, from 39-44 %, on the non-proprietary parts studied when sold at retail to their customers. Dealers realize a gross profit on these sales to the trade of from 17-35% (the same as the incentive).

5.3.1.3.3 American Motors (Reference 109)

a. Stocking Allowance

American Motors does not offer their dealers a stocking allowance for proprietary or non-proprietary parts. Parts supplied from American Motors warehouses to their dealers are supplied at one fixed price except for a few very fast moving, competitive parts. These high volume parts are coded and made available in quantity groups offering additional discounts of approximately 2½-10%(off list price) when purchased by the dealer in three levels of specified quantities. Only non-proprietary parts fall into this category. Starters, shocks, spark plugs, and filters from the list of parts sampled qualified for the quantity purchase considerations.

b. Redistribution Allowance

There is no redistribution allowance for proprietary or non-proprietary parts. However, wholesale prices are listed in the dealer price books for all parts. Of the parts studied, the established wholesale prices resulted in a gross profit to the trade of approximately 25% with a range of 15-25% for proprietary parts and 25-35% for non-proprietary parts. The gross profit to the dealer on these parts is predominantly 20% with a range of 18.5-27.5% for proprietary parts and 13-24% for non-proprietary parts.

5.3.1.3.4 Chrysler Corporation (References 94,108)

a. Stocking Allowance

Chrysler gives a 5% stocking allowance on all proprietary parts sampled and most similar parts shown in the parts book.

For the non-proprietary parts, Chrysler offers a 15% stocking allowance on all parts studied, which fall in the general category of competitive, medium to fast moving parts.

The Chrysler requirement for the dealer to qualify for the allowance is to: order for stock on the specified mail-in form; order no more frequently than once per week (specified day will ensure most rapid delivery of stock order); and order a minimum dollar value ($1,000 currently) or more.

b. Redistribution Allowance

A redistribution allowance of 25% is offered by Chrysler for applicable proprietary parts. Requirements for sale to the trade are the same as General Motors. From the list of parts the fuel tank, front door, and seat bottom pad were excluded by Chrysler, as they were by General Motors and Ford. Chrysler allowed 25% on the roof panel where General Motors and Ford did not. For those parts with the redistribution allowance, the trade cost is the same as dealer cost. The service shop then makes the same 35% gross profit on parts he uses to repair a customer's car as a dealer would if the repairs had been made at the dealer's shop. When the dealer sells these parts to the trade, his gross profit becomes 25% (the redistribtuion allowance). On parts without the allowance the trade grosses 25% selling at list to his customer and the dealer grosses 13% on the sale to the trade firm.

The non-proprietary parts carry a lower allowance, from 6-15% on applicable parts. Electrical parts (voltage regulator and spark plugs) do not receive any allowance nor do brake shoes. The highest allowances are for master cylinders and filters and the lowest for shocks and water pumps. The gross profits for the trade on these items are normally 25% because, even though small allowances are made to the dealer on some parts, the normal price to the trade is a 25% discount from list(not the dealer cost as on most items with a redistribution allowance). Spark plugs and oil filters are normally sold at approximately 35% off list to the trade. When sold in this manner the dealer usually realizes from 20-32% on the sale of these parts to the trade, depending on the redistribtuion allowance. But the large stocking allowance can add another 12% or so to this value. In large volume sales or repeated sales to shops that might use other sources, the price to the trade may be adjusted so the repair shop could realize a larger gross and the dealer somewhat less to make the sale. This would usually be limited to parts qualifying for the 15% stocking allowance.

5.3.1.3.5 Toyota (References 99, 113)

a. Stocking Allowance

Toyota does not offer a stocking allowance to their dealers for either proprietary or non-proprietary parts.

b. Redistribution Allowance

Toyota does not offer a redistribution allowance for proprietary or non-proprietary parts. Parts are sold to the trade at a 15% discount from list. When the trade resells at list, a gross profit on these parts of 15% is realized. The dealer receives a gross profit of 29% on the sale to the trade. The exception shown is spark plugs at 26% gross profit for the trade and 59% for the dealer, although, at the dealer's option, this split might be adjusted either way.

5.3.1.3.6 Volkswagen (References 101, 115)

a. Stocking Allowance

Volkswagen does not offer stocking allowances for proprietary or non-proprietary parts.

b. Redistribution Allowance

Redistribution allowances are not given for proprietary or non-proprietary parts. Parts are sold to the trade at a 10% discount from list, giving the trade a 10% gross profit on parts for service work. The dealer makes a gross profit of 33% on sales to the trade (compared to 40% for a list price sale). This means that the trade turns to domestic suppliers and general parts importers, who may carry higher list prices, but offer the service shop a larger gross parts profit, except for parts only available from Volkswagen. Alternatives might be to charge higher than list for parts purchased from a VW dealer and used on service jobs, or to negotiate a special purchase price from the dealer.

5.3.1.4 Overall Effect of Allowances

a. Stocking Allowances

These allowances add profit to the dealer parts operation when qualifying conditions are met by the dealer and the allowance is offered by the manufacturer. For example, on a normal retail sale that carries a gross profit of 40%, a stock allowance of 5% of dealer cost will result in an overall gross profit of 43% (the 3% increase applies to the 30-40% range). For Chrysler[108] non-proprietary parts that carry a 15% stocking allowance, a normal retail sale with a 40% gross profit will return a gross profit of 49% with the allowance. This 15% allowance also adds 12% to the gross profit on sales to the trade. A 5% stocking allowance normally adds 3-5% to the gross profit on sales to the trade.

b. Redistribution Allowances

When applicable, these incentives allow the dealer to sell parts to the trade at dealer cost so that the trade can make a gross profit equal to the dealer's gross profit on the retail sale of the same parts. The exception is for Chrysler[108] non-proprietary parts that carry a reduced allowance which compensates the dealer somewhat, but not to the extent that the dealer can sell at dealer cost to the trade. In these cases Chrysler's normal 25% discount to the trade applies, but the dealer gross profit (not considering stocking allowance) increases from 20% with no allowance, to 24-31% with the variable allowance. The net result in all cases is to modify the normal prices so that the trade and dealer can both make an adequate profit.

5.3.2 Labor

Labor charges vary according to many factors. Geographic area of the country, type of service facility, rural or urban location, and special local factors all combine to create various labor rates. However, there are some basic observations that can be made in relation to auto repair labor charges. These observations are the result of numerous telephone conversations with many different establishments in various parts of the continental United States.

a. Most car dealers, independent garages and service stations use a published labor guide to determine repair job time for basic repair work. These flat rates are used regardless of the actual time used to complete the job.

b. Service stations and smaller independent garages may also establish "job" prices applicable to all cars to simplify their labor schedules. Charging $25 to repair a water pump on any domestic car is an example of this.

c. Service stations may install some parts at no labor cost. This practice is normally limited to easily changed parts like wiper blades, bulbs, oil filters (with an oil change) or batteries.

d. Luxury car dealer labor rates are generally higher than all others. Urban area labor rates are higher than rural, with rates in New York City, Seattle, and San Francisco center city areas leading the country. The northwest, west central and northeast are higher than the southwest, east central and southeast areas of the country.

e. Car dealer labor rates are the highest, with independent garages and service stations following. Specialty shop rates normally fall between service station and independent repair garage rates, but could be higher depending on the labor efficiency and how much of the job price is allotted to labor.

Labor charges for a particular service job may vary extensively due to many influencing factors. Labor rates vary by general sections of the country due to various economic factors, but a wide range of variations may be found within any given area. A shop having particular, needed skills not available elsewhere in the vicinity, or a shop that caters to servicing a particularly high income segment of the population, may charge significantly higher rates than most other shops in the same local area. A service repair shop equipped for quick service or serving a low income population segment may charge lower rates than the average of shops in the surrounding area. The nature of a particular business and personality of the owner also have an effect of the rates charged.

There are, however, several general patterns that occur regarding labor rates in different parts of the country, in urban or rural areas, and among different types of service facilities.

Labor rates in urban areas are generally higher than in rural areas. Higher overhead and operating expenses in the cities require higher prices to support a profitable operation. Certain cities in the country, due to local economic conditions, charge higher rates than other seemingly comparable cities. New York, San Francisco and Seattle are among the cities with the highest service labor rates. Areas of the country that show the highest dealer labor rates are the northwest, west central, and northeast, in that order, followed by the southwest, east central and southeast.

Car dealer rates are usually higher than independent garages, which are followed by service stations. Again, the relative overhead would seem to be the justification for the order. Within the category of car dealers, the luxury car dealers have higher labor rates than non-luxury dealers.

Foreign car dealers' rates may be equal, above, or below the domestic car dealers' rates. A higher concentration of foreign cars and hence, foreign car dealers, usually creates lower foreign car labor rates. For that reason the foreign car rates in remote areas are generally higher than in more highly populated areas. This is due to the scarcity of dealers and added costs for acquiring necessary service parts.

Specialty shops normally charge a flat fee for a job which includes parts and labor charges as a lump sum. However, specialty shop labor rates are usually equivalent to independent repair garage labor rates. This can be increased greatly in a highly specialized shop that has a very high utilization and efficient service procedures, supported by specialized service equipment. A muffler and exhaust system service shop may add $12 to the cost of parts for labor to replace the exhaust system. If the normal service time on this job is 1.8 hours, the new car dealer would charge (at $13 per hour) $23.40 for the work. If the muffler shop takes 1.8 hours for this work, the hourly return is only $6.67 per hour. But if special procedures and equipment allow the work to be performed in one hour, then the rate is $12 per hour. Since the specialty shop probably receives a high discount on the parts, the profit will be high. If his operation is not so efficient and

1.5 hours is required for the work, then the rate will be $8 per hour and the profit must come from the parts margin. If on the other hand, the operation is very efficient and the work is performed in 45 minutes, the hourly rate would then be $16 per hour which would be fairly high. Thus the specialty shop rates can vary widely but will generally be equivalent to the range between the service station and independent garage.

The other factor affecting labor costs is the application of the rate. Most service facilities use a published flat rate labor guide to some extent in assessing labor charges. These guides list average hours required to perform specific service operations on specific vehicles and are intended to be used as a guideline for applying labor rates to determine labor costs. New car dealers use these guides almost exclusively. Labor hours go by flat rates recommended by the manufacturer regardless of the actual time required to complete the job. Independent garages use the guides on many jobs and service stations look to the guide's list frequently. The smaller independent garages and the service stations often develop more simplified "job" rates for the work commonly performed, rather than having individual rates for various cars and models for the same operation. With a smaller, more personal clientele the simplified "job" rates for work such as tune-ups, water pump changes, alternator replacement, valve adjustments and so forth, are easier for the service personnel to remember and cause less confusion to the individual customers. The "job" prices usually reflect a labor time somewhere between the fastest and slowest time for the range of cars serviced. On some jobs the garage will make more money and on some he will lose relative to his desired labor rate. The fact that special features of one car may require twice as much time to perform a given service operation compared to another make car without those features is not easily understood by most customers. Therefore telling all customers that a water pump change costs $25 becomes easier for the customer to understand and for the service station or garage mechanic to remember, and simplifies business procedures.

Service stations often install certain parts for no labor charge when the parts are purchased at the service station. Engine oil, transmission oil, brake fluid and rear end oil are usually installed with no labor charge. Oil filters are installed free with an oil change and wiper blades, antifreeze, bulbs and batteries are commonly installed at no charge. These are all items that are relatively quick to service and the service station parts markup compensates for the labor required.

5.3.3 Specialty Shops

Specialty shops offer the customer a service at a competitive price which includes both parts and labor. The following observations were made:

a. Specialty shop parts and labor prices are normally combined and not distinguished separately. Examples of this are: "Tune-up, $29.95 with points, plugs and condenser" and "Muffler, $23.95 installed."

b. Specialty shops normally purchase parts form their franchising or parent company, bypassing a warehouse stop in the supply chain and receiving larger discounts than available from a jobber or dealer. Franchise fees reduce some of the "extra" profit, however.

c. Specialty shop profitability is based on larger parts discounts and reduced labor time due to efficiencies achieved by limiting service to specialized areas and equipping the shop with special tooling. Due to the large equipment investment, the facility must operate near maximum capacity in order to achieve desired profit levels.

d. The better specialty shops offer the customer quick service work at competitive prices and often with long term gurantees, serviced nationwide. Gross profits before franchise fees can be 30-50%.

e. Parts are not required to be purchased from the franchiser but quality may be controlled.

Specialty shops provide service to one automotive system or group of systems that can be serviced with similar service equipment. One common example is brake, shock and exhaust system service. This service is usually based on muffler or exhaust system service. When the car is raised on a lift for exhaust system work, the shocks and brakes are readily accessible and few additional tools are necessary (the lift constitutes the most expensive tooling investment). Combined with the fact that all three operations are high volume service items the potential profit for these operations are high and the service variety helps to maximize facility utilization.

By charging reasonable prices, producing the work in a minimum time and often enjoying a high parts discount, the specialty shop can be a satisfactory business. Profits, however, are shared with the franchising company, if a franchise business and this reduces the gross profits somewhat. Operators hope that the name and reputation of the parent organization will generate sufficient additional business to justify the fees.

A nationwide exhaust system franchise distributes parts to their shops at a 55-60% discount[129]. However, the shop must install the mufflers for the list price and at no additional labor charge. If 25% is considered an assumed amount for installation labor, the shop earns $6.25 for the half-hour required to install a $25 muffler or an hourly rate of $12.50. The parts profit can then be considered to be 30% or $7.50 which would amount to a gross profit of 30% on the parts, about the same as a service shop would make on a jobber part. If an hourly rate of $10 is assumed and the job required 30 minutes labor time (usually a maximum time quotes) then $20 is left for the part cost and profit. The part cost of $11.25 ($25 less 55%)

leaves $8.75 as parts profit or a gross parts profit of 35%. Figure 5.2 illustrates this example. However, the installation for complete systems usually carries a $10-$20 labor charge over the total parts prices and the job usually requires 45 minutes to 1 hour. In these cases the gross profit can be as high as 55% on the parts.

The determining factor in profitability is efficiency. A continuously busy and efficient shop will use up less of the parts gross profit in labor costs and will realize higher profit levels. More expensive component applications will also return higher profits.

A specialty tune-up shop performing a tune-up including parts (plugs, points, condenser) for a fixed fee will have a similar parts discount situation with a parent company supplier. But to enjoy the increased gross profits (minus franchise fee) an investment is made in exotic service equipment which reduces required labor time. Thus this specialty shop can offer a quality tune-up at highly competitive prices, and, even after fees, enjoy a sustaining profit.

Job: Muffler Replacement

Charge: $25, installed

Parts Cost: at 55% discount

Time Required: 30 minutes

Analysis: Method 1; Assume 25% labor charge

Method 2; Assume $10 per hour labor charge

	Method 1			Method 2		
	%	$	Hourly Rate ($)	%	$	Hourly Rate ($)
Parts Cost	45	11.25		45	11.25	
Assessed Labor Amount	25	6.25	12.50	20	5.00	10.00
Parts Profit	30	7.50		35	8.75	
Total	100	25.00		100	25.00	

FIGURE 5.2 SPECIALTY SHOP SERVICE CHARGE BREAKDOWN

TWO METHODS OF ANALYSIS

6. VEHICLE MAINTENANCE

6.1 INTRODUCTION

This Section represents the background and assumptions used to develop the Scheduled and Unscheduled Maintenance requirements of 212 automobiles in model years 1970 to 1975. (A complete listing of the cars appears in Appendix C.) The assumptions used represent our best estimate of the requirements of modern automobiles.

Scheduled maintenance are those periodic vehicle repair and service operations required by the manufacturer as published in the owners' and factory workshop manuals. For example, replacement of an air filter at certain specified intervals is scheduled maintenance. These operations occur throughout the 10-year 100,000 mile life of a typical modern vehicle. As such they represent the minimum maintenance operations necessary to keep the vehicle in proper running condition.

Unscheduled maintenance is defined as any repair, adjustment, or placement of parts not specified in scheduled maintenance. For example while the inspection of brake pads may be scheduled maintenance, the replacement of the pads when they are worn is unscheduled maintenance. The distinction is made because the replacement interval of some parts varies with driver habits and usage of the vehicle.

Repairs resulting from corrosion and collision were specifically excluded from the scheduled or unscheduled maintenance.

6.2 SCHEDULED MAINTENANCE

6.2.1 Methodology

6.2.1.1 Maintenance Items, the individual maintenance items and recommended mileage intervals for each of the vehicle configurations were determined from the Owner's Manuals and/or the Maintenance Manuals published by each of the automobile manufacturers for 1970 through 1975. With a few minor exceptions, the recommended scheduled maintenance for all vehicle models of one manufacturer was basically the same. For example, all General Motors cars, regardless of division, had virtually the same recommended maintenance.

If the Owner's Manual indicated that a task be performed on either a time or mileage interval, whichever came first, the mileage interval was used. Thus '6 months or 6000 miles' was alway assumed to be 6000 miles.

TABLE 6.1 SCHEDULED MAINTENANCE ITEMS

Oil
Oil Filter
Coolant
Cooling System Flush
Cooling System Hoses
Chassis Lubrication
Fuel Filter
Spark Plugs
Spark Plug Wires
Repack Wheel Bearings
Air Filter Element
Distributor Points
PCV Valve
Eavaporative Emission Canister
Body Lubrication
Fluid Level Check
Air Conditioning Check
Cooling System Check
Brake Check
Power Steering Check
Drive (fan) Belt Check
Wheel Bearing Check
PCV Valve Check
Carburetor Shaft and Idle Cam Check
Crankcase Inlet Air Filter Check
Manifold Head Control Valve Lube
Air Filter Element Check
EGR System Check
Spark Advance Control Check
Automatic Choke Check
Catalyst Protection System Check
Exhaust System Check
Air Injection System Check
Ignition Timing Check and Adjust
Idle Speed and Mixture Check and Adjust
Engine Tune-up
Tire Rotation
Transmission Fluid
Idle Stop Solenoid

It was assumed that only the Scheduled Maintenance specifically designated in the manuals was performed. If the recommendation was to "inspect or check," no replacement of parts was made, i.e., "inspect spark plugs every 18,000 miles." In this case, the cost of new plugs would not be included in Scheduled Maintenance, but would be included in Unscheduled Maintenance. While the items specified by the manufacturers varied somewhat by manufacturer, the general type of scheduled maintenance items was similar. A general listing of all the scheduled maintenance items appears in Table 6.1. A general listing of all the scheduled maintenance items and maintenance intervals appears below. The reader is referred to Appendix E for a vehicle by vehicle listing of all scheduled maintenance items.

6.2.1.2 Parts Cost by Source

The replacement cost for Scheduled Maintenance parts were suggested list prices as of June/August 1975 and were derived from the following sources:

- Car manufacturers' parts/price books for car dealers (References 88 through 115).
- Atlas parts and price catalogs for Service Stations (References 123)
- NAPA parts and price catalogs for Independent Repair Garages (References 116, 117, 122, 130 through 139)
- Purolator's catalog and price list (Reference 124)

Since Atlas Supply Company (under the Atlas brand) is an aftermarket parts supplier to Exxon, American Oil and Standard Oil Companies, the Atlas pricing was considered most representative of pricing at the service station level.

NAPA (National Automotive Parts Association) is the largest independent aftermarket distribtuion group with 22 major distribution centers and 4,500 jobber outlets throughout the country. NAPA pricing, therefore, was considered representative for repair garages.

Purolator, the largest aftermarket filter supplier, was used for pricing data on selected filters not handled by either NAPA or Atlas Supply Company.

In all cases, where a cooling system flush was recommended, Union Carbide's Prestone Heavy Duty Flush ($1.95 per can) was assumed to be used, since this product has the major market share. When the coolant was changed, a 50-50 mixture of antifreeze ($1.75 per quart) and water was assumed.

For highly competitive products such as oil and antifreeze, national brand pricing was used even though the car dealer may have had an OEM product - with a part number - available to him. Usually, but not always, when the OEM price is higher, it is common dealership practice to use national brand products, such as Kendall or Quaker State oil ($0.95 per quart) and Prestone antifreeze, and this study assumed that this is the case. For purposes of this study a fixed price of $1.75 per quart was used for antifreeze for all servicing outlets, even though the price fluctuated greatly depending on the time of year.

For replacement proprietary parts, the same OEM product and cost was used for Service Stations and Independent Repair Garages, assuming that they would buy the product from a car dealer for resale. For example, the distributor cam lubricator for Cadillac Eldorados is not available in the aftermarket from other parts suppliers. A non-dealer would buy this part from a Cadillac Dealer at a discount (see Chapter 5) and resell it to his customer at the same list price. Costs are discussed in detail in Chapter 5.

6.2.1.3

Labor Hours, the labor hours used in determining labor costs were derived from Chilton Company studies for their Labor Guide Manuals. As such, labor hours are constant for all establishment types. The basis for the Chilton Labor hours is the OEM Warranty Time Schedules adjusted for differences that exist in servicing vehicles in used condition (dirt and corrosion) and under less than ideal facility conditions.

The reported labor hours cannot be used for all Scheduled Maintenance functions. For example, the labor hours for an oil change is 0.3 hours and for an oil filter change is 0.3 hour. However, when the oil and filter are changed at the same time, the total is only 0.3 hour. In a similar manner, if the manufacturer indicates that spark plugs should only be checked, there is no labor charged for their replacement, as the labor is the same for checking and re-newing as checking and re-installing. The labor hours were adjusted to account for such overlapping functions.

Most independent repair shops and service stations do not charge for labor for Scheduled Maintenance when a parts sale is made. They do not, for example, charge labor for an oil change and oil filter replacement, but they depend on profit from the sale of the filter and oil. In a very few cases, dealers have the same policy for fast moving parts. Toyota, for example, has a sales price for points which includes the labor of installation.

It is assumed that all servicing facilities use the recommended labor hours multiplied by their hourly rate for all service where an across the board 'flat rate price' is not established (such as repacking wheel bearings or performing an emission inspection).

Much of the Scheduled Maintenance requires a series of checks, adjustments or inspections at various intervals with no replacement parts used. Servicing facilities charge the customer a 'package' rate for groups of maintenance checks such as $14.95 for an emissions check. Therefore, all maintenance items in this adjust or inspect category were grouped into three areas - safety, emissions and tune-up. Tables 6.2, 6.3 and 6.4 indicate the typical emissions maintenance functions performed for each vehicle manufacturer. Hourly rates were assigned based on the amount of work done in each area at each interval. In determining Scheduled Maintenance costs, consideration was given to overlapping jobs (adjusting idle fuel mixture in a tune-up and emission check) so as not to duplicate the labor dollars. Similarly, no labor is charged for spark plug replacement, as an example, since this labor would be charged with the labor of the tuneup for removal and replacement of spark plugs, whether or not they are the old or the new plugs. The Chilton Parts & Labor Guide (144) indicates a recommended Safety Emission and Tune-up rate, including the specific checks to be made (Figure 6.1). These were compared to the OEM servicing recommendations for each vehicle and adjusted, if necessary, to the time allocated to perform only the recommended service at each mileage interval.

It was determined that the Specialty Repair facilities such as Midas, AAMCO, Rayco, etc., would not be involved in Scheduled Maintenance except on rare occasions - i.e., adjust transmission bands at AAMCO. Labor and parts costs for Specialty Shops, therefore, are not included in Scheduled Maintenance.

6.2.1.4

Labor Rates By Facility, labor rates charged by Car dealers, Service Stations and Independent Repair Garages vary considerably with the area of the country and/or the metropolitan area. Generally, rates in the South and in suburban areas of the balance of the country are considerably lower than in major metropolitan areas. Labor rates of Car Dealers are normally highest followed by those of Independent Repair Garages and Service Stations, respectively. Labor rate differences between types of service facilities reflect overhead burdens, investment and mechanic pay scales (presumably based on competence and training).

6.2.1.4.1

New Car Dealers, the labor rate for Car Dealers was established from data accumulated by Chilton(16). Even though the reate varies by kind of dealership and deomgraphic factors mentioned above, the rate used for the Scheduled Maintenance task was computed by Chilton as being a reasonable

TABLE 6.2 1975 DODGE DART MAINTENANCE SCHEDULE

(Typical of Chrysler Corp.)

Every 5000 Miles (Emissions 1)	Every 15,000 Miles (Emissions 2)	Every 30,000 Miles (Emissions 3)
Check Automatic Choke	Check and Lube Exhaust Control Valve	Replace Air Filter
Clean Fast Idle Cam & Pivot	Check and Clean or Replace PCV Valve System	
	Clean or Replace Crankcase Air Filter	
	Check Spark Advance Delay Valve	
	Clean Air Filter	
	Check Catalyst Over Temp. Devices	
	Check EGR System	
	Check and Adjust Ignition System, Idle speed, Fuel Mixture, as required.**	

TABLE 6.3 1974 CHEVROLET IMPALA MAINTENANCE SCHEDULE (DATA SHEET 144)
(Typical of General Motors)

First 6000 Miles Only (Emissions 1)	Every 12,000 Miles (Emissions 2)	Every 24,000 Miles (Emissions 3)
Check Carburetor Mounting	Check Thermo Control Air Cleaner	Check Evaporative
	Check Carburetor and Choke	Fuel Emissions
	Check PCU System	Valve
	Check Idle Stop Solenoid	Replace Air Cleaner
	Check Idle Speed	Check Air System
	Check EGR System	
	Check Transmission Control Switch	
	Check Spark Plug Wires	
	Check and Adjust Timing	
	Check Manifold Head Valve	
	Check Vaccuum Advance	

TABLE 6.4 1975 FORD PRODUCT MAINTENANCE SCHEDULE

First 5,000 Miles	Every 20,000 Miles
Check and Adjust Fuel Decleration Valve	Check Exhaust Control Valve
Chek and Adjust Fast Idle Speed	Replace Air Cleaner Element
Check and Adjust Carburetor Idle Speed	Check and Adjust Idle Speed and Mixture
Check and Adjust Throttle Solenoid "off" Speed	Check Automatic Choke
	Inspeed Evaporative Emission System
	Check and Clean PCV System
	Check Spark Control and Delay System
	Check Air Cleaner Temp. Control
	Check Thermal Reactor System
	Check Fuel Deceleration Valve

Based on Data Sheet 182 and Ford 1975-1976 Car Shop Manual, Vol. 5, Schedule "A" (49 state) FPS 365 126 76E.

CHILTON'S EMISSION CONTROL TUNE-UP

1. Clean or renew P.C.V. valve, hoses and filter
2. Check fuel tank cap for sealing ability
3. Check fuel tank and fuel lines for leakage
4. Check evaporation canister and filter. Replace if necessary
5. Check engine compression to determine leakage of unburned gases. (Add time for items of interference)
6. Test and clean or renew spark plugs
7. Check engine oil dipstick for sealing ability
8. Test exhaust system with analyzer and check system for leakage
9. Check exhaust manifold heat valve for operation
10. Adjust ignition timing and carburetor idle speed and mixture.
11. Check automatic choke mechanism for free operation.
12. Inspect air cleaner and element
13. On models so equipped test distributor vacuum control switch and transmission control switch

All models

Six	1.5
V-8	1.8

For repairs made charge accordingly

CHILTON'S 10 POINT SAFETY CHECK

CHECK OPERATION & CONDITION OF THE FOLLOWING ITEMS:

1. Legal Registration (serial no.)
2. Tires & Wheels
3. Brake System (R&R all wheels)
4. Light Systems & Signals
5. Accelerator Linkage, Neutral Safety Switch, Shift Indicator Pointer & Seat Position Locks
6. Glass, Mirrors, Door Locks, Seat Belts & Harness
7. Wipers, Washers & Defrosters
8. Frame, Steering, Shocks, Front & Rear Suspension
9. Fuel & Exhaust Systems
10. Road Test Vehicle

All models	1.0
Exhaust Smog Analysis add	.4

Compression Test

Six—1968-75 (.7)	.8
V-8—1968-75 (.9)	1.1
w/A.C. add	.3

Engine Tune Up, (Minor)

Includes: Clean or renew spark plugs, renew ignition points and condenser, set ignition timing, set carburetor idle mixture and idle speed. Service carburetor air cleaner.

Six—1968-75	1.2
V-8—1968-75	1.6
w/A.C. add	.6

Source: Chilton (Reference 144)

FIGURE 6.1 RECOMMENDED LABOR TIME RELATED TO SAFETY AND EMISSIONS OPERATIONS

national average. The rate does take into consideration however, the fact that luxury car dealers normally have a higher labor rate than all others.

Luxury Cars	$14.00
All Others	13.00

6.2.1.4.2

Service Stations. The labor rate for service stations was established at $9.50 per hour from a survey performed by the Sun Oil Company of their dealers from Maine to Florida[39]. Service stations often charge on a 'job basis' rather than an 'hourly' basis for frequent and common jobs such as:

- Lubrication $2.50-3.00
- Tire Service 1.50-200/Wheel

Service stations use their hourly rate for repair and servicing of:

- Air Conditioning
- Valves/Rings
- Fuel/Water Pumps
- Front End Suspension
- Engine

6.2.1.4.3

Independent Garages. The labor rate for independent repair garages was established from data accumulated by Chilton[41]. Although they charge flat rate prices for common jobs, as do service stations, the majority of their work is in more complicated repairs. As a result, they charge more labor by hour than service stations. The average labor rate is $11.00/hour.

6.2.2 Summary

The scheduled maintenance and its cost for 212 1970-1975 automobiles has been compiled by make and specific model. These compilations are presented in tabular form in Appendix E. The scheduled maintenance costs are based upon the manufacturers recommended maintenance schedules for each, and reflect the actual scheduled costs (1975 dollars) for operating a car for 100,000 miles. These costs are somewhat dependent upon the repair facility which the owner partronizes. The average cost to perform the required maintenance over the life cycle of a vehicle is approximately $1100. However, comparison of aftermarket spark plug sales and the number of total vehicles on the road results in the conclusion that the whole scheduled maintenance is not performed as often as recommended by the manufacturer.

6.3 UNSCHEDULED MAINTENANCE

Unlike the scheduled maintenance, unscheduled maintenance could not be developed for each specific car. Instead, the frequencies for performing unscheduled maintenance, and the components which are normally replaced during the typical 100,000 mile, 10-year life of a car, are generalized for all cars. The parts and their replacement frequency are based upon the aftermarket sales of the parts and the "typical" vehicle life. It was impossible to determine the actual unscheduled maintenance costs for each make and model of car because the wear-out rate for the various makes and models of cars could not be determined with any credibility (see Section 6.3.1.1).

The unscheduled maintenance costs in this Section are dependent upon vehicle make and model only to the extent that the cost of parts and repair times were determined as a function of car make and model. By necessity the replacement frequencies were considered the same for all cars.

6.3.1 Methodology

The following assumptions are made relative to listing component parts of a vehicle that may require repair or replacement, the frequency or probability of replacement, and the associated costs incurred:

a. All scheduled maintenance recommended by the manufacturer for each vehicle is completed on schedule

b. Because scheduled maintenance is performed there are no basic engine or transmission failures over a 100,000 mile designed life cycle.

c. The contract directs that crash repairs not be included in the unscheduled maintenance cost. It is further assumed that proper owner performed preventive maintenance precludes body corrosion damage. Therefore, body part replacement costs are not included in the unscheduled maintenance costs.

d. Because an actual ten-year vehicle maintenance history does not exist, unscheduled maintenance for all the study vehicles is forecasted as described in Section 6.3.1.1

e. All vehicle component parts are designed and sized to perform satisfactorily on the vehicle on which they are used. For example, brakes and suspension components for standard size cars are larger and stronger than those installed on compact cars. The assumption is made that replacement intervals and mechanical component failures are consistent throughout the range of vehicles studied.

TABLE 6.5 UNSCHEDULED MAINTENANCE ITEMS

Oil Pump
Carburetor
Fuel Pump
Power Steering Pump
Hoses and Belts
Generator/Alternator
Starter Motor
Water Pump
Radiator
Wheel Bearings
Shock Absorber
Ball Joints
Front Wheel Alignment
Universal Joints
Front and Rear Brake Pads/Shoes
Front and Rear Brake Discs/Drums
Master Cylinders
Wheel Cylinders
Brake Hoses
Brake Fluid
Brake Booster
Tie Rod Ends
Exhaust Pipe
Muffler/Resonator
Tail Pipe
Windshield Washer Pump
Wiper Blades
Battery
Voltage Regulator
Distributor Cap
Rotor
Points
Condenser
Lamps/Bulbs/Flasher Unit
Spark Plugs
Spark Plug Wires
Air Conditioning Compressor
Air Conditioning Condenser
Power Window Mechanism
Heater
Tires

- Differences in tire construction are considered in assessing required replacement intervals for tires.

6.3.1.1

Component Replacement: Frequency and Probability. An in-depth study was conducted of 19 different organizations to review all potential sources of available extended-life maintenance data. It was concluded that all previous studies and available data were either not credible or were not typical of normal usage and hence not applicable to this study (see Appendix B). The forecasting base was then established by:

- Listing of wear components serviced by unscheduled maintenance ("wear components" are those components which wear out with vehicle usage).

- Listing wear rate factors corresponding to the selected components to indicate frequency of service during the vehicle's life cycle.

The list of wear components was drawn up after consultation with OEM and aftermarket manufacturers, aftermarket sales outlets and Chilton Company automotive service experts. The final list was confirmed by Chilton experts as a reasonable representation of items serviced within the unscheduled maintenance definition, see Table 6.4.

While many of the components required multiple changes throughout the 10-year 100,000-mile life cycle, some parts listed only required service on a fraction of the vehicle universe. Some items, such as spark plugs, were replaced for some vehicles during scheduled maintenance, and hence are not universally unscheduled maintenance items. The components selected represents our best estimate of parts that would require unscheduled maintenance on a vehicle receiving normal usage throughout its life. We recognize, however, that there will be many exceptions to both our selection of components and failure frequencies.

Input for establishing wear rate factors (frequency factors) from service personnel, automotive manufacturers, aftermarket manufacturers, trade associations and Chilton service experts. The summation of this information was used to establish most of the wear rate factors listed on the unscheduled maintenance work sheets in Appendix F.

Three basic 'hard data' sources were used - the 1972 Census of Manufacturers; Hunter Publishing Company, 1975 Service Job Analysis and Frost & Sullivan's 1975 Automotive Aftermarket studies. The weaknesses of each of these sources, however, should be recognized.

Another source verifies that average battery life is 42-48 months.

$$\frac{120 \text{ months}}{42 \text{ months}} = 2.86 \text{ batteries for 19 year life}$$

The factor used was 2.8 for batteries.

a. Shock Absorbers

The shock absorber picture is more complex because the industry does not believe shocks are sold for cars over 10 years old. (Statistics indicate sales for cars over 10 years old are negligible.) So the vehicle population considered is less than tht total vehicle population. The population of cars 10 years old or less is 93,200,00 for 1975 compared to a total population of 107,000,000. Total shocks sales figures indicates 45 to 50 million shocks were sold for use on these 93.2M cars and light trucks.

$$\frac{48M}{93.2M} \times 10 \text{ years} - 5.2 \text{ shocks for}$$

each car during 10 year life. The factor used is 5.0.

b. Fuel Pumps

Both new and rebuilt fuel pumps were used in unscheduled maintenance. The 1972 Census of Manufacturers reports 7.9 million new fuel pumps being shipped to the aftermarket. In addition, 2.5 million rebuilt units are reported to be shipped through all channels. Since it is doubtful that rebuilt units would be used at the OEM level, it is assumed that these 2.5 million rebuilt units would be shipped to the aftermarket - making the total aftermarket unit sales 10.4 million in 1972.

Frost and Sullivan forecasts that unit shipments have declined approximately 3.7% per year from 1972 to 1975 because of improved quality of OEM pumps. This therefore would provide an estimated total replacement market of 9.5 million units in 1975. With a total of 130 million total vehicles on the road in 1975 it is estimated that 7.3% or 9.5 million of them replaced a fuel pump. Over a 10 year period therefore, a factor of .73 was used.

c. Water Pumps

The 1972 Census of Manufacturers reports sales of 6.6 million new water pumps to the aftermarket. In addition, 6.2 million rebuilt units were sold. Assuming all rebuilt units would be sold in the aftermarket the total number of units sold in 1972 was 12.8 million. With 117 million total vehicle using 12.8 million water pumps in 1972, it is estimated that 11% of them replaced a water pump. Assuming no reason for this relationship to change by 1975 a factor of 1.0 was used over a 10 year period.

d. Oil Pumps

The 1972 Census of Manufacturers reports 2.9 million oil pumps being shipped in total. Although the quantity shipped to the aftermarket is not available, we estimate that almost all OHM oil pumps are shipped as part of the engine and the 2.9 million therefore are primarily all going into the aftermarket. With 117 million total vehicles using 2.9 million oil pumps in 1972, it is estimated that 2.5% of them replaced an oil pump. Assuming no reason for this relationship to change by 1975, a factor of .3 was used over a 10 year period.

e. Starters/Generators/Alternators

The only published data that could be found relative to the market for starters, generators or alternators is the 1975 Service Job Analysis from Hunter Publishing Company. This data reports that 11,579,000 new or rebuilt starters were installed in 1975 and 5,148,000 generators. Direct contact with the major aftermarket manufacturers in these areas (Champion Parts, Raylock Corporation and Arrow Automotive) basically confirms the market for starters as being about 11.6 million units but reports the generator market at about the same volume - as opposed to the 5 million reported by Hunter. Based on the available information, and using our own experience, we estimate both markets to be about 11.6 million units in 1975 - assuming the data reported by Hunter for generators was due to a sampling error.

The 11.5 million unit total replacement market includes some 10 million trucks and buses over 10,000 GVW. Because of the high mileage associated with this group we estimated that their use of starters, generators and alternators would be greater than the light duty truck or passenger car market - thereby reducing the market to some 10,000,000 units of each for the passenger vehicle market.

With 120,000,000 cars and light trucks using 10,000,000 starters or alternators in 1975, we estimated that 8.3% of them had a replacement. Over a 10 year period therefore a factor of .8% was used.

f. Carburetors

It was assumed that rebuilt carburetors would be used for all unscheduled maintenance except for luxury and import cars. There are two published sources of data on carburetor replacements (new and used) both of which are considered 'soft'. Hunter Publishing 1975 Service Job Analysis reports a total of 4,082,000 new or rebuilt carburetors being installed in 1975. This amounts to about 3% of the 125,000,000 gas engine vehicles on the road. Based on contacts with major manufacturers the replacement market is known to be much larger. Frost & Sullivan, based on their projections of the special reports to FTC in 1967 (which they indicated may be 'understated')

reports total wholesale sales of $55,800,000 for carburetors. Considering an average wholesale price of $18.00 each, the unit market would be about 3.1 million, or less than the Hunter data. The missing element appears to be the number of carburetor kits that are used for rebuilding by the repair shop rather than buying a rebuilt unit complete. Frost & Sullivan further projects a market of $36.6 million for carburetor kits in 1975. At an average wholesale price of $5.00 each, a total of about 7.3 million units were sold.

Considering only the Frost & Sullivan data therefore, approximately 3.1 million complete units were sold plus 7.3 million kits for rebuilding - for a total of 10.4 million carburetors service jobs.

Unlike the U.S. Census of Manufacturers where the data reported is for motor vehicles (SIC 3711) only, we suspect that the information provided to the FTC in 1967 by the component manufacturers may have been for all of their sales including off-road (SIC 3254, 3531, 3533, and 3537). Accordingly, we adjusted the market volume figure downward by 10% - from 10.4 million to 9.4 million - to apply to the automotive market only. With 125 million gas engine vehicles on the road in 1975, 7.5% had either a new or rebuilt carburetor. The replacement factor of .75 was used over a 10 year period.

g. Universal Joints

The 1972 Census of Manufacturers reports 10.3 million universal joint repair kits being shipped into the automotive aftermarket as well as 600,000 new ones, or about one universal joint per vehicle. This compares to the 1975 Hunter Service Job Analysis information of 13.5 million replacements with the increase of vehicles in 1975 as compared to 1972. The frequency factor used therefore was 1.0.

h. Radiators

Maintenance costs for radiators is difficult to allocate based on available information. The 1972 U.S. Census of Manufacturers reports 800,000 radiators being sold into the aftermarket. It is assumed that most of these were for replacements in vehicles involved in accidents. Hunter's 1975 Service Job Analysis reports 11,923,000 jobs performed on radiators. These jobs could range from a minor leak repair to a complete cleaning of the core or replacement of the tanks or oil cooler. These repairs would have a broad range in cost including labor and parts and would vary by vehicle based on size and accessory equipment such as air conditioning.

Based on Hunter information, all vehicles will have at least one radiator repair over a 10 year period. In order to assign a cost by vehicle to these repairs, we used the cost for a new radiator and reduced the frequency from 1.0 to .5 - recognizing a complete radiator would cost more than a repair.

Although new radiators would not be used with the frequency indicated, it is felt that the total fleet cost for radiator maintenance would be about the same.

i. Ball Joints

Hunter's 1975 Service Job Analysis reports 10,193,000 jobs performed for ball joint replacements, or about 10% of the vehicles every year. This is equivalent to 1.0 of the vehicles over a 10 year period.

j. Mufflers

The 1972 U.S. Census of Manufacturers reports 32.5 million mufflers being shipped to the automotive aftermarket. Frost & Sullivan projected an increase to 37.8 million in 1975. This would be the equivalent of about 30% of the vehicles in 1975 replacing a muffler or all vehicles replacing a muffler an average of three times over a 10 year (100,000 mile) period.

k. Exhaust and Tail Pipes

Based on the 1972 Census of Manufacturers 42.3 million pipes (used in exhaust systems) were shipped to the automotive aftermarket. Using Frost & Sullivan's projections, the market in 1975 would have grown to about 45 million units. This would be equivalent to 4 pipes/vehicle over a 10 year period.

Based on otherindependent estimates we had received on the total market, the figure of 45 million units appeared somewhat low. A review of the Census data showed that the 42.3 million pipes sold in 1972 for a total value of $98.8 million or $2.30/pipe at manufacturer's selling prices. The actual average wholesale price for all exhaust pipes used in a 1972 Chevelle however, was closer to $5.00 - leading us to believe that the census was understated. Recognizing that industry practice frequently involves replacement of a tail pipe at the same time as a muffler, we estimate that about 30 million tail pipes are replaced or about three/vehicle over a 10 year period. In addition, we estimate, based on industry contact, that two exhaust and/or crossover pipes are replaced over a 10 year period, which would make the total market close to 50 million pipes rather than the 42.3 reported in the census.

l. Wheel Cylinders

The 1972 U.S. Census of Manufacturers reports 5.5 million wheel cylinders being shipped into the automotive aftermarket. This data however is not indicative of the maintenance performed on wheel cylinders since the majority of repairs are made with rebuilding kits. Hunter's 1975 Service Job Analysis reports 35.5 million jobs performed in replacing or overhauling wheel cylinders. This is equivalent to servicing all four wheel cylinders on about

10 million vehicles - or once for all vehicles over a 10 year period. (Note: costs used in computing replacement was based on use of rebuilding kits.)

m. Brake Drums

Much of the service work performed on brake drums involves "turning" or "grinding" them rather than actual replacement. The census data therefore is not adequate to determine maintenance costs.

The Hunter 1975 Service Job Analysis reports a total of about 40 million service jobs being performed on brake drums - either new replacements or "turned". This is equivalent to 10 million vehicles having all four drums repaired in 1975 - or all vehicles having four drums repaired over a 10 year period.

n. Windshield Wiper Blades

Frost & Sullivan projections indicate that the aftermarket for windshield wiper products in 1975 was $71.5 million - and it is assumed that about 80% (or $56 million) of this volume would be attributed to wiper blades. Using an average wholesale volume of one dollar per blade this would place the unit volume at about 56 million - or 28 million vehicles replacing two blades each year. Over a 10 year (100,000 mile) period therefore the average vehicle would replace about four blades (56 x 10 divided by 130 = 4.3).

o. Brake Linings/Pads

The 1975 Hunter Service Job Analysis reports 60.8 million (wheels) brake shoes relined; and, 16.9 million (wheels) disc pads replaced. This is equivalent to about 30 million axle sets of replacement brake shoes/pads in 1975. No other "hard" data could be found to confirm these statistics.

The Hunter data is based on jobs performed in all repair facilities except mass merchandisers, specialty brake shops or the "do-it-yourself" market. Brake lining repair is a service activity that is performed to a large degree through repair facilities not covered by the Hunter study. To adjust the market size accordingly therefore, we estimate these facilities perform an additional 25-30% of the brake lining repairs - increasing the total market to about 50 million axle sets annually. Over 100,000 miles therefore the average vehicle would used about 5 axle sets of linings/pads.

Based upon interviews with manufacturers and experience in the repair industry it was determined that these 5 axle sets would be used with three sets on the front axle and two on the rear.

p. Brake Fluid

The 1975 Hunter Service Job Analysis reports sales of 39.8 million pints of brake fluid. As was indicated previously, this data does not include the mass merchandise market which is estimated to add an additional 10 million pints for a total market of 50 million pints of brake fluid. Over a 10 year period this would be equivalent to about 2 quarts/vehicle, which appears to be very high in our expert opinion.

The average hydraulic brake system contains about 1½ pints of brake fluid. This system should be "bled" completely at time of cylinder repair. Considering that wheel cylinders will be replaced once in a 100,000 miles therefore, approximately 1½ pints would be used. In addition, it is expected that 12-16 ounces of brake fluid would also be purchased to "top off" master cylinders throughout the life of a vehicle. Although only 1-2 ounces may be required to "top-off", the car owner almost always must buy the complete can since it is unsafe to reseal a can of brake fluid (moisture absorption lowers boiling point).

Considering these factors we estimate the average vehicle uses one quart of brake fluid over a 100,000 miles.

q. Ignition Parts (Points, Distributor Caps, Voltage Regulators, Spark Plug Wires, Battery Cables, etc.)

The only published "hard data" that could be found in this area included a number of parts as a group or category. Frost & Sullivan projected a total wholesale market of $390 million in 1975 for this category - which is equivalent to about $1 billion at retail.

Based on contacts with manufacturers we estimated the frequency of replacement for these components as follows:

Voltage Regulator	100
Distributor Cap	100
Rotor	400
Spark Plug Wires	100

Note: Points and condenser were included as part of scheduled maintenance

Using these frequencies and applying the component cost for an average vechile (1975 Chevelle, 350 CIV-V-8) the cost per vehicl totaled about $90.

Voltage Regulator	100 x	$22.00	= $ 22.00
Distributor Cap	100 x	11.65	= 11.65
Rotor	400 x	3.65	= 14.60
Spark Plug Wires	100 x	41.50	= 41.50
			$ 89.75

At $90.00 per vehicle times the number of vehicles (117 million) the total market would be $1.05 billion, or equivalent to the Frost & Sullivan projection.

The unscheduled maintenance costs shown for these components are therefore substantiated by the Frost & Sullivan projectsions using the indicated frequencies of replacement. These frequencies were established through discussions with manufacturers and industry experts.

r. Tires

The replacement intervals for tires were developed by vehicle, based on the assumption that all tires are replaced by the same size and type as original equipment and that replacement tires will run the guaranteed mileage. This results in variables by vehicle such as eight replacement tires being used for those with radials, 16 for bias belted and 20 for bias ply tires.

Since the replacement interval varies by vehicle it is difficult to relate to market figures for any given year. In broad terms, however, the intervals appear to be realistic considering that the total number of new tires sold in 1974 was about 130 million with about 30 million of these being radials. This is equal to about one tire per vehicle year or 10 over a 100,000 mile period.

s. Lamps/Bulbs/Flashers

These components were included as a group with a fixed cost of replacement of $5.00 over a 100,000 mile period. It was predicated on two sealed beams and one flasher being replaced at a cost of $1.50 each plus several parking bulbs.

The sealed beam replacement figures are supported somewhat by the Hunter 1975 Service Job Analysis which reports 32 million sealed beams as being sold, although this figure appears slightly inflated based on inputs received from various manufacturers.

t. Spark Plugs

Although spark plugs were listed as an unscheduled maintenance component they in fact, were scheduled maintenance items in all cases except:

American Motors	1970-1975
Ford	1970-1971
Mazda	1975

In these cases, the replacement cycle selected, corresponded with the manufacturers' recommended tune-up interval. As had been discussed in the scheduled maintenance report all service or replacement work was assumed to have been done at the manufacturer's recommended interval.

Replacement cycles for spark plugs range between 300 and 800 dependent upon manufacturer and model year.

u. Front End Alignment

The 1975 Hunter Service Job Analysis reports 31 million front end alignment jobs being performed. This is equivalent to about 25% of the vehicles being serviced each year or each vehicle being serviced a little more than twice over 100,000 miles. The frequency factor used was 2.0.

v. Brake Boosters, Power Steering/Seats, Washer Pumps, Heater Cores, AC Compressor and Condenser/Receiver, Hose and Belts, Tie Rods Ends, Power Window

Replacement or service intervals on these items were estimated based on discussions with various industry experts. No hard data to support them could be found.

Tire life was considered to be Sears guaranteed mileage life for the same size, quality, and type tire supplied as original equipment for the vehicle.

The final selection of all factors assigned was made by Chilton after considering all sources of input relating to a given time. The final factors were sent to several automotive manufacturers for their review and concurrence. As such, we believe that these factors are a best estimate of industry-wied failure frequencies.

6.3.1.2 Component Cost

6.3.1.2.1

By Establishment Type. Two factors, parts cost and labor cost (labor time times labor rate) determine the cost of servicing a component. Parts costs from several sources were used for references.

a. New Car Dealers

New Car dealer parts books and lists were used to establish part numbers for unscheduled maintenance components supplied by the manufacturers. These parts were priced using manufacturers' price books in effect for September 1975.

It was generally considered that repairs made by a new car dealer's shop would use OEM supplied parts. Discussion with dealership service people indicated that some items were usually serviced with rebuilt parts. Since this is a most cost-effective service procedure, the assumption was made that carburetors, power steering pump, alternators, generators and starters were serviced with rebuilt components by all service facilities, including dealers. These parts were considered to be supplied by NAPA sources.

On the other hand, radiators, brake boosters, air conditioning condensers and heater cores were normally available only from the dealer as new parts and these were considered to be OEM supplied for all service facilities: dealers, service stations, and independent repair shops.

b. Service Stations

A survey of several service station operators indicated that in most cases, a minimum selected-parts inventory was stocked. In general, a comprehensive supply of hoses and belts, shock absorbers, universal joints and tune-up parts were on hand and were supplied from the service station parent company supply channel. Certain economic considerations supported by company policy influences this source selection. For service jobs beyond these items most service station operators turn to their local parts houses (jobbers) for needed parts, thereby avoiding large inventory expenditures. This study showed that the use of service station parent company supply sources was

cost effective for repair jobs requiring hoses, belts, shock absorbers, and unversal joint kits. Therefore, these items are shown as priced from the Exxon Company price[118,123] book effective April 1975 in the column indicating service station unscheduled maintenance costs. Other components are procured from parts house sources such as World Parts[143] and NAPA[132]. Rebuilt parts are used as previously noted, except for items available only from OEM sources mentioned above.

c. Independent Repair Garages

Independent repair garages procure necessary parts from local parts houses who are backed up by national supply warehouse systems. All components, except those noted as being rebuilt or OEM supplied, are considered to be supplied by NAPA parts system jobbers for domestic cars and Volkswagen, and by World Parts jobbers for foreign cars. For this study NAPA parts prices were taken from the July 1975 issue catalog[122], World Parts prices from May 1975 catalog[143],rebuilt power steering pumps and carburetors from November 1975 price sheets[121], rebuilt alternator prices from December 1974[116], and rebuilt starters from February 1975 lists[117]. Windshield washer pumps are Anco items priced from November 1975 sheets[120].

When parts were not found to be available from aftermarket sources the OEM sources were used, since the repair shop or service station would have to use the new car dealer as his supply source. Foregin car parts availability from sources other than OEM are limited, except for Volkswagen, Toyota and Datsun.

d. Specialty Shops

Specialty shop services were found to be applicable only to the most common service jobs such as tune-ups, muffler and exhaust system repairs, shock absorber replacement, front end alignment, ball joints, and brake work. These jobs often go hand-in-hand, since preparing a car for one job automatically readies the car for certain other repair work (a car on a lift for a muffler change is easily accessible for brake or shock work). Franchise outlets and mass merchandiser service rate sheets and advertising literature were surveyed to establish common specialty shop jobs and rates. Midas Muffler cost sheets were the primary source used to establish exhaust system repair costs.

Factors that increased the cost of specialty shop work were:

- additional cylinders in tune-up work (4,6 or 8)
- air conditioning (affected alignment and tune-up work due to limited accessibility)
- Chrysler cars' torsion bars (increased cost of alignment work)

- disc brakes (compared to drums)

Specialty shop work was found to be limited to the most common domestic cars and excluded work on cars with unusual mechanical features and foreign cars.

6.3.1.2.2

By Component. A single cost was used for batteries and tires which was independent of the source of these components. These components are highly competitive and prices vary with locality and time of year as much as by facility.

The battery cost of $30.00 that was used, was based on a concensus of industry experts as to the average cost to the consumer for a replacement battery. Few car manufacturers list batteries in their Dealer's Price Books - since they sell very few replacements. One-third of all batteries are sold by mass merchandisers and many of these are installed by the car owner.

Battery quality (plates and guarantee life) vary considerably by choice (i.e.-24, 30, 36, 40, 48 months etc.) rather than - in most cases - by car type. The variation was so widespread that the average cost of $30.00 was reasonable for across-the-board application.

Dealers, service stations and independent garages sell a wide range of batteries for any car at a wide variety of prices - even for the same quality. It doesn't necessarily mean that a replacement battery for a luxury car would cost more than for a compact.

As further confirmation for the average price of $30.00 that was used, we referred to the Sears Catalog for the Fall of 1975 - which listed a 42 month battery for $30.45 with trade in.

Tire costs were based on replacement with original equipment type and quality - i.e. - radial, bias belted or bias ply. The frequency of replacement and cost again were based on the Sears Fall 1975 Catalog price since Sears is a major factor in aftermarket tire sales. Sears mileage guarantees were divided into the 100,000 miles to determine how many tire sets were required. Since tire prices vary greatly by quality, manufacturer and type it was felt this approach was reasonable and consistent (see copy of our work data sheets - attached).

6.3.1.3

Labor Hours. As mentioned in Section 6.2.1.3 labor times were taken from Chilton Professional Labor Guide[144] for 1976 covering 1969 to 1976 cars. These times are published as a guide for repair facilities to estimate the time

required for various service jobs on individual vehicles. The times reflect the warranty repair times specified by the manufacturers, but are adjusted to account for additional time required when working on cars that have been to service for some time. Labor hours are the same for all service establishments.

6.3.1.4

Labor Rates by Establishment Type. Labor rates used are those determined by a national survey [12-16] and used for the unscheduled maintenance phase of the program. Specialty shop labor costs were determined separately as described previously in Section 5.3.3.

6.3.1.5

Summary. The cost differences for unscheduled maintenance of a vehicle at the various service facilities studied are limited to the following factors:

- Parts cost differences by model and manufacturer
- Labor time differences by model and manufacturer
- Labor rate differences by various service facilities
- Availability of parts from a variety of aftermarket sources
- Auxilliary equipment of the vehicle
- Degree of specialization of the service shop
- Service work performed as scheduled maintenance

It is important to note that regardless of the time it actually takes to perform a job, the number of labor hours for which the customer pays are determined by the flat rate manuals.

6.3.2 Unscheduled Maintenance by Make and Specific Model

The unscheduled maintenance and the associated costs for each of 212 cars for the model years 1970-1975 have been compiled. These compilations are presented in tabular form in Appendix F.

7. ESTABLISHMENTS NORMALLY PERFORMING MAINTENANCE

7.1 INTRODUCTION

The automotive aftermarket for Tire-Battery-Accessory (TBA) parts and service has been growing rapidly and going through revolutionary changes over the past 10 years, both in terms of where the products are sold and where the service is performed. Figure 7.1 indicates the total market for TBA parts and service.

Some key factors influencing the growth of the market are:

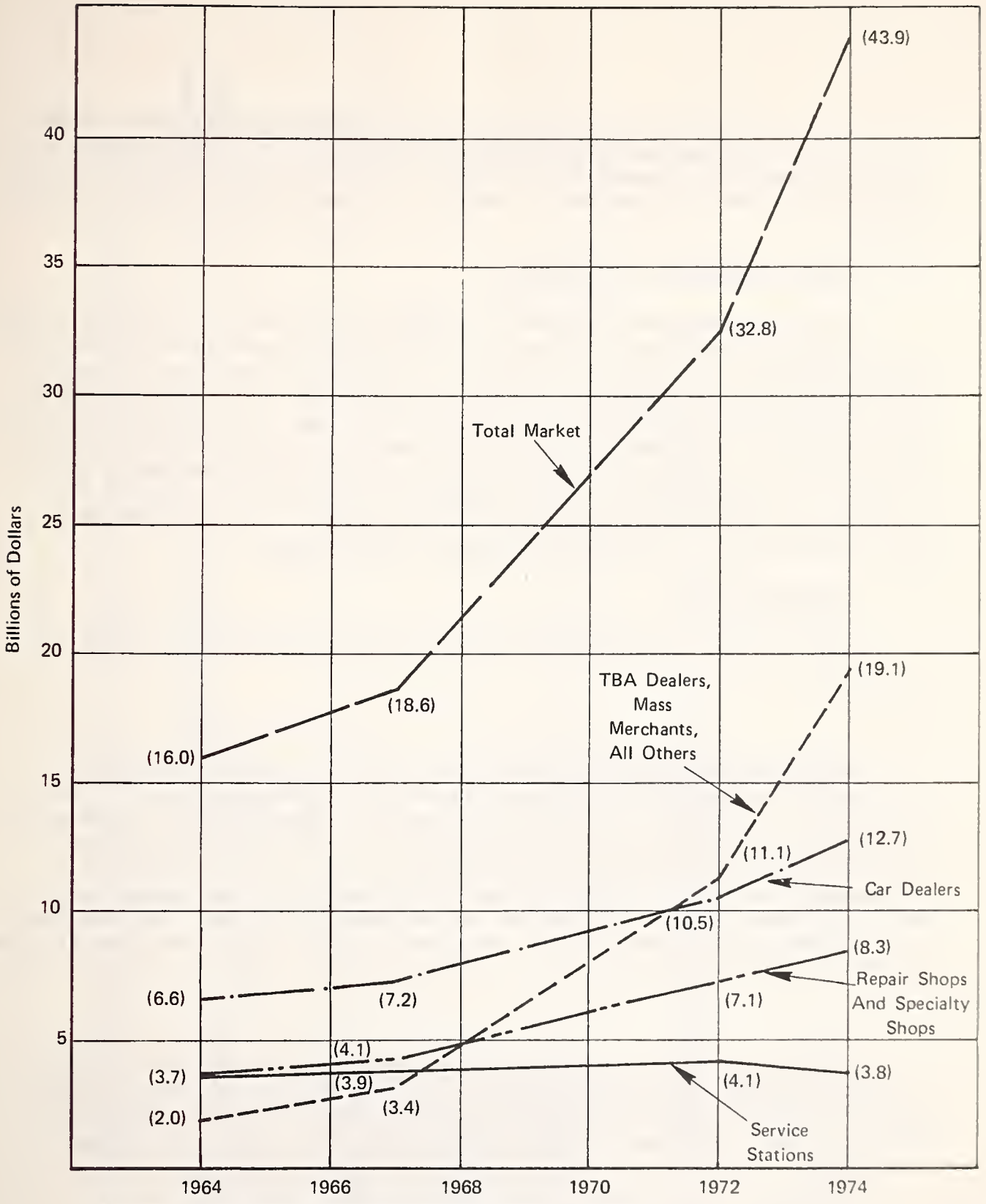
- increased vehicle registrations (67% from 1959 to 1974)[1 7]
- increase in total miles driven (77% from 1959 to 1974)[1 7]
- more sophisticated equipment requiring more maintenance
- inflation

This dramatic growth invited, and in some cases created, the need for new merchants to service the market. Traditional outlets such as service stations and repair shops, did not capitalize on the opportunity and gave way to the more aggressive marketing of mass merchandisers. Car dealers were happy with the increasing sales of new cars and relinquished some of their service business to specialty shops, TBA dealers and service centers.

The growth of specialty shop requirements stimulated franchise operations with strong merchandising programs. Major tire manufacturers were forced to change their distribution methods from Oil Company TBA programs to opening their own retail outlets. The consumer became more knowledgeable about his car, more cost conscious, and was subjected to mass merchants and aftermarket manufacturer's promotional efforts - creating the fast growing do-it-yourself market.

Some of these changes have been accelerated and others reversed over the past several years. Inflation, the energy crisis and unemployment forced people to keep their cars longer and seek more economical means of maintaining them. Thus, the do-it-yourself market, TBA dealers and service centers of mass merchants showed dramatic increases in sales contributing significantly to the total market growth.

Responsive to the 'repair versus buy' philosophy, car dealers and independent repair shops also reflect gains in TBA, parts and service sales. Part of this can also be attributed to more complex emission and ignition systems requiring more sophisticated equipment and trained mechanics for repair. Service stations are the only facility failing to show sales gains



Sources: U.S. Census, National Automobile Dealers Association, Chilton Research – Chilton Company.

FIGURE 7.1 TOTAL MARKET FOR TBA PARTS AND SERVICE

over the last several years. The major oil companies placed more emphasis on 'self service' company-owned stations with no TBA or service sales. Per capita consumption of gasoline declined as a result of the energy crisis and high prices. The total number of service stations declined 11.5% from 1972 to 1974.

7.2 WHERE MAINTENANCE IS PERFORMED

With the automotive aftermarket changing dramatically from year-to year, it is impossibe to define the type of facility that would normally perform maintenance over the life of a vehicle. In addition, the type of facility normally used is influenced by the class of vehicle, age of driver, ownership (first or subsequent), area of the country, age of vehicle and numerous other factors. Opinions were solicited from a group of individuals knowledgeable in the automotive industry, particularly the aftermarket. Tables 7.1 and 7.2, developed from these opinions, indicate the percentage of dollars spent for services performed by each of the facilities for each year over the 'life' of a car, by vehicle type and age.

7.2.1 By Type of Car

There are some major differences by class of car, as seen in Tables 7.1 and 7.2.

7.2.1.1

Luxury Cars and Imported Cars. Luxury cars and imported cars are serviced by car dealers more frequently and for a longer period of time. The owner of a luxury car is more concerned with protecting his investment and assumes the car dealer is better equipped to service his car. The economics offered by the mass merchandiser are not as attractive to him. The imported car owner has been forced to return to the car dealer for most maintenance because of the lack of availability of parts until recent years. Many service stations and independent repair shops have been reluctant to work on imported cars.

7.2.1.2

Domestic Standard, Intermediate and Compact Cars. Domestic cars are serviced and more at all other types of service facilities than luxury or imported cars. Especially after the first two years, the do-it-yourself market is the single most dominant service facility outside of the car dealership.

7.2.2 By Year

The following is the rationale used in generating the information for Tables 7.1 and 7.2.

TABLE 7.1 PERCENTAGE OF DOLLARS SPENT ON SCHEDULED AND UNSCHEDULED MAINTENANCE BY FACILITY AND YEAR FOR LUXURY OR IMPORTED CARS

Facility	Age of Car (Years) 1	2	3	4	5	6	7	8	9	10	Ten Year Average	
Car Dealer	90%	75%	50%	50%	30%	30%	20%	15%	15%	15%	39.0	
Service Station	5	10	10	10	10	10	10	10	10	10	9.5	
Independent Repair	0	5	5	5	15	15	15	10	10	10	9.0	18.5
Specialty Shop	0	0	5	5	15	10	15	15	15	15	9.5	
TBA Dealers & Service Centers	0	5	20	20	15	15	20	25	25	25	17.0	
Do-It-Yourself	5	5	10	10	15	20	20	25	25	25	16.0	33.0
TOTAL	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	

Source: Chilton Automotive Publications Experts

TABLE 7.2 PERCENTAGE OF DOLLARS SPENT ON SCHEDULED AND UNSCHEDULED MAINTENANCE BY FACILITY AND YEAR FOR A STANDARD-SIZE DOMESTIC PASSENGER CAR

Facility	Age of Car (Years) 1	2	3	4	5	6	7	8	9	10	Ten Year Average	
Car Dealer	80%	45%	15%	15%	15%	15%	10%	10%	10%	10%	22.5	
Service Station	10	10	10	15	15	15	10	10	10	10	11.5	
Independent Repair	0	10	20	20	15	10	10	10	10	10	11.5	21.5
Specialty Shop	0	5	15	15	10	10	15	10	10	10	10.0	
TBA Dealers & Service Centers	0	10	20	15	20	25	25	25	25	25	19.0	44.5
Do-It-Yourself	10	20	20	20	25	25	30	35	35	35	25.5	
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	

Source: Chilton's Automotive Publications Experts

a. First Year (0-10,000 miles)

The car is under warranty, therefore little or no unscheduled maintenance is performed. The car is returned to car dealer for warranty and inspections and much of the scheduled maintenance is performed at the same time. A small percentage of owners use local service stations for scheduled oil and filter changes and some do-it-themselves.

b. Second Year (10,000 - 20,000 miles)

The car is out of warranty resulting in a substantial decline in maintenance done at Car Dealerships. Owners utilize more convenient/economical local Service Stations, Independent Repair Shops and Service Centers of mass merchandisers.

c. Third Year (20,000 - 30,000 miles)

The car dealer again loses a large percentage of service and parts sales as owners look for more convenient and economical maintenance. Unscheduled maintenance is more significant with tires and brakes as large factors. TBA dealers and Service Centers are more heavily involved.

d. Fourth Year (30,000 to 40,000 miles)

On the average, the car changes ownership in this year and the new owner has purchased his "used car" from a Car Dealer - returning for a short while for his "used car" warranty. During the same year the car is subject to more Unscheduled Maintenance - i.e: brakes, exhaust system, batteries, tires, etc. - much of which is serviced through facilities other than the Car Dealer.

e. Fifth Year and Sixth Year (40,000 - 60,000 miles)

The second car owner returns to the Car Dealer for repairs of major items such as engine/transmission, but generally seeks more economical maintenance and tends to do more work himself.

f. Seventh, Eighth, Ninth and Tenth Years (70,000 to 100,000 miles)

The service patterns for the last four years of the car's "life" are reasonably stable. The car probably changes owners again. Much of the maintenance is done by the owner. TBA dealers and mass merchandising service centers are servicing the tires and battery requirements. Specialty Shops are doing the repairs on

TABLE 7.3 COMPARISON OF TOTAL AFTERMARKET SALES BY FACILITY
TEN-YEAR WEIGHTED PERCENTAGES vs. ACTUAL SALES

	Weighted %	Sales by Weighted % of Total Market (Billions of Dollars)	1974 Actual Sales (Billions of Dollars)
Car Dealers	26.6	11.7	12.7
Service Stations	11.0	4.8	3.8
Independent Repair and Specialty Shops	20.8	9.1	8.3
TBA & Mass Merchandisers and Do-It-Yourself	41.6	18.3	19.1
	100.0%	43.9 billion dollars	43.9 billion dollars

tune ups, transmission and exhaust system and the oil changes, belts, hoses, brakes, etc. are split between the Car Dealers, Independent Repair Shops and Service Stations.

7.3 ANALYSIS OF AFTERMARKET SALES BY SERVICE FACILITIES

7.3.1 Based on Dollars Spent

A rough crosscheck of the servicing facilities can be made by comparing the total market breakdown (Figure 7.1) with the weighted averages of total service, over 10 years, for both luxury/imports and other vehicles by facility as follows:

a. Group average percentages over 10 years for Independent Repair Shops and Specialty Shops

b. Group average percentages over 10 years for TBA Dealers, Service Centers and Do-It-Yourself

c. Develop weighted percentages between the ten year averages for facilities in Tables 7.1 and 7.2. The ten year averages for facilities in Table 7.1 equal to 25% and Table 7.2 equal to 75% of repair and service sales (luxury and import cars accounted for 25% of total registrations in 1974.)

The weighted percentages are applied to the total 1974 aftermarket and compared to the actual sales as shown in Table 7.3. Although there are some differences, the analysis in Table 7.3 supports the maintenance schedules by facility indicated in Tables 7.1 and 7.2.

Some of the differences can be explained as follows:

a. Car Dealers actual sales are higher than by taking a percentage of their service, since their parts prices and labor rates are normally higher than the other facilities.

b. Service Stations and Repair Shops are higher than actual because their parts prices are lower and they frequently charge no labor for maintenance when a product sale is involved - i.e: oil change.

c. TBA and mass merchandiser sales are actually higher since the market figure of $43.9 billion includes sales of products not considered in our Scheduled and Unscheduled Maintenance study - i.e: car products, floor mats, seat covers, mag wheels, etc. In addition, a large percentage of sales in these outlets are for Parts and Accessories with no labor.

7.3.2 Based on Number of Purchases

A 1970 study by Stanford Research Institute (Ref. 4) shows the percentage of purchases of selected aftermarket services, parts and TBA by facility (Table 7.4). The data developed by the Stanford Study show some significant differences in average frequencies by facility vs. the study based on "where the dollars were spent." For example:

a. Stanford reports Service Stations averages 30.4% of all purchases of services, TBA and parts.

b. The study based on dollar share of market shows Service Stations averaged only 11%.

The differences are explained by reviewing the type of service being performed. The most expensive maintenance items, clutches, transmission and engine overhaul are very low volume items for Service Stations compared to the relatively low cost/high volume maintenance items like tire repairs, wiper blades, oil changes and brake adjustments.

In addition, the automotive aftermarket has changes considerably since the Stanford study as indicated previously.

7.4 FUTURE CONSIDERATIONS FOR MAINTENANCE FACILITIES

There are many current pending situations that could affect where maintenance is performed in the future.

7.4.1 Sophisticated Equipment

More sophisticated equipment (pollution controls, electronic ignition, etc.) and the growing population of import cars, will tend to increase the amount of service being performed by Car Dealers. "Factory trained" and certified mechanics, expensive equipment and availability of parts will be a necessity to compete in the market.

7.4.2 Periodic Motor Vehicle Inspection (PMVI)

PMVI programs could also influence the maintenance market. Currently all but 17 of the 50 states have a PMVI program (Figure 7.2). Three of these states have state owned and operated systems - where state stations perform the inspection. The other 31 states operate through licensed, private inspection stations such as Service Stations, Car Dealers, Independent Repair Shops, etc. Although there is considerable resistance to mandatory state PMVI, current legislation gives DOT authority in this area. Should PMVI, particularly as it relates to the Clear Air Act of 1967 for strict anti-pollution standards, become more prevalent, it would require investments in diagnostic equipment for those facilities performing the inspections.

TABLE 7.4 WHERE AUTOMOTIVE SERVICE WORK IS DONE

(% OF PURCHASE)

Service	Service Station	General Repair	Car Dealer	Other*
Anti-Freeze	42.6	6.4	6.5	44.5
Belts & Hoses	46.2	9.8	14.4	29.6
Radiators	15.1	44.9	30.6	9.4
Thermostats	35.9	16.7	21.6	25.8
Water Pumps	25.7	8.5	31.3	34.5
Clutchs	1.5	28.7	45.0	24.8
Transmission	7.3	40.5	38.5	13.7
U-Joints	18.8	24.7	25.4	31.3
Brakes (Adjust)	45.3	16.6	24.8	13.3
Brakes (Relined)	24.1	27.6	16.1	32.2
Brake Cylinders	36.3	27.0	13.1	23.6
New Tires	36.6	5.9	4.0	53.5
Tires Repaired	83.4	.9	3.1	12.6
Front End Alignment	18.7	29.2	28.5	23.6
Shock Absorbers	23.7	19.3	15.6	39.4
Wiper Blades	45.3	12.6	16.6	25.5
Oil Change/Filter	58.5	3.3	18.5	19.7
Air Filters	40.4	6.6	18.4	34.6
Engine Overhaul	3.1	27.2	28.5	41.2
Tune Ups	28.7	16.3	32.1	22.9
Carburetor Service	24.3	19.8	27.6	28.3
Fuel Pumps	24.6	10.8	33.6	31.0
Mufflers and Tailpipes	26.7	21.0	15.5	36.8
Alternators	23.7	23.3	19.6	33.4
Batteries	37.8	7.5	5.7	49.0
Starters	28.0	9.6	8.6	53.8
Voltage Regulators	19.1	9.2	14.3	56.4
Average	30.4	17.6	20.6	31.3

Source: Stanford Research Institute Study - 1970 (Ref. 4)

* Fleet owners, do-it-yourself (DIY), specialty shops.

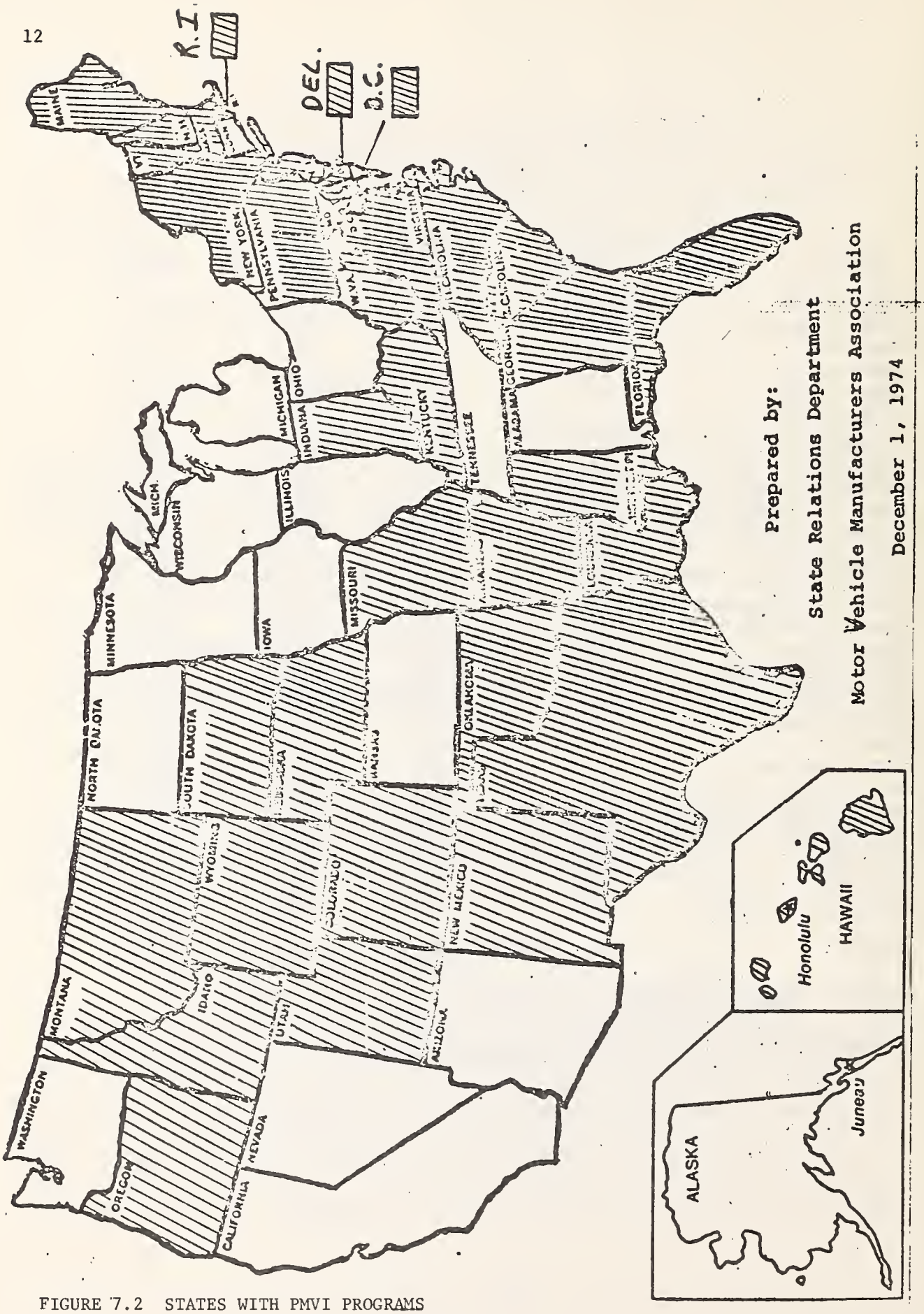


FIGURE 7.2 STATES WITH PMVI PROGRAMS

This could affect the under-capitalized independent Service Station and Repair Shops who couldn't afford to purchase this equipment.

7.4.3 "Gas Only" Service Stations

The interest of major oil companies to operate high volume "gas only" Service Stations may continue. Of the 226,459 stations reported in the 1972 Census (145,146,147), only 145,268 reported sales of TBA and Parts and only 97,440 indicated Service Labor Sales (9,10,147). If this trend continued, facilities other than Service Stations will be utilized for maintenance.

7.4.4 Do-It-Yourself Market

The TBA Dealers, and Mass Merchandisers Service Centers are expected to continue increasing their share of the maintenance market through aggressive merchandising. High costs of maintenance under current economic conditions will continue to encourage the do-it-yourself market.

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APPENDIX A

REPORT OF INVENTIONS

After a diligent review of the work performed under this contract, no new innovation, discovery, improvement, or invention was made. However, a detailed data base of the maintenance requirements of 212 1970 through 1975 passenger cars and light trucks was developed, and the pricing policies and service industry facility costs were determined in 1975 dollars.

APPENDIX B
UNSCHEDULED MAINTENANCE SOURCES

1. Peterson, Howe and Heather Fleet Data

   Data covers complete maintenance (Unscheduled and Scheduled) by component failure and mileage for their fleet of approximately 1,500 vehicles.

   Significant data exists on relatively few models of cars. Most vehicles are tracked for only two to three years with maximum mileage of 50 - 60,000 miles and the use rate of the cars is not typical.

   Information would provide valuable input to the study however but it is costly and restricted - because car companies purchase of data for their own use. DOT/TSC attempted to get copies of reports being used by NTSTA. This effort not successful at this time.

2. Consumer Reports, Consumers Union

   Data in annual issues reports comparative ratings on certain component systems by vehicle model versus other models. Data base of over 200,000 cars. Information would provide some input to study if in greater detail but Consumers Union would not make available.

3. AAA - Missouri

   AAA of Missouri conducts diagnostic test centers from which they gather data on component failures. Reports are computerized and sold for research. No vehicle history exists so data would provide only component "failure," mileage and vehicle model on a one-shot basis. Data would provide valuable input but cost ($4.00/vehicle report) was not cost effective. Also, data limited to one geographic area and not nationally representative.

4. Maintainability & Repairability - Booz Allen - 1970

   DOT-HS-800-511

   Report deals with maintenance problem and was based on PHH data. Received microfiche copy of report and studying for potential input. Conclusions reached indicate "no adequate data available to determine repairability data."

5. AAA - Maryland, Southern California, San Francisco

   Explored reports by AAA in these three areas and determined their limited value. Data is based on "road calls" and is concerned primarily with flat tires and electrical problems (dead batteries).

6. Automotive Repair Industry - Senate Hearings - 1969

   No specific data included.

7. "The Great American Auto Repair Robbery" - Dr. Randall - 1972

   Material studied but limited data available for this study.

8. Alleghany Ballistics Laboratory, Hercules, Inc.

   Has limited fleet of cars that test automotive component failures on an accelerated basis (1,000 miles/day). They do not keep data on components other than those being studied (mostly tires and shock absorbers). Judged to be of no value to our study. Not representative of normal mileage-time relationship.

9. Computerized Fleet Analysis, Hillside, Illinois

   Not useful to this study.

10. Mainstem - Princeton, NJ

    Company owned by PHH - primarily concerned with Maintenance Data for trucking industry.

11. Hertz, Avis, National Car Rentals

    Data that might be available only reports maintenance cost/mile. Vehicle models are limited, use not typical, no mileage interval or specific component failure data.

12. Virginia Highway Department

    Reports road failure only. Most instances are similar to AAA data reagarding flat tires and electrical failures. No mileage intervals or model data available.

13. Cost of Operating an Automobile - DOT/FHA - 1972-1974

    Data deals only in terms of cost/mile. No specifics available.

14. Vehicle Disablement Studies DOT/HS
    Vehicle--in--use Safety Standards - DOT/HS
    Used Car Safety - DOT/HS
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    Vehicles and Road Failure - DOT/HS

    All studies conducted by DOT/HS from 1969-1974 have been collected and are being studied for project input. Computer tapes on the Motor Vehicle Inspection studies for five states are being programmed to combine data and provide specific component failure rate, mileage and vehicle model data. Data found to be suspect and not reliable in our opinion.

15. Fleet Maintenance records from Philadelphia Gas Works, Port Authority of New York, Consolidated Gas Supply of West Virginia, Baltimore County, Chestnut Fleet Rentals, Automotive Rentals.

    Data analyzed from maintenance records of fleets for input to project. Deals mostly with light trucks, not representative of normal passenger car use.

16. Component manufacturers - Exhaust, electrical, brake systems, tires, batteries, etc.

    Manufacturers were contacted regarding their data of frequency of repair by vehicle models. Since most parts fit more than one car, this data not relevant to specific models.

17. Glenn Mitchell Manuals -

    Includes a section entitled "Latest changes and correction" which reports on potential repair or service problems of components parts by vehicle make and model. This is an accumulation of data from manufacturers Technical Bulletins.

    It is of little value to our study since there is no indication as to the number of vehicles that may have had a problem, the mileage interval involved, or whether or not it was serviced under warranty. The implication was that a great many of the service problems reported were warranty problems.

18. Car Manufacturers Warranty Records

    Data could provide valuable input to project but contacts made indicate records are not available to us.

19. National Aftermarket Audit - Starch Hooper Inc.

    Contact with principal discloses data has not been developed as yet (new program) - and when it starts it will be done by mail to sample audiences and may or may not be representative. Possible source of data several years hence.

APPENDIX C
LIST OF CARS

The key to this listing is as follows:

BODY CLASS

S = standard
I = intermediate
C = compact
SC = subcompact
L = luxury
M = minicompact
T(1) = truck under 6,000 lbs. GUW
T(2) = truck over 6,000 lbs. GUW

TRANSMISSION

A = automatic
M = manual (number in parenthesis indicates number of forward speeds if above three speeds)

ENGINE

S = this engine is standard for this car
O = this engine is an option for this car

STEERING

P = power assisted
M = not assisted (manual)

BRAKES

P = power assisted
M = not assisted (manual)
DC = disc
DM = drum

Motor Vehicle Classification by Body Size

1975

YEAR	BODY CLASS	MAKE	MODEL	TRANS.	CID	ENGINE	STEERING	BRAKES	AIR COND.	DOORS	
1975	S	Chev.	Impala Bel Air	A	350	V-8 S	P	P DC	AC	4	
1975	S	Ford	Galaxie-Custom	A	400	V-8 O	P	P DC	AC	4	
1975	S	Chrys.	Newport	A	360	V-8 S	P	P DC	AC	4	
1975	S	Plym.	Fury/Grand Prix	A	318	V-8 S	P	P DC	AC	4	
1975	S	AMC	Ambassador								Discontinued
1975	I	Chev.	Chevelle	A	350	V-8 S	P	P DC	AC	2	
1975	I	Pont.	Grand Prix	A	400	V-8 S	P	P DC	AC	4	
1975	I	Ford	Torino	A	351	V-8 S	P	P DC	AC	4	
1975	I	Plym.	Satellite/ Fury	A	318	V-8 S	P	P DC	AC	4	
1975	I	AMC	Matador	A	304	V-8 O	P	P DC	AC	4	
1975	C	Chev.	Nova	A	350	V-8 O	P	P DC	none	4	
1975	C	Chev.	Camaro	A	350	V-8 S	P	P DC	AC	2	
1975	C	Ford	Mustang	A	302	V-8 O	P	P DC	none	2	
1975	C	Ford	Maverick	A	250	L-6	P	M DM	AC	4	
1975	C	Dodge	Dart	A	225	L-6	P	M DC	AC	4	
1975	C	AMC	Hornet	A	258	L-6	P	M DM	none	4	
1975	C	AMC	Javelin								Discontinued
1975	C	Plym.	Valiant	A	225	L-6	P	M DM	none	4	
1975	SC	Chev.	Vega	A	140	L-4	M	M DC	none	2	
1975	SC	Olds.	Starfire	A	231	V-6	P	P DC	AC	2	
1975	SC	Ford	Pinto	A	140	L-4	M	M DC	none	2	
1975	SC	AMC	Gremlin	A	232	L-6	P	M DM	none	2	
1975	SC	Buick	Opel Manta	M-4	115.8	L-4	M	P DC	none	2	
1975	SC	Ford	Capri 2800	A	170.3	V-6	M	M DC	none	2	
1975	SC	Dodge	Colt Coupe	M	97.6	L-4	M	M DC	none	2	
1975	SC	VW	Rabbit	M	89.7	L-4	M	M DC	none	2	
1975	SC	Toyota	Corolla	M	96.9	L-4	M	M DC	none	2	
1975	SC	Datsun	610	M	119.1	L-4	M	M DC	none	2	
1975	SC	Mazda	RX3 Coupe	M	70	Rotary	M	M DC	none	2	

Motor Vehicle Classification by Body Size

1975

YEAR	BODY CLASS	MAKE	MODEL	TRANS.	CID	ENGINE	STEERING	BRAKES	AIR COND.	DOORS
1975	L	Buick	Electra 225	A	455	V-8 S	P	P DC	AC	4
1975	L	Cad.	Eldorado	A	500	V-8 S	P	P DC	AC	4
1975	L	Cad.	de Ville	A	500	V-8 S	P	P DC	AC	4
1975	L	Lincoln	Continental	A	460	V-8 S	P	P DC	AC	4
1975	M	Honda	Civic (CVCC)	M	90.8	L-4	M	M DC	none	2
1975	T(1)	Chev.	C-10	M	350	V-8 2bbl.	M	M DC	none	2
1975	T(1)	Ford	F-100	M	300	L-6	M	M DC	none	2
1975	T(2)	Chev.	C-20	A	350	V-8 4bbl.	M	P DC	AC	2
1975	T(2)	Ford	F-250	A	360	V-8	M	P DC	AC	2

Motor Vehicle Classification by Body Size

1974

YEAR	BODY CLASS	MAKE	MODEL	TRANS.	CID	ENGINE	STEERING	BRAKES	AIR COND.	DOORS
1974	S	Chev.	Impala Bel Air	A	350	V-8 S	P	P DC	AC	4
1974	S	Ford	Galaxie-Custom	A	400	V-8 O	P	P DC	AC	4
1974	S	Chrys.	Newport	A	400	V-8 S	P	P DC	AC	4
1974	S	Plym.	Fury	A	400	V-8 S	P	P DC	AC	4
1974	S	AMC	Ambassador	A	360	V-8 O	P	P DC	AC	4
1974	I	Chev.	Chevelle	A	350	V-8 S	P	P DC	AC	2
1974	I	Pont.	Grand Prix	A	400	V-8 S	P	P DC	AC	4
1974	I	Ford	Torino	A	351	V-8 S	P	P DC	AC	4
1974	I	Plym.	Satellite	A	318	V-8 S	P	P DC	AC	4
1974	I	AMC	Matador	A	360	V-8 O	P	P DC	AC	4
1974	C	Chev.	Nova	A	350	V-8 S	P	M DM	none	4
1974	C	Chev.	Camaro	A	350	V-8 S	P	P DC	AC	2
1974	C	Ford	Mustang	A	140	L-4	P	M DC	none	2
1974	C	Ford	Maverick	A	200	L-6	P	M DM	none	4
1974	C	Dodge	Dart	A	198	L-6	P	M DM	none	4
1974	C	Plym.	Valiant	A	198	L-6	P	M DM	none	4
1974	C	AMC	Hornet	A	232	L-6	P	M DM	none	4
1974	C	AMC	Javelin	A	360	V-8 O	P	P DC	none	2
1974	SC	Chev.	Vega	A	140	L-4	M	M DC	none	2
1974	SC	Ford	Pinto	A	122	L-4	M	M DC	none	2
1974	SC	AMC	Gremlin	A	232	L-6	M	M DM	none	2
1974	SC	Buick	Opel Manta	M	115.8	L-4	M	M DC	none	2
1974	SC	Ford	Capri 2800	A	170	V-6	M	M DC	none	2
1974	SC	Dodge	Colt Coupe	M	97.5	L-4	M	M DC	none	2
1974	SC	VW	Beetle	M	96.7	H-4	M	M DC	none	2
1974	SC	Toyota	Corolla 1600	M	96.9	L-4	M	M DC	none	2
1974	SC	Datsun	610	M	119	L-4	M	M DC	none	2
1974	SC	Mazda	RX3 Coupe	M	70	Rotary	M	M DC	none	2
1974	L	Buick	Electra 225	A	455	V-8 S	P	P DC	AC	4
1974	L	Cad.	Eldorado	A	500	V-8 S	P	P DC	AC	4
1974	L	Cad.	de Ville	A	472	V-8 S	P	P DC	AC	4
1974	L	Lincoln	Continental	A	460	V-8 S	P	P DC	AC	4

Motor Vehicle Classification by Body Size

1974

YEAR	BODY CLASS	MAKE	MODEL	TRANS.	CID	ENGINE	STEERING	BRAKES	AIR COND.	DOORS
1974	M	Honda	Civic	M	71.3	L-4	M	M DC	none	2
1974	T(1)	Chev.	C-10	M	350	V-8 2bbl	M	M DC	none	2
1974	T(1)	Ford	F-100	M	300	L-6	M	M DC	none	2
1974	T(2)	Chev.	C-20	A	350	V-8 4bbl	M	P DC	AC	2
1974	T(2)	Ford	F-250	A	360	V-8	M	P DC	AC	2

Motor Vehicle Classification by Body Size

1973

YEAR	BODY CLASS	MAKE	MODEL	TRANS.	CID	ENGINE	STEERING	BRAKES	AIR COND.	DOORS
1973	S	Chev.	Impala Bel Air	A	350	V-8 S	P	P DC	AC	4
1973	S	Ford	Galaxie-Custom	A	400	V-8 O	P	P DC	AC	4
1973	S	Chrys.	Newport	A	400	V-8 S	P	P DC	AC	4
1973	S	Plym.	Fury	A	360	V-8 O	P	P DC	AC	4
1973	S	AMC	Ambassador	A	360	V-8 O	P	P DC	AC	4
1973	I	Chev.	Chevelle	A	350	V-8 O	P	P DC	AC	2
1973	I	Pont.	Grand Prix	A	400	V-8 S	P	P DC	AC	4
1973	I	Ford	Torino	A	302	V-8 S	P	P DC	AC	4
1973	I	Plym.	Satellite	A	318	V-8 S	P	P DC	AC	4
1973	I	AMC	Matador	A	360	V-8 O	P	M DM	AC	4
1973	C	Chev.	Nova	A	307	V-8 S	P	M DM	none	4
1973	C	Chev.	Camaro	A	350	V-8 O	P	P DC	AC	2
1973	C	Ford	Mustang	A	351	V-8 O	P	P DC	AC	2
1973	C	Ford	Maverick	A	200	L-6	P	M DM	none	4
1973	C	Dodge	Dart	A	198	L-6	P	M DM	none	4
1973	C	Plym.	Valiant	A	198	L-6	P	M DM	none	4
1973	C	AMC	Hornet	A	232	L-6	P	M DM	none	4
1973	C	AMC	Javelin	A	360	V-8 O	P	M DM	none	2
1973	SC	Chev.	Vega	A	140	L-4	M	M DC	none	2
1973	SC	Ford	Pinto	A	97.6	L-4	M	M DC	none	2
1973	SC	AMC	Gremlin	A	232	L-6	M	M DM	none	2
1973	SC	Buick	Opel Manta	M	115.8	L-4	M	M DC	none	2
1973	SC	Ford	Capri 2600	A	155	V-6	M	M DC	none	2
1973	SC	Dodge	Colt HT	M	97.5	L-4	M	M DC	none	2
1973	SC	VW	Beetle	M	96.7	H-4	M	M DM	none	2
1973	SC	Toyota	Corolla 1600	M	96.9	L-4	M	M DC	none	2
1973	SC	Datsun	PL 610	M	108	L-4	M	M DM	none	2
1973	SC	Mazda	RX 3 Coupe	M	70	Rotary	M	M DM	none	2
1973	L	Buick	Electra 225	A	455	V-8 S	P	P DC	AC	4
1973	L	Cad.	Eldorado	A	500	V-8 S	P	P DC	AC	4
1973	L	Cad.	de Ville	A	472	V-8 S	P	P DC	AC	4
1973	L	Lincoln	Continental	A	460	V-8 S	P	P DC	AC	4

Motor Vehicle Classification by Body Size

1973

YEAR	BODY CLASS	MAKE	MODEL	TRANS.	CID	ENGINE	STEERING	BRAKES	AIR COND.	DOORS
1973	M	Honda	Civic	M	71.3	L-4	M	M DC	none	2
1973	T(1)	Chev.	C-10	M	350	V-8 2bbl	M	M DC	none	2
1973	T(1)	Ford	F-100	M	300	L-6	M	M DC	none	2
1973	T(2)	Chev.	C-20	A	350	V-8 4bbl	M	P DC	AC	2
1973	T(2)	Ford	F-250	A	360	V-8	M	P DC	AC	2

Motor Vehicle Classification by Body Size

1972

YEAR	BODY CLASS	MAKE	MODEL	TRANS.	CID	ENGINE	STEERING	BRAKES	AIR COND.	DOORS
1972	S	Chev.	Impala Bel Air	A	350	V-8 S	P	P DC	AC	4
1972	S	Ford	Galaxia	A	351	V-8 S	P	P DC	AC	4
1972	S	Chrys.	Newport	A	360	V-8 S	P	P DC	AC	4
1972	S	Plym.	Fury	A	360	V-8 O	P	P DC	AC	4
1972	S	AMC	Ambassador	A	304	V-8 S	P	P DM	AC	4
1972	I	Chev.	Chevelle	A	350	V-8 O	P	P DM	AC	2
1972	I	Pont.	Grand Prix	A	400	V-8 S	P	P DC	AC	4
1972	I	Ford	Torino	A	351	V-8 O	P	P DC	AC	4
1972	I	Plym.	Satellite	A	318	V-8 S	P	P DC	AC	4
1972	I	AMC	Matador	A	360	V-8 O	P	M DM	none	4
1972	C	Chev.	Nova	A	250	L-6	P	M DM	none	4
1972	C	Chev.	Camaro	A	350	V-8 O	P	M DC	none	2
1972	C	Ford	Mustang	A	351	V-8 O	P	P DC	none	2
1972	C	Ford	Maverick	A	170	L-6	P	M DM	none	4
1972	C	Dodge	Dart	A	198	L-6	P	M DM	none	4
1972	C	Plym.	Valiant	A	198	L-6	P	M DM	none	4
1972	C	AMC	Hornet	A	232	L-6	P	M DM	none	4
1972	C	AMC	Javelin	A	360	V-8 O	P	M DM	AC	2
1972	SC	Chev.	Vega 2300	M	140	L-4	M	M DC	none	2
1972	SC	Ford	Pinto	A	97.6	L-4	M	M DC	none	2
1972	SC	AMC	Gremlin	A	232	L-6	M	M DM	none	2
1972	SC	Buick	Opel Manta 1900 Sport Coupe	M	115.8	L-4	M	M DC	none	2
1972	SC	Ford	Capri 2000	M	122	L-4	M	P DC	none	2
1972	SC	Dodge	Colt HT	A	97.5	L-4	M	M DC	none	2
1972	SC	VW	Beetle	M	96.7	H-4	M	M DM	none	2
1972	SC	Toyota	Corolla 1600	M	96.9	L-4	M	M DC	none	2
1972	SC	Datsun	PL 510	M	97.3	L-4	M	M DC	none	2
1972	SC	Mazda	RX2 Coupe	M	70	Rotary	M	M DM	none	2
1972	L	Buick	Electra 225	A	455	V-8 S	P	P DC	AC	4
1972	L	Cad.	Eldorado	A	500	V-8 S	P	P DC	AC	4
1972	L	Cad.	de Ville	A	472	V-8 S	P	P DC	AC	4

Motor Vehicle Classification by Body Size

1972

YEAR	BODY CLASS	MAKE	MODEL	TRANS.	CID	ENGINE	STEERING	BRAKES	AIR COND.	DOORS	
1972	L	Lincoln	Continental	A	460	V-8 S	P	P DC	AC	4	
1972	M	Honda									not imported in suff. quantity
1972	T(1)	Chev.	C-10	M	350	V-8 2bbl	M	M DC	none	2	
1972	T(1)	Ford	F-100	M	300	L-6	M	M DC	none	2	
1972	T(2)	Chev.	C-20	A	350	V-8 4bbl	M	P DC	AC	2	
1972	T(2)	Ford	F-250	A	360	V-8	M	P DC	AC	2	

Motor Vehicle Classification by Body Size

1971

YEAR	BODY CLASS	MAKE	MODEL	TRANS.	CID	ENGINE	STEERING	BRAKES	AIR COND.	DOORS
1971	S	Chev.	Impala Bel Air	A	350	V-8 S	P	M DC	AC	4
1971	S	Ford	Galaxie	A	351	V-8 S	P	M DC	AC	4
1971	S	Chrys.	Newport	A	360	V-8 S	P	M DC	AC	4
1971	S	Plym.	Fury	A	360	V-8 O	P	M DC	AC	4
1971	S	AMC	Ambassador	A	304	V-8 S	P	P DM	AC	4
1971	I	Chev.	Chevelle	A	307	V-8 S	P	M DM	AC	2
1971	I	Pont.	Grand Prix	A	400	V-8 S	P	M DC	AC	4
1971	I	Ford	Torino	A	351	V-8 O	P	M DM	AC	4
1971	I	Plym.	Satellite	A	318	V-8 S	P	M DM	AC	4
1971	I	AMC	Matador	A	360	V-8 O	P	M DM	none	4
1971	C	Chev.	Nova	A	250	L-6	P	M DM	none	4
1971	C	Chev.	Camaro	A	307	V-8 S	P	M DM	none	2
1971	C	Ford	Mustang	A	351	V-8 O	P	M DM	none	2
1971	C	Ford	Maverick	A	170	L-6	M	M DM	none	4
1971	C	Dodge	Dart	A	198	L-6	P	M DM	none	4
1971	C	Plym.	Valiant	A	198	L-6	P	M DM	none	4
1971	C	AMC	Hornet	A	232	L-6	M	M DM	none	4
1971	C	AMC	Javelin	A	360	V-8 O	P	M DM	none	2
1971	SC	Chev.	Vega	M	140	L-4	M	M DC	none	2
1971	SC	Ford	Pinto	M	97.6	L-4	M	M DM	none	2
1971	SC	AMC	Gremlin	M	232	L-6	M	M DM	none	2
1971	SC	Buick	Opel 1900 Sports Coupe	M	115.8	L-4	M	M DC	none	2
1971	SC	Ford	Capri 1600	M	97.6	L-4	M	M DC	none	2
1971	SC	Dodge	Colt HT	A	97.5	L-4	M	M DM	none	2
1971	SC	VW	Beetle	M	96.7	H-4	M	M DM	none	2
1971	SC	Toyota	Corolla 1600	M	96.9	L-4	M	M DC	none	2
1971	SC	Datsun	PL 510	M	97.3	L-4	M	M DC	none	2
1971	SC	Mazda	R-100 Coupe	M	70	Rotary	M	M DC	none	2
1971	L	Buick	Electra 225	A	455	V-8 S	P	M DC	AC	4
1971	L	Cad.	Eldorado	A	500	V-8 S	P	M DC	AC	4
1971	L	Cad.	de Ville	A	472	V-8 S	P	M DC	AC	4

Motor Vehicle Classification by Body Size

1971

YEAR	BODY CLASS	MAKE	MODEL	TRANS.	CID	ENGINE	STEERING	BRAKES	AIR COND.	DOORS
1971	L	Lincoln	Continental	A	460	V-8 S	P	M DC	AC	4
1971	T(1)	Chev.	C-10	M	350	V-8 2bbl	M	M DC	none	2
1971	T(1)	Ford	F-100	M	300	L-6	M	M DC	none	2
1971	T(2)	Chev.	C-20	A	350	V-8 4bbl	M	P DC	AC	2
1971	T(2)	Ford	F-250	A	360	V-8	M	P DC	AC	2

Motor Vehicle Classification by Body Size

1970

YEAR	BODY CLASS	MAKE	MODEL	TRANS.	CID	ENGINE	STEERING	BRAKES	AIR COND.	DOORS	
1970	S	Chev.	Impala Bel Air	A	350	V-8 S	P	M DC	AC	4	
1970	S	Ford	Galaxie	A	351	V-8 S	P	M DC	AC	4	
1970	S	Chrys.	Newport	A	383	V-8 S	P	P DM	AC	4	
1970	S	Plym.	Fury	A	318	V-8 S	P	P DM	AC	4	
1970	S	AMC	Ambassador	A	304	V-8 S	P	P DM	AC	4	
1970	I	Chev.	Chevelle	A	350	V-8 O	P	M DM	none	2	
1970	I	Pont.	Grand Prix	A	400	V-8 S	P	M DC	AC	4	
1970	I	Ford	Torino (Fairlane)	A	351	V-8 O	P	M DM	none	4	
1970	I	Plym.	Belvedere	A	318	V-8 S	P	M DM	none	4	Satellite not in production
1970	I	AMC	Matador								not in production
1970	C	Chev.	Nova	A	230	L-6	P	M DM	none	4	
1970	C	Chev.	Camaro	A	307	V-8 S	P	M DM & M DC	none	2	(1970) (1970 1/2)
1970	C	Ford	Mustang	A	351	V-8 O	P	M DM	none	2	
1970	C	Ford	Maverick	A	170	L-6	M	M DM	none	4	
1970	C	Dodge	Dart	A	198	L-6	P	M DM	none	4	
1970	C	Plym.	Valiant	A	198	L-6	M	M DM	none	4	
1970	C	AMC	Hornet	A	199	L-6	M	M DM	none	4	
1970	C	AMC	Javelin	A	360	V-8 O	P	M DM	none	2	
1970	SC	Chev.	Vega								not in production
1970	SC	Ford	Pinto								not in production
1970	SC	AMC	Gremlin	M	199	L-6	M	M DM	none	2	
1970	SC	Buick	Opel Manta	M	65.8	L-4	M	M DC	none	2	
1970	SC	Ford	Capri								not available
1970	SC	Dodge	Colt								not available
1970	SC	VW	Beetle	M	96.7	H-4	M	M DM	none	2	
1970	SC	Toyota	Corolla	M	71.1	L-4	M	M DM	none	2	
1970	SC	Datsun	PL 510	M	97.3	L-4	M	M DC	none	2	
1970	SC	Mazda									not available
1970	L	Buick	Electra 225	A	455	V-8 S	P	M DC	AC	4	
1970	L	Cad.	Eldorado	A	500	V-8 S	P	M DC	AC	4	
1970	L	Cad.	de Ville	A	472	V-8 S	P	M DC	AC	4	

Motor Vehicle Classification by Body Size

1970

YEAR	BODY CLASS	MAKE	MODEL	TRANS	CID	ENGINE	STEERING	BRAKES	AIR COND.	DOORS
1970	L	Lincoln	Continental	A	460	V-8 S	P	M DC	AC	4
1970	T(1)	Chev.	C-10	M	350	V-8 2bbl	M	M DC	none	2
1970	T(1)	Ford	F-100	M	300	L-6	M	M DC	none	2
1970	T(2)	Chev.	C-20	A	350	V-8 4bbl	M	P DC	AC	2
1970	T(2)	Ford	F-250	A	360	V-8	M	P DC	AC	2

APPENDIX D

TOOLS AND EQUIPMENT LISTS FOR EACH SERVICE ESTABLISHMENT TYPE

This appendix contains a detailed listing of the recommended tools and equipment for:

New Car Dealers

Service Stations

Independent Repair Garages

Specialty Shop

- Tune-up and Brakes
- Radiator and Air Conditioning
- Diagnostic Tune-up
- Transmission
- Muffler
- Wheel Alignment

These lists were used to establish the costs for the tools and equipment used in each type of service establishment.

Tooling and Equipment Detail by Facility
(1975$)

Item	Cost Per Unit $	Car Dealer	Service Station	Independent Repair Garage	Specialty Shops: Tuneup-Air Cond. and Brakes	Radiator and Air Cond.	Diagnostic Tuneup	Transmission	Muffler	Wheel Alignment
1-1/2 Ton Floor Jack	170		1	2					1	
2 Ton Floor Jack	240	1			1	1	1	1		1
3 Ton Floor Jack	300	1		1						
4 Ton Floor Jack	400	1								
10 Ton Floor Jack	675									
1/2" El.Drill (H.D. Reversible)	60	1		1	1	1		1	1	1
Parts Washer	375	1		1	1			1		1
Vacuum Cleaner	60			1	1	1	1	1	1	1
Heavy Duty Vacuum Cleaner	200	1								
Jack Stands - 2 Ton	30			2	2	2	2	2	1	2
Jack Stands - 5 Ton	43	2		2				2	1	
Bench Grinder and Stand	130	1		1	1	1		1	1	1
Creeper	12	4		2	1	2	1	2		1
Fender Covers	8	22		8	8	4	4	12	10	6
First Aid Kit	18	1	1	1	1	1	1	1	1	1
Arc Welder-225 AMP	150	1		1				1	1	
Gas Welder and Cutter Set	170	1		1	1	2		1	5	1
Cylinder Hand Truck	33	1		1	1	1		1	5	1
Hydraulic Press-30 Ton	400	1		1	1			1	1	1
Straight Edge - Precision	12			1						1
Storage Cabinet	60			1	1	1	1	1		1
Diff. Chain Hoist- 1-1/2 Ton	220	1		1						
Hand Truck-H.D. 600#	40	1		1	1	1		1		1
Hand Truck-H.D. 800#	100	1		1	1	1		1		1
Drill Press 1/2 H.P.	250	1		1						
One End Jack 1-1/2 Ton	160			1						
Fire Extinguisher	53		2	2	3	2	2	4	5	2
Fire Extinguisher	80	3								
Waste Can-Fireproof	47	4	2	3	5	2	2	6	5	3
Bench Vise	41	5	1	2	1	1	1	3	2	1
Drop Light 25' Reel	20		1	5	5	2	2	6	5	3
Drop Light 30' Reel	30	15								
25' Air Hose	13	8		5	5	2	2	6	5	3
Extension Cord	18	9								
3/8" Electric Drill	25			1	1	1		1	1	1
3/8" Electric Drill Heavy Duty	55	1								
Utility Lift Jack	65	2		2	2			4	10	2
1-1/2 Ton Jack Stand	75	2		2					4	
Air Chisel and Bits	75	1		1					5	
Air Impact Wrench	200	1		1	1			1	5	1
Torque Wrench 0-100 In. Lbs.	36	1		1				6	2	
Torque Wrench 0-250 Ft. Lbs.	50	1		1	1			6	2	1
Bearing Packer	21	1		1	1				1	1
Front Grease Seal Installer Kit	5			1	1				1	1
Rear Grease Seal Installer Kit	6			1	1				1	1
Vacuum Tester	21	1		1	1		1	1		
Headlight Aimer	125	1	1	1						
Tap and Die Set w/Extractor	85	1		1	1	1	1	1	1	1
Universal Dial Indicator	40	1		1			6			
Service Station Misc. Pkg.	411		1							

Tooling and Equipment Detail by Facility
(1975$)

Item	Cost Per Unit $	Car Dealer	Service Station	Independent Repair Garage	Specialty Shops					
					Tuneup-Air Cond. and Brakes	Radiator and Air Cond.	Diagnostic Tuneup	Transmission	Muffler	Wheel Alignment
Come-Along Hoist-1 Ton	31	1		1				1		
Drain Pan	7	2		2		2		2		
Storage Shelving	132			1	1	1		1		1
Repair Order Rack	30	1		1	1	1		1	2	1
Peg Board Set-Up	60			1				1		
Air Blow Guns	6	8		3	5	2	2	6	5	1
Senior Gear Puller	50			1				1		
Standard Z Arm Puller	50			1						
Reversible Jaw Puller	33			1						
Junior Gear Puller	25			1	1			1	1	1
Flange Type Puller	26			1	1			1	1	1
Slide Hammer Puller	40			1				1	1	
Gear and Pulley Puller	12			1		1		1		
Universal Hub Puller	40			1	1			1	1	1
Internal Pulling Attachment	42			1				1		
Bearing Separator-2-1/4" Cap	13	1		1	1			1		1
Bearing Separator-4-1/4" Cap	28	1		1	1			1	1	1
Belt Tension Tester	20	1		1	1					
Razor Blade Scraper	2	10	2	4						1
Torque Wrench 3/4"	165	1								
Socket Wrench Set 3/4"	118	1								
Steam Cleaner	800									
Under Coater	495									
Portable Hydraulic Crane	300	1								
Overhead Hoist-1 Ton	450	1								
Hoist Trolley	55	1								
20-Ton Hand Jack	60	1								
High Pressure Washer	700	1								
Shop Exhaust System	1900	1								
Special Service Tools*	3000	1								
Air/Water Leak Detector	240	1								
Portable Fuel Storage	270	1								
Locker Sets (8 Men)	200	2								
Write-Up Desk	260	1								
Wheel Dolly	275	1								
Heavy Duty Work Bench	75	10								
Buffer Polisher	100	1								
Inventory Boxes	100							1	1	
TOTAL GENERAL EQUIPMENT		$15,145	$1,059	$5,060	$3,205	$1,714	$907	$4,843	$5,891	$2,929

Tooling and Equipment Detail by Facility
(1975$)

Item	Cost Per Unit $	Car Dealer	Service Station	Independent Repair Garage	Specialty Shops: Tuneup-Air Cond. and Brakes	Radiator and Air Cond.	Diagnostic Tuneup	Transmission	Muffler	Wheel Alignment
Mop	10	1	1	1	1	1	1	1	1	1
Mop Bucket	27	1	1	1	1	1	1	1	1	1
Toilet Brush	2	1	1	1	1	1	1	1	1	1
Push Broom	6	1	1	1	1	1	1	1	1	1
Window Squeegee	7	1	1	1	1	1	1	1	1	1
Window Brush	9	1	1	1	1	1	1	1	1	1
Floor Squeegee	11	1	1	1	1	1	1	1	1	1
Soap etc.	10	1	1	1	1	1	1	1	1	1
Snow Shovel	7	1	1	1	1	1	1	1	1	1
Water Hose - 100'	30	1	1	1	1	1	1	1	1	1
Broad Shovel	8	1	1	1	1	1	1	1	1	1
Oil Soak Compound	8	1	1	1	1	1	1	1	1	1
Ladder 10'	55	1		1	1	1	1	1	1	1
Floor Cleaner	500	1								
TOTAL CLEANING SUPPLIES		$690	$135	$190	$190	$190	$190	$190	$190	$190
A/C Tester/Charger/Tool Kit	911	1		1	1	1				
Antifreeze Tester	3	1	1	1	1	1		1		
Radiator Water Bucket	7	1		1	1	1		1		
Radiator Pressure Tester	32	1	1	1	1	1				
Reverse Flushing Gun	45	1		1	1	1				
Thermostat Tester	38	1								
Radiator Test and Hot Tanks	3500					1				
TOTAL A/C-COOLING/HEATING		$1,036	$35	$998	$998	$4,505	-	$10	-	-
36" Pit Alignment Rack-Incl. Air Jacks and Tools	3800			1						1
Hub Cap Tool	3	1		1						1
Rubber Mallet	3	1		1						1
Coil Spring Compressor	96			1						1
Bushing Remover-Installer	34			1						1
Ball Joint Check Guage	38	1	1	1						1
Steering Wheel Puller	13			1						1
24" Power Rack-Incl. Air Jack Tools, etc.	6000	1								1
TOTAL ALIGNMENT/STEERING		$6,044	$38	$3,987	-	-	-	-	-	$9,987
Mobile Brake Shop with Drum & Disc Lathe, Grinder and all Tools	3660	1		1	1				1	1
Brake Bleeder Set	152	1		1	1				1	1
Dial Indicator Set	56	1		1	1				1	1
Disc Micrometer Set	61	1	1	1	1				1	1
Disc Pad Lining Wear Guage	12	1	1	1	1				1	1
Brake Drum Micrometer	42		1							

Tooling and Equipment Detail by Facility
(1975$)

Item	Cost Per Unit $	Car Dealer	Service Station	Independent Repair Garage	Specialty Shops: Tuneup-Air Cond. and Brakes	Specialty Shops: Radiator and Air Cond.	Specialty Shops: Diagnostic Tuneup	Specialty Shops: Transmission	Specialty Shops: Muffler	Specialty Shops: Wheel Alignment
Brake Lining Near Guage	22	1	1	1	1				1	1
Brake Shoe Setting Guage	10	1		1	1				1	1
Wheel Cylinder Hone	9	1		1	1				1	1
Caliper Bore Hone	18	1		1	1				1	1
Caliper Piston Pliers	11	1		1	1				1	1
Brake Hand Tool Kit	65	1		1	2				2	1
Tube Cutter & Double Flaker Set	24	1		1	1	1		24	1	1
Wheel Cylinder Clamps	6	1								
Hand Tools	25		1							
TOTAL BRAKE REPAIRS		$4,106	$162	$4,100	$4,165	$24	-	$24	$4,165	$4,100
Trans. Hilift Hyd. Jack 1/4 Ton	510	1		1				2		
Trans. Low Type Hyd. Jack 1/2 Ton	290			1						
Trans. Holding Fixture	84	1		1				1		
Clutch Align. Tool Kit	10			1				1		
Counter Gear Loading Tool	8			1				1		
400 PSI Press Guage	15	1		1				1		
30 in. Vacuum Guage	10	1		1				1		
Trans. Clutch Spring Compresssor	143			1				1		
Bushing Driver Set	107			1				1		
Governor Bore Tool	36			1				1		
Installation Sleeve Set	105			1				1		
Universal Joint Tool	36			1				1		
Service Bench - Rebuild	415							1		
Port. Waste Oil Drain Cabinet	145	1								
Transmission Tester	182	1								
Transmission Bench	160	1								
Transmission Converter Cleaner	480	1								
Trans. Clean Equip. & Supplies	690							1		
TOTAL CLUTCH/TRANS.		$1,586		$1,354	-	-	-	$2,679	-	-
Battery-Alt.-Reg. Tester	220				1					
Dynamometer - Chassis	8000						2			
Cooling Fan	100						2			
Stethoscope	11	1		1			2			
Timing Light	40	1		1	1		2			
Vac. Guage & Fuel Pump Test	20	1		1	1		1			
Spark Plug Viewer	10			1	1		1			
Remote Starter Switch	4	1		2	2		2			
Spark-Plug Cleaning Tap	4	1		1	1		1			
Spring Guages - Point Test	4	1		1	1		1			
Spark Plug Cleaner	115	1		1						
Tuneup Meter Set	190	1								
Speed Control Tester	260	1								
12" Scope Analyzer	3800				2		2			
Dwell Tach Voltmeter	160	1								
Tuneup Analyzer w/Scope	667									
Diagnostic Oscilloscope	402									
HC/CO Meter	300									
Tune Up Set - 4 Meters & Timing	265		1							
Tune Master Kit - 4 Meters & Tire Light	440									

Tooling and Equipment Detail by Facility
(1975$)

Item	Cost Per Unit $	Car Dealer	Service Station	Independent Repair Garage	Specialty Shops: Tuneup-Air Cond. and Brakes	Radiator and Air Cond.	Diagnostic Tuneup	Transmission	Muffler	Wheel Alignment
Super Pro Analyzer Set	600									
Diagnostic Tuneup Center	995			1						
Infra Red Emissions Analyzer	895	1		1						
8" Scope Analyzer (No Emission)	2660	1								
Distributor Tester Machine	1500	1								
Alt./Gen; Regulator Test Bench	1350									
Choke Tester	35	1								
Infra Red Emissions Analyzer	2700				1		1			
TOTAL ENGINE TUNE UP - DIAG.		$5,898	$265	$2,088	$10,646	-	$26,648	-	-	-
Battery Tester	40	1	1	1		1	1			
Battery Charger (Port.)	190	1	1	1	1	1	1	1	1	1
Battery Hydrometer	4	1		1	1	1	1	1	1	1
Battery Terminal Brush	3	1	1	1	1	1	1	1	1	1
Battery Pliers	3	1	1	1	1	1	1	1	1	1
Battery Terminal Spreader	2	1	1	1			1			
Battery Water Cont. & Syringe	16	1	1	1			1			
Armature Growler	82	1								
Battery Carrier	16	1		1						
Battery Starter Tester	220	1								
Charging System Tester	125	1								
Alt./Regulator Test Bench	750	1								
Ohm Meter	110	1								
Rack & Filler	24		1							
TOTAL ELECTRICAL SYSTEMS		$1,561	$290	$274	$200	$240	$258	$200	$200	$200
Engine Repair Stand	203	1		1						
Micrometers 1-2, 2-3, 3-4 out	105	1		1						
Micrometers - Inside	51	1		1						
Grinder Surfacing Hone	25	1		1						
Cylinder Hone	75	1		1						
Compression Tester	27	1		1						
Valve Spring Compressor	9	1		1						
Piston Ring Compressor	3	1		1						
Piston Ring Expander	4	1		1						
Ridge Reamer	11	1		1						
Ring Groove Cleaner	7	1		1						
Oil Pressure Guage	3	1		1						
Harmonic Balancer Puller	14	1		1						
Rocker Arm Stud Remover	12			1						
Torsional Damper Remover	45			1						
Valve Guide Reamers	40			1						
Valve Guide Recondition Kit	450	1								
Hyd. Lifter Tester	100	1								
Valve Guide Reline Kit	25	1		1						
Valve Reconditioner	1150	1		1						
Valve Seat Refacer Kit	330	1		1						
TOTAL ENGINE REPAIRS		$2,579		$2,120	-	-	-	-	-	-
Oil Spout	2	1	2	2						
Trans. Funnel Spout	9	1	1	1						
Grease Fitting Asst.	5	1	1	1						
Filter Tool	2	1	1	1						

Tooling and Equipment Detail by Facility
(1975$)

Item	Cost Per Unit $	Car Dealer	Service Station	Independent Repair Garage	Specialty Shops: Tuneup-Air Cond. and Brakes	Radiator and Air Cond.	Diagnostic Tuneup	Transmission	Muffler	Wheel Alignment
Portable Lube Cabinet	312			1						
Portable Gear Oil Cabinet	157			1						
Portable Drain Cabinet	101			1				2		
Portable Auto Trans Fluid Disp.	150			1						
Oil Fill Can-Flex Spout	18	1		1				2		
Portable Power Lube Cabinet	445	1								
Portable Power Lube Gear Oil	441	1								
Portable Lube Cabinet Auto Transmission Fluid	268	1								
Portable Waste Oil Drain Cabinet	145	1								
Drain to Outside Tank	292									
Oil Cabinet and Lube Center	182		1							
TOTAL LUBRICATION		$1,326	$203	$758	-	-	-	$238	-	-
Wheel Balancer - off Car	110	1	1	1						1
Wheel Balancer - on Car	910	1		1						1
Tire Changer	570	1	1	1						
Tire Changer	390		1	1						
Tool Rack	24	1		1						
Tire Spreader	22	1		1						1
Wheel Adapters	32	1		1						
Tire and Wheel Runout Indicator	40	1		1						
Bead Lubricant and Applier	17	1	1	1						
Tire Water Tank	17	1		1						
Hose in Line Press Guage	30	1	1	1						
Tire Repair Gun Kit	28	1	1	1						
Bead Extender	51	1	1	1						
Lugwrench	12	1	1	1						
Misc. Tools, Mallets Guages	20	1	1	1						
Misc. Tools, Mallets Guages	4								2	
Misc. Tools, Mallets Guages	25									1
TOTAL TIRE SERVICE		$1,883	$655	$1,633	-	-	-	-	$8	$1,067

Sources: References 20,24,41,52thru87,140

APPENDIX E

SCHEDULED MAINTENANCE DATA SHEETS

(See Volume II)

APPENDIX F

UNSCHEDULED MAINTENANCE DATA SHEETS

(See Volume III)

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