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Department of Economic and Social Affairs

Centre for Industrial Development

EXPERTS GROUP ON SECOND-HAND MACHINERY
FOR DEVELOPING COUNTRIES,
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SECOND HAND AUTOMOTIVE EQUIPMENT WITH SPECIAL REFERENCE TO USE IN DEVELOPING COUNTRIES

by

Max Alth

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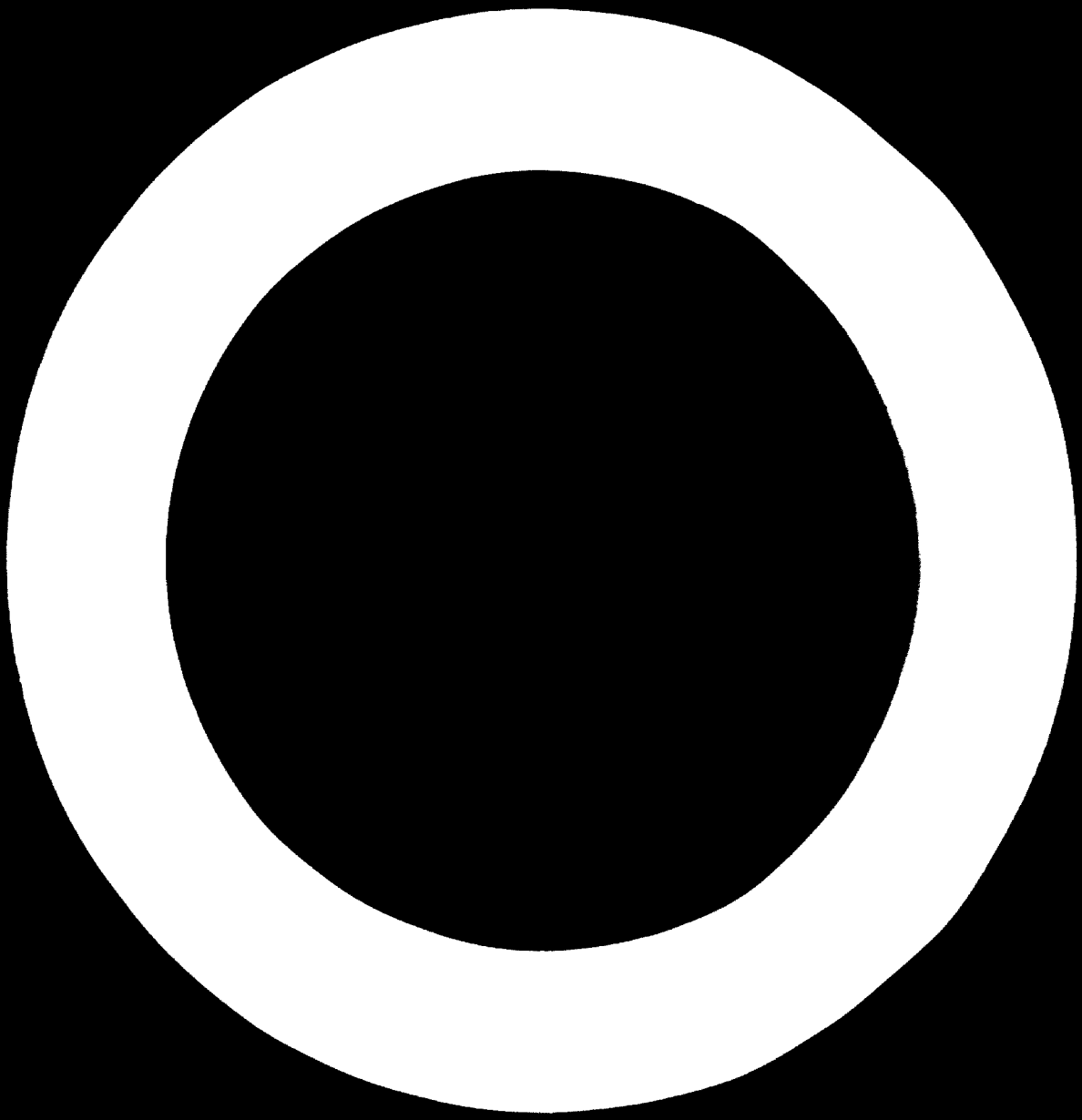


Second-hand Automotive Equipment With Special Reference to Use in Developing Countries

Foreword

The used vehicle offers its purchaser transportation at a bargain price, but only in special circumstances and only when the purchaser is fully prepared and equipped to deal with the used vehicle. All others will find the used vehicle a financial trap, fraught with problems, disappointments and excessive costs.

This study examines the financial, maintenance and operational factors involved in the purchase and operation of both new and used vehicles.

Introduction

What is a used vehicle?

The phrase "used vehicle" has many meanings and shades of meaning to the people involved in the motor transportation industry. Therefore, before one can discuss the used vehicle and its applications and problems, the term should be clarified.

A used vehicle is generally considered to be any vehicle -- from a two-wheel motorcycle on up to a multiaxle truck train that is sold for the second time. So long as the manufacturer of the vehicle, his distributor, wholesaler or dealer possess the vehicle, and it has not been used -- although it may have been driven for a considerable distance, the industry considers the vehicle new. Should one dealer sell the vehicle to another dealer, the vehicle is still considered new.

The vehicle becomes used when a customer, meaning any individual or company, purchases the vehicle with plans to actually operate the vehicle. Technically, so far as the industry is concerned, the vehicle becomes used on the day the dealer sells it. This is a very important point, for it indicates that a used vehicle may be in any state and condition from a few miles and a few days to hundreds of thousands of miles and years of operation, and still bear the same simple designation: used vehicle. The term "used vehicle" is then very broad, and in one sense, almost meaningless so far as its use as a yardstick for indicating the remaining life and value of a truck or automobile is concerned. However, as will be shown, the appellation itself serves to make the selling price of used automobiles far lower than it should be when measured by the expected life remaining in the car being sold.

A practical definition of "used vehicle".

For the purpose of this discussion, all vehicles shall be marked by their years of service. A vehicle that has just been purchased and put to work shall be designated as being less than one year old. A vehicle that has been operated more than one year but less than two shall be called one year old, and so on.

The selling price of a used vehicle.

The price at which a used vehicle is sold depends upon many factors. Obviously, the usual market price factors are operative. The eagerness of the purchaser to acquire, the eagerness of the seller to dispose, or his reluctance to dispose. These factors are very similar to those that operate in any market place in any commodity, all over the world, i.e., supply and demand. However, the used vehicle is subject to many factors beyond and to a great extent above supply and demand, although, as will be seen, these play a very important part in the final determination of the sale price of a used vehicle.

Automobiles

General price determination, automobiles.

Considering the automobile exclusively for the moment, the factors that control and establish the selling price of a used car are the following:

The original sale price of the automobile.

The manufacturer of the automobile.

The age of the automobile measured from the date the model was first accounced, not necessarily the exact date on which the vehicle was purchased from the dealer. (For example, a 1960 Ford, announced to the public December 1959, but actually purchased December 1960, would be considered a full one year old if it were offered for resale in the same month of December 1960; the 1961's would be on display, and the 1960 Ford would be last year's model).

The appearance of the automobile.

The time of the year the vehicle was offered for sale.

The type of automobile, large, small, station wagon, etc.

The mechanical condition of the vehicle.

Each of these factors varies with time, place, country, make of car, model, changing public taste and manufacturer popularity, and so on.

The original sale price of the automobile.

It would appear that the higher the original price paid for the automobile, the greater its resale price. This is not true over the life of all automobiles. For a few makes it holds true for their entire lifetime. For other expensive cars it holds true for a year or two but then acts as a detriment and these cars end up as being less desirable than cars originally lower in price by half or more. The resale price of some makes of cars falls off very rapidly. Other makes hold up excellently.

The rule of thumb in the United States (but not in other countries, although the general trend is very similar and grows more and more like the United States as that country grows in material comfort and the number of its automobiles) is: an auto drops in price by one third after one model year

one fourth more the following year, one fifth by the end of the third year, one sixth the next year, one seventh the next year, and so on.

Countries in which it is difficult to purchase autos, because of high import duties and other reasons, do not follow this abrupt drop-off in value, but follow a more gradual scale.

The reason for the great drop in price during the first year is, of course, human vanity. The general public, in the United States perhaps to the greatest extent, has been conditioned to look upon a new car every year as a sign of luxury and wealth. The condition of the car at the end of one year, its appearance, its useful life, its actual comparison to the new model, all have no bearing upon the drop in price of one third in the first year. Assuming that the average new car is driven no more than all other cars -- on an average, some 10,000 miles, a one year old car is in better mechanical condition in a number of ways than a brand new car. Most engines are not fully broken in until they reach 10 or 20,000 miles; until this point is reached optimum power and mileage is not realized. When one adds to this the fact that the average new car today is good for about 100,000 miles without engine overhaul or replacement (although other parts will have to be replaced) the financial waste of the new-car-a-year habit becomes obvious.

Price drop schedule by make of car.

The price drop schedule is different for different makes of cars. In general the top luxury cars such as the Bentley, Rolls, Ferrari, and others in that group tend to hold their prices very well, dropping gradually. The exception here are the cars that have some special and expensive equipment. Perhaps special upholstery; an actress lines her Rolls with wolf skins, or the like. These special items usually have little or no resale value.

The middle luxury group which includes the Mercedes, the Lincoln, the Cadillac and such drop very rapidly with the years, far more rapidly than do their less luxurious siblings. The reason being that the middle group appeal most to the very group that is most conscious of the new models.

The very wealthy purchase for keeps, the upper middle income group purchase for display, seeking to appear more wealthy than they really are. Still another factor that depreciates these cars very rapidly is the fact that parts are very expensive, and despite glowing sales messages, these cars wear out and break down almost as often as their less costly sisters do. To put it in numbers, a $7,000 Lincoln does not last two-and-a-half times longer than a $2,000 Ford.

The lower priced automobiles, the Fords, the Chevrolets, Austins, Fiats, and so on, suffer no more than the usual annual price drop given at the beginning of this section. Among these cars, those with special equipment, automatic transmissions, air-conditioning, etc., also tend to drop more rapidly than their plainer, simpler cousins.

In general, the lower the initial price, the plainer, the more utilitarian the vehicle, the slower its price drops with the passage of years.

Some typical prices: A 1965 Cadillac, 4-door sedan "Calais" model costs $5,144. A 1955 Cadillac costs $245. A 1965 Lincoln Continental costs $6,798. A 1961 Lincoln Continental costs $1,945; in four years this car's value on the marketplace dropped $4,000.

A 1965 6-cylinder Ford "Falcon" sold for $2,037. A 1962 Ford "Falcon" sold for $510.

A 1965 Plymouth "Valiant", 6-cylinders, 4-door sedan sold for $2,050. A 1962 "Valiant", 4-door sold for $395.

The appearance of the automobile.

So far as the general used car buying public is concerned, the appearance of the vehicle is far more important than the mechanical condition, and in some instances than the actual or model age of the automobile. The only group not particularly interested in the outside aspect of the vehicle is a very small group of car buyers that purchase

on mechanical condition alone. Even this group is somewhat influenced by appearance because frequently the outside of the car is indicative of its mechanical inside.

In general the appearance of a used automobile tends to depress the resale value of the car far faster than its mechanical condition and equally as fast as its age.

The time of year the vehicle is offered for sale.

The seasonal date on which the used vehicle is offered or sought influences the general individual buying public considerably. The point of highest price asked and received is the Fourth of July. Prices taper off after this point to a low just at the time new plates are required -- January. This point is approximately the same as the time that new car models are put on the market. However, the tendency is to push the new cars ahead of the first of the new year. The difference between the price of a used car on January 1 and July 1 can be ten to twenty per cent.

Type of vehicle.

In general the prices of used cars by different types, 2-door, 4-door, sedans, station wagons, etc., follows the original price line with one variation. The price of used station wagons holds up better than the rest because the station wagon is often used by small businessmen, and because the station wagon is often desired as a second car. It can be used for hauling things conveniently, whereas the 2-door and the sedan cannot. It is more desirable because it is more useful.

The mechanical condition of the vehicle.

Again the mechanical condition of the vehicle like many of the other price-affecting factors mentioned, does not follow logic, but follows the buying public's fancy.

Every used car purchaser wants a perfect vehicle. Unfortunately, very, very few used car buyers -- excluding the professional purchaser -- have the slightest idea of how to test and evaluate a used car. If the car is not noisy, if the car displays more power in relation to its weight than the buyer is accustomed to, if the car goes through its gears without trouble and makes no smoke nor loses water, the car is considered satisfactory. Many take their vehicles to their mechanics for an evaluation. His examination is somewhat better, but still far from perfect.

In fact, the average mechanic is so incompetent that, as a group, they are, after vanity, the second single greatest cause of new car purchasing. Many people buy a new car every year just to keep out of their clutches.

There are many reasons for the incompetence of the average mechanic, and one big reason is the very group he deals with: the motoring public. A good mechanic is a field engineer, worth in the United States eight to ten thousand dollars per year. Few companies pay this rate, and few motorists will pay the 10 or 15 dollars per hour necessary to keep a man of this caliber working in a well equipped shop. Instead the average car owner takes his repairs to the cheapest -- at the moment -- mechanic he can find.

One direct result of this situation is the sudden growth of giant diagnostic centres constructed and operated by the large oil companies at which a motorist can have his car tested -- but no repaired -- for eight to ten dollars. He is told exactly what is wrong, and then he can go and have the work done elsewhere. Some centres have local repair facilities.

Worn vehicles.

So far we have considered automobiles from the point of view of false depreciation or the time element alone. There are, however, individuals and groups that wear out their automobiles well before their cars reach

the bottom of the depreciation curve. These are commercial driver-salesmen and such, taxi drivers and municipal drivers. Some of the drivers in this group put 50 to 100,000 miles on their cars in one year. Some burn out their transmissions early because they keep the car in second gear much of the time; policemen and taxi drivers give their cars an overall beating because they continuously "push" their cars (the income of the latter depends upon their speed). Some cities force taxi owners to drill holes in the dash-board of their vehicle spelling out the word "Taxi" to protect the unsuspecting, but not all do. The group of purchasers who have been "stuck" with cars that are far older than their years quickly join the group who prefer "new" cars -- at least they know what they are getting.

The relative value of the used automobile.

It can be readily seen from the foregoing that it is quite possible by judicious study of the habits of the auto-buying public and a knowledge of motor cars to purchase used vehicles at a selected period in their price/age curve that offers considerable more transportation than does a new vehicle on a dollar-per-mile basis. In four to five years an automobile will lose an average of 75 to 90 per cent of its original sale value. However, since the average automobile is good for 100,000 miles and the average driver goes but 10,000 miles per year, by a car's fifth year it will have half of its useful life remaining, while its cost may be but one tenth. Roughly, in dollar-to-mile analogy -- this is a five-to-one improvement. If a new, $4,000 car will go 100,000 miles and a used five-year old car costing $400 will go 50,000 miles, the new car mileage costs $4.00 per 100 miles, the used car mileage costs only $0.80 per 100 miles.

This relationship is not exactly true because the one and two-year old car <u>may</u> go without repairs, while the three and four and five-year old car will not.

Trucks

The used truck.

A somewhat similar situation as for automobiles exists for used trucks. However, the factor of human vanity operates far less strongly with trucks than it does with motor cars. The general rule of depreciation for trucks is one-fourth the first year, one-fifth the second year, one-sixth the third year, one-seventh the fourth year, and so on until the truck reaches a level below which its sale price never drops so long as it is able to operate or can be repaired.

However, there are other factors at work in the truck field that operate to reduce the price of a used truck beyond what its loss of remaining operating life would warrant.

Automobiles become obsolescent artificially. The manufacturers put out new models each year and their sales efforts are in effect condemnations of existing models. The actual change in automobile efficiency, carrying capacity, safety, comfort and dependability does increase each year -- but not as fast as the dollar drop in resale value of the car goes down. Mechanical improvements come slowly. The big change in braking was some 30 to 35 years ago when the hydraulic brake was introduced. The only major change since then has been the introduction, slowly, of disc brakes. The only change in transmission was the introduction of the automatic transmission after World War II. It is not superior to manual shifting, except in special applications, merely more convenient. The introduction of the alternator is a definite improvement, but not a vital one. Transistorized ignition is another example; it is important to high speed engines (racing engines). To the average motorist it offers somewhat better cold weather starting and somewhat improved efficiency (indirectly). On the other hand, ninety-nine mechanics out of one hundred have not the

slightest idea of how to repair a transistorized ignition system and many manufacturers provide plugs so that in an emergency the ignition can be returned to standard.

The same slow but definite improvements in efficiency are constantly being made in trucks; the future holds promises of some big changes, but these are still years off. However, trucks are being constantly made obsolete by changes in road laws, improvements in roads, changes in packaging, increases in driver's salaries and, in the free world, constant competition for business between truckers and trucking companies.

The effect of road and road-law changes upon the resale price of used trucks.

When a country improves a major road, or any road, so as to permit faster movement of vehicles over that road, that country acts to reduce the number of vehicles required in that area. When a country acts to increase the speeds permissible over its roads, or acts to permit greater axle loading of vehicles on its roads, that country acts to reduce the number of vehicles the transportation industry in that country requires. This is being constantly done in all the countries throughout the world, in varying degrees.

Obviously when top speed is increased, say by ten per cent, vehicles capable of operating ten per cent faster can make their trips in roughly ten per cent less time; thus ten per cent fewer vehicles are required. The same holds true when permissible loads are increased. Ten per cent may not appear to be a large factor, but this figure cuts right across most costs. Not only are ten per cent fewer vehicles needed, but ten per cent less fuel, fewer drivers, fewer mechanics, fewer spare parts, less capital investment, insurance, garage space, and so on.

It can be readily seen then that as the roads of the world improve, as greater speeds and heavier loads are permitted, groups of vehicles

will be taken from service despite their remaining life, and replaced by vehicles capable of greater speeds and greater loads. These are the facts of free enterprise, and this is what is continuously happening all over the world to varying degrees.

Vehicle obsolescense.

Existing vehicles are not made obsolete by mechanical improvements nearly as fast as by the forementioned road conditions and road-laws. Mechanical improvements in all fields of vehicular transportation are at work constantly, but the day by day effect is negligible, and the yearly result noticeable in certain fleets only, over long periods of time and in limited areas at any given time.

One reason is the nature of technological advance. An inventor develops a concept. A manufacturer carries the concept on into the development stage -- with reluctance. Actually, manufacturers develop new products from necessity only. If they do not, their competitors will. Therefore they must. The switch of a new product from development to manufacture is a slow, painful, dangerous and highly expensive step. For one, the public has to be prepared for the change. For another the field crew-mechanics, users, etc., must also be prepared for the change. In addition, there is design, tooling, manufacturing, and last but not least, the new idea or product must pass actual trial by use. There are dozens of inventions and improvements that come readily to mind which were brought out with great expense and fanfare, but which died ignominously - many through no fault of their own. Chrysler's uni-frame car coupled with its air-flow design -- two basic and accepted principles of auto and truck design today -- were almost the ruination of the company when produced in volume back in 1935. Free-wheeling is another idea that never made it,

but this one was not a good one. The air-filled rubber bumper, still touted every now and again, and an important life-saver as it acts to drastically reduce the impact of a crash -- has never been accepted, it is ugly compared to the chrome-steel bumper.

Current inventions under development and field test include the turbine engine, the differential diesel engine, the Wankel rotary engine (used in some cars). These, according to their manufacturers, will not be in general manufacture for many years to come although they have passed the testing in the laboratory stage and are now awaiting field trials and public acceptance.

The life of a vehicle.

It can be stated without fear of contradiction, that a vehicle can be operated for as long as its owner wishes to operate it. There are ERF's that have been in constant commercial use for 25 years. There are Mack's in use for equal periods of time, and so on. Unlike living creatures, a vehicle has no fixed life span, it has parts that wear but which can be replaced. From the practical point of view, the life of a vehicle can be said to be over when it is no longer financially advantageous to its owner to continue to repair it.

This is not a simple decision, nor can any such decision be applicable to all vehicles in all services in all parts of the world. Each type of vehicle wears at a different rate, each type of service affects the same vehicle differently, much depends upon the driver, the maintenance or lack of maintenance bestowed upon the vehicle.

Roughly, the average pleasure car can be operated with its original engine, transmission (if manual) and rear end for 100,000 miles or so -- if care is used. This would include five or more sets of tyres, three to five batteries, three or four mufflers, exhaust pipes, point adjustment and perhaps replacement every 10-15,000 miles, four to eight sets of brakes (shows) a complete front-end overhaul at least once and a complete transmission overhaul at least once if an automatic transmission is used. These would be the

minimum repairs that could be expected if the vehicle were not used as a taxi, were not confined to fast city driving, nor limited to slow-speed driving such as cruising as a police car, and were not handled by a bad driver, nor carelessly lubricated. A bad driver, lack of maintenance, etc. could easily double, triple and quadruple these repairs.

The life of a truck depends upon much the same factors, its work, its load, its engine, driver and maintenance. A truck with a gasoline engine could be expected to go 4,000 to 55,000 miles without engine replacement or complete overhaul when engaged in house to house, or so called "retail" delivery work. When used for city delivery work, longer runs between stops and less shifting through the gears, the same truck might go 75,000 miles with the same gasoline engine. Used for city to city work, long hauls with few stops, the same truck will easily go more than 100,000 miles, and with special care even 200,000 miles with the same engine. With the diesel engine, the vehicle could easily double and triple these figures.

On retail delivery it is not unusual to replace a transmission every 20,000 to 30,000 miles -- depending upon the driver, brakes every 10,000 miles, again depending upon the driver. Wholesale delivery, meaning fewer stops per working day, would permit the vehicle to go further without repairs. And, over-the-road work, city to city, would give even more life. Transmissions on road trucks can be expected to go 300,000 to 400,000 miles between overhauls. Tyre life is also greater when the driving is constant and the road is smooth and straight. An over-the-road truck can be expected to run 100,000 miles on one set of tyres, and several hundred more if the tyres are recapped. A retail delivery truck is lucky if it gets 20,000 miles before requiring its tyres to be recapped.

Truck maintenance.

All in all, the total cost of maintenance, on the average, for all United States truckers runs to about 10 per cent of their total income. Maintenance includes repairs, parts, labour, lubrication, inspections, washing and painting. The exact sum varies with different fleets, different types of

loads and work, but the figure is useful as a typical cost figure. This figure was determined by a study conducted by the American Trucking Associations, 1953 to 1962.

Typical maintenance figures.

Diesel powered tractors engaged in line hauls, long distance hauling, required repairs of one kind or another once every 1,758 miles, or every six calendar days. Engines were the most expensive component to maintain: one third of the total repair cost. Engines required repair every 13,000 miles, or once every seven and half weeks.

Road failures in the fleets studied amounted to about one per vehicle for each two years of vehicle operation. (It should be noted that these figures are representative of vehicles with an average age of six to eight years).

At a labour rate of $4.50 per hour, direct labour charges amounted to $2.65 per mile of operation.

Sixty-six carriers were studied. Of the repairs encountered by these groups, 82 per cent were conducted in their own shops. All of the carriers surveyed were successful financially and all displayed an above average degree of self-sufficiency.

Typical successful fleets.

For a number of years, "Fleet Owner" a McGraw-Hill publication has been conducting a yearly competition among fleets to determine which 20 fleets (20 truck fleets and 30 bus fleets) were the best managed and directed during the year concerned. One winning fleet is Adley (New Haven, Connecticut). During the year of interest, Adley's vehicles did more than 20 million miles of city and inter-city hauling and operated a total of 652 power units (tractors or self-powered trucks). Of this group of vehicles Adley had 90 trucks between six to ten years of age, 90 trucks over ten years of age and 79 tractors between six and ten years of age. Other vehicles were newer.

To maintain this fleet they employed a crew of some 65 mechanics, or one mechanic for every 9.4 vehicles, of 14.5 man hours of work for every 1,000 vehicle miles.

In the same period, Indian Head Truck Lines operated 40 tractors less than two years old and 100 tractors aged between two and five years. A few miscellaneous units brought the company's total number of power units to 151, which did 7,870,000 miles. Its crew of mechanics numbered approximately 22, averaging only 6.3 vehicles per mechanic, and 18.7 man hours of work for every 1,000 vehicle miles.

In the year following, H.P.Hood and Sons, operated some 2,000 power units of which 588 were six to ten years old, and 715 ten years or older; 1,300 units were six or more years old. The balance were newer vehicles. Roughly, this company needed only 225 mechanics for 1,000 miles of vehicle operation for every 17.8 hours of mechanics labour, and requiring but one man for every 11.8 vehicles. Total fleet mileage was in excess of 21 million miles.

Who uses used vehicles.

The suprising, perhaps, answer to this question is -- almost everyone. The United States, home of the new motor car and brand new truck -- has trucks on its roads today that average (1963) 8.07 years in age. This is the average, not the medium. This figure is up from previous years. In 1941 the average truck age was 5.60 years. In 1961 the age was 7.92. In 1962 the figure went up to 7.99 years, 1963 was 8.07. If we extrapolate we can safely assume the present average age of United States trucks to be close to nine years.

In 1941 there were half a million trucks that were eleven years old or older. In 1963 there were almost 4 million trucks eleven years or more old, with 2 million between eight and eleven years, 2 million between five and eight years of age, and about 2-1/4 million over two years but under five years of age.

A study of the percentages of vehicles in use in 1963 uncovers that no percentage is higher than 7.9 (1 to 2 years of age) and that no percentage is less than 5.7 of the total. This, the 10% per cent figure, includes all age groups up to 16 years of age and older. For the latter, the figure was 7.4. Figures indicate that almost all trucks are operated by someone for 16 years and more. Only 6.2 per cent of the trucks on the road in 1962 were less than one year old. There were 876,000 trucks in use 16 years or more in 1963. That is, America, the home of the new truck, operates more 16 year old vehicles than it operates one year old vehicles.

Average vehicle age outside the United States.

The average vehicle age (trucks) for the United States is eight plus years. There are no figures available for the average age of trucks outside the United States, but one can estimate and judge from fleet reports (Fleet International, McGraw-Hill) and other sources that the age of trucks is several years greater; at a minimum 10 to 12 years of age, and that the average age of automobiles is also a third or more greater.

Typical used truck prices.

A 1958 Jeep brought $375. A 1955 three-quarter-ton Ford brought $360. A 1951 1-ton GMC sold for $200. A 1956 Dodge dump truck sold for $435. A three-quarter-ton 1960 Ford stake-body truck sold for $880. A 1953 Jeep station wagon for $105. A 1961 Chevrolet 2-ton for $1,440. A 1960 GMC 2-ton truck for $1,175.

In England a 1955 Atkinson (gardner, sidel engine) 41-seat bus sold for £575 (Sterling). A 1957 Leyland tipper for £585. A 1960 Guy 8-wheel tipper, diesel engine went for £1,600. A 1959 Bedford tipper, 7-ton, sold for £245. A 1956 AEC Tractor for £450.

Vehicular Population

In 1963 the world total of cars, trucks and buses amounted to 140 million, of which the United States had 79 million, Europe [illegible] million and the balance was divided among the other areas.

In 1964 the figure was 158 million for the world, 83 million for the United States and some 41 million for Europe.

The estimated total world population of vehicles as of the beginning of 1965 is roughly 168 million, a jump of 11.6 million over the previous year.

In 1964 Asia had a total of 7 million vehicles, Canada, in contrast, has 6 million vehicles registered in the same period and Oceania had only 4 million.

As of the beginning of 1965 Africa had a total of 3.4 million, Asia had 8.8 million, Western Europe had 46 million, the United States had 86 million, the other Americas had 6.4 million, the Communist bloc had 5.9 million.

In sad comparison to these gigantic numbers, some very large countries had and still have but few vehicles. The 1965 figure for India is but 657,000; the 1964 number is 632,000, a gain of only 25,000 units. This is far below the world 1964 to 1965 percentage gain figure of 7.5 per cent. The Philippines showed 244,000 in 1964 and only 266,000 by 1965.

Algeria had 289,000 vehicles registered in 1964 and this group has increased to 299,500 by the beginning of 1965. The Congo had 75,000 units in 1964 and only 76,900 in 1965. Mozambique had 51,000 units in 1964 and 54,500 by 1965.

Cost Considerations

The comparisons that need to be made between the used and the new vehicle.

(a) The initial or purchase cost.
(b) Operating life expected.
(c) Cost of operation for the period expected.
(d) Resale value, if any.
(e) Identical costs (to be ignored).
(f) Choice of vehicle types available in relation to service required.
(g) Replacement parts.
(h) Special problems.

The initial or purchase cost.

Using the rule of thumb, it takes only four years on the average for an automobile to drop to 10 per cent of its original retail sale price. It takes only six years for a truck to drop to this figure -- in the United States. In other countries the drop is slower.

Operating life expected.

The life expectancy of an automobile in average private service is 100,000 miles without complete overhaul. This distance may be extended indefinitely if extensive repairs are made. Thus, at the end of four years an auto has 60,000 useful miles of life remaining. Thus a four-year old car will provide transportation (ignoring repairs) a little less than one-fifth that of a new car. The life of a truck depends greatly upon its type and service, but the same general rule is operative because the trucks that are worked hard, i.e., the retail delivery trucks lose value more quickly than do the over-the-road vehicles. A six-year old truck, may on the average be purchased for 10 per cent of its original cost.

It will have about 40 to 50,000 miles life on its original motor before overhaul. But, unlike the passenger car, trucks are completely overhauled and given new engines several times during their useful life. So, one cannot state that the six-year old truck has but 40 per cent of its useful life remaining. But even if this were true, the six-year old truck offers transportation at roughly one-quarter that of a new truck.

Cost of operation for the period expected.

Comparing the costs of operating a new vehicle with a like but new vehicle brings to light the fact that many of the costs are similar -- driver, taxes etc. The costs that are different include repairs, road breakdowns and fuel economy.

Fuel costs favour the new vehicle. However, most new vehicles do not secure their best mileage until they have been operated a number of miles. On cars this may be after 20,000 miles. On trucks this may be after 10 or 20,000 miles. Fuel efficiency drops rapidly at first, then less rapidly as the engine wears out. The pistons in the new engine are relatively tight and act as a load on the engine. As the rings wear out, the efficiency of compression falls off, but also as the rings wear out, their pressure against the cylinder walls decreases, the spacing increases, lubrication increases and change for the worse decreases. At 30,000 miles fuel consumption may be noticeably worse than at 20,000 miles. But at 40,000 and 50,000 miles the change is not quite as noticable.

Roughly, when an engine's efficiency drops by one-third, the engine is overhauled. However, when a vehicle's yearly mileage is low, the savings in fuel are not offset by a new engine and/or an engine overhaul and the engine is not replaced.

Obviously road breakdowns are more frequent with an old vehicle than with a new one, but not obvious to those in the trade is the fact that

road breakdowns are a direct reflection of lack of maintenence and inspection, not of a vehicle's age. It is possible by modern techniques to prevent breakdowns to the point of but one a year or two. It is possible to know exactly when an engine will throw a rod, or when an engine will burn a bearing and so prevent the road breakdown from happening.

Obviously, repairs are more frequent, more costly and complicated with an older vehicle than with a new. However, it is impossible to operate any vehicle, new or old, without some breakdowns and some repairs.

Individuals who are accustomed to owning their own cars have experienced periods of perfect service from their vehicles. Months and even years may go by without trouble of any kind, the vehicle needing nothing but routine attention. However, it is impossible to drive down any busy public highway without seeing a number of vehicles on the side of the road for one reason or another. When one considers a fleet of vehicles, one must accept the fact that no group of vehicles, and this includes the very best that can be made no matter how little used, will escape the law of averages. A certain number will always have trouble of one kind or another. The difference between a fleet of new vehicles and a fleet of old vehicles is not in the presence or absence of mechanics, but only in the number of mechanics needed. And, as has been shown, the number of mechanics needed depends as much upon the skill and experience of the mechanics and their supervisors as on the age of the vehicles.

Still another reason why all vehicles must be accompanied by mechanics, either public or private, is that vehicles always have accidents. Trucks and cars go off the road, collide, fail to be filled with fuel, water, or oil; fail to be driven properly, and so on. If for no other reason than rescue, mechanics must be available for all vehicles.

Resale value.

The resale value of both trucks and passenger cars, and of course buses also, drops most sharply the first few years. Therefore, from the point of view of long term investment, from the point of view of maximum return from the invested dollar, the older vehicle offers more, and the vehicle held the longest offers the most.

An automobile held but one year and operated but one tenth of its possible life or mileage and sold at the end of one year costs the purchaser one third less. If we assume a $10,000 vehicle for ease of computation the ownership of one year costs $3,300. Holding the same car ten years brings the annual cost down to $1,000.

Identical costs.

Many costs are identical for the new vehicle and the used vehicle. Garaging, washing lubrication, inspection, driving, insurance (depending upon comparative conditions) record keeping, fueling and similar.

Choice of vehicle types.

There is some difference in the choice of vehicles between new and used. For one, the new vehicle can be factory-altered to specification. For another, each year brings more models and types than the previous year by the same manufacturer. This is due to the need for more and more specialized vehicles, and in some degree due to the very volume of business. Manufacturers are competing and seek to offer different models each with its own special advantage, real or imagined. However, the difference in choice is not as great as it would seem. The real decision should be based upon actual individual needs, the compromise that might be made, and the relative costs involved.

Replacement parts.

Replacement parts for new vehicles are more readily available than replacement parts for old vehicles. However, the cost of new replacement parts can, in certain circumstances, be several times greater than that of old parts.

Special problems.

New vehicles have problems that old vehicles do not. New vehicles almost always incorporate some new idea or design which must be field tried, laboratory and proving ground tests are not equal to actual field tests by the user. As a result, it is quite possible to purchase new vehicles with "bugs" and troubles that are costly to find and remove. Old vehicles have the same troubles; but the troubles in old vehicles have been found and cured or the vehicle has been removed from the road. For example, the 1955 Plymouth passenger car was constructed with independent front wheel suspension and hydraulic brakes. When the front end on this particular car wears the play or movement of the wheels up and down is considerably greater than when the car is new. As a result, this car has a tendency to break the flexible front brakes lines after going over a severe bump. Breaking the hydraulic lines leaves the car without brakes. Mechanics experienced with this car always replace the front brake hoses with longer-length hoses to permit the extra play. How many drivers suddenly found themselves without brakes without any pre-warning when the car was two or three or more years old. This particular weakness in design was corrected after sufficient field experience was gained.

Cost of operation comparison between new and used vehicles.

Assuming that both the new and old vehicle are identical in power, load capacity and speed, and assuming that both are sufficiently alike to make driving and road handling similar, the difference in operating costs between the new vehicle and the old is fuel, lubricating oil, and repairs.

It is impractical to operate any fleet of vehicles without a repair crew if for no other reasons that human error will always bring trouble to a number of vehicles. Assuming brand new vehicles alone are employed, it is financially impractical to replace the vehicles each year; therefore the vehicles must be kept a number of years and they become used vehicles.

It can be stated then that all financially practical fleets operate used vehicles, and further that all financially successful fleets maintain a crew of mechanics to care for their used vehicles. The difference then is one of degree; the average between a fleet of vehicles and another fleet of vehicles.

In dollars and cents the comparison between the cost of maintaining a fleet of trucks with an average age of two years (replaced at the end of every two-year period) and a fleet of trucks with an average age of six years (replaced at the end of each six-year period) would be a comparison of the number of mechanics employed, the parts used, the road breakdowns between the two fleets, and the cost of replacing the two fleets at varying periods.

If we used trucks costing $10,000 each for our example, we could roughly figure that vehicle replacement costs for the two-year old fleet would be $4,000 per vehicle for every two years. The two-year old $10,000 truck has a resale value of $6,000. This works out to $2,000 per year for the purchase cost for the trucks alone. The six-year fleet would cost $9,000 for the six years which would work out to about $1,300 per year. Held for 10 years, the annual vehicle costs come down to $1,000 per year. The financial decisions as to which would be better would depend upon the relative costs of keeping the two fleets in repair and to a lesser degree upon fuel costs because repairs would improve fuel costs every so often when the motors were overhauled or replaced.

Most important to this study is the fact that repair costs are basically labour costs -- more than half the cost of a repair is labour. This works to favour new trucks in the United States and other high labour cost countries, and to favour used trucks in lower labour cost countries. But it should be kept in mind that even in the United States the average trucks age is over eight years.

This comparison does not include the factors mentioned before which work to make trucks obsolescent: better roads, more liberal road laws regarding axle loads and speeds, more efficient vehicles.

However, in a developing country, a country whose roads are under par, the vehicles suited to that country are also a number of years behind. There is no point in purchasing a 60-mph truck for roads that limit safe truck speed to 25 mph. In fact, an over-powered truck is not only a financial waste, the extra engine weight is a non-paying load, and an under-worked engine runs cold, is subject to sludging and excessive wear. It is desirable to have some 10 to 20 per cent more engine as reserve power, but more than that is undesirable and to be avoided.

The used-vehicle fleet.

The given comparison between a two-year old fleet and a six-year old fleet illustrates that the vehicle costs alone would be (starting with a $10,000 truck) $2,000 per year and $1,300 per year respectively.

The resale value of the six-year old truck is roughly one-tenth that of the new truck or $1,000. Assume now that one purchases the six-year old truck at $1,000 and operates it for 10 years. The cost per truck per year drops dramatically to $100 per truck per year. This is why fleets that are not forced to -- by competition -- to reduce the number of drivers and have trucks well suited to their needs continue to operate trucks for 10 and more years. A used truck is a used truck and once the shine has worn off and the parts have begun to wear, it does not make much difference whether the truck is five years old or 10 years old, provided it is maintained.

It should be noted that there are definite time or mileage periods that are important, before or after an engine has been replaced, before or after the vehicle has been repaired, new tyres put on, etc. But over the long run, there is little to distinguish a five-year old truck for an identical 10 year old truck. This is somewhat of an exaggeration, of course,

but it is meant to emphasise the fact that the difference between vehicles is not their age per se, but their actual condition. It is quite possible for a 10-year old truck to be in better condition than a five-year old truck.

Maintenance comparison.

Assuming a particular vehicle in a particular service, well defined and clear cut, and ignoring accidents, driver and repairman carelessness, this vehicle will wear out along definite and predictable lines. For example, if the truck is a long-haul truck we can safely assume that its tyres will need to be recapped every 100,000 miles. If the engine is gasoline it will need to be overhauled or replaced every 200,000 miles; if diesel, overhaul or replacement will be about every 300,000 miles, and so on. Naturally, as time goes by almost every part will need to be repaired or replaced; some parts may need to be replaced several times. After this vehicle has reached a certain age, its parts replacement programme begins to repeat itself. Although there will be an increasing requirement for parts replacement as time goes by, repairs tend to become somewhat stablilized and do not dramatically increase as time goes by. A kind of plateau is reached, and with proper maintenance costs of repairs remain fairly level.

Repair costs for a new vehicle differ considerably from those of an old vehicle. At first, repair costs for a new vehicle are negligible; there may be little or nothing the first year, a few hundred dollars the second year, a thousand or so the third year. The curve of repair costs for a new vehicle rises very quickly. That is why there are fleet owners who make a practice of dumping their trucks at the end of the third or fourth year. Doing this they avoid the complete overhaul, the new paint job, the new engine and new set of tyres, and so on. For those companies

where appearance is very important and which are motivated by competition, high labour costs and the like, this is good practice. But it is sound only when the savings exceed the high cost of vehicle replacement.

Comparing the cost of a new fleet to a used fleet.

Starting with vehicles that cost $[illegible],000 when new, and can be purchased for $1,000 when six or so years old, and operating both groups 10 years, we come up with the per year vehicle cost figure of $1,[illegible]00 to $[illegible]00. It has been established that no vehicle remains new and that all vehicles require a minimum number of repairmen no matter what the vehicle's age may be, and thus we have an annual per vehicle per year dollar difference of $1,200 with which to maintain and repair the old vehicles.

For the sake of illustration, let us estimate that the old group of vehicles will require $2,200 per year per vehicle for repairs. The new vehicle's cost of repairs will be far below this figure. In fact, the first year may see little repair costs at all. However, the cost of repairing the new vehicles will rise very rapidly -- so fast that by the fifth year or so, repair costs for the new vehicles will be close or approaching that of the old. Obviously, the old group will cost more than the new, but as both groups age the difference will become smaller and smaller. A two-year old child is twice as old as a one year old child. Ten years later the difference is down to 10 per cent or so.

A Plan for Vehicular Transportation in a Developing Country

In the foregoing the cost of maintaining a new fleet versus an old fleet were illustrated. It was shown that there are some savings in maintenance costs with the older fleet. The difference is not great and seems not particularly worthwhile, especially since there is a possibility that there will be little or no savings.

However, the foregoing overlooked one major fact -- the initial cost of setting up the two fleets. The new-vehicle fleet at $10,000 per unit would cost 10 million dollars for a 1,000-unit fleet. The old fleet would cost one-tenth this or one million dollars. The older fleet would require a larger group of mechanics than the newer fleet, at first. is the very essence of successful motor transportation. The money that would be saved by buying the older fleet would be used for additional mechanics necessary.

No vehicle is more dependable than the mechanic who can repair it. No vehicle can go further than the distance its available repair parts will let it go. In other words, no vehicle is worth purchasing without an attendant repairman and without replacement parts. A developing country, having no public repairmen, needs the mechanics more than it needs the vehicles. This cannot be emphasized too strongly.

An old fleet of vehicles with a large, well-trained, competent group of mechanics and supervisors and a large well equipped overhaul shop is the basis of an automotive industry. From this starting point an entire nation can be furnished with motor transport.

Men can be trained in the shop to be sent out to establish other shops in which more men can be trained, and so on.

Parts can be rebuilt for local and national vehicle repairs. Then small parts can be manufactured locally for inclusion in the rebuilt components, and then component parts can be built, and so on. The most important need is know-how and experience. The first complete overhaul shop can be the starting point for the entire industry.

Guidelines.

(1) The fleet must consist of at least one thousand power units -- it makes no difference whether the units are autos, trucks or tractors. There must be a minimum of one thousand units of the same kind in the fleet.

(2) Each of the one thousand units must be of the same manufacture and the same model -- identical.

(3) [illegible] per cent inventory of spare parts, i.e., sufficient parts to [illegible] at least 200 vehicles.

(4) There must be additional general parts for the more frequently replaced components such as tyres, batteries, brake linings, nuts and bolts, and so on.

(5) A complete repair and overhaul shop must be installed. This shop should also have its repair parts. The shop should include everything necessary for complete engine rebuilding including diesel engine pump tests and calibrating equipment, a dynamometer, crankshaft grinder, and so on.

(6) The shop must be staffed by an experienced crew of mechanics, supervisors, parts men and clerks. This group will make or break the fleet and no effort should be spared to find the right men. Untrained men can be added later to this group for training, but at the outset the group must know exactly what it is doing and have many years of experience.

The most practical way to achieve this is to hire an experienced crew and bring them bodily with families to the country. This will mean that the cost per man will probably be anywhere from three to five times local labour costs, and perhaps double what the trained men received in their home countries. This must be repeated: there is no other way to run this operation.

To make certain that the men hired have experience with the vehicles purchased, the men can possibly be hired away from shops utilizing this equipment.

The man in charge of maintenance is a field engineer, and his salary will reflect this. It will amount to at least $20,000 per year; top men in the United States are getting $15,000 to $25,000 for the same job.

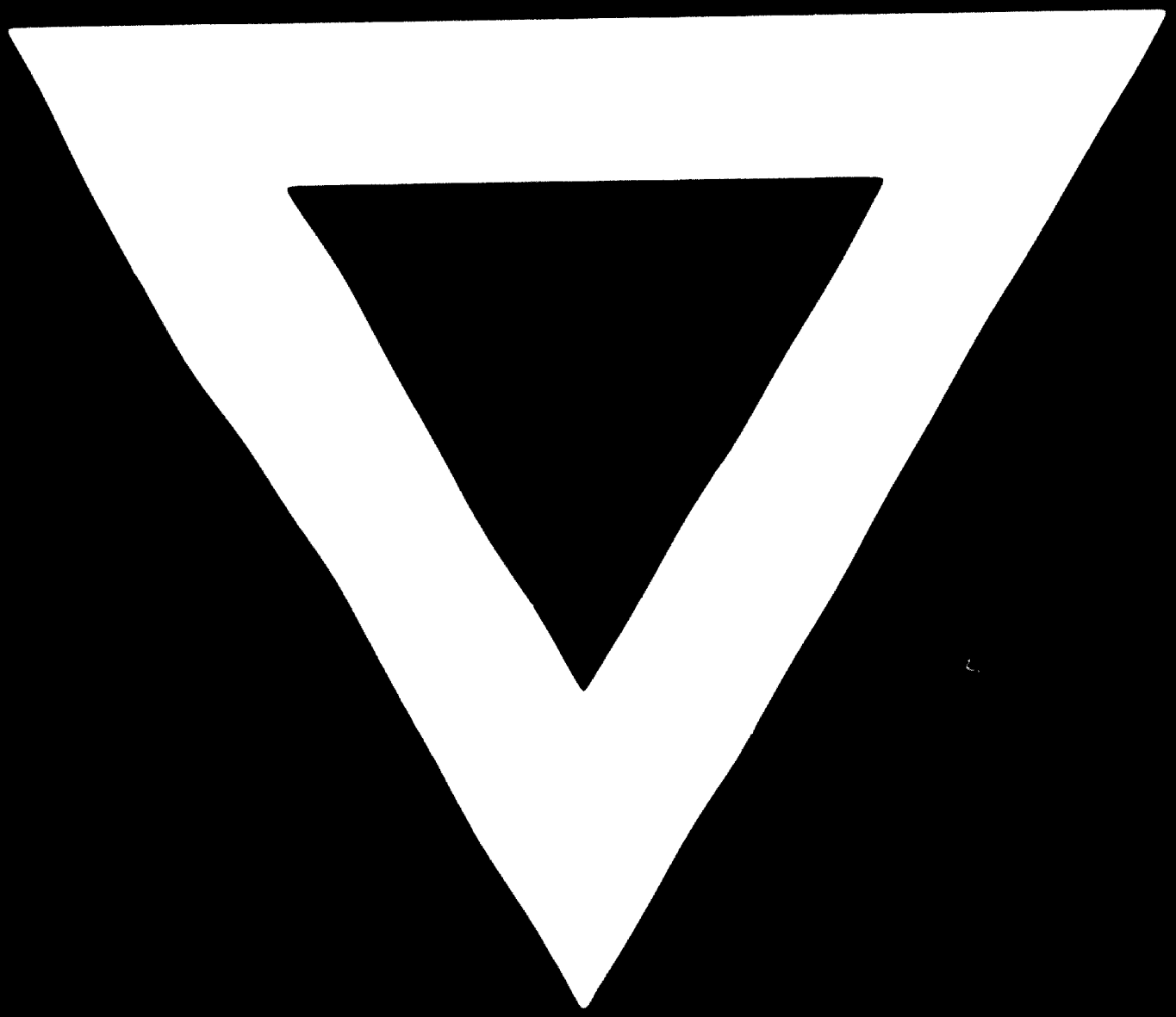
(7) There are a number of ways in which vehicles can be purchased in practical numbers. Large fleets may be contacted and arrangements and agreements made in advance so that when a fleet replaces its vehicles, the old vehicles can be purchased as a group at a better price than by individual purchasing. Companies engaged in leasing fleets can also be contacted.

(8) One advantage to purchasing a group of vehicles from a fleet is that the parts kept by the fleets for repairs can also be purchased at the same time. And it may be possible to hire a few men who are particularly experienced on that type of vehicle at the same time.

(9) It should be possible to purchase 1,000 trucks for one million dollars. Another half million will be required to construct and equip a repair shop and garage. One thousand vehicles will require a repair crew of 100 to 150 men. It is suggested that the greater number be hired at first, and that later the crew be reduced as experience grows.

A fleet of new trucks might cost 10 million dollars. A repair shop and garage will still be needed; even if the vehicles are replaced at the end of three or four years, a crew of 50 to 100 men will be needed. The maintenance savings would be in the smaller crew and the smaller repair shop. It is doubtful that the difference between the complete shop and an average shop -- for a 1,000-unit fleet -- would be more than $250,000. At worst, the difference between the new fleet and shop and the old fleet and shop would be almost eight million dollars.

Most important, the old fleet will provide the opportunity to learn that that is more important than even the savings themselves.



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