Evaluation of Magnitude of Unnecessary Automobile Repairs

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The results of a four-year study to evaluate the magnitude of unnecessary automobile repairs are summarized. The sources of data were the Alabama Motor Vehicle Diagnostic Inspection Demonstration Project, the Missouri and California American Automobile Association diagnostic centers, and a seven-city undercover survey. The results indicate that users of diagnostic centers may experience a lower unnecessary repair rate and that the repair industry's knowledge of the after-repair inspection may have an effect on the quality of repairs.

The cost of owning and operating automobiles in the United States comprises the fourth largest item of personal expenditure--approximately $158 billion annually (1). The distribution of these expenditures is given in Figure 1 (2) (adjusted for consumer price index for transportation for 1977). Twenty-two percent, or $35 billion, is for maintenance and repairs. Light-truck expenditures and the value of economic loss due to inadequate repairs, accidents, wasted fuel, pollution, and reduced vehicle life amount to an additional $15 billion annually. When these expenditures are added to the cost of repairs and maintenance, this totals some $50 billion annually.

There has been much discussion and debate on the costs of maintaining and repairing an automobile and on how much of this $50 billion could have been saved. As a result, there has been much criticism of the repair industry. Beginning in 1968, the Senate Subcommittee on Antitrust and Monopoly began a four-year investigation of the automobile repair industry. These Senate hearings disclosed major areas where multibillion dollar economic losses occur to motorists. Foremost was the cost of unnecessary and unsatisfactory repairs. Testimony was given that the consumer loss may exceed $8-$10 billion annually. If this figure is adjusted for inflation and the increase in the vehicle fleet, the $8-$10 billion would exceed $20 billion (3). Testimony of other areas of consumer loss included the enormous damage suffered by vehicles in very low-speed crashes, used cars that had odometers turned back to enhance their value, and the economic losses that result from stolen vehicles.

Studies in eight states between 1973 and 1975, in which 200 vehicles with known faults were taken to repair shops, showed 40 percent of the shops charging for unnecessary repairs and 10 percent of them charging for work not performed. In addition, a survey of owner knowledge made by the National Highway Traffic Safety Administration (NHTSA) showed that close to half the vehicle owners lacked the rudimentary knowledge needed for correctly purchasing routine maintenance and repairs.

A survey published in the Harvard Business Review showed 35 percent of the respondents had recent complaints about faulty or unneeded automobile repairs and that 50 percent of owner complaints about repair quality are not satisfactorily resolved. Consumer complaint files from states and business organizations as well as other surveys provided similar data.

A study by NHTSA (3) came to the conclusion that approximately 40 percent ($20 billion) of the costs associated with automobile repairs was wasted. The NHTSA-estimated distribution of these consumer losses is given in Figure 2 (3).

Even though there has been this discussion and debate on the automobile repair problem, very few data have been collected that quantify the magnitude of the problem. The University of Alabama in Huntsville has conducted five studies funded by NHTSA (4-6), the Federal Trade Commission (FTC) (7), and the U.S. Department of Transportation (DOT) (8), which attempt to quantify the magnitude of unnecessary and unsatisfactory automobile repairs. This report compares one of the parameters common to each of these studies: the magnitude of the rate of unnecessary repairs.

DATA SOURCES

Automobile repair costs were collected and analyzed from four sources: the Alabama Diagnostic Inspection Demonstration Project, the Missouri American Automobile Association (AAA) diagnostic center, the California AAA diagnostic center, and an undercover survey conducted in seven cities throughout the country (5-8). The following sections briefly discuss each of these data sources.

Alabama Diagnostic Center

The results of the Senate hearings in the late 1960s were the justification for the passage of the Motor Vehicle Information and Cost Savings Act (P.L. 92-513) in 1972. Title III of the Act authorized the Secretary of Transportation to establish a number of motor vehicle diagnostic inspection and testing centers throughout the country. The objective of the program was to provide for the accumulation of data to determine if diagnostic inspections are cost effective in that public benefits would exceed program costs. Specific types of data collected by the inspection centers included vehicle outages, exhaust emission rates, repair costs, facility operation and staffing requirements, vehicle-in-use standards and feasible reject levels, equipment reliability and interchangeability, and the capability of the repair industry to correct diagnosed deficiencies.

The Alabama Motor Vehicle Diagnostic Inspection Demonstration Project (Auto Check) was one of five diagnostic centers established under the Act. The Auto Check facility is located on the campus of the University of Alabama in Huntsville. Under the initial program, from October 1974 through June 1976, only selected 1968-1973 vehicles were inspected. Since July 1976, the center has been inspecting all model years. To date, more than 19 000 vehicles have received more than 32 000 inspections.

Federal funding for automobile inspections at the center ceased in October 1977. Since then, the center's inspection program has been supported by university funds and by a $10.00 inspection fee. Currently, only one of the three lanes is being maintained and is staffed to perform 10 inspections/day.

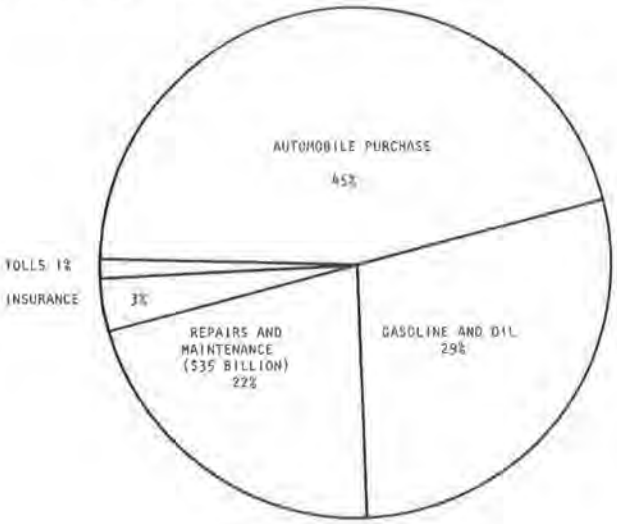
Each vehicle is given a thorough diagnostic inspection. After the inspection, the motorist is counseled concerning the condition of the vehicle. During the counseling the motorist is requested to have the necessary repairs performed and then to

return to Auto Check for a repair inspection. In addition, the motorist is also requested to retain all repair receipts and to make these receipts available to Auto Check.

Beginning in 1977, the counselor gave all participants a prescription form that gave participants specific repair instructions to convey to the repair facility. Two prescription forms were used. One form was for engine-related outages while the second form was for brake, tire, steering, suspension, and wheel-alignment outages. The forms have a priority column where the counselor indicates the relative importance of each repair.

A sample of cars was selected from the Alabama center that failed the brakes, emission, suspension, steering, or alignment system; returned for an after-repair inspection; and provided the corresponding repair receipts.

Figure 1. How the automobile dollar is spent.



Missouri Diagnostic Center

The Missouri AAA diagnostic center is located at 3925 Lindell Boulevard in St. Louis. The center was originally established as a service to AAA members, although nonmembers may also use the center.

The center opened in the fall of 1967. The center occupies 10 000 ft² and is equipped with the latest equipment for static and dynamic analysis. Four types of inspections are performed: a complete diagnostic inspection at a cost of $30.00 for members and $40.00 for nonmembers, a system and component inspection, an after-repair inspection at a cost of $1.00, and the state motor vehicle safety inspection, required annually by Missouri. Since it opened, the facility has inspected more than 120 000 automobiles.

A sample of 444 cars was selected from the Missouri center that met the following conditions: inspected in 1978, failed the brakes or emissions inspection, returned for an after-repair inspection, and provided the corresponding brake or emissions repair receipts.

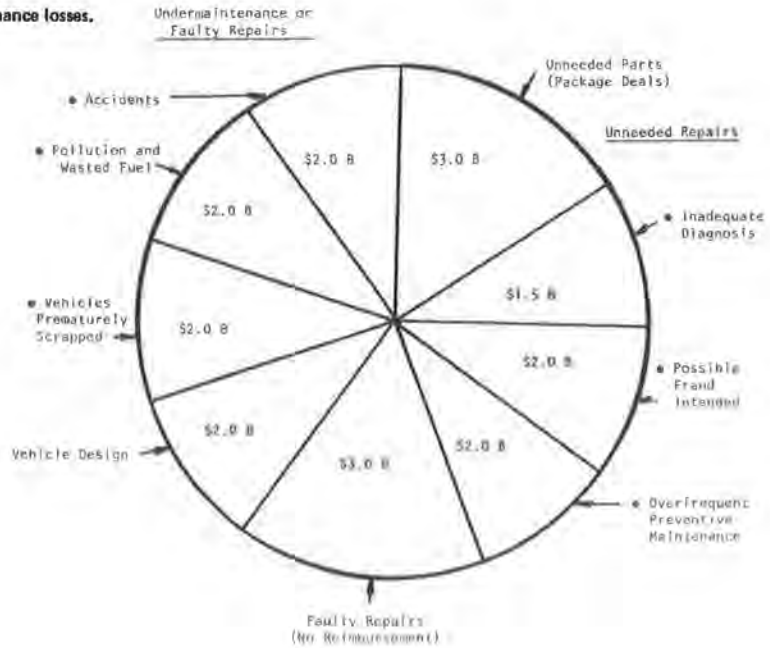
California Diagnostic Center

The California AAA diagnostic centers are located at 150 Hayes Street in San Francisco and at 2615 Keystone Avenue in San Jose. The San Francisco center opened in the fall of 1968 while the San Jose center opened in 1974.

The centers are equipped with the latest equipment for static and dynamic analysis. The centers perform complete diagnostic inspections at a cost of $30.00 for members and $40.00 for nonmembers. A system and component inspection costs from $6.00 to $22.00. Unlike the Missouri AAA diagnostic center, no post-repair inspections are normally performed. The San Francisco center has conducted more than 75 000 inspections while the San Jose center has conducted more than 33 000 inspections.

A sample of 513 cars was selected from these centers that met the following conditions: inspected in 1978, failed the brakes or emissions inspection, agreed to return for an after-repair inspection at no cost, and provided the corresponding brake or emissions repair receipts. During this

Figure 2. Estimated distribution of automotive repair and maintenance losses.



data-collection period, all motorists whose vehicles failed the brake or emissions inspection were asked to return for an after-repair inspection in order to collect repair receipts. There was no charge for the after-repair inspection.

Transportation Survey

The University of Alabama, under contract to DOT, conducted an undercover survey of repair facilities in the following seven cities: Atlanta; Philadelphia; Miami; Nashville; Houston; White Plains, New York; and Brooklyn, New York. The survey was conducted between January and March 1979.

In six of the cities, the survey was carried out in cooperation with the District Attorneys' offices. This effort was coordinated by the project director of the National District Attorney's Association Economic Crime Project. In the seventh city, Atlanta, the survey was carried out in cooperation with the Georgia Governor's Office of Consumer Affairs.

A reputable repair facility was identified in each of the cities and used as the secure facility. These secure facilities provided the inspection space and equipment and the master mechanics who assisted in the inspection of the vehicles. Sixty-two cars were inspected at the secure facilities and documented. Engine and suspension malfunctions were introduced into these cars, and the cars were then taken to randomly selected repair facilities in each city. No induced malfunctions were made in the brakes. After the repairs were made, the cars were inspected at the secure facilities and the repairs documented.

APPROACH

The detailed data-reduction procedures were initially developed during the analysis of the repair-cost data from the Alabama Diagnostic Inspection Demonstration Project. A description of these procedures is given elsewhere (4). These same procedures were used to reduce the data from the other sources. Therefore, the data could be readily compared among the four sources.

In summary, each repair action on a repair receipt was classified as being required, recommended, optional, or unnecessary. The criteria for determining the repair classification were as follows:

1. A repair was considered required if the item was found to be faulty (i.e., failed) during the inspection,
2. A repair was considered recommended if the repaired item is normally repaired as part of the repair of another faulty item repair even though nothing was found to be faulty with the subject item during the inspection,
3. A repair was considered optional if the repaired item may or may not be normally repaired as part of another faulty item repair even though nothing was found to be faulty with the subject item during the inspection, and
4. A repair was considered unnecessary if the repaired item passed the inspection and no other repair of another marginal or failed component would normally affect the decision to repair the subject item.

The determination of the repair classification was done by a team of individuals--an experienced diagnostic inspector and an experienced automotive parts specialist. Only the diagnostic inspector was used to classify the survey data.

UNNECESSARY REPAIRS

The repair actions and the corresponding costs for each of the four sites are given in Tables 1 and 2. In summary, 6075 repair actions that represent $129 217 were analyzed from Alabama, 680 repair actions that represent $18 475 were analyzed after Alabama introduced the prescription forms, 1454 repair actions that represent $67 444 were analyzed from California, 1014 repair actions that represent $31 610 were analyzed from Missouri, and 120 repair actions that represent $3163 were analyzed from the seven-city survey.

Unnecessary Repair Frequencies

Figure 3 contains a comparison of the unnecessary repair frequencies for each of the data sources. The seven-city survey had the highest unnecessary repair frequency of 27 percent, followed by 25 percent from the Alabama center during its first two years of operation. Statistically, there is no significant difference between the two frequencies ($\chi^2 = 0.18$).

After two years of inspections, the unnecessary repair frequency in Alabama was reduced from 25 to 18 percent. There may be several reasons for this reduction. One obvious reason is the classic learning-curve effect for project personnel, vehicle owners, and the repair industry. A second reason is the introduction of the prescription forms in 1977. A study of the data at the time (6) indicated that the overall unnecessary repair frequency was 26 percent between 1975 and 1977--24 percent during the first six months of 1976 and 15 percent during the first nine months of 1977. Therefore, it appears that the learning effect may be minimal and that the use of the prescription forms may have been a major reason for this reduction of the unnecessary repair frequencies. The California and Missouri centers have been using a similar procedure in relaying to the motorist what should be repaired. The AAA centers have been in operation since the late 1960s; therefore, this possible learning effect by the repair industry, which was observed in the Alabama data, may have already occurred and is reflected by the lower unnecessary repair frequencies for the California and Missouri centers.

The unnecessary repair frequency for Missouri (10 percent) was significantly lower than for the other sites. Even after the introduction of the prescription forms in Alabama, which reduced the unnecessary repair frequency to 15 percent, there was still a significant difference ($\chi^2 = 10.0$, $p < 0.005$), with Missouri significantly lower. One possible explanation for the low unnecessary repair frequency for Missouri (besides the learning effect) is the possible effect on the repair industry of the after-repair inspection being performed by the Missouri center. The repair industry is probably aware of this procedure. On the other hand, the California center is not performing after-repair inspections and the unnecessary repair frequency was 18 percent.

The unnecessary repair frequency for California (18 percent) was significantly lower than Alabama before the introduction of the prescription forms (25 percent) ($\chi^2 = 28.8$, $p < 0.001$). After the use of the prescription forms in Alabama, there was no significant difference in the unnecessary repair frequency (18 percent versus 15 percent) ($\chi^2 = 2.6$). These results suggest that unnecessary repair frequencies may be reduced by providing the motorist with understandable repair information for communicating with the repair industry.

In summary, the data in Figure 3 suggest that the magnitude of unnecessary automobile repairs may be

as high as 25-27 percent. However, it appears that diagnostic centers may have an effect on reducing unnecessary automobile repairs. The data from the Alabama center, which has been in operation since 1975, indicated a high initial unnecessary repair frequency that was supported by the seven-city survey. After several years of operation, the Alabama unnecessary repair frequency was reduced significantly. Furthermore, it appears that the frequency may be reduced even further with time, as indicated by the Missouri center. This suggests that a definite learning effect does exist as the repair industry becomes aware of the diagnostic centers.

Coupled with this learning effect in decreasing unnecessary repairs is the after-repair inspection service that is provided by the diagnostic centers. The Missouri and Alabama centers have been providing this service while California has not. It appears that the repair industry's knowledge of the after-repair inspection may also have an effect on unnecessary repairs.

Unnecessary Repair Costs

Figure 4 contains a comparison of unnecessary repair costs. Overall, 53 cents of every dollar at the seven-city survey was spent on unnecessary repairs versus 29 cents for Alabama, 19 cents for Alabama after the prescription forms, 13 cents for California, and 11 cents for Missouri. There is close correlation between the unnecessary repair frequencies and the unnecessary costs for all sites with the exception of the seven-city survey. For the survey, 27 percent of the repair actions were unnecessary while 53 cents of each repair dollar was spent on unnecessary repairs. One explanation for this high unnecessary repair rate could be that the induced engine malfunction (shorting the number 4 spark plug) and the induced suspension malfunction (removing the stabilizer link) caused higher unnecessary repairs (8). No malfunction was induced for the brakes. A second possible explanation for this anomaly could be the relatively smaller sample size for the seven-city survey.

Table 1. Comparison of repairs.

	Alabama (overall)		Alabama (after prescription)		California		Missouri		Survey	
Repair	No.	Percent	No.	Percent	No.	Percent	No.	Percent	No.	Percent
Required	3932	65	575	85	1043	72	834	82	62	52
Recommended or optional	627	10			145	10	76	8	26	21
Unnecessary	1516	25	105	15	266	18	104	10	32	27
Total	6075		680		1454		1014		120	

Table 2. Comparison of repair costs.

	Alabama (overall)		Alabama (after prescription)		California		Missouri		Survey	
Repair	Cost ($)	Percent	Cost ($)	Percent	Cost ($)	Percent	Cost ($)	Percent	Cost ($)	Percent
Required	77 250	60	14 908	81	54 212	80	26 126	83	768	24
Recommended or optional	14 329	11			4 960	8	2 182	7	724	23
Unnecessary	37 638	29	3 567	19	8 272	12	3 302	10	1671	53
Total	129 217		18 475		67 444		31 610		3163	

Figure 3. Comparison of unnecessary repair rates.

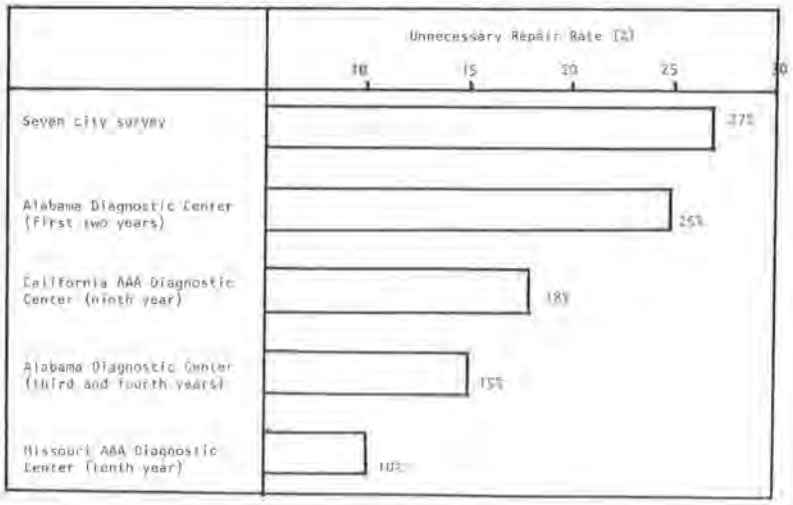
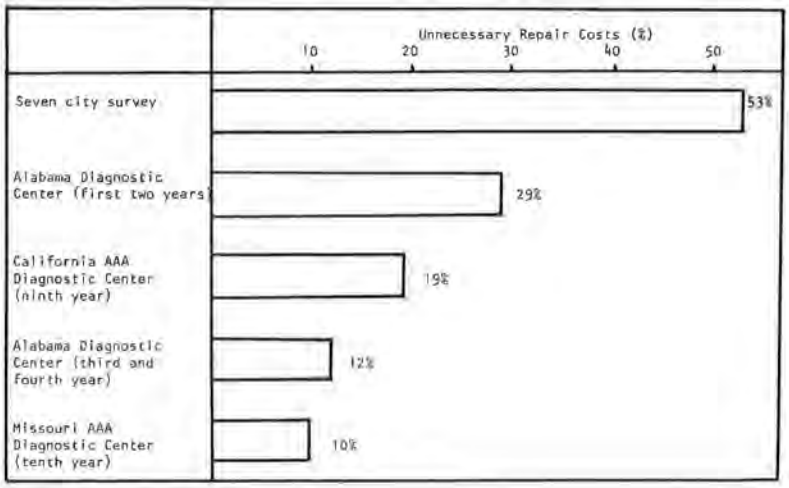


Figure 4. Comparison of unnecessary repair costs.



In summary, the data in Figure 4 suggest that the magnitude of unnecessary repair costs may be between 29-53 cents but probably closer to 29 cents. However, it is apparent that diagnostic centers reduce the rate of unnecessary repairs while also reducing the cost of unnecessary repairs. The magnitude of the reduction may be 10-12 cents/diagnostic center.

UNNECESSARY REPAIRS BY SYSTEM

Unnecessary Repair Frequencies

Table 3 contains a comparison of the unnecessary repair frequencies by system for each of the four sources. The unnecessary brake-repair frequencies were similar for California (28 percent), Alabama (28 percent), and the seven-city survey (26 percent). Likewise, the unnecessary brake-repair frequencies were similar for Missouri (19 percent) and Alabama after the prescription forms (15 percent).

There was a significant difference in the distribution of the unnecessary brake repairs (χ^2 = 22.04, $p < 0.001$), with Alabama (after the prescription form) and Missouri having a significantly lower unnecessary brake-repair frequency. These lower unnecessary brake-repair frequencies may indicate the effect of conducting after-repair inspection at the Alabama and Missouri centers.

The unnecessary engine-repair frequencies were identical (30 percent) for Alabama and the seven-city survey. After the use of the prescription forms, the unnecessary engine-repair frequency for Alabama was reduced to 16 percent. Missouri and California had the lowest unnecessary engine-repair frequencies (5 and 8 percent, respectively).

There was a significant difference in the distribution of the unnecessary engine-repair frequencies (χ^2 = 174.19, $p < 0.001$). The frequencies were significantly lower for California, Missouri, and Alabama (after the prescription form). Again, these lower unnecessary engine frequencies may indicate the long-term effect of conducting after-repair inspections at the Alabama and Missouri centers. Note that the unnecessary engine-repair frequency for Alabama fell from 30 to 16 percent during the third and fourth years, but not to the more long-term reduction as for the Missouri and California centers (5 and 8 percent, respectively).

The unnecessary engine-repair frequency was also low for the California centers, even though no after-repair inspections are conducted at the centers. One explanation may be the strong state legislation on emissions and, consequently, high public awareness and high awareness by the repair industry.

There was a wide variation in the unnecessary suspension-repair frequencies. Alabama (overall) had the highest (35 percent). California, Alabama (after prescription forms), and the seven-city survey were similar (21, 21, and 19 percent, respectively). Missouri had the lowest unnecessary suspension-repair frequency (11 percent).

Table 3. Percentage comparison of unnecessary repair frequencies.

Repair	California	Missouri	Alabama (overall)	Alabama (after prescription)	Survey
Brakes	28	19	28	18	26
Emissions	8	5	30	16	30
Alignment	6	4	8	4	0[a]
Suspension	21	11	35	21	19
Steering	20	0	22	-	67[b]
Total	18	10	25	15	27

[a]Sample of five repairs. [b]Sample of three repairs.

Unnecessary Repair Costs

Table 4 contains a comparison of the corresponding unnecessary costs by system for each of the four sources. The unnecessary repair costs by system closely followed the unnecessary repair frequencies. The anomaly is the unnecessary repair costs from the seven survey cities, where 43 cents of every dollar spent on brake repairs was unnecessary, 68 cents of every dollar spent on engine repairs was unnecessary, and 48 cents of every dollar spent on suspension repairs was unnecessary. These survey percentages for each system are the highest for all four sites. A possible explanation of these high costs could be that the induced malfunctions caused higher unnecessary repair costs.

CONCLUSIONS

The following conclusions are made based on the results of this study:

1. Users of diagnostic centers may experience a lower unnecessary repair frequency--on the order of 10-18 percent. But the higher 25 percent value was also experienced by users of the Alabama center. The final frequency is likely to be to some degree a function of comprehensiveness of the diagnostic inspection. The lower frequencies may be unique to

Table 4. Percentage comparison of unnecessary repair costs.

Repair	California	Missouri	Alabama (overall)	Alabama (after prescription)	Survey
Brakes	18	18	28	20	43
Emissions	7	6	35	20	62
Alignment	6	4	8	4	0[a]
Suspension	21	15	37	24	48
Steering	2	0	23	-	72[b]
Total	12	10	29	19	53

[a]Sample of five repairs. [b]Sample of three repairs.

the users of the centers, but may not have an effect on entire cities (9).

2. Diagnostic centers probably have an effect on reducing unnecessary automobile repairs. This effect probably increases with the length of operation of the facility, until some fairly stable level is achieved.

3. The industry's knowledge of the after-repair inspection may have an effect on the quality of repairs.

4. A learning effect probably exists while the repair industry becomes aware of diagnostic centers. The low unnecessary repair frequency for the Missouri center, which has been in operation for many years, by itself does not make that conclusion evident.

5. Unnecessary repair frequencies may be reduced by providing the motorist with understandable repair information for communicating with the repair industry.

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Electric Vehicle Technology Update

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Electric vehicles (EVs) may offer some advantages over gasoline and alternately fueled vehicles in terms of operating cost and as a hedge against future fuel shortages. However, existing EV technologies need to be advanced so that EVs will be as easy to operate and maintain as gasoline vehicles. An overview of some areas in which technology improvement is needed and is now being addressed by participants in the Electric Vehicle Demonstration Project of the U.S. Department of Energy is provided. These areas include state-of-charge monitoring, charging, battery capacity testing, electrolyte management, and battery connectors.

Given past experience with gasoline shortages and rising operating costs due to increased gasoline prices, vehicle owners, particularly fleet operators, have been looking into the potential of alternately fueled vehicles as a hedge against similar conditions in the future. Among the alternate-fuel options that have been tested are the following: diesel, propane, methane, methanol, and electricity. Of these, electricity may offer the most flexibility in that it is widely available, easily tapped, and not as susceptible to shortages as the others. Electricity may also perform well in terms of operating cost since it can be generated from a variety of fuels, and it should therefore not increase in price as rapidly as any one particular fuel.

Although ownership of an electric vehicle (EV) thus offers potential advantages, some obstacles need to be addressed. The transition from gasoline vehicles to EVs may not be as easy as the transition from gasoline to other fuels. Because electricity cannot be used in an internal-combustion engine, a significantly different propulsion system is required. Therefore, in a typical conversion of a gasoline vehicle to an EV, the propulsion system of the gasoline vehicle is removed and EV systems are added, which results in a purchase price about double that of the gasoline vehicle. As manufacturers gain production experience and demand allows large-scale production of EVs, this price gap can be expected to lessen.

In addition to its higher price, the operating and maintenance requirements of EVs differ more widely from gasoline vehicles than do those of other