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AUTO REPAIR AND MAINTENANCE

Program to Reduce Consumer Loss

Prepared by :

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16. Abstract

This is the summary report of a NHTSA Task Force that studied consumer losses in auto repair and maintenance. It contains an analysis of the problem and a description of alternative action programs for reducing losses.

The Task force systematically analyzed the repair process and estimated that consumers lose about $20 billion annually due to improper or unnecessary repair and maintenance practices. The losses consist of wasted repair expenditures, wasted fuel, avoidable accidents and pollution, and reduced car life. An initial set of remedy categories was prepared and included: diagnostic inspection, vehicle standards, consumer information on vehicles, and State and local actions (model laws, rating of repair facilities, complaint handling systems, and education). Except for consumer information on vehicles which is being studied separately under Title II of the Motor Vehicle Information and Cost Savings Act, the Task Force identified and evaluated 22 potentially effective and feasible remedies involving Federal, State, local or private action.

The Task Force defined 12 alternative action programs (packages of one or more of the remedies) with estimated benefits ranging from approximately $1.5 billion to $8.3 billion.

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EXECUTIVE SUMMARY

In these days of increasing everyday living costs, it has become necessary for consumers to carefully watch their family budgets. Over 80 percent of American households own at least one motor vehicle. Personal transportation accounts for a substantial share of consumption expenditures. Repairs and maintenance, in turn, account for a large portion of the cost of owning a motor vehicle. There is a well entrenched conviction among consumers that their repair expenses could be significantly reduced. To help consumers find ways to trim their budgets, the National Highway Traffic Safety Administration established a task force on auto repair and gave it three assignments: to identify the problems consumers face in getting their cars repaired, to estimate the costs associated with these problems, and to explore potential programs to reduce these costs. In this report, the task force presents its findings.

The Department of Transportation* has long had a significant ongoing program to determine the cost of owning and operating a motor vehicle. At latest count, the total amount spent each year for repair and maintenance of personal vehicles was estimated to exceed $45 billion, even excluding the cost of body work and warranty work. Indirect expenses, such as the cost of accidents involving vehicles with deteriorated parts and fuel wasted by poorly running automobiles may add as much as $5 billion to that estimate. It was thus evident at the start of the task force's work that if an appreciable part of these costs were unnecessary, the resulting loss to the consumer would be in the billions of dollars.

The task force began its work by breaking the repair process down into a series of events affecting the vehicle. For each event, it determined the actions that are typically taken by the vehicle owner, or by the repair shop if the owner decided to have a shop repair the car. Some of these actions would be appropriate, from a cost standpoint, while others would result in excessive costs or an improperly repaired vehicle. The task force defined consumer losses as the sum of direct out-of-pocket consumer costs and readily quantifiable societal costs that could have been avoided by a correct action with respect to each event.

The estimates of consumer loss were based on 14 studies dealing with various aspects of the auto repair process. The studies showed significant losses occurring at many stages. For example, in the NHTSA diagnostic projects, nearly 30 percent of the cars that failed initial inspection also failed reinspection, reflecting a measure of unsatisfactory repair. In the Alabama diagnostic project 30 percent of the repairs purchased by participants were not necessary according to the inspection findings. The Missouri Auto Club had similar findings. Studies in eight States between 1973 and 1975 in which 200 vehicles with known faults were taken to repair shops showed that 40 percent of the shops charged for unnecessary repairs and 10 percent of them charged for work not performed. A survey of owner knowledge made by NHTSA showed that close to half the vehicle owners lacked the rudimentary knowledge needed for correctly

* Office of Highway Planning, Federal Highway Administration

purchasing routine maintenance and repairs. A survey published in the Harvard Business Review showed that 35 percent of the respondents had recent complaints about faulty or unneeded auto 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. Information about accidents, fuel waste, pollution and premature vehicle retirements was obtained from sources such as the University of Indiana accident studies, NHTSA diagnostic demonstrations and the Swedish diagnostic centers. The task force took great care in interpreting the results of the studies and adjusted them for inherent biases before using them in the analysis. The estimate of losses was consequently more conservative than would have been if the available studies had been taken at face value.

The analysis led to a primary estimate that approximately 40 percent of the costs associated with auto repair were unnecessary. This translates into an annual consumer loss of $20 billion. The task force also performed sensitivity tests on their analysis to produce alternate estimates of consumer loss. The lowest estimate was $ 13 1/2 billion - a figure that still indicates considerable potential for reducing consumer expenditures and one which would not greatly alter the findings in this report.

The estimate made in this report is also conservative in comparison to the figure of $8-10 billion given during the Hart hearings of 1968-70. That figure was based on a consensus of experts and covered only losses on actual direct repair expenses. If it were to be adjusted for:

- inflation of repair costs since 1970
- growth of the vehicle fleet since 1970
- inclusion of the value of accidents, fuel waste, pollution and reduced vehicle life due to improper repairs and maintenance,

it would exceed $20 billion today.

To aid in developing and assessing remedies and programs to reduce consumer losses, the task force classified the various points of consumer loss into 16 basic problem areas. For each area the task force then looked for specific, well defined remedies that could be considered for implementation. For each potential remedy, costs were estimated including those incurred by States, cities, private groups and consumers as well as the Federal government.

While the remedies differed considerably in terms of immediate objectives and implementation responsibility they all had the same basic long-range goal: to arm the individual consumer with the tools he needs to solve problems by himself - to provide him with sufficient knowledge and authority to take action - to eliminate institutional barriers that currently limit his right of action.

Potential remedies were first grouped into the following categories

- Diagnostic inspection
- Vehicle standards
- Consumer information on vehicles
- State and local actions, including model laws, rating of repair facilities, complaint handling systems, and education.

Specific remedies for most of these categories were analyzed to determine their potential benefits based on assumptions about their effectiveness and about the likelihood of State, local and consumer participation. Since there are a wide variety of existing programs aimed at, or relating to reducing auto repair losses, most of the remedies are not new, although some represent new modifications of existing programs. Highlights of the task force's findings are as follows:

Diagnostic inspection. Five diagnostic inspection alternatives were developed and analyzed. This approach to repair and maintenance loss reduction, as well as safety, fuel economy, emission and noise abatement has long been considered one of the more desirable remedies. The demonstration projects recently completed showed positive results even when limited primarily to safety and emissions. While many questions of how to implement this type of remedy - particularly on ways to finance such facilities - remain, the alternatives are an attempt to address several possibilities, ranging from mandatory State programs to voluntary enterprises in the private sector. Diagnostic programs are expensive, but offer substantial benefits.

Standards for new vehicles. Turning to the automobile, eight component system designs and devices were analyzed as potential remedies. When translated into performance standards each could be a candidate for rulemaking. In fact some of them, such as the low tire pressure indicator, are planned in the near future. A considerable range of benefit and cost values can be found among these remedies.

Consumer information on vehicles. The NHTSA has the authority under Title II of the Motor Vehicle Information and Cost Savings Act to issue consumer information on vehicle damageability, repairability, and the ease of diagnosis of problems in automobiles. A separate effort to study the feasibility of developing this information is planned.

State and local actions

- State laws on auto repair. A number of States have laws dealing specifically with auto repairs, requiring disclosure of shop practices, such as itemized estimates of specific repairs, obtaining customer's signature on the estimate, and return of replaced parts. There are facility and mechanic licensing programs as well. The benefits of such laws when compared to the other remedies are generally low, but so are costs, which makes them attractive possibilities.

- Repair facility ratings. Repair facility ratings are already available in several localities. This is where private organizations or local governments survey repair shop facilities and their customers and develop ratings of quality of service and price. The concept does not differ from what has long been done in the hotel, motel and restaurant trade. Rating systems turned out to yield relatively high benefits, particularly when cast against their estimated costs.

- Consumer complaint administration systems. A series of programs which involve the consumer directly are included among the remedies. Complaint agencies where a frustrated consumer can get help are operating in a number of States. The agency would have authority to submit owners and repair shops to binding arbitration, to require refunds, and where justified assist consumers in obtaining legal remedies. There are also many private and local groups providing such services. The systems would expand consumers' rights of action while reducing associated inconvenience and expense.

- Consumer education. An informed and knowledgeable consumer can minimize auto repair and maintenance losses. The public can be informed through booklets on how to select a repair shop, how to assist in diagnosing what is wrong with the car, and how to check out the quality of completed repairs. Other approaches include classroom courses and media programs which would work directly to increase consumer knowledge.

Having calculated the benefits and costs of each of the over 20 potential remedies, the task force recognized that choices and priorities depend on such factors as cost, public acceptance, and the time it takes to establish a program and achieve benefits. Therefore, it devised a set of 12 program packages, each containing a number of these remedies. The packages are designed to give the reader an opportunity to assess both the magnitude of benefits and costs various programs might offer.

The report concludes with an outline of projects that should be performed on a continuing basis to refine the analyses and to monitor the effects of potential remedy programs. Before proceeding to those projects, however, the National Highway Traffic Safety Administration considers this a propitious time to circulate this preliminary report among representatives of government, industry and consumers. The Agency welcomes all comments and suggestions.

THE PROBLEM

In these days of increasing everyday living costs, it has become necessary for consumers to carefully watch their family budgets. Over 80 percent of American households own at least one motor vehicle. Personal transportation accounts for a substantial share of consumption expenditures. Repairs and maintenance, in turn, account for a large portion of the cost of owning a motor vehicle. There is a well entrenched conviction among consumers that their repair expenses could be significantly reduced. To help consumers find ways to trim their budgets, the National Highway Traffic Safety Administration established a task force on auto repair and gave it three assignments: to identify the problems consumers face in getting their cars repaired, to estimate the costs associated with these problems, and to explore potential programs to reduce these costs. In this report, the task force presents its findings.

The first step in carrying out the study was to define what is included among consumer losses and to estimate the amount of loss. It was decided to study all expenditures for repairs, maintenance, tires, batteries, oil and accessories for automobiles and light trucks used in personal transportation. Warranty work and body work were, in general, not studied. In addition, accidents, fuel waste, pollution and reduced vehicle life due to improper repairs and maintenance were studied.

Americans now spend a total of $50 billion a year or more on the above items. In 1978, the annual cost of repairs, maintenance, tires, oil and accessories averages about $380 per vehicle. This estimate is based on two sources: "Cost of Owning and Operating an Automobile, 1976," published by the Federal Highway Administration (based on an on-going program by their Office of Highway Planning) and "Facilities and Capital Investment for Performing Motor Vehicle Maintenance," published by the Chilton Company. Both sources, when adjusted for inflation, lead to an estimated average of $380 per vehicle in 1978. There are about 124 million passenger cars and trucks used primarily for personal transportation on the road. When $380 is multiplied by 124 million, one obtains a total of $47 billion spent on repairs and maintenance in 1978. In addition, consumers lose about $6 billion per year on maintenance-related accidents, fuel waste, pollution and premature vehicle retirement. (See discussion elsewhere in this report). When these $6 billion are added to the $47 billion one obtains an estimated total of $53 billion per year of maintenance related consumer expenditures. This has been rounded down to an even $50 billion throughout the report.

For the purposes of this report, "consumer losses" have been defined to include direct out-of-pocket consumer costs and readily quantifiable societal costs (see the next paragraph) that could have been avoided by the correct actions of all repair shops, vehicle owners and manufacturers within the constraints of a repair environment not fundamentally different from the current one. Not counted as "loss" are, for example, repair expenses that could be saved if repair were a non-profit industry, or if all owners did their own repairs, or if manufacturers sold "maintenance-free" cars.

Repair and maintenance expenses (including oil, tires and accessories), added fuel costs, and reduced vehicle life are the "direct out of pocket consumer costs." Accidents and pollution due to improper maintenance or repair are the "readily quantifiable societal costs." Other costs, such as time lost getting repairs, time without one's vehicle, frustration, anxiety and discomfort of driving a faulty vehicle were excluded because they have not been adequately quantified.

No single body of data exists from which one may reliably calculate overall losses. Available studies only deal with selected stages of the repair process. The task force estimated overall losses by designing a simulation model that breaks up the repair process into its component stages. The model traces jobs and cash flow through the process and tallies up the consumer losses generated at various points. (The model is discussed in detail in "The Analytic Approach" and in Appendix C.)

At each stage in the simulation, the assumptions on job and cash flow used in the model were based on existing data sources dealing with that stage. A total of 14 studies were used in constructing the model. The studies showed significant losses occurring at many stages.

For example, in the NHTSA diagnostic projects, nearly 30 percent of the cars that failed initial inspection also failed reinspection, reflecting a measure of unsatisfactory repair. In the Alabama diagnostic project 30 percent of the repairs purchased by participants were not necessary according to the inspection findings. The Missouri Auto Club had similar findings. Studies in eight States between 1973 and 1975 in which 200 vehicles with known faults were taken to repair shops showed that 40 percent of the shops charging for unnecessary repairs and 10 percent of them charging for work not performed. A survey of owner knowledge made by 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 auto 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. Information about accidents, fuel waste, pollution and premature vehicle retirements was obtained from sources such as the University of Indiana accident studies, NHTSA diagnostic demonstrations and the Swedish diagnostic centers. The task force took great care in interpreting the results of the studies and adjusted them for inherent biases before using them in the analysis. The estimate of losses was consequently more conservative than would have been if the available studies had been taken at face value.

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The estimate made in this report is also conservative in comparison to the figure of $8-10 billion given during the Hart hearings of 1968-70. That figure was based on a consensus of experts and covered only losses on actual direct repair expenses. If it were to be adjusted for:

- inflation of repair costs since 1970
- growth of the vehicle fleet since 1970
- inclusion of the value of accidents, fuel waste, pollution and reduced vehicle life due to improper repairs and maintenance,

it would exceed $20 billion today.

The NHTSA estimated that the total consumer losses are broken down roughly as follows:

° Unneeded parts of package deals	$ 3 Billion
° Unneeded repairs due to inadequate diagnosis	$ 1 1/2 B
° Faulty repairs for which owners did not get their money back	$ 3 B
° Unneeded repairs sold with possible fraudulent intent	$ 2 B
° Wasteful overfrequent preventive maintenance	$ 2 B
° Vehicle design requiring use of overly modularized parts, highly non-standard parts or excessively laborious repair techniques	$ 2 B
TOTAL: EXCESSIVE REPAIR EXPENSES	$13.5 B
° Accidents due to undermaintenace or faulty repairs	$ 2 B
° Pollution and wasted fuel due to undermaintenance	$ 2 B
° Cars prematurely retired due to undermaintenance or faulty repairs	$ 2 B
TOTAL	$19.5 B

In a refinement of the major loss categories, the task force identified 16 specific consumer problem areas that consistently lead to losses in auto repairs and maintenance. Fraud or fraudulent intent, while one possible cause of consumer loss, was found to be at most a small percentage of that loss. The list provided a clearer set of target areas against which remedies could be developed. As used in this report, a "remedy" is a specific well defined set of actions to be taken with direct consumer benefits that can be estimated, and at a cost that can be computed. Costs include those incurred by States, cities, private concerns, or directly by the consumer, depending on their degree of participation.

The specific problem areas, and the methods by which remedy benefits are calculated - using a simulation model - are presented later in this report. More details of the analysis are available in Appendix C.

Several aspects were considered during the definition and analysis of each potential remedy since it was the objective of the task force to present an initial series of program choices which would be logical, acceptable and feasible, but at the same time not timid nor temporarily expedient. Among the questions posed were technological sufficiency, effects on the repair and maintenance labor force, impact on industry structure, State and local government participation and most critical of all, the general public reaction to the proposals. The task force sought and received advice, suggestions and assorted information from a number of people, but the usual time constraints put a limit on this quest.

The task force was assigned to develop a number of alternative action programs that would, within several years, offer significant benefits for consumers. An "action program" is defined here as a package of remedies, some of which could be implemented directly by the Federal government and others by States, communities, industry and consumers in response to a specific Federal initiative. The objective was to develop a series of options from which States and communities would have an opportunity to select the approaches they find most suitable as well as from which programs could be implemented nationwide. Another objective was that alternative programs should be cost-effective - fully recognizing that it would be difficult to verify estimated benefits.

Whereas the remedies differed considerably in terms of immediate objectives and implementation responsibility they all had the basic long-range goal: to arm the individual consumer with the tools he needs to solve problems by himself - to provide him with sufficient knowledge and with authority to take action himself - to eliminate institutional barriers that currently limit his right of action.

An initial set of remedy categories was prepared and included:

- Diagnostic inspection
- Vehicle standards
- Consumer information on vehicles
- State and local actions, including model laws, rating of repair facilities, complaint handling systems, and education.

At least two specific actions or initiatives were defined within each category except for consumer information on vehicles. The NHTSA has the authority under Title II of the Motor Vehicle Information and Cost Savings Act to issue consumer information on vehicle damageability, repairability and ease of diagnosis of problems in automobiles. A separate effort to study the feasibility of developing this information is planned. A brief description of this work is included at the end of this section.

In all, 22 remedies which satisfied the stated goals and constraints were developed. For analysis the task force studied the categories of remedies in a different order than is listed above and the remainder of this section and Appendix B will reflect this. Table 1 lists the remedies, their estimated benefits, costs and lead time.* A more detailed summary of each remedy including assumptions is included in Appendix B.

Synopsis of Remedies

Diagnostic inspection remedies would all rely on technology much of which has already been developed and proven (some further optimizing of diagnostic inspection technology is desirable through research and development to improve cost-effectiveness and keep abreast of changing vehicle designs). Five alternative levels of implementation are suggested, ranging from nationwide mandatory State programs to purely voluntary programs in the private sector.

* No adjustments to any dollar estimates, current or projected were made for inflation or changes in the characteristics of the vehicle population.

TABLE 1

AUTO REPAIR AND MAINTENANCE REMEDIES
(Benefits, Costs and Lead Time)

Remedies	Annual Benefits ($ Millions)	Annual Costs ($ Millions)	Lead Time (Years)
A. State Laws on Auto Repair			
1. Facility licensing and business regulations	132	15	5
2. Disclosure and trade practices	63	10	5
3. Mechanic licensing	73	30	10
B. Repair Facility Ratings			
4. Repair facility rating system - State operated	320	40	6
5. Repair facility rating systems - community or private operation	622	50	6
C. Federal Standards for New Vehicles and Replacement Parts			
6. Low tire inflation warning device	222	61	12
7. Ball joint wear indicator	118	61	7
8. Electrical systems integrity	500	361	14
9. Brake systems inspectability	135-335	181	12
10. Aftermarket brake shoe and pad quality	299	31	5
11. Long life brake systems	2491	1201	14
12. Plug-ins for electrical and air-conditioning systems diagnosis	88	37	12
13. Demodularize exhaust system components	402	151	12
D. Diagnostic Inspection			
14. Mandatory diagnostic inspection in every State	3273	1816	6
15. Voluntary or mandatory diagnostic inspection in every State	834	511	8
16. Voluntary or mandatory diagnostic inspection in some States	513	288	11
17. Community or private diagnostic centers with Federal support	364	226	9
18. VIMO's-vehicle inspection/maintenance organizations in the private sector	323	202	7
E. Consumer Complaint Administration Systems			
19. Consumer complaint administration systems - public management	273	40	7
20. Consumer complaint administration systems - private management	132	25	8
F. Consumer Education			
21. Courses for high school students and adults	245	30	15
22. Mass media information campaigns	98	30	2

Regulations, under current legislative authority are limited to standards for safety problems. Planned rulemaking lists a number of standards which include maintainability as a secondary benefit. Eight potential rulemaking areas were identified which would improve maintainability of brakes, tires, electrical, suspension and exhaust systems.

A number of States already have laws dealing specifically with auto repair. The Federal government would encourage more States to pass such laws by providing model legislative packages and other assistance. A model law could have sections dealing with facility licensing, disclosure practices, and mechanic licensing. Each section is treated as a separate remedy because it could be enacted as a single law or amendment.

Facility rating systems could make the repair industry more competitive by giving consumer information on where they can get the best price, repair quality and customer service. Rating systems could be implemented at the State level, the local level, or by private agencies.

A legislative/administrative package for a model consumer complaint administration system is another remedy that would be used for all phases of complaint handling and would be exclusively devoted to auto repair problems. The systems could be implemented by governments, by private institutions, or both.

Consumer education programs would stress basic knowledge on sound maintenance practice and communication with repair facilities, rather than detailed do-it-yourself repair training. Such a program would include development of syllabi for short high school or adult courses, or use mass media information campaigns.

Analysis of Remedies

The dollar benefits of each remedy were estimated using a computer simulation model. The structure of the model and the assumptions about remedy usage and effectiveness that must be entered in the model are discussed in "The Analytic Approach." The benefits as computed by the model are shown in Figure 1. Benefts are the sum of any reduction in valid, necessary repair costs which would result from the remedy plus reduction of conumer losses (wasted repair expenses, wasted fuel, etc.). The model moreover categorizes the reduction of consumer losses by source (incompetent repairs, package deals, etc.). For comparison purposes, total remedy costs has been entered on the last line of Figure 1, just below total benefits. The main findings on benefits and costs are that:

- Nearly all of the selected remedies appear to be cost effective, most of them very much so.

- The State laws have rather small benefits, but their costs are almost negligible.*

* Although State laws have potential for larger benefits, we have been conservative in our estimates of the number of States enacting such legislation as well as the specific benefits of the various parts of each law - the feeling being that higher benefits would require unreasonable enforcement at undesirable costs.

ANNUAL BENEFITS OF REMEDIES

IN REDUCING REPAIR COSTS AND CONSUMER LOSSES

($ MILLIONS)

FIGURE 1

		REMEDIES																				
		STATE LAWS			FACILITY RATINGS		FEDERAL STANDARDS FOR NEW VEHICLES AND PARTS							DIAGNOSTIC INSPECTION					COMPLAINT ADMIN.		CONSUMER EDUCATION	
		Facility Licensing & Business Regulation	Disclosure Laws - Writ Estim.	State Laws - Mechanic Licensing	State Operated Repair Facility Rating	Community or Private Repair Facility Rating	Low Tire Inflation Warning Device	Ball Joint Wear Indicator	Electrical System Integrity	Brake System Inspectability	Aftermarket Brake Quality	Long Life Brake Systems	Plug-ins for Electrical & A/C Diagnosis	Demodularize Exhaust System Components	Mandatory Diagnostic Inspection- every State	Voluntary or Mandatory Diag. Insp.- Ev. State	Vol. or Mand. Diag. Insp. - Some States	Community or Private Diagnostic Centers	Veh. Insp./Maint. Orgs in private sector (VIMO's)	Model Consumer Compl. System- Public Mg't.	Model Consumer Compl. System - Private Mg't	High School and Adult Courses	Mass Media Information Campaigns
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Reduction of Valid Repair Costs					131	236			304		182	1518										
REDUCTION IN CONSUMER LOSSES	Inadequate Repairs	68	-	53	63	128	24	(2)	38	11	23	190	8	-	712	178	110	79	81	162	98	51	17
	Package Deals and Over Repair	3	(1)	4	29	55	11	48	34	9	21	168	5	-	324	85	51	37	57	17	8	41	19
	Unnecessary Repairs and Possible Fraudulent Intent	50	64	1	48	111	16	29	23	13	14	115	(13)	-	532	142	87	63	53	86	22	32	20
	Shotgun Repairs, Bad Diagnosis	12	-	14	18	35	11	(3)	13	11	8	61	118	-	207	55	33	24	22	12	7	3	2
	Overmaintenance	(2)	-	(1)	7	12	(16)	34	21	63	13	108	(10)	-	397	98	60	42	34	(2)	(1)	43	8
	Undermaintenance	-	-	1	14	25	170	8	45	22	27	219	(22)	-	1001	252	155	108	67	(4)	(2)	68	30
	Modularized non-standard parts	1	(1)	-	10	19	7	5	22	6	13	111	2	402	100	26	16	11	9	2	-	8	2
	Total Reduction in Consumer Losses	132	63	73	189	386	222	118	196	135	117	973	88	402	3273	834	513	364	323	273	132	245	98
Total Benefits		132	63	73	320	622	222	118	500	135 1/	299	2491	88	402	3273	834	513	364	323	273	132	245	98
Estimated Costs		15	10	30	40	50	61	61	361	181	31	1201	37	151	1816	511	288	226	202	40	25	30	30

( ): Negative Benefit

1/ If 15 States begin brake component inspection during PMVI, Benefits total $335 Million

- Facility ratings have fairly large benefits and an exceptionally high ratio of benefits to costs.

- Vehicle standards would vary considerably in amount of benefits and in cost effectiveness.

- **Diagnostic inspection has the highest potential for benefits but the costs are substantial.**

- **Complaint systems and consumer education provide moderate benefits at low cost.**

Source of funding for remedies is an important policy matter. What portion of the cost should be born by Federal, State and local governments and how much should be passed on to consumers? Specifically, for those remedies where there is no Federal legislation mandating nationwide implementation, Federal financial support may enhance implementation by States and usage by consumers. The task force has assumed that Federal funding would account for a rather large portion of the cost of voluntary projects. Whether this assumption is realistic depends upon prevailing priorities among the many interested constituencies. Source of funding and estimated total cost of each remedy are shown in the top section of Figure 2. The task force's principal assumptions on funding are:

- The Federal government would provide 80 percent of the funds for voluntary State and community programs such as enforcement of State laws, rating systems, complaint systems and consumer education.

- The cost of Federal vehicle standards would in essence, be passed on to the consumer as is now the case for Federal Motor Vehicle Safety Standards.

- Mandatory inspection operating costs would be paid out of State revenues; Federal funds would pay for capital costs.

- Voluntary inspection, whether public or private, would be paid by consumers, with possible Federal subsidy in some cases.

Leadtime is another big consideration in selecting viable remedies. The task force tried to select remedies that would yield substantial payoffs in ten years or less, preferably much less. "Lead time to 100 percent implementation" is defined as the number of years from Federal remedy initiation (e.g. passing the necessary legislation) to achievement of full benefits. It includes, wherever applicable, time needed for research or program development, time for States, communities or private groups to make a decision to implement the program and then to set it up. If usage is voluntary, it takes time for consumers to become aware of the program and begin using it. Finally, for vehicle standards or training programs, there is a long lag until the entire vehicle or human population is involved. Lead time to 100 percent as well as 50 percent implementation is shown in the middle section of Figure 2. Principal findings are:

- Lead time ranges from 2 to 15 years.

COST, LEADTIME AND UTILIZATION OF REMEDIES

FIGURE 2

	REMEDIES																				
	STATE LAWS			FACILITY RATINGS		FEDERAL STANDARDS FOR NEW VEHICLES AND PARTS								DIAGNOSTIC INSPECTION					COMPLAINT ADMIN.		CONSUMER EDUCATION	
	Facility Licensing & Business Regulation	Disclosure Laws Writ. Estim.	State Laws - Mechanic Licensing	State Operated Repair Facility Rating	Community or Private Repair Facility Rating	Low Tire Inflation Warning Device	Ball Joint Wear Indicator	Electrical System Integrity	Brake System Inspectability	Aftermarket Brake Quality	Long Life Brake Systems	Plug-ins for Electrical & A/C Diagnosis	Demodularize Exhaust System Components	Mandatory Diagnostic Inspection- every State	Voluntary or Mandatory Diag. Insp.- Ev. State	Vol. or Mand. Diag. Insp. - Some States	Community or Private Diagnostic Centers	Veh. Insp./Maint. Orgs in private sector (VIMO's)	Model Consumer Compl. System- Public Mg't.	Model Consumer Compl. System - Private Mg't	High School and Adult Courses	Mass Media Information Campaigns
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Annual Estimated Costs: ($ Millions)																						
Federal Government	10	8	16	32	40	1	1	1	1	1	1	1	1	204	133	60	64	2	32	20	22	30
Other Governments	3	2	4	8	1	-	-	-	-	-	-	-	-	1485	141	141	48	-	8	1	6	-
Industry	2	-	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Negl.	4	-	-
Direct Consumer Payment	-	-	-	Negl.	9	60	60	360	180	30	1200	36	150	127	237	87	114	200	Negl.	Negl.	2	-
Total Cost	15	10	30	40	50	61	61	361	181	31	1201	37	151	1816	511	288	226	202	40	25	30	30
Total Benefits	132	63	73	320	622	222	118	500	335	299	2491	88	402	3273	834	513	364	323	273	132	245	98
Leadtime to 100 percent implementation (Years)	5	5	10	6	6	12 1/	7 1/	14 1/	12 1/	5 1/	14 1/	12 1/	12 1/	6	8	11	9	7	7	8	15 1/	2
Leadtime to 50 percent implementation (Years)	3½	3½	7½	4½	4½	7	4½	9	7	3½	9	7	7	4½	5	4	6	5½	4½	4½	8	1½
Utilization																						
Number of States	5	10	5	5	-									50	52	20	-	-	20	-	5	-
Percent of Population						Applicable to the entire fleet								95	20	13	8	2	-	-	15	-

1/ Leadtime to 90 percent Implementation

- **Diagnostic inspection, State laws, facility rating and complaint systems and standards for replacement parts all produce substantial benefits in five years or less.**

- **Standards for new vehicles, mechanic licensing and courses for consumers require 7 to 9 years for 50 percent of benefits and up to 15 years for full benefits.**

Utilization of voluntary remedies may vary greatly depending on the extent of the Federal initiative, the difficulty of implementation at the State level and the time and cost that would be spent by consumers. The task force's assumptions about how many States would likely implement voluntary State programs and what percent of consumers would participate are shown in the lower section of Figure 2. The principal assumptions are:

- About 5 States would likely require facility licensing, require mechanic licensing, establish a Statewide facility rating system or include maintenance education in high school curricula in response to a Federal initiative.

- About 10 States could be expected to pass disclosure laws relating specifically to auto repairs.

- About 20 States might establish a diagnostic inspection program or a model complaint administration system in response to a Federal initiative and financial support.

- Consumer participation in voluntary diagnostic inspection programs would range between 2 and 20 percent in the alternatives under study.

Many additional remedies were suggested and described. A number of these are listed below. They were <u>not</u> included in this initial analysis, primarily because of major obstacles to acceptance and implementation, as well as the difficulty of estimating benefits or costs based on currently available information.

- Outlawing the sale of certain types of "package deals"

- Restricting use of flat rates or commissions

- Standards specifying vehicle component locations for easy accessibility and repair

- A Nationwide consumer complaint administration system

Consumer Information

The feasibility of utilizing Title II of the Motor Vehicle Information and Cost Savings Act to rate automobiles on the basis of routine and corrective maintenance costs should be pursued. If a rating system is feasible and can be developed for new automobiles, the consumer would then be given life cycle cost information or relative rankings at the point of sale for the maintenance of the automobile considered for purchase.

Included would be routine maintenance items such as oil changes, filter changes, spark plug and ignition point replacement. In addition, any system of rating automobiles on the basis of routine maintenance costs should be accompanied by a system for rating on the basis of nonroutine, corrective maintenance as well. Establishing rating systems for corrective maintenance tasks, like grinding valves, ring replacement, and transmission overhauls should be pursued.

Information of this type in the hands of consumers would be a positive inducement for auto manufacturers to improve the quality of automobiles from a routine and corrective maintenance standpoint. At the same time, there are substantial questions regarding the feasibility of establishing such a rating system. While there are a number of data sources available for rating automobiles in use on the basis of routine and corrective maintenance, like owner's manuals, fleet operation and repair shop records, and other data sources, the task of developing ratings information for new automobiles is much more difficult. In most cases, there is no readily available data source for new automobiles and a predictive method of analyzing routine and corrective costs must be developed. Even if predictive ratings for new automobiles are not feasible, a valuable service can be provided to consumers by rating automobiles in use. At this point, the benefits of a rating system are difficult to assess since the result is conditioned upon marketplace responses.

While NHTSA is convinced that there is a great need for this type of information, work should proceed carefully. The initial task should be to examine existing sources of data to compile frequency of repair and repair cost information for existing automobiles. The results of that data collection effort should be presented to consumers and an assessment made of its value. If distinctions among competing automobiles are found and it is confirmed that information is valuable to consumers, the task of establishing predictive ratings for new automobiles should be pursued. This will also present an opportunity to estimate the benefits of such a rating system more precisely.

PROGRAM ALTERNATIVES

Twelve potential action programs to reduce consumer loss in auto repair are presented here. Each program is a package containing from one to as many as 16 remedies. The choice of specific remedies for each package, of course, need not be considered final. Substitution of some characteristically similar remedies would not significantly alter the thrust of each program.

Program packages are grouped into three "benefit levels," defined as follows:

> Level 1: Five alternative programs, each estimated to attain approximately $1.5 billion annual gross benefits.
>
> Level 2: Five alternative programs, each estimated to attain approximately $3.0 billion annual gross benefits.
>
> Level 3: Two high benefit programs; one of which is estimated to yield $4.8 billion, and the other $8.3 billion in annual gross benefits.

A summary of key values and constituent remedies for each of the twelve programs is shown in Figure 3. For both Levels 1 and 2, there are programs which conform to certain overall criteria or emphasis such as those estimated to be achievable at relatively low cost; those that are expected to be highly feasible; programs that might yield benefits within a short lead time; and programs that could be undertaken with few, if any changes in existing Federal operations. The criteria are described as follows:

> Low cost - The remedies were ranked in order of their estimated benefit/cost ratio. Program packages were constructed, essentially, by starting with the one on the top of the list and adding remedies one-by-one until target benefits were achieved. The resultant packages generally include facility rating systems, consumer education, complaint administration, State laws and those vehicle standards that are highly cost effective. With this approach, one may hope to achieve $1.5 billion benefits at a cost of just over $150 million and $3 billion benefits at a cost of just over $700 million.
>
> High feasibility and acceptability - Remedies were given a relative rating on: money and time spent by consumers to obtain the remedies; State organizational changes that might be required; Federal legislative requirements. Then, all remedies were ranked, with those getting good ratings on all three items, at the top. Again, program packages were constructed by working from the top of the list downwards. Resultant packages emphasized voluntary rather than mandatory remedies, private sector rather than State operation, and low-cost vehicle standards that could be promulgated under the Motor Vehicle Safety Act.

SUMMARY OF PROGRAM ALTERNATIVES

FIGURE 3

OPTIONS BY BENEFIT LEVEL

		BENEFITS $ MILLIONS	COSTS $ MILLIONS	LEAD TIME → YEARS 1/	REMEDIES: STATE LAWS — Facility Licensing & Business Regulation	Disclosure Laws Writ. Estim.	State Laws - Mechanic Licensing	FACILITY RATINGS — State Operated Repair Facility Rating	Community or Private Repair Facility Rating	FEDERAL STANDARDS FOR NEW VEHICLES AND PARTS — Low Tire Inflation Warning Device	Ball Joint Wear Indicator	Electrical System Integrity	Brake System Inspectability	Aftermarket Brake Quality	Long Life Brake Systems	Plug-ins for Electrical & A/C Diagnosis	Demodularize Exhaust System Components	DIAGNOSTIC INSPECTION — Mandatory Diagnostic Inspection- every State	Voluntary or Mandatory Diag. Insp.- Ev. State	Vol. or Mand. Diag. Insp. - Some States	Community or Private Diagnostic Centers	Veh. Insp./Maint. Orgs in private sector (VIMO's)	COMPLAINT ADMIN. — Model Consumer Compl. System- Public Mg't.	Model Consumer Compl. System - Private Mg't.	CONSUMER EDUCATION — High School and Adult Courses	Mass Media Information Campaigns
					1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
First Level Benefits (Approx. $1.5B)																										
OPTIONS	Low Cost	1524	166	7	X				X					X									X		X	
OPTIONS	High Feasibility	1622	379	7		X			X	X				X								X		X		
OPTIONS	Short Leadtime	1691	424	6	X	X			X					X						X						X
OPTIONS	Closest to Existing Fed. Operations	1446	655	9½	X	X	X			X			X							X			X			X
OPTIONS	Federal Vehicle Standards Only	1615	702	13						X	X	X		X		X	X									
Second Level Benefits (Approx $3.0B)																										
OPTIONS	Low Cost	2998	709	9½	X	X		X	X	X				X			X				X		X	X	X	X
OPTIONS	High Feasibility	3003	1300	11½		X			X	X	X	X	X	X						X		X		X	X	
OPTIONS	Short Lead Time	2737	813	6	X	X		X	X		X			X					X				X	X		X
OPTIONS	Closest to Existing Fed. Operations	3097	1137	10	X	X	X	X	X	X		X	X	X						X			X			X
OPTIONS	Mandatory Diag. Inspection Only	3237	1816	6														X								
High Benefit Program - Vehicle Standards and Mandatory Diagnostic Inspection		4845	2699	10						X	X	X	X	X		X	X	X								
High Benefit Program Comprehensive Series of Remedies		8286	3958	12½	X	X	X	X	X	X	X	X			X	X	X	X					X	X	X	X

1/ Time to achieve 90 percent of benefits

Short lead time - Remedies were ranked by lead time required to produce 50 percent of their benefits. Diagnostic inspection and facility rating systems, in particular, generate large benefits within a few years. This approach resulted in packages that would be making a substantial impact within 3-4 years and producing their full target benefits within 5-6 years.

Continuity of existing Federal operations - Packages of remedies that could most likely be implemented and administered under existing procedures in Federal agencies, and under existing Federal legislation with minor modifications, and with minimal increases in staff. Resultant packages generally include voluntary State programs and Federal vehicle standards that can be promulgated under the Safety Act.

This approach, using selective emphasis criteria, does not apply to programs with benefits significantly above $3.0 billion since a large number of remedies must be included at that level to achieve such benefits. More detailed summaries for each of the twelve program alternatives, including a breakdown of cost attribution, lead times to achieve benefits and constituent remedies are included in Appendix A.

THE ANALYTIC APPROACH

The task force analysed the automobile repair problem in terms of the process whereby consumers make maintenance decisions and obtain repairs. The center of the analytic approach was a model that simulates this maintenance and repair process as a series of events (e.g. occurrence of a fault, owner observes the fault, diagnosis by repair facility, repair, presentation of a bill). After each event, there is a decision as to which event comes next. For example, after a system becomes due for preventive maintenance, does the owner take the necessary action or does he wait until serious problems occur? When a car has been incorrectly repaired, does the owner detect this or not? If the "wrong" decision is made, it will lead to events that increase the cost of repair work, cause accidents, pollution or fuel waste - in short, it will lead to events that cause consumer loss. The amount of money consumers actually lose depends on how often the "wrong" choice is made at each of the decision points in the repair process, how much costs increase due to the chain of events that occur subsequent to wrong choices and to what extent that increased expense constitutes consumer loss.

The model adds up the total amount lost and, moreover, ascribes each individual loss to one of the following categories:

Faulty repair: Losses due to errors in repairs actually performed regardless of whether these were necessary or unnecessary.

Package deals: The repair facility knowingly replaces more parts than would be cost-optimal, but the added repairs are somewhat related to the needed repairs and doing the work together has wide industry/consumer acceptance. Package deals are generally convenient for the consumer and easy for the repair facility to perform and, in some cases, may save the consumer some money. But in many cases (especially "complete" brake jobs, front-end jobs and tune ups) they can result in substantial consumer losses.

Unneeded repairs sold with possible fraudulent intent: The repair facility charges for work clearly not needed and perhaps not even done. The work is so unrelated to the actual problem that the repair industry would not consider it a "package deal."

"Shotgun" repairs - bad diagnosis: Unneeded repairs due to incorrect diagnosis of the problem. Replacing parts till the car "works."

Overmaintenance: The owner may have wasted money by asking for maintenance more often than needed or by preventive replacement of components for which it is more economical to wait till they fail.

Undermaintenance: More expensive repairs, accidents, wasted fuel, etc. that result from failure to perform maintenance, too infrequent maintenance, or failure to notice evident faults.

Modularized or non-standard parts: Excessively expensive replacement parts or repair techniques which could readily have been avoided by vehicle design modifications possible within present technology, and minimal retooling.

These were felt to be the most important sources of loss that might be directly alleviated by remedy programs without excessive disruption of the repair industry structure. There are other important categories of loss that were not modeled, because it was not clear how programs could directly benefit consumers without undesirable side effects. Two examples are:

Overcharges using flat rate manual: Consumers pay for the number of labor hours listed in the flat rate manual, which could be higher than the labor hours they actually received. The Task Force did not have sufficient information to judge whether, or to what degree the flat rate system creates consumer losses.

Excessive prices paid for parts: Some lines of parts have considerably higher prices than others. Some retailers mark up parts more than others. Consumers patronizing those lines or retailers may be spending more than they have to. The extra costs, however, were considered to be "valid repair costs" in the model since price differences are a characteristic of most retail markets.

A model structure consisting of 52 events was devised. The structure is described in detail in Appendix C. Briefly, the model reflects and deals with the following specific stages (questions) of the repair process:

- How do owners approach vehicle maintenance? Do they perform preventive maintenance or do they have the component fixed when it fails?
- What happens when owners perform much less maintenance than needed for safe and economical operation? What happens when they perform much more?
- What happens when owners fail to notice a fault in their car before it becomes critical? What happens when a problem is incorrectly diagnosed?

- How often do repair facilities attempt to sell unneeded repairs with possible fraudulent intent? How do owners respond?

- How does the purchase of package deals affect the consumers' pocketbook?

- How often are repairs incorrectly performed? What are the consequences?

The structure was devised with two design guidelines in mind: (1) all entries should be justified by existing data, and could potentially be refined by collecting additional data; (2) that the model entries can be modified in a natural, straightforward manner to reflect the impact of remedy programs.

Next, entries needed for running the model were estimated from existing data. All values and their sources are described in Appendix C. Here are some of the most important ones:

- Roughly 20% of owners perform considerably more preventive maintenance (about double) than needed for safe, economical operation. Twenty percent of owners perform so little preventive maintenance that they incur serious losses (prematurely ruined cars, more expensive repairs, accidents, etc.). The wide disparities in owner maintenance practices may be inferred from a DOT study on that subject. 1/

- Inadequate maintenance and faulty repairs that go undetected may cause accidents, fuel waste, pollution or premature vehicle retirement. Consumers lose $6 billion a year, as a result. The $6 billion does not include additional losses that occur when deferred maintenance leads to more expensive repairs at a later date. The sources of information on maintenance-related losses were the following: accidents - an AVCO study 2/ based in part on the Indiana accident causation study 3/; fuel waste and pollution - the NHTSA diagnostic demonstration projects 4/; premature vehicle retirement - Sweden's experience with diagnostic inspection 5/.

1/ J.J. Dunstone et. al., Motor Vehicle Owner Maintenance Practices, DOT HS-801 278, NTIS 1970.

2/ K.P. Joncas et al., Diagnostic Motor Vehicle Inspection Demonstration Projects, Program Engineering Support, Volume 8, DOT HS-802 497, NTIS, 1977.

3/ Tri-Level Study of The Causes of Accidents. Vol. 1 - Research Findings DOT HS-801 334, NTIS, 1974.

4/ J.J. Innes and L.E. Eder, Motor Vehicle Diagnostic Inspection Demonstration Projects, DOT HS-802 760, NTIS, 1977.

5/ Weak Points of Cars, A.B. Svensk Bilproving, 1976.

- It was assumed that attempts to sell unneeded repairs with possible fraudulent intent occur on about five percent of repair transactions. The best source of data on this problem are the "Blue Goose" studies that were conducted in Chicago 1/ and eight other cities 2/ a few years ago. In those studies, what resembled fraud occurred on 15-20 percent of transactions. That range, however, was not taken literally for use in the model, since the Blue Goose studies were performed under conditions that may have encouraged such practices.

- Package deals are performed on approximately 20 percent of transactions. When an owner buys a package deal, his repair bill is, on the average, double what it would have been if he had bought only the repairs he needed. Both these assumptions are based on an analysis of the Alabama diagnostic project data 3/. The analysis showed that nearly 30 percent of repairs purchased by participants were "unnecessary." Most of the unnecessary repairs were part of a package deal. The Missouri Auto Club had similar findings. 4/

- The following assumptions were made about incorrect diagnosis and repair: Ten percent of diagnoses made by repair shops are not fully correct. Five percent of package deal repairs, five percent of preventive maintenance jobs and 10 percent of all other repair jobs are not correctly performed. These assumptions are based on the reinspection failure rate experienced by participants in the five NHTSA diagnostic demonstration projects 5/. (Reinspection failure is an indication that a repair was not fully satisfactory.) In those projects, 13 percent of subsystems repaired failed reinspection. Rates lower than 13 percent were used in the model because, in the projects, vehicles were required to meet rather tight specifications to pass reinspection. Thus some vehicles that failed reinspection may have been, for practical purposes, adequately repaired.

- If they have received faulty repairs, consumers usually seek some form of satisfaction - their money back or the job redone. It was assumed that consumers are successful in obtaining satisfaction 50 percent of the time. This was the finding in a consumer survey published in the Harvard Business Review 6/.

1/ W. Gaines, M. Anderson and E. Baumann, Articles in the Chicago Tribune, June 20-24, 1976.

2/ Unpublished staff paper, Division of Professional Services, Federal Trade Commission, 1977.

3/ B.J. Schroer et al., "An Evaluation of Component Repair Costs for Auto Check Participants," Report No. 201, University of Alabama at Huntsville, 1977.

4/ D. Ancona, "Vehicle Repairs Following Diagnostic Inspection", Unpublished paper, Office of State Vehicle Programs, NHTSA, 1977.

5/ J.J. Innes & L.E. Eder, op. cit.

6/ A.R. Andreasen and A. Best, "Consumer Complain -- Does Business Respond"? Harvard Business Review, July-August 1977.

Next, the Task Force ran the model. Given a total of $50 billion spent annually by consumers on repairs, maintenance and maintenance-related accidents, fuel waste, etc. (see "The Problem"), the model provides an estimated distribution of valid expenses and losses as follows:

TABLE 2

DISTRIBUTION OF CURRENT AUTO REPAIR EXPENDITURES AND CONSUMER LOSSES

Category	$ Millions	% of total
Valid repair costs	30350	61
1. Faulty repairs	3826	8
2. Package deals	3366	7
3. Unneeded repairs sold with possible fraudulent intent	2324	5
4. Shotgun repairs - bad diagnosis	1239	2
5. Overmaintenance	2128	4
6. Undermaintenance	4534	9
7. Modularized or non-standard parts	2233	4
Total - Consumer losses	19650	39
Total	50000	100

The results shown in Table 2 must be veiwed with a degree of caution, based as they are on a variety of imperfect data sources each of which may contain certain problems of definition and bias. The Task Force was conservative in their interpretation of existing data (e.g., it was assumed that the overall incidence of possible fraudulent intent was only one-fourth to one-third the rate experienced in Blue Goose studies and the incidence of a faulty repair was one-half the reinspection failure rate in the diagnostic projects). The Task Force considered it prudent, however, to perform two sensitivity test with the model: First, the model was run using "lower-bound" assumptions that, for the most part, fell far below what is suggested by the existing data. Then, a higher estimate was made using, in a few places, somewhat more literal interpretations of the data than those employed in the baseline case. Some key inputs for the primary, lower and higher estimates are compared in Table 3.

TABLE 3
MODEL INPUTS FOR SENSITIVITY TESTS

Frequency of:	Primary estimate	Lower estimate	Higher estimate
Improper diagnosis	10%	10%	20%
Possible attempted "fraud"	5%	2%	10%
Package deals	20%	10%	20%
Faulty repair	10%	5%	13%
Modularized, non-standard parts	4%	2%	4%
Improper maintenance intervals	20%	10%	20%

When the model was run with the lower inputs, consumer losses were estimated to be $13.4 billion, annually. The higher result was $23.3 billion. The sensitivity runs present a range of interpretations of existing data sources.

What the lower estimate shows is that, even with assumptions about rates of unnecessary and improper repair that are far below what is suggested by existing data, one infers that annual consumer losses exceed $13 billion. Even if consumer losses were only $13.4 billion instead of the nominal $19.6 billion, nearly all of the remedies described in this paper would still be cost-effective and the conclusions of this study would be substantially the same.

For evaluating the effectiveness of future remedies, and to refine the estimates of current losses, additional, and more accurate data are needed. The concluding section of Appendix C outlines some studies that should be undertaken to provide such data.

After using the model to estimate current consumer losses, the Task Force turned their attention to the prediction of remedy benefits. The model could be used for estimating benefits by employing the following procedure:

1. An estimate of how much each of the baseline model entries would be modified if the remedy were implemented.

2. Running the model with the modified entries and with valid repair expenses the same as in the baseline case (minus any reduction in valid expenses that can be attributed to the remedy).

3. The model then estimates residuel waste after remedy implementation and adds it to the valid expense.

4. That total is subtracted from $50 billion (the baseline total consumer expenditures) to determine the benefit due to the remedy.

The procedure for entering remedy effectiveness into the model was simplified by the Task Force. All of the model entries that would likely be modified by remedies were grouped into 16 "consumer problem areas." It was required only that an estimate of a remedy's effectiveness against each of those areas be specified. The 16 problem areas are:

1. Failure to perform needed preventive maintenance

2. Unnecessary replacement of a component, when it is more economical to wait until it fails

3. Failure to detect faults before they become critical

4. Too much time between maintenance work

5. Superfluous maintenance

6. Inadequate diagnosis of the problem

7. Attempts to sell unneeded repairs with possible fraudulent intent

8. Failure to detect possible intended fraud before repairs

9. Failure to detect possible fraud after repairs

10. Work charged for and never performed

11. Failure to resolve possible fraud

12. Package deals which are not in the consumers' interest

13. Instances of faulty repair

14. Failure to detect faulty repair

15. Failure to resolve faulty repair

16. Vehicle design requiring use of modularized or non-standard parts

A remedy was said to be 10 percent effective against a specific problem area if it reduced by 10 percent the likelihood of making the "wrong" choice at each of the decision points in the model associated with that problem area. For example, a remedy 10 percent effective against "instances of faulty repair" would reduce the rate of improper repair on ordinary jobs from 10 percent to nine percent, and the rate of improper repair on package deals and routine maintenance from five percent to 4 1/2 percent. Thus, the number that is entered into the model corresponds closely to a layman's intuition of what constitutes "remedy effectiveness."

As a result, using the model for estimating the effectiveness of a remedy requires the entry of only 17 numbers (many of which are zero, for the typical remedy): The dollar reduction in valid expenses (if any) and the percent effectiveness in alleviating each of the 16 problem areas, respectively. The 17 entry numbers for each of the remedies studied by the Task Force are specified in Figure 4. The results of the model runs - total benefits and reduction of each loss category - were summarized in Figure 1 (See: The Remedies).

The effectiveness percentages for the various remedies shown in Figure 4 were derived as follows: The net effectiveness of a remedy against a problem area equals net usage multiplied by the effectiveness when used. To understand "net usage" one must recall how "remedy" is defined in this study: It is a specific program undertaken or initiated by government, or through other agencies, to increase utilization of a procedure, device, etc. beneficial to consumers. If the device or procedure are already being used in some places, current utilization must be subtracted from utilization after the program is implemented. Other considerations that decrease net usage include:

- State or regions that do not participate even after the program is implemented.
- Groups of vehicles, repair facilities or owners that are excluded by definition (e.g. do-it-yourselfers from mechanic licensing laws).
- Vehicle subsystems or components to which a remedy does not apply.
- For voluntary programs, expected participation of the target group.

It must be stressed that the benefits calculated by the task force generally reflect somewhat conservative expectations of likely usage and not the abstract ideal situation where the remedy is used by every eligible person. This approach tends to deflate benefits from remedies aimed at enrolling States on a voluntary basis.

NET EFFECTIVENESS OF REMEDIES
IN REDUCING OCCURRENCE OF CONSUMER PROBLEM AREAS
(PERCENT)

FIGURE 4

REMEDIES

CONSUMER PROBLEM AREAS	STATE LAWS: Facility Licensing & Business Regulation (1)	STATE LAWS: Disclosure Laws Writ Estim. (2)	STATE LAWS: State Laws - Mechanic Licensing (3)	FACILITY RATINGS: State Operated Repair Facility Rating (4)	FACILITY RATINGS: Community or Private Repair Facility Rating (5)	FEDERAL STANDARDS FOR NEW VEHICLES AND PARTS: Low Tire Inflation Warning Device (6)	FEDERAL STANDARDS FOR NEW VEHICLES AND PARTS: Ball Joint Wear Indicator (7)	FEDERAL STANDARDS FOR NEW VEHICLES AND PARTS: Electrical System Integrity (8)	FEDERAL STANDARDS FOR NEW VEHICLES AND PARTS: Brake System Inspectability (9)	FEDERAL STANDARDS FOR NEW VEHICLES AND PARTS: Aftermarket Brake Quality (10)	FEDERAL STANDARDS FOR NEW VEHICLES AND PARTS: Long Life Brake Systems (11)	FEDERAL STANDARDS FOR NEW VEHICLES AND PARTS: Plug-ins for Electrical & A/C Diagnosis (12)	FEDERAL STANDARDS FOR NEW VEHICLES AND PARTS: Demodularize Exhaust System Components (13)	DIAGNOSTIC INSPECTION: Mandatory Diagnostic Inspection- every State (14)	DIAGNOSTIC INSPECTION: Voluntary or Mandatory Diag. Insp.- Ev. State (15)	DIAGNOSTIC INSPECTION: Vol. or Mand. Diag. Insp. - Some States (16)	DIAGNOSTIC INSPECTION: Community or Private Diagnostic Centers (17)	DIAGNOSTIC INSPECTION: Veh. Insp./Maint. Orgs in private sector (VIMO's) (18)	COMPLAINT ADMIN.: Model Consumer Compl. System- Public Mg't. (19)	COMPLAINT ADMIN.: Model Consumer Compl. System - Private Mg't (20)	CONSUMER EDUCATION: High School and Adult Courses (21)	CONSUMER EDUCATION: Mass Media Information Campaigns (22)
1. Failure to perform needed preventive maintenance	.1		.1			5.0	.4				-.5			22.1	5.6	3.4	2.4	1.9	.1	.04	2.0	1.25
2. Unnec. repl. of a component, when it is more econ. to wait until it fails	.1		.1				1.5		2.5					21.0	5.3	3.2	2.3	1.8	.1	.04	2.0	.5
3. Failure to detect faults before they become critical	.1		.1			1.3	.4		1.3					23.3	5.8	3.6	2.5	1.4	.1	.04	1.0	
4. Too much time between maintenance work	.1		.1			5.0	.4							21.0	5.3	3.2	2.3	1.9	.1	.04	2.0	1.25
5. Superfluous maintenance							1.5		2.5					18.6	4.7	2.9	2.0	1.8	.1	.04	2.0	.5
6. Inadequate diagnosis of the problem	.8		1.0	.9	1.9				1.0			9.7		13.5	3.5	2.1	1.5	1.5	.4	.2		
7. Attempts to sell unneeded repairs with possible fraudulent intent	1.5	.9		.9	2.3		.3		.1					6.7	1.8	1.1	.8	1.8	2.0	.4		
8. Failure to detect possible intended fraud before repairs		.9					1.2		.5					13.5	3.5	2.1	1.5				1.0	.5
9. Failure to detect possible intended fraud after repairs	.3	1.7												21.5	5.3	3.3	2.5	1.8			1.0	.5
10. Work charged for and never performed		2.0		.9	2.3																	
11. Failure to resolve possible fraud	2.3	1.7		1.9	4.2									6.7	1.4	.9	.6	.8	5.0	1.2	1.0	1.25
12. Package deals which are not in the consumers' interest				.4	.8		1.5							6.7	1.8	1.1	.8	1.5	.2		1.0	.5
13. Instances of faulty repair	.8		1.0	.9	1.9													1.5				
14. Failure to detect faulty repair						.5								21.5	5.3	3.3	2.3				1.0	
15. Failure to resolve faulty repair	2.7		.9	.9	1.9									17.0	4.2	2.6	1.8	1.0	12.9	7.7	2.0	1.25
16. Vehicle design requiring use of modularized or non-standard parts													18.0									
Reduction in Valid Repair Costs ($ Millions)				131	236			304		182	1518											

Benefits are calculated under the assumptions of "full" implementation, i.e., 100 percent of likely expected usage, against current baseline repair expenditures. Leadtime or years till "full" implementation as well as 50 percent of full implementation, were also calculated for each remedy (e.g., for motor vehicle standards this includes 10 years for phasing out the pre-standard fleet).

Consumer losses in auto repair were defined to include the value of avoidable accidents, wasted fuel, preventable pollution and reduced car life as well as unneeded repair expenses (See "The Problem"). The dollar benefits of a remedy, as calculated by the model, thus, include the value of accidents prevented by the remedy.

Annual remedy costs are calculated under the assumptions of (1) steady state conditions after full implementation and (2) current baseline repair expenditures, number of vehicles, number of repair facilities, etc. Excess costs prior to full implementation are noted in the discussion of individual remedies. Costs include outlays by Federal, State and local governments, direct out-of-pocket expenses of consumers, and direct industry expenses that cannot be recovered. Figure 2 breaks them down by those sources.

Finally, the task force formulated packages or subsets of the more than 20 remedies that could be considered for simultaneous implementation. Costs and benefits of packages were calculated. The cost of a package is the simple sum of its constituent remedy costs. The benefit is calculated running the model with a single "remedy" whose effectiveness against each problem area is the simple compounding of the constituent remedies' effectiveness.* As a result, the package benefit is typically a little bit less than the sum of the constituent benefits. This technique does not make allowance for synergistic effects that may possibly occur as a result of certain remedy combinations.

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* e.g. if Remedy 1 is 10 percent effective and Remedy 2 is 10 percent effective then the package of 1 and 2 is 19 percent effective.

ELEMENTS OF ALTERNATIVE PROGRAMS

This is a summary listing of the 12 program packages that were constructed to give an overview of the magnitude of benefits and related costs when various mixes of remedies are used. There are three "levels", each at a different benefit amount, e.g., $1.5 billion; $3.0 billion; and a "high benefit" program which includes a large number of remedies. The following list begins with the first level and describes programs for different criteria, beginning with a "low cost" option.

PROGRAM: 1st Level Benefits (Approx. $1.5 Billion) - Low Cost Option

Constituent remedies:

No. 1	Facility licensing and business regulations
5	Repair facility rating systems - community or private operation
10	Aftermarket brake shoe and pad quality
19	Consumer complaint administration systems - public management
21	Courses for high school students and adults

Estimated program benefits	$ 1524 million per year
Estimated program costs	$ 166 million per year
Federal share	$ 105
Other governments	$ 18
Industry	$ 2
Consumers	$ 41

Time to achieve 90% of benefits:	7 years
Time to achieve 50% of benefits:	4 1/2 years

PROGRAM: 1st Level Benefits (Approx. $1.5 Billion) - High Feasibility Option

Constituent remedies:

No. 2 Disclosure and trade practices
5 Repair facility rating systems - community or private operation
6 Low tire inflation warning device
10 Aftermarket brake shoe and pad quality
18 VIMO's - vehicle inspection/maintenance organizations in the private sector
20 Consumer complaint administration systems - private management

Estimated program benefits	$ 1622 million per year
Estimated program costs	$ 379 million per year
Federal government	$ 72
Other governments	$ 4
Industry	$ 4
Consumers	$ 299

Time to achieve 90% of benefits:	7 years
Time to achieve 50% of benefits	5 years

PROGRAM: 1st Level Benefits (Approx. $1.5 Billion) - Short Leadtime Option

Constituent remedies:

No. 1 Facility licensing and business regulations
2 Disclosure and trade practices
5 Repair facility rating systems - community or private operation
10 Aftermarket brake shoe and pad quality
16 Voluntary or mandatory diagnostic inspection in some States
22 Mass media information campaigns

Estimated program benefits:	$ 1691 million per year
Estimate program costs :	$ 424 million per year
Federal government :	$ 149
Other governments :	$ 147
Industry :	$ 2
Consumers :	$ 126

Time to achieve 90% of benefits:	6 years
Time to achieve 50% of benefits:	3 1/2 years

PROGRAM: 1st Level Benefits (Approx. $1.5 Billion) - Option Closest to Existing Federal Operations

Constituent remedies:

No. 1 Facility licensing and business regulations
2 Disclosure and trade practices
3 Mechanic licensing
6 Low tire inflation warning device
9 Brake systems inspectability
16 Voluntary or mandatory diagnostic inspection in some States
19 Consumer complaint administration systems - public management
22 Mass media information campaigns

Estimated program benefits:		$ 1446 million per year
Estimated program costs	:	$ 655 million per year
Federal government	:	$ 158
Other governments	:	$ 158
Industry	:	$ 12
Consumers	:	$ 327

Time to achieve 90% of benefits: 9 1/2 years
Time to achieve 50% of benefits: 4 1/2 years

PROGRAM: 1st Level Benefits (Approx. $1.5 Billion) - Federal Vehicle Standards Option

Constituent remedies:

No. 6 Low tire inflation warning device
7 Ball joint wear indicator
8 Electrical systems integrity
10 Aftermarket brake shoe and pad quality
12 Plug-ins for electrical and air-conditioning systems diagnosis
13 Demodularize exhaust system components

Estimated program benefits:		$ 1615 million per year
Estimated program costs	:	$ 702 million per year
Federal government	:	$ 6
Other governments	:	$ -
Industry	:	$ -
Consumers	:	$ 696

Time to achieve 90% of benefits 13 years
Time to achieve 50% of benefits: 6 1/2 years

PROGRAM: 2nd Level Benefits (Approx. $3 Billion) - Low Cost Option

Constituent remedies:

No. 1 Facility licensing and business regulations
2 Disclosure and trade practices
4 Repair facility rating system - State operated*
5 Repair facility rating systems - community or private operation*
6 Low tire inflation warning device
10 Aftermarket brake shoe and pad quality
13 Demodularize exhaust system components
17 Community or private diagnostic centers with Federal support
19 Consumer complaint administration systems - public management*
20 Consumer complaint administration systems - private management*
21 Courses for high school students and adults
22 Mass media information campaigns

Estimated program benefits:		$ 2998 million per year
Estimated program costs	:	$ 709 million per year
Federal government	:	$ 261
Other governments	:	$ 77
Industry	:	$ 6
Consumers	:	$ 365

Time to achieve 90% of benefits: 9 1/2 years
Time to achieve 50% of benefits: 4 1/2 years

PROGRAM: 2nd Level Benefits (Approx. $3 Billion) - High Feasibility Approach

Constituent remedies:

No. 2 Disclosure and trade practices
5 Repair facility rating systems - community or private operation
6 Low tire inflation warning device
7 Ball joint wear indicator
8 Electrical systems integrity
9 Brake systems inspectability
10 Aftermarket brake shoe and pad quality
16 Voluntary or mandatory diagnostic inspection in some States
18 VIMO's - vehicle inspection/maintenance organizations in the private sector
20 Consumer complaint administration systems - private management
21 Courses for high school students and adults

Estimated program benefits:		$ 3030 million per year
Estimated program costs	:	$ 1300 million per year
Federal government	:	$ 157
Other governments	:	$ 151
Industry	:	$ 4
Consumers	:	$ 988

Time to achieve 90% of benefits: 11 1/2 years
Time to achieve 50% of benefits: 5 1/2 years

* Private systems would be established in jurisdictions that do not implement public systems.

PROGRAM: 2nd Level Benefits (Approx. $3 Billion) - Short Leadtime Option

Constituent remedies:

No. 1 Facility licensing and business regulations
2 Disclosure and trade practices
4 Repair facility rating system - State operated
5 Repair facility rating systems - community or private operation
7 Ball joint wear indicator
10 Aftermarket brake shoe and pad quality
15 Voluntary or mandatory diagnostic inspection in every State
19 Consumer complaint administration systems - public management
20 Consumer complaint administration systems - private management
22 Mass media information campaigns

Estimated program benefits:		$ 2737 million per year
Estimated program costs	:	$ 813 million per year
Federal government	:	$ 307
Other governments	:	$ 164
Industry	:	$ 6
Consumers	:	$ 336

Time to achieve 90% of benefits: 6 years
Time to achieve 50% of benefits: 4 years

PROGRAM: 2nd Level Benefits (Approx. $3 Billion) - Option Closest to Existing Federal Operations

Constituent remedies:

No. 1 Facility licensing and business regulations
2 Disclosure and trade practices
3 Mechanic licensing
4 Repair facility rating system - State operated
5 Repair facility rating systems - community or private operation
6 Low tire inflation warning device
8 Electrical systems integrity
9 Brake systems inspectability
10 Aftermarket brake shoe and pad quality
16 Voluntary or mandatory diagnostic inspection in some States
19 Consumer complaint administration systems - public management
22 Mass media information campaigns

Estimated program benefits:		$ 3097 million per year
Estimated program costs	:	$ 1137 million per year
Federal government	:	$ 232
Other governments	:	$ 167
Industry	:	$ 12
Consumers	:	$ 726

Time to achieve 90% of benefits: 10 1/2 years
Time to achieve 50% of benefits: 4 1/2 years

PROGRAM: 2nd Level Benefits (Approx. $3 Billion) - Mandatory Diagnostic Inspection Approach

Constituent remedy:

No. 14 Mandatory diagnostic inspection in every State

Estimated program benefits:		$ 3273 million per year
Estimated program costs	:	$ 1816 million per year
Federal government	:	$ 204
Other governments	:	$ 1485
Industry	:	$ 0
Consumers	:	$ 127

Time to achieve 90% of benefits:	6 years
Time to achieve 50% of benefits:	4 1/2 years

PROGRAM: High Benefit Program - Vehicle Standards and Mandatory Diagnostics

Constituent remedies:

No. 6 Low tire inflation warning device
7 Ball joint wear indicator
8 Electrical systems integirty
9 Brake systems inspectability
10 Aftermarket brake shoe and pad quality
12 Plug-ins for electrical and air-conditioning systems diagnosis
13 Demodularize exhaust system components
14 Mandatory diagnostic inspection in every State

Estimated program benefits:		$ 4845 million per year
Estimated program costs	:	$ 2699 million per year
Federal government	:	$ 211
Other governments	:	$ 1485
Industry	:	$ 0
Consumers	:	$ 1003

Time to achieve 90% of benefits:	10 years
Time to achieve 50% of benefits:	5 years

PROGRAM: High Benefit Program - Comprehensive Series of Remedies

Constituent remedies:

No.		
	1	Facility licensing and business regulations
	2	Disclosure and trade practices
	3	Mechanic licensing
	4	Repair facility rating system - State operated
	5	Repair facility rating systems - community or private operation
	6	Low tire inflation warning device
	7	Ball joint wear indicator
	8	Electrical systems integrity
	11	Long life brake systems
	12	Plug-ins for electrical and air-conditioning systems diagnosis
	13	Demodularize exhaust system components
	14	Mandatory diagnostic inspection in every State
	19	Consumer complaint administration systems - public management
	20	Consumer complaint administration systems - private management
	21	Courses for high school students and adults
	22	Mass media information campaigns

Estimated program benefits:		$ 8286 million per year
Estimated program costs	:	$ 3958 million per year
Federal government	:	$ 420
Other governments	:	$ 1518
Industry	:	$ 16
Consumers	:	$ 2004

Time to achieve 90% of benefits:	12 1/2 years
Time to achieve 50% of benefits:	5 1/2 years

BASIS AND DESCRIPTION OF THE INDIVIDUAL REMEDIES

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BASIS AND DESCRIPTION OF THE INDIVIDUAL REMEDIES

MODEL STATE CONSUMER LAW ON AUTOMOBILE REPAIR (Remedies 1. - 3.)

A model consumer law dealing with the automobile repair problem would ideally be comprised of three basic types of auto repair laws:

- facility licensing laws -- require auto repair facilities to refrain from engaging in deceptive practices or face loss of the license permitting them to perform repairs
- disclosure laws -- give the consumer a right to certain information concerning the automobile repair transaction
- mechanics licensing laws -- require mechanics to meet certain competency standards before being allowed to repair motor vehicles

These will be treated as separate remedies below, since they can be independently implemented and since few States can be expected to implement all at once.

Federal participation includes devising a legislative package for each remedy for use by the States, encouraging States to adopt the laws, providing technical guidance and grants on an 80-20 cost-sharing basis as needed to implement and enforce the laws. New Federal legislation may be required to provide authority for grants.

Current levels of implementation: Three States now have laws roughly equivalent to Remedy 1; four States equivalent to Remedy 2; three States equivalent to Remedy 3.

1. Facility licensing and business regulations

Description:

A State law would require licensing of all shops doing a substantial amount of repair business. Licensing requirements include:

- minimum standards for facility, tools and equipment
- certification of a given percentage of mechanics

- employment of licensed supervisory inspector
- adequacy of business forms
- posting a surety bond
- proof of adequate credit rating

All major repairs performed by the shops would have to be inspected and approved by a certified mechanic.

The State would have a complaint office and inspectors to enforce the law, and would have the power to impose civil penalties or suspend the license of a shop that fails to maintain the requirements or has a record of deceptive practice or unwillingness to make good on faulty repairs. The State would also define damages payable to consumers who sustained loss due to violations of the law. Consumers would be able to sue for damages by private action in small claims courts, by class action or under parens patriae action (in which the State brings the suit as the consumer's agent).

The threat of loss of license will make shops more flexible in satisfying customers who detect that they are victims of possible fraud or inadequate repair. Shops would also be inclined to check the quality of completed repairs more thoroughly.

Expected participation: Five additional States would enact the law in response to a Federal initiative.

Expected benefits: About $130 million annually.*

Total costs: About $15 million annually, with funding assumed as follows:

- Federal share - $10 million for grants
- State share - $ 3 million for matching funds
- Repair industry share - $ 2 million for facility licensing fees

Time to full implementation: Five years after Federal grants become available, with 50 percent implementation after 3 1/2 years.

Implementation problems: Few States now license shops and $10 million in grants may not be sufficient to overcome the inherent administrative and enforcement drawbacks of a licensing program.

2. Disclosure and trade practices

Description:

A State law would require all shops doing a substantial amount of repair business to:

- Provide itemized estimates of specific repairs.

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* Net effectiveness by consumer program area itemized in Figure 4
Loss reduction by consumer loss area itemized in Figure 1

- Obtain customer's signature on the estimate.
- Obtain customer's oral or written authorization for work not listed in the original estimate.
- Provide customer with an itemized invoice.
- Provide information on details of warranty agreement on the invoice.
- Return replaced parts to customer (with certain exceptions), and
- Conspicuously post disclosure requirements.

The law would also outlaw mechanic's lien.

The State would have a complaints office and inspectors to enforce the law and would have the power to impose fines for violations. The State would also define damages payable to consumers who sustained loss due to violations of the law. Consumers would be able to sue for damages by private action in small claims courts, by class action or under parens patriae (in which the State brings the suit as the consumer's agent).

The estimates and invoices provide a body of written evidence to help detect and resolve unnecessary repairs and possible fraudulent intent. Return of parts will make it harder to charge for work never performed.

Expected participation: Ten additional States would enact a law in response to Federal grants and encouragement.

Total benefits: About $60 million annually.*

Total cost: About $10 million annually, with funding assumed as follows:

- Federal share - $8 million for grants
- State share - $2 million for matching funds

Time to full implementation: Five years after Federal grants become available, with 50 percent implementation after 3 1/2 years.

Feasibility assessment: More States would be interested in this Remedy than in Remedies No. 1 or 3, since licensing, with its administrative and enforcement drawbacks, is not involved here.

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* Net effectiveness by consumer program area itemized in Figure 4
Loss reduction by consumer loss area itemized in Figure 1

3. Mechanic licensing

Description:

A State law would require all mechanics doing a substantial amount of repair work to be licensed or to be in an approved training program leading to licensing. The mechanic would have to pass written and shop tests at certain intervals to retain his license. Additional tests and licenses would be required for certain specialties.

The State would provide opportunities for training for those who wish to become licensed mechanics. Training would include classroom instruction at a State or contractor facility and on-the-job training through a State-certified apprenticeship program. The State would fund a substantial portion of training expense.

The State would investigate complaints about quality of work and diagnosis and would have the power to suspend the license of mechanics who consistently fail in either regard.

Training and testing should lead to more mechanics competent in diagnosis and repair. The threat of loss of license may also make mechanics more flexible in satisfying customers complaining about improper repair.

Expected participation: Five additional States would enact the law in response to Federal grants and encouragement.

Total benefits: About $73 million annually.*

Total costs: About $30 million annually, with funding assumed as follows:

° Federal Share	-	$16 million for grants
° State share	-	$ 4 million for matching funds
° Repair industry share	-	$10 million paid by mechanics for tuition and licensing fees.

Time to full implementation: Ten years after Federal grants become available, with 50 percent implementation after 7 1/2 years.

Implementation problems: Most States would be reluctant to create additional barriers to entry in a profession which already suffers from shortages.

* Net effectiveness by consumer program area itemized in Figure 4
Loss reduction by consumer loss area itemized in Figure 1

REPAIR FACILITY RATING SYSTEMS
(Remedies 4. - 5.)

All major repair facilities in an area would be given quality ratings (such as "superior," "satisfactory," "below average") on each of three criteria:

- price - based on cost of a shopping list of typical repairs; tendency of the shop to push sales of extravagant package deals.
- repair quality - frequency of complaints about poor work, complaints about unneeded work due to poor diagnosis, quality of equipment, mechanics' experience and training.
- responsiveness to consumer needs - frequency of complaints about possible fraudulent sales practices, complaints about difficulty of resolving consumer grievances, quality of shop's customer service practices.

The objective is to inject more competition in an industry where more consumer knowledge would motivate shops to improve their practices in order to get better ratings the next time.

The wider the dissemination and the higher the credibility of the ratings, the greater the benefits. Credibility requires that the rating institution be impartial and respected by the public and that the ratings be based on a significant body of supporting data.

The specific target of the price rating is to reduce overall valid expenses* and losses due to package deals.** The repair quality ratings will reduce "shotgun" repairs* and occurrence of faulty repairs.* The responsiveness ratings will increase shops' willingness to resolve disputes due to faulty repair* and reduce their inclination** to sell unneeded repairs and charge for work not performed.**

Current level of implementation: Private consumer groups in a few large cities now publish repair facility ratings. These are relatively low-budget efforts, with limited dissemination. Government agencies do not now rate repair facilities, but a number of States and local governments have successfully rated food products, hotels and restaurants and could draw on that experience.

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* Large effect
** Small effect

4. Repair facility rating system - State operated

Description:

The Federal government could encourage, through grants and technical guidance,*** States to publish annual ratings of all shops doing a significant amount of repair business. To be eligible for grants, States would have to meet Federal technical and policy guidelines in their programs.

Ratings would be conspicuously posted at all rated repair facilities. A book of ratings would also be available to the public at token cost. States would conduct a significant multimedia campaign to advertise use of the ratings and to solicit comments on repair shops. Ratings would be based on direct price quotations from repair shops, inspection of shops' equipment, customer service policies, sales records and personnel information, records of complaints submitted by the public directly to the rating office and to other agencies, and experience with actual vehicles brought to shops for repairs (a form of "Blue Goose" studies).

Summary of Potential Federal Actions:

- Modify existing legislation to provide for grants
- Estimated level of grants: about $32 million per year
- Develop rating techniques
- Training program for people who are going to do the rating

Expected participation:

- Assume five States would participate in response to Federal initiative
- Shops accounting for 80 percent of repairs sold would be rated

Total benefits: About $320 million annually.*

Total costs: About $40 million annually, with funding assumed as follows

° Federal share	-	$32 million for grants covering 80 percent of costs
° State share	-	$ 8 million matching funds for 20 percent of costs
° Direct user payments	-	negligible (less than $1 million), for purchase of rating books at token cost in some States

* Net effectiveness by consumer program area itemized in Figure 4
Loss reduction by consumer loss area itemized in Figure 1

*** Federal Research and Development would be conducted to improve rating systems - assure fairness in their application and methods for updating ratings.

Time to full implementation: Six years after initiating the programs, with 50 percent implementation after 4 1/2 years.

Feasibility assessment: Fair to good; program is attractive to consumers and causes them no inconvenience; ratio of benefits to costs is high; considerable resistance to implementation will be encountered, however, at the Federal level and in most States.

5. Repair facility rating systems - community or private operation

Description:

In each of the nation's metropolitan areas of 500,000 or more persons, the Federal government would strongly encourage, through grants and technical guidance, a community or county government, consumer groups or private concerns to publish annual ratings of all shops doing a significant amount of repair business within the area. The rating institution would have to meet Federal technical and policy guidelines.

A booklet containing the ratings would be made available to the public at low cost. If a community or county government is doing the ratings, they may also require that the ratings be posted at repair facilities. A significant portion of the budget would be devoted to advertising the booklet and to solicit comments on repair shops. Ratings would be based on direct price quotations from repair shops, inspection of shops' equipment, customer service policies and personnel information, and records of complaints submitted by the public directly to the rating institution and to other agencies.

Summary of Potential Federal Actions:

- New legislation may be required
- Estimated grant level: assumed at about $40 million per year
- Develop rating techniques
- Training program for people who will do the rating

Expected participation:

- Ratings would be conducted in 90 percent of metropolitan areas with populations exceeding 500,000
- Shops accounting for 80 percent of repairs would be rated

Total benefits: About $620 million annually.*

* Net effectiveness by consumer program area itemized in Figure 4
Loss reduction by consumer loss area itemized in Figure 1

Total costs: About $50 million annually, with funding assumed as follows:

° Federal share	-	$40 million for grants covering 80 percent of costs
° Local government share	-	$ 1 million matching funds for 20 percent of costs where ratings are performed by local governments
° Direct user payments	-	$ 9 million for purchase of rating booklets (about $1-2 per booklet)

Time to full implementation: Six years after initiating the program, with 50 percent implementation after 4 1/2 years.

Feasibility assessment: Good; program is attractive to consumers and causes them no inconvenience; ratio of benefits to costs is high; no difficulty expected in finding qualified institutions to perform ratings; concept of Federal government funding this activity, however, is unconventional.

FEDERAL MOTOR VEHICLE STANDARDS
(Remedies 6. - 13.)

Federal Motor Vehicle Standards would be applied to new cars and light trucks used for personal transportation and to replacement parts in order to extend maintenance intervals, and simplify diagnosis and repair. The Federal government has the authority, under the National Traffic and Motor Vehicle Safety Act, to promulgate motor vehicle safety standards for vehicles and vehicle equipment that can have the secondary effect of reducing the amount of maintenance and repair required, providing warnings to consumers of impending failure or the need for maintenance, or facilitating diagnosis of problems. If new legislation does not seem likely, some of the following remedies could be issued under the Motor Vehicle Safety Act.

The standards would typically follow the two year rulemaking process to issue the standard and ten years to phase out 90 percent of the pre-standard vehicles. As is typical for vehicle standards, the entire cost is paid directly by consumers except for about $1 million per standard per year for Federal program support.

6. Low tire inflation warning device

Description:

A Federal standard would require low tire pressure warning devices on new vehicles. For example, a device in the valve stem would pop out when tire pressure is below some preset minimum. Owners' manuals and media advertising would inform the public about the standard and the hazards of underinflation.

The device would make a substantial percentage of owners aware that they must increase tire pressure, with direct benefits of longer tire life, better gas mileage, and fewer accidents.

Total benefits: About $220 million annually*

Total costs: About $60 million annually

Time to 90% implementation: Twelve years after initial NPRM**, with 50 percent implementation after seven years.

7. Ball joint wear indicator

Description:

A Federal standard would require new and aftermarket ball joints to contain a visually inspectable device indicating amount of wear. Owner's manuals and media advertising would inform the public about the standard and its potential utility.

Currently, 85 percent of ball joint replacements are apparently premature, either by inclusion in front-end package deals or by the owner's lack of knowledge. The device will, when used, make obvious whether replacement is necessary.

Total benefits: About $120 million annually.*

Total costs: About $60 million annually.

Time to 90% implementation: Seven years after initial NPRM with 50 percent implementation after 4 1/2 years.

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* Net effectiveness by consumer program area itemized in Figure 4
Loss reduction by consumer loss area itemized in Figure 1

** Notice of Proposed Rulemaking (required before promulgation of NHTSA vehicle standards).

8. Electrical systems integrity

Description:

A Federal standard would require new vehicles to be equipped with more durable electrical systems that, specifically, are less susceptible to short circuits. This could be achieved by a separate return circuit, better insulation, and hard-wiring connections.

It is estimated that the standard could reduce incidence of short circuits by 50 percent, thereby directly reducing repair expenditures.

Total benefits: About $500 million annually.*

Total costs: Perhaps $360 million annually.

Time to 90% implementation: 14 years after initial decision to develop a standard, with 50 percent implementation after nine years.

Implementation problems: Technology not fully developed. May be difficult to write performance specifications.

9. Brake systems inspectability

Description:

A Federal standard would require brake components for new vehicles (friction material, automatic adjusters, hydraulic seals, springs and some other parts) to be inspectable without wheel pull. This could be achieved by putting a "window" in the wheel rim and by coloring friction materials, layer by layer. Owners' manuals and media advertising would inform the public about the standard.

NHTSA would encourage States who do not pull wheels during Periodic Motor Vehicle Inspection (PMVI) to inspect brakes of vehicles meeting the standard.

The standard would reduce the number of "complete brake jobs" sold because of owner or repair shop unawareness of brake condition. It would reduce accidents due to defective brakes, especially in PMVI States.

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* Net effectiveness by consumer program area itemized in Figure 4
Loss reduction by consumer loss area itemized in Figure 1

Total benefits: About $140 million annually,* assuming no change in States' PMVI procedures.

About $340 million annually if 15 States begin inspecting brake components during PMVI in response to the standard.

Total costs: About $180 million annually.

Time to 90% implementation: Twelve years after initial NPRM, with 50 percent implementation after seven years.

10. Aftermarket brake shoe and pad quality

Description:

A Federal standard would extend existing performance requirements for new vehicle brake shoes and pads to aftermarket shoes and pads.

The standard would directly increase the longevity of aftermarket brakes and reduce frequency of subsequent replacement.

There would also be some safety benefits.

Total benefits: About $300 million annually.*

Total costs: About $30 million annually.

Time to 90% implementation: Five years after initial NPRM, with 50 percent implementation after 3 1/2 years.

11. Long life brake systems

Description:

A Federal standard would require new vehicle manufacturers to install brake systems that comply with a performance test roughly equivalent to 100,000 mile operating life. It appears that the requirement would be met by use of heavier duty components without major design changes.

The standard would likely cut in half expenditures for brake work.

Total benefits: About $2500 million annually.*

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* Net effectiveness by consumer program area itemized in Figure 4
Loss reduction by consumer loss area itemized in Figure 1

Total costs: About $1200 million annually.

Time to 90% implementation: 14 years after initial decision to develop a standard, with 50 percent implementation after nine years.

Implementation problems: Technology not fully developed. Standard would cause dislocation in repair industry, especially reducing demand for labor.

12. Plug-ins for electrical and air-conditioning systems diagnosis

Description:

A Federal standard would require a receptacle to be installed on all new vehicles that would permit diagnosis of electrical and air-conditioning systems faults by a standardized plug-in analyzer.

The standard would reduce unneeded "shot-gun" repairs due to inability to diagnose problems in those systems.

Total benefits: About $90 million annually.*

Total costs: About $37 million annually.

Time to 90% implementation: Twelve years after initial NPRM, with 50 percent implementation after seven years.

Implementation problems: Gives advantage to large volume repair establishments who can easily afford analyzers.

13. Demodularize exhaust system components

Description:

A Federal standard would demodularize new and aftermarket exhaust system component assemblies.** It would require individual components within the assembly to be joined by hardware that can be removed by hand tools and is in standardized locations.*** These joints are currently welded.

The standard would provide the opportunity, in many cases, to avoid the replacement of serviceable components that are joined to faulty ones.

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* Net effectiveness by consumer program area itemized in Figure 4
Loss reduction by consumer loss area itemized in Figure 1

** Consideration should also be given to preventing commonly used male/female joints which use U-Bolt type clamps - these joints often rust together which result in destructive disassembly.

*** Exhaust systems is an example of demodularization. Other examples include bearings and oil pumps.

Total benefits: Perhaps $400 million annually.***

Total costs: Perhaps $150 million annually.

Timé to 90% implementation: Twelve years after initial NPRM, with 50 percent implementation after seven years.

Implementation problem: May be difficult to express in terms of performance requirements.

DIAGNOSTIC INSPECTION
(Remedies 14. - 18.)

Diagnostic centers perform detailed inspections of vehicle components and advise owners what repair are presently needed and what they are likely to cost. The centers perform three types of inspections.

- periodic - a complete inspection (about 1 hour) of all major vehicle components to advise owners of needed repairs and preventive maintenance. Improves owner maintenance practices* and reduces sale of unnecessary repairs due to bad diagnosis,** and package deals.**
- trouble-shooting - a brief inspection to give a specific diagnosis for a problem identified by the owner and to recommend needed repairs. Reduces sale of unnecessary repairs.
- reinspection - after repairs have been performed in response to either of the above, the center determines whether the repairs were properly performed and advises the owner on whether he has been sold unneeded repairs. Improves detection* and resolution** of inadequate repair and possible fraud.

By improving maintenance practices on safety and emission critical systems and detecting faults both before and after repairs, inspection will not only reduce repair costs but also will significantly improve:

- fuel economy
- air quality

Current level of implementation: There are about 500 private diagnostic centers and no permanent public centers. Less than one percent of vehicle owners use them. Private centers have not expanded recently due to lack of profitability. States have had little initiative to start public centers due to high cost and unknown public reaction to mandatory inspection.

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* Highly effective when used

** less effect

*** Net effectiveness by consumer program area itemized in Figure 4
Loss reduction by consumer loss area itemized in Figure 1

14. Mandatory diagnostic inspection in every State

Description:

Federal legislation would require each State to implement an approved diagnostic inspection program as a condition for receiving Federal highway and safety grants. States could operate the centers themselves or contract or license private centers, with quality control by the State. Inspection techniques would follow Federal vehicle-in-use standards. Annual inspection would be mandatory for all cars and for trucks used in personal transportation. Repairs to safety, emissions or fuel-economy critical items that failed the inspection would be mandatory. The vehicle would have to be reinspected subsequent to repairs if it failed any of those items. Repair and reinspection of any other items that failed the inspection would be done at the owner's discretion. Optional trouble-shooting and midyear complete inspection would be available. Mandatory inspections would be paid from State and Federal funds. The cost of optional inspections would be shared by users and the governments. Mandatory inspection would replace existing PMVI.

Summary of Potential Federal Actions;

- Legislation to create the program
- Capital costs (about $200 million per year; more in the early years)
- Definition and enforcement of inspection techniques and vehicle-in-use standards, with research program to support the definitions
- Training program for inspection personnel

Expected participation

- All but perhaps 1 or 2 States would participate
- 95% of vehicle owners would get annual inspection, perform safety or emissions critical repairs and get reinspected.
- 35% of non-safety-critical repairs recommended at the annual inspection will be performed.
- 20% of non-safety-critical repairs recommended at the annual inspection will be reinspected.
- 20% of owners will use trouble-shooting inspection
- 10% will obtain a midyear complete inspection.

Total benefits: About $3300 million annually*

* Net effectiveness by consumer program area itemized in Figure 4
Loss reduction by consumer loss area itemized in Figure 1

Total costs: About $1800 million annually, with funding assumed as follows:

- Federal share - $204 million for all capital costs
- State share - $1485 million for operating costs,* to be raised by State gasoline tax (2¢ per gallon) or vehicle registration fee ($12.50).
- Direct user fees - $127 million, for optional inspections only

Time to full implementation: Six years after enactment of legislation, with 50 percent implementation after 4 1/2 years.

Feasibility assessment: Unlikely, unless there is substantial change in public attitude about auto repair, reasonable financing possibilities, or there is a nationwide mandatory emissions inspection program to which this remedy can be piggybacked.

15. Voluntary or mandatory diagnostic inspection in every State

Description:

Federal legislation would require each State to implement one of three alternative diagnostic inspection programs as a condition for receiving Federal highway and safety grants:

(1) Statewide mandatory program, as in Remedy No. 14.

(2) Establish inspection centers, with purely voluntary participation, in densely populated areas that could generate enough users that at least half of operating cost can be earned from direct user fees.

(3) Mandatory inspection in some regions of the State and voluntary centers in other regions.

Each State would have to obtain Federal approval for their program, based on technical considerations and cost effectiveness. Inspection techniques would follow Federal vehicle-in-use standards. States could operate the centers themselves or contract or license private centers, with quality control by the State.

Voluntary centers would offer periodic, trouble-shooting and reinspection to users for a direct fee. The fee would be set low enough to assure high patronage for efficient operations. Costs not covered by user fees would be reimbused by the Federal government (but only if the subsidy amounts to less than half of total cost). The States would conduct a multimedia campaign to advertise the voluntary centers.

Summary of Potential Federal Actions:

- Legislation that creates the program
- Capital costs (about $50 million per year; more in the earlier years)

* This is the incremental cost of mandatory inspection over existing PMVI

° Operating subsidies and promotional expense (about $80 million per year)

° Monitor costs and revenues of voluntary centers

° Definition and enforcement of inspection techniques and vehicle-in-use standards, with research program to support the definitions

° Training program for inspection personnel

Expected participation

° All States would participate

° Five States would choose a mandatory program

° The others would choose a voluntary program (no State would choose a mixed program)

° In the voluntary States, 2/3 of the population would live in urbanized areas containing inspection centers.

° 15 percent of the owners in such urbanized areas would obtain annual complete inspections.

° 7.5 percent would obtain trouble-shooting and midyear inspections

° 70 percent of inspection customers would return for reinspection after repairs

oo Overall, 20 percent of the nation's vehicles would be inspected

Total benefits: About $830 million annually.*

Total costs: About $510 million annually, with funding assumed as follows:

- ° Federal share - $133 million for all capital costs, plus operating subsidies and promotional expense in the voluntary States.
- ° State share - $141 million for operating costs in the mandatory States,** to be raised by State gasoline tax (2¢ per gallon) or vehicle registration fee ($12.50).
- ° Direct user fees - $237 million, covering 2/3 of cost of voluntary inspections.

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* Net effectiveness by consumer program area itemized in Figure 4
Loss reduction by consumer loss area itemized in Figure 1

** This is the incremental cost of mandatory inspection over existing PMVI

Time to full implementation: Eight years after enactment of legislation, with 50 percent implementation after five years.

Feasibility assessment: Fair; given increasing public concern about fuel economy, emissions and automobile repair costs, enabling legislation may be obtained within the next five years.

16. Voluntary or mandatory diagnostic inspection in some States

Description:

The Federal government would strongly encourage, through grants, loans and technical guidance, States to implement a diagnostic program. The alternative types of programs, that would receive Federal approval, would have funding provisions and technical standards identical to those in Remedy 15, except that no State will be penalized by loss of highway and safety funds for failure to enact a program. Possibly diagnostic inspection could be included with emissions inspections. This remedy could perhaps be implemented under existing legislation with appropriate modifications and an increased appropriation. New legislation, however, may be required.

Summary of Potential Federal Actions:

° Pass new or modify existing legislation and provide needed appropriation.

° Capital costs (about $33 million per year; more in the early years)

° Operating subsidies and promotional expense (about $27 million per year)

° Monitor costs and revenues of voluntary centers

° Definition and enforcement of inspection techniques and vehicle-in-use standards, with research program to support the definitions

° Training program for inspection personnel

Expected participation

° About 20 States would participate

° Five States would choose a mandatory program

° 15 States would choose a voluntary program

° Public participation in the mandatory States would be as in Remedy 14.

° Public participation in the voluntary States would be as in Remedy 15.

oo Overall, 13 percent of the nation's vehicles would be inspected.

Total benefits: About $510 million annually.*

Total costs: About $290 million annually, with funding assumed as follows:

- Federal share - $ 60 million for all capital costs, plus operating subsidies and promotional expense in voluntary States.
- State share - $141 million for operating costs in the mandatory States** to be raised by State gasoline Tax (2¢ per gallon) or vehicle registration fee ($12.50).
- Direct user fees - $ 87 million, covering 2/3 of cost of voluntary inspections.

Time to full implementation: Eleven years after initiating the program, with 50 percent implementation after four years and 75 percent after five years.

Feasibility assessment: Excellent; requirement for Federal funds is not too large and existing legislation may be adequate. Could likely be initiated within two years.

17. Community or private diagnostic centers with Federal support

Description:

The Federal government would strongly encourage community and county governments, auto clubs, business associations, colleges, vocational schools and private concerns to start up and operate diagnostic centers. Encouragement would take the form of guaranteed loans for plant and equipment and subsidies (up to 1/2 of operating cost) as needed to provide a fair and reasonable return to the operator.

The Federal government would identify urbanized areas that could support diagnostic centers. First, community governments would be encouraged to start up mandatory or voluntary programs (similar to those operated by the States in Remedies 14 and 15). In areas where local governments do not get involved, the Federal government will solicit bids for centers directly from the private sector. Eligible bidders must be wholly independent from auto repair facilities. In return for the guaranteed loans and subsidies, the private centers must meet Federal standards on equipment and inspection techniques and be subject to Federal quality control and audit.

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* Net effectiveness by consumer program area itemized in Figure 4
Loss reduction by consumer loss area itemized in Figure 1

** This is the incremental cost of mandatory inspection over existing PMVI

Summary of Potential Federal Actions:

- New legislation probably required
- Capital costs (about $14 million per year; more in the early years)
- Loan guarantees for capital investments by private concerns (one-time guarantee of about $100 million)
- Operating subsidies and promotional expense (about $40 million per year)
- Monitor costs and revenues of voluntary centers
- Definition and enforcement of inspection techniques and vehicle-in-use standards, with research program to support the definition
- Training program for inspection personnel
- Quality control for private centers
- Selection of bidders from the private sector

Expected participation

- Cities and counties with five percent of urbanized population would set up mandatory program.
- Cities and counties with 15 percent of urbanized population would set up voluntary program.
- Private centers established in areas covering 70 percent of urbanized population
- Public participation in mandatory city programs as in Remedy 14.
- Public participation in voluntary city programs as in Remedy 15.
- Public participation in private centers 1/2 as high as voluntary city programs.

oo Overall, eight percent of the nation's vehicles would be inspected.

Total benefits: About $360 million annually.*

Total costs: About $225 million annually, with funding assumed as follows:

- Federal share - $ 64 million for capital costs, defaults on Federally guaranteed loans, operating subsidies and promotional expense.
- Local government share - $ 48 million for operating costs of mandatory inspections,*** to be raised by local gasoline taxes or registration fees.
- Direct user fees - $114 million, covering 2/3 of cost of voluntary inspections.

Time to full implementation: Nine years after enactment of legislation, with 50 percent implementation after six years.

Feasibility assessment: Fair-to-good; cost to the Federal government and public opposition would be relatively low. On the other hand, benefits may be too low to be an incentive in establishing centers by direct Federal recruiting of cities and private concerns.

18. VIMO's - vehicle inspection/maintenance organizations in the private Sector

Description:

A Vehicle Inspection/Maintenance Organization (VIMO) charges participating vehicle owners a flat fee** by the year and thereby takes complete responsibility for all repairs and maintenance needed by the vehicle. The VIMO can also require the owner to bring in his vehicle periodically for complete diagnostic inspection. The VIMO could be a fully equipped repair facility or a primarily diagnostic facility that contracts out heavy repairs.****

The VIMO concept eliminates the motivation for most of the problems currently causing consumer loss. VIMO's take away the profit motive for selling unneeded repairs (due to package deals, or poor diagnosis) because the owner pays the same fee regardless of how many repairs are performed. VIMO's take out of the owners' hands most of the responsibility for decisions on when to perform repairs and preventive maintenance. The VIMO maximizes profits by performing repairs and maintenance at correct intervals. VIMO's would be likely to attract a quality-conscious clientele, so they would be motivated to perform high quality repairs rather than cut corners.

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* Net effectiveness by consumer program area itemized in Figure 4
Loss reduction by consumer loss area itemized in Figure 1

** Fee varies depending on vehicle age, make, model and usage Characteristics

*** This is the incremental cost of mandatory inspection over existing PMVI

**** VIMO's could be established as a cooperative

Summary of Potential Federal Actions:

In this remedy, the Federal government would stimulate the creation of VIMO's in the private sector. The nation would be subdivided into urbanized areas of sufficient size to support one VIMO each. On a competitive basis, one firm will be selected in each area that would conduct part or all of its business on a VIMO basis. The Federal government would guarantee loans needed for plant and equipment and for publicizing the VIMO in local media. The Federal government would take responsibility for losses during the first three years. It would provide information and technial guidance, especially on rate making. It would maintain a data base to assist ratemaking. VIMO's receiving Federal aid would have to follow selected Federal standards on inspection techniques, business practices and reporting. Cost to the Federal government would begin at $10 million per year and decline, levelling off at $2 million per year after five years. The activity could be managed by the Small Business Administration with technical input from NHTSA.

Expected participation

° Urbanized VIMO areas contain 60 percent of national population

° VIMO's will be established in 75 percent of these areas

° 15 percent of cars 3-6 years old, used primarily in-town, will be enrolled in VIMO's.

oo Overall, two percent of the nation's vehicles will be enrolled in VIMO's.

Total benefits: About $320 million annually.*

Total costs: About $200 million annually, almost entirely from the private sector. The cost equals the difference between fees charged to participating owners and actual repair costs had the same repairs been purchased from an ordinary repair facility. It includes profits for the VIMO (above and beyond the normal profits it earns for performing the repairs). Federal funding would be restricted to covering loan defaults and operating losses during the first three years plus maintenance of a repair cost data bank.

Time to full implementation: Seven years after seed funding is provided by modifying existing legislation, with 50 percent implementation after 5 1/2 years. Success of this remedy may permit the VIMO concept to gain further acceptance within the private sector beyond the levels of participation suggested here.

* Net effectiveness by consumer program area itemized in Figure 4
Loss reduction by consumer loss area itemized in Figure 1

Feasibility assessment: Excellent; Federal involvement is limited and temporary. On the other hand, even though implementation of this remedy would be easy, it is not clear whether VIMO's would ever appeal to any but a highly restricted segment of the public.

MODEL CONSUMER COMPLAINT ADMINISTRATION SYSTEM (Remedies 19. - 20.)

The majority of consumer complaints about unnecessary or incompetent repair are never resolved. Many consumers do not know where to go next if they are unable to obtain satisfication directly from the repair facility. In most communities there is no organization with the specific job of receiving automobile repair complaints and helping the consumer obtain prompt remedies.

A model consumer complaint administration system would:

° have excellent public recognition - be "a household word"

° be simple to use - all functions under a single organization

° have adequate staff to analyze validity of complaints

° handle cases promptly

° have the power to assure the problem would be resolved

The Federal government would design packages for model systems under alternative organizational structures and would provide grants for promotional and operating expenses and technical guidance to encourage their implementation in many locations.

In addition to increasing frequency of resolution of unnecessary and inadequate repair, the systems would have a secondary benefit of discouraging possible fraudulent practice.

Current level of implementation: Five States now have consumer complaint procedures resembling Remedy 19. Six metropolitan areas now have private arbitration panels (the approach used in Remedy 20). Better Business Bureaus handle auto repair complaints, among others, in most cities.

19. Consumer complaint administration systems - public management

Description:

A single State agency would be created with responsibility for all facets of complaint administration. It would have a substantial advertising budget. It would have a standard form for complaint reporting and would require repair shops to post availability of the forms. Complaints could also be reported using a toll-free phone number. There would be branch offices in major cities

and travelling investigators for complaints from other areas. An automated file would be maintained. The agency would have authority to submit owners and repair shops to binding arbitration; to require refunds, where justified, by administrative procedure; to assist consumers in obtaining legal remedies, such as instructions for private small claims actions, building a file for class action, or building a case for parens patriae action by the State Attorney General on behalf of the consumer, when administrative procedures, alone, are inadequate; to impose fines for fraudulent practices; to publish a list of establishments fined; and to refer serious cases of fraud for criminal prosecution.

Summary of Potential Federal Actions:

- Federal legislation to fund the program
- Sample legislative/organizational package for the States
- Technical guidance as needed
- Grants of $32 million annually to cover 80 percent of operating and promotional cost

Expected participation: Twenty States would implement the equivalent of a model system in response to the Federal initiative.

Total benefits: About $270 million annually.*

Total costs: About $40 million annually, with funding assumed as follows:

° Federal share	- $32 million grants
° State share	- $8 million matching funds
° Repair industry share	- negligible; fines are a deterrent since they create bad publicity, not a revenue-raising measure
° Direct user payments	- negligible; token fees for filing complaint in some States

Time to full implementation: Seven years after initiating the program, with 50 percent implementation after 4 1/2 years.

Feasibility assessment: Excellent; most States already have endorsed concept of consumer complaint administration; problem lies in creating single agency devoted to auto repairs.

20. Consumer complaint administration systems - private management

Description:

The Federal government would strongly encourage local governments or business organizations to create independent arbitration panels such as "Auto CAPs" in every metropolitan area whose population exceeds 500,000.

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* Net effectiveness by consumer program area itemized in Figure 4
Loss reduction by consumer loss area itemized in Figure 1

The panel would resemble a local Better Business Bureau, but concern itself strictly with auto repair complaints. It would have a substantial advertising budget. It would have a standard complaint reporting form. Complaints could also be phoned in to the panel. It would have the authority (granted by the local government or by mutual agreement of the business community) to investigate complaints and submit owners and repair shops to binding arbitration. A complaint file would be maintained and partially available for public inspection. Government-operated panels might be endowed with further powers, similar to the systems in Remedy 19.

Summary of Potential Federal Actions:

° Federal legislation to fund the program

° Sample legislative/organizational packages and an effort to enroll cities

° Technical guidance as needed

° Grants of $20 million annually to cover 80 percent of costs

Expected participation: Ninety percent of the cities that do not now have Auto CAPs or similar organizations would start a panel before or during the time frame of the program.

Total benefits: About $130 million annually.*

Total costs: About $25 million annually, with funding assumed as follows:

° Federal share	- $20 million
° Local government share	- $ 1 million, where government operates panel.
° Business community share	- $ 4 million
° Direct user payments	- negligible; token payments to process complaints by some panels.

Time to full implementation: Eight years after initiating the program, with 50 percent implementation after 4 1/2 years.

Implementation problem: Role of Federal government in funding business associations.

* Net effectiveness by consumer program area itemized in Figure 4
Loss reduction by consumer loss area itemized in Figure 1

CONSUMER EDUCATION IN AUTO MAINTENANCE
(Remedies 21. - 22.)

A large portion of consumer losses are directly due to owners' improper maintenance practices. Other losses, attributable to repair shops, could have been prevented if the owner had had a better understanding of how vehicle operation and repair needs. Many of the first 20 remedies indirectly attacked the problem of consumers' lack of knowledge by taking decisions out of the owners' hands. The next two directly approach the problem by providing large groups of consumers with basic information on:

- the need for a regular schedule of preventive maintenance of certain component systems
- the disadvantages of overmaintenance, in general, and any preventive replacement of certain component systems
- readily noticeable fault symptoms
- simple troubleshooting
- how to satisfactorily communicate with repair shop personnel
- common fraudulent sales pitches
- useful versus wasteful package deals
- typical repair costs
- actions to take if not satisfied with repair quality
- driving techniques that prolong vehicle life
- using available remedies to advantage

Current level of utilization: Do-it-yourself repair courses are widely available, but less than one percent of vehicle owners have taken them. There are some good books on the above topics, but less than one percent of vehicle owners have read them. A fair number of owners have seen Shell's booklets and educational television commericals.

21. Courses for high school students and adults

Description:

The Federal government would develop detailed syllabi for a basic 30 hour classroom course covering the topics listed above and a more advanced course including shop sessions that would teach simple repairs and provide more detailed information. The Federal government would make a strong effort to

enlist State and community boards of education and private educational systems to include the courses in high school and adult education curricula. Preferably, the basic course would be made mandatory for high school students. The Government Printing Office would also sell the texts to the public for self-teaching, at nominal cost.

Summary of Potential Federal Actions:

- Legislation that provides funding and authorization
- Development and possibly demonstration of syllabi and texts
- Grants of $22 million per year (sharing costs 80-20 with States and communities)
- Training for instructors
- Publish and advertize the texts
- Work with States and localities to advertize the adult courses

Expected participation:

- 15 percent of the nation's vehicle owners will take a course
- Five states will include it in high school curricula statewide

Total benefits: About $250 million annually.*

Total costs: About $30 million annually, with funding assumed as follows:

° Federal share	- $22 million
° State and local government share	- $ 6 million in matching funds
° Direct user payments	- $ 2 million for tuition and texts

Time to 90% implementation: 15 years after program initiation, with 50 percent implementation after 8 years. The very long lead time is expected, of course, because most current vehicle owners finished high school before the remedy was initiated.

Feasibility assessment: Excellent; there is ample precedent for Federal assistance to educational institutions on related subjects; remedy appears quite cost-effective. In addition seven States already require some form of consumer education courses in public schools.

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* Net effectiveness by consumer program areas itemized in Figure 4
Loss reduction by consumer loss area itemized in Figure 1

22. Mass media information campaigns

Description:

Television and radio spots or space in printed media for brief, greatly simplified presentations on

- the need for a regular schedule of preventive maintenance
- readily noticeable fault symptoms
- common fraudulent sales pitches
- actions to take if not satisfied with repair quality
- how to obtain a government publication on these topics

Mailings may also be made to recent purchasers of new cars, in cooperation with State licensing agencies. The program would be organized to reach as many owners as possible and, especially, classes of owners most vulnerable to losses. Would probably require new legislation.

Total benefits: About $100 million annually.*

Total costs: About $30 million annually.

Time to full implementation: Two years after program initiation, with 50 percent implementation after 1 1/2 years.

Feasibility assessment: Very good; if problems that cause large losses are stressed.

* Net effectiveness by consumer program areas itemized in Figure 4
Loss reduction by consumer loss area itemized in Figure 1

APPENDIX C

REPAIR PROCESS AND CONSUMER LOSS SIMULATION MODEL

TABLE OF CONTENTS

APPENDIX C

REPAIR PROCESS AND CONSUMER LOSS SIMULATION MODEL

OBJECTIVES

A method was needed for estimating how much consumers are losing on auto repairs and maintenance. The repair process is a relatively complicated one. There is no single body of data that can be used to calculate total losses. Instead, there are several sources of data, each dealing with one or more stages in the repair process.

A simulation model, which traces jobs and cash flow through the repair process, can be used as a method to calculate consumer losses. At each stage in the simulation, the assumptions on job and cash flow would be based on the data source dealing with that particular stage in the repair process. The model would add up losses created at each stage.

A method was also needed to provide a consistent basis for evaluating the dollar benefits to the consumer of a series of diverse remedy programs. Different remedies interact with the repair process at different points. Moreover, a remedy that directly affects one stage of the process may indirectly result in consumer benefits at later stages. A simulation model provides a uniform basis for estimating dollar benefits of diverse remedies. For each remedy, one modifies the model inputs at the stages of the repair process directly affected. The model then sums up the dollar benefits subsequently created as it traces jobs through the repair process.

The simulation model described here was constructed in response to the dual needs of loss estimation and remedy evaluation. It formed the basis for the calculations presented in this report.

Throughout the work of developing the **model structure, two design guidelines** were kept in mind: (1) all inputs should be **justified by existing data** and could potentially be refined by collecting additional data; (2) that the model inputs can be modified in a natural, straightforword manner to reflect the impact of remedy programs. The model as constructed reflects the guidelines and, as a result, provides an adequate analytic basis for this exploratory study.

of what could be done about repair and maintenance problems. The sensitivity tests, which involved drastic changes in the assumptions used in the model, produced estimates of consumer loss that would not have substantially changed the conclusions of the study.

The appendix concludes with an outline of projects that should be performed on a continuing basis to refine the analyses and to monitor the effects of potential remedy programs. Before proceeding to those projects, however, the National Highway Traffic Safety Administration considers this a propitious time to circulate this preliminary report among representatives of government, industry and consumers. The Agency looks forward to their comments and suggestions.

SIMULATION APPROACH

Description of the repair process

The repair process is a sequential one. A repair transaction can be viewed as passing logically and chronologically through a series of tangible or intangible events. After each event, someone makes a conscious or unconscious decision as to what event will take place next. The owner enters the chain of events with a vehicle that requires some specific repair or maintenance, at a fair and reasonable "valid repair cost." Each subsequent event may or may not add to the initial repair cost and may or may not result in money being wasted by the owner. The owner's car thus proceeds through a series of events and decisions until, at last, it reaches a terminal event: it is either properly fixed or permanently ruined. Upon reaching the terminal event, the consumer pays a bill, possibly higher than the initial "valid repair cost."

An example of the event/decision process is:

Event #1:	Fan belt deteriorates and develops flaws in normal usage (valid diagnosis and repair costs - $6)
Decision #1:	Owner has previously decided on a rather limited preventive maintenance policy. Specifically, he does not obtain periodic checks of fan belt condition and does not become aware of the flaws at this time.
Event #2:	Fan belt breaks while owners is driving his car.
Decision #2:	Owner does not respond to warning light on his dashboard (Maybe he noticed the light but underestimated the severity of the problem or maybe he failed to notice the light.)

Event # 3:	Engine overheats.	
Decision # 3:	Owner does notice a cloud of steam, pulls off the road and seeks assistance.	
Event # 4:	Repair facility provides emergency road service, installs a new fan blet and replaces lost coolant. (Repair bill (including emergency road service) $30)	
Tally:	Total repair expenses	$ 30.00
minus	Valid repair costs	- 6.00
	Wasted, improper owner practices	$ 24.00

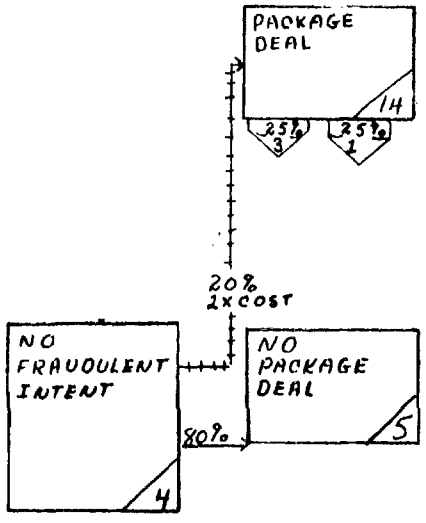
Some events or stages in the repair process stand out. They are the points where large consumer losses may arise if the wrong decisions are made and where tangible remedies can be devised to prevent the wrong decisions. The following stages (questions) are crucial and should be addressed by the simulation model:

- How do owners approach vehicle maintenance? Do they perform preventive maintenance or do they have the component fixed when it fails?
- What happens when owners perform much less maintenance than needed for safe and economical operation? What happens when they perform much more?
- What happens when owners fail to notice a fault in their car before it becomes critical? What happens when a problem is incorrectly diagnosed?
- How often do repair facilities attempt to sell unneeded repairs with possible fraudulent intent? How do owners respond?
- How does the purchase of package deals affect the consumers' pocketbook?
- How often are repairs incorrectly performed? What are the consequences?

Formulation of a model

A structure of 52 events was devised to model the various stages of the repair process discussed above. Event #1, the starting point in the process, represents a vehicle in use whose components are gradually deteriorating. From each event, there may be 0, 1, or, most commonly 2 paths to other events. The "decision" to be made after an event is modelled by specifying the probabilities of the alternative paths. For example, in Figure C-1, there are 2 paths leading away from Event #4 (No Fraudulent Intent): Path #1 leads to Event #5 (No Package Deal). Path #2 leads to Event #14 (Package Deal). Path #1 is taken on 80% of transactions and Path #2 on 20% of them. (Note the numbers 80% and 20% written next to the respective paths on Figure C-1). The two paths, with their associated probabilities, are the way in which the model simulates the "decision" that takes place in the repair process, viz., the (conscious or unconscious) decision by owners and repair facilities to agree on a package deal on 20% of transactions. Note also that when there are 2 paths leading out of one event, there is typically a "bad" path (in the sense that it may lead to increased costs and consumer losses) and a "good" one. In the above example, the decision to employ a package deal is the "bad" path. On the average, it doubles the cost of the job (Note that "2 x cost" is written next to the path on Figure 1). Also it leads to an event (#14, Sale of Package Deal) that, on the average, creates consumer losses (observe the arrowhead with "25%" and "3" in it coming out of Event #14 - it means that 25% of the cash flowing into Event #14 has become a consumer loss and the loss falls into Loss Category #3 - see below).

FIGURE C-1



The primary effect of remedy programs, in the language of the model will be to reduce the probability of taking the "bad" path and increase the probability of taking the "good" path.

Some events do not have 2 exit paths, but rather only 0 to 1. An event without exit paths is a "terminal" event: it symbolizes that the car has been properly fixed or irreparably damaged. When an event has one exit path it means that there is only one event likely to follow it and that no real decision needs to be made as to what comes next.

The flow of the simulation model begins by placing an arbitrary amount of cash in Event #1. The model looks to see if Event #1 creates any consumer losses. If it does, it tallies the loss. Then it finds the alternative exit paths from Event #1. Cash flows from Event #1 to the events that the exit paths from Event #1 point to (this will be explained in detail, below). This completes the processing for Event #1. Next, Events #2 - #52 are similarly processed. Then, the model returns to Event #1 and starts over. It cycles through all the events over and over until no significant amount of cash is flowing through the process any more. At that point, it stops and reports the losses that have been tallied up.

Here, in more detail, is how Event #4 would be processed. (Refer, again, to Figure C-1). Suppose that $10 had flowed into Event #4 since the last time it was processed. Note that 80 percent of transactions proceed from Event #4 to Event #5. Thus, on this cycle, $8 flows into Event #5 from Event #4. Twenty percent of transactions proceed from Event #4 to Event #14 and that their cost becomes, on the average, doubled. Twenty percent of $10 is $2 and double that is $4. Thus, $4 flows into Event #14.

When the model processes Event #14, later on in this cycle, it sees $4 has flowed in. The model notes that 25 percent of this flow - i.e. $1 - is lost to the consumer. It adds the $1 to the losses already accumulated in Loss Category #3 (described below).

The complete model structure of 52 events is depicted as a flow chart in Figure C-2.

Definition of loss categories

In the discussions of the flow of the simulation, it was mentioned that the model not only tallies up all the losses that occur but moreover assigns each loss to one of several alternative defined categories. The assigning was done to provide more information on where the losses are coming from and where remedies might be effective. A total of eight categories were defined, one for valid repair expenses and seven loss categories, as follows:

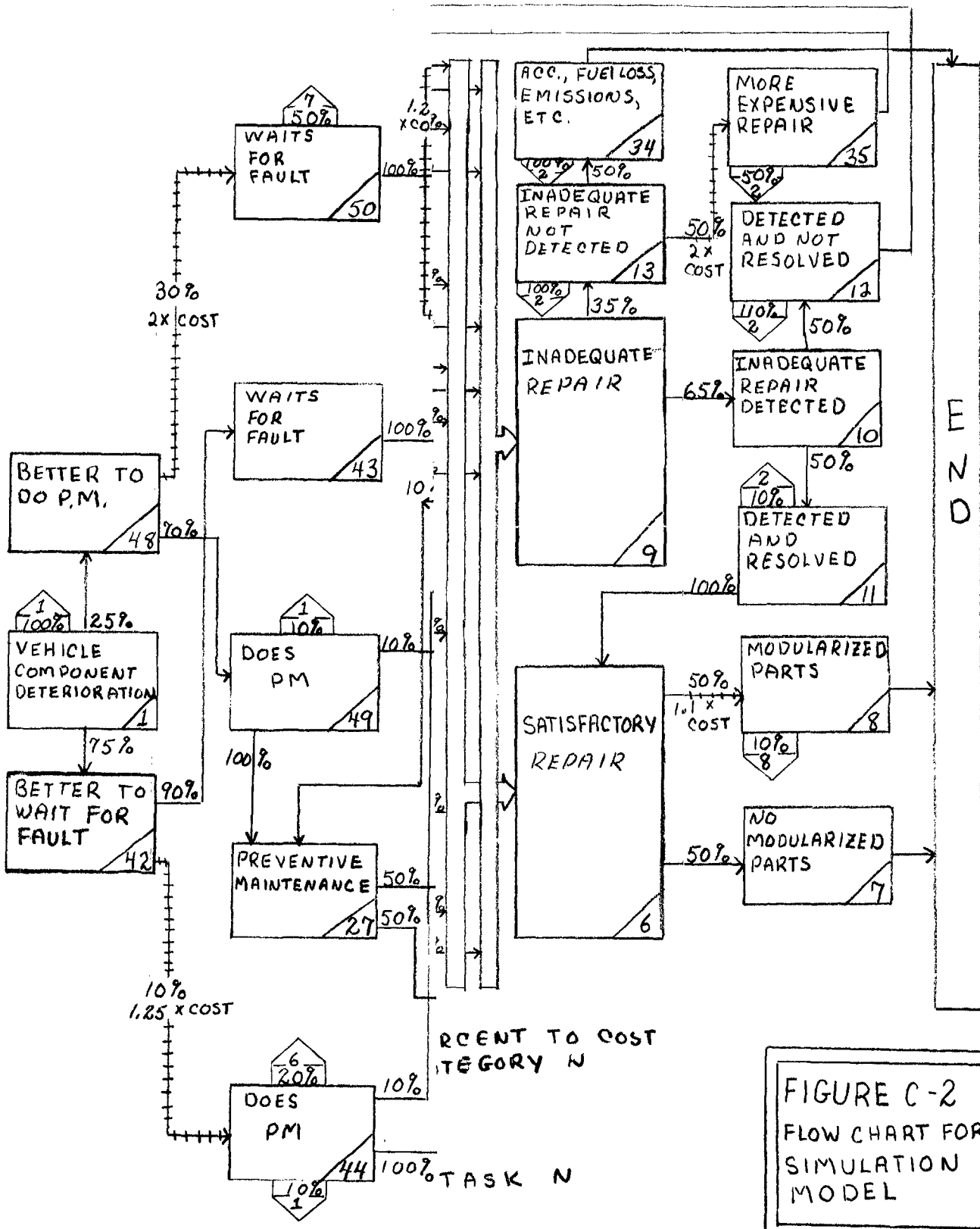


FIGURE C-2
FLOW CHART FOR SIMULATION MODEL

1. Valid Repair Costs - This is the amount that would have been spent nationwide in one year for the repair and maintenance of passenger cars, motorcycles and light trucks used in personal transport under the assumption that (1) owners follow cost-optimal maintenance and repair policies, (2) faults are correctly diagnosed (by owner, diagnostic center or repair facility) and repairs are competently performed by owner or repair facility, (3) vehicle manufacturers design and locate components, within the limitations of current technology, which can be replaced without excessive cost for parts or labor.

2. - 8. Loss Categories Each loss category is assessed the cost difference to the consumer between the actual cost of his repairs as an immediate consequence of the inappropriate action included in that category and the hypothetical cost had that inappropriate action not occurred. Additional losses that are not immediate consequences of the inappropriate action are not assigned to that action. Example: The owner's manual recommends replacing the oil filter once a year (valid maintenance cost - $4). The owner changes the filter four times a year (his maintenance cost - $16). Loss of $12 for the owner's inappropriate action (overmaintenance). Twelve dollars is the difference between his repair cost for four filters and the valid repair cost for one filter.

2. Faulty Repair - Errors made in the actual repair or replacement of components, regardless of the diagnosis that had been made and regardless as to whether the repair in question was appropriate or necessary. An error in repair has taken place if (1) the component causing the fault was found and repaired but the fault remains or (2) new faults in any component are created unintentionally during the repairs. The new faults include those that are immediately apparent and those that cause later losses.

3. Package deals - overrepair - The repair facility knowingly replaces more parts than need to be replaced or uses a more expensive part than would be cost optimal, but the extraneous repairs are related to the minimally needed repairs, are normally performed by repair facilities and have the tacit or active approval of owners and vehicle manufacturers.

   Example: Turning the drums when replacing brake linings.

4. Possible Fraud - The repair facility, with possible fraudulent intent, replaces more parts than need to be replaced or makes charges for such replacement without actually doing the work. The extraneous repairs would not normally be performed by most repair facilities, are not highly related to the actual fault and would not be recommended by vehicle manufacturers or relatively knowledgeable owners.

   Example: Giving a complete engine tune-up when the vehicle has a minor transmission problem. Sell ball-joints because the front wheels move freely when the car is lifted. Charging for new parts but installing used parts.

5. Shotgun repairs - bad diagnosis - (1) Repairing or replacing a number of components possibly related to the actual fault as a consequence of being unable to pinpoint which component actually caused the fault. (2) Performing the wrong repair for this reason. Excluded are package deals performed by mutual consent of owner and seller prior to any attempt to pinpoint the fault.

   Example: Putting in new parts until the car "works."

6. Overmaintenance - Performing routine preventive maintenance tasks at the owner's direction more often than is cost-optimal. Performing preventive replacement of components where it is more cost effective to wait till they are at fault.

   Example: The owner requests oil changes twice as often as recommended by the owners manual. The onwer routinely replaces his shock absorbers every 20,000 miles.

7. Undermaintenance - The net immediate cost consequences of performing routine maintenance at the owner's direction less often than is cost optimal or not at all.

   Example: The owner never gets a new air filter. His additional fuel costs minus the savings of not getting new air filters equal his loss due to undermaintenance.

8. Modularized and non-standard parts - Consumer losses due to excessively expensive replacement parts or labor when the vehicle could have been designed, at little or no additional capital cost and within present technology, to use a less expensive part or one that could be installed for a much lower labor cost. This includes, especially, the replacement of components not causing the fault because the necessary replacement part is a module containing those components.

   Example: Replacement of an entire lamp fixture when the bulb burned out, because it is impossible to buy the bulb alone.

These were felt to be the most important sources of loss that might be directly alleviated by remedy programs without excessive disruption of the repair industry structure. There are other important categories of loss that were not modeled, because it was not clear how Federal programs could directly benefit consumers without undesirable side effects. Two examples are:

Overcharges using flat rate manual: Consumers pay for the number of labor hours listed in the flat rate manual, which could be higher than the labor hours they actually received. The Task Force did not have sufficient information to judge whether or to what degree the flat rate system creates consumer losses.

Excessive prices paid for parts: Some lines of parts have considerably higher prices than others. Some retailers mark up parts more than others. Consumers patronizing those lines or retailers may be spending more than they have to. The extra costs, however, were considered to be "valid repair costs" in the model since price differences are a characteristic of most retail markets.

USING THE MODEL

Estimating current losses

The model structure, as described in the preceding section, simulates the cash flow through various stages of the repair process. The structure consists of a series of events and paths. Some of the events generate consumer losses when cash flows through them. When one runs the model, it sums up those losses. The amount of loss generated by the model depends on the assumptions made about:

(1) What percentage of the cash flowing through an event constitutes consumer loss?

(2) What are the respective probabilities of taking each of the alternative paths after an event?

(3) Does taking a certain path lead to a change in the cost of the job? If so, how much change?

In order to use the model to estimate current losses, one must answer the above questions in a manner that best describes the current repair environment. Given those answers as input and given a total of $50 billion spent annually by consumers on repairs, maintenance and maintenance-related accidents, fuel waste, etc.,* the model provides an estimated distribution of valid expenses and losses as follows:

* In 1978, the annual cost of repairs, maintenance, tires, oil and accessories averages about $380 per vehicle. This estimate is based on two sources: "Cost of Owning and Operating an Automobile, 1976," published by the Federal Highway Administration and "Facilities and Capital Investment for Performing Motor Vehicle Maintenance," published by the Chilton Company. Both sources, when adjusted for inflation, lead to an estimated average of $380 per vehicle in 1978. There are about 124 million passenger cars and trucks used primarily for personal transportation on the road nowadays. When $380 is multiplied by 124 million, one obtains a total of $47 billion spent on repairs and maintenance in 1978. In addition, consumers lose about $6 billion per year on maintenance-related accidents, fuel waste, pollution and premature vehicle retirement. (See discussion elsewhere in this Appendix). When these $6 billion are added to the $47 billion one obtains an estimated total of $53 billion per year of maintenance related consumer expenditures. This has been rounded down to an even $50 billion thoughout the report.

TABLE C-1

ESTIMATED DISTRIBUTION OF CURRENT AUTO REPAIR EXPENDITURES AND CONSUMER LOSSES

Category	$ Millions	% of Total
Valid repair costs	30350	61
1. Faulty repairs	3826	8
2. Package deals	3366	7
3. Unneeded repairs sold with possible fraudulent intent	2324	5
4. Shotgun repairs - bad diagnosis	1239	2
5. Overmaintenance	2128	4
6. Undermaintenance	4534	9
7. Modularized or non-standard parts	2233	4
Total - Consumer losses	19650	39
Total	50000	100

The model inputs used in making this estimate are shown on the system flowchart (Figure C-2).

The assumptions that were made to generate the model inputs are discussed in detail in the "Step-by-Step Model Documentation" which follows this section. The data sources on which the assumptions are based are also described there. Briefly, though, here are some of the most important assumptions that were made about the current repair environment.

- Roughly 20 percent of owners perform considerably more preventive maintenance (about double) than needed for safe, economical operation. Twenty percent of owners perform so little preventive maintenance that they incur serious losses (prematurely ruined cars, more expensive repairs, accidents, etc.). The wide disparties in owner maintenance practices may be inferred from a DOT study of that subject. 1/

- Inadequate maintenance and faulty repairs that go undetected may cause accidents, fuel waste, pollution or premature vehicle retirement. Consumers lose $6 billion a year, as a result. The $6 billion does not inlcude additional losses that occur when deferred maintenance leads to more expensive repairs at a later date. The sources of information on maintenance-related losses were the following: accidents - an AVCO study 2/ based in part on the Indiana accident causation study 3/; fuel waste and pollution - the NHTSA diagnostic demonstration projects 4/; premature vehicle retirement - Sweden's experience with diagnostic inspection 5/.

- It was assumed that attempts to sell unneeded repairs with possible fraudulent intent occur on about five percent of repair transactions. The best source of data on this problem are the "Blue Goose" studies that were conducted in Chicago 6/ and eight other cities 7/ a few years ago. In those studies, what resembled fraud occurred on 15-20 percent of transactions. That range, however, probably should not be taken literally for use in the model, since the Blue Goose studies were performed under conditions that may have encouraged such practices.

1/ J.J. Dunstone et. al., Motor Vehicle Owner Maintenance Practices, DOT HS-801 278, NTIS 1970.

2/ K.P. Joncas et al., Diagnostic Motor Vehicle Inspection Demonstration Projects, Program Engineering Support, Volume 8, DOT HS-802 497, NTIS, 1977.

3/ Tri-Level Study of the Causes of Accidents. Vol. 1 - Research Findings DOT HS-801 334, NTIS, 1974.

4/ J.J. Innes and L.E. Eder, Motor Vehicle Diagnostic Inspection Demonstration Projects, DOT HS-802 760, NTIS, 1977.

5/ Weak Points of Cars, A.B. Svensk Bilproving, 1976.

6/ W. Gaines, M. Anderson and E. Baumann, Articles in the Chicago Tribune, June 20-24, 1976.

7/ Unpublished staff paper, Division of Professional Services, Federal Trade Commission.

- Package deals are performed on approximately 20 percent of transactions. When an owner buys a package deal, his repair bill is, on the average, double what it would have been if he had bought only the repairs he needed. Both these assumptions are based on an analysis of the Alabama diagnostic project data 1/. The analysis showed that nearly 30 percent of repairs purchased by participants were "unnecessary." Most of the unnecessary repairs were part of a package deal. The Missouri Auto Club had similar findings 2/.

- The following assumptions were made about incorrect diagnosis and repair: Ten percent of diagnoses made by repair shops are not fully correct. Five percent of package deal repairs, five percent of preventive maintenance jobs and 10 percent of all other repair jobs are not correctly performed. These assumptions are based on the reinspection failure rate experienced by participants in the five NHTSA diagnostic demonstration projects 3/. (Reinspection failure is an indication that a repair was not fully satisfactory.) In those projects, 13 percent of subsystems repaired failed reinspection. Rates lower than 13 percent were used in the model because, in the projects, vehicles were required to meet rather tight specifications to pass reinspection. Thus some vehicles that failed reinspection may have been, for practical purposes, adequately repaired.

- If they have received faulty repairs, consumers usually seek some form of satisfaction - their money back or the job redone. It was assumed that consumers are successful in obtaining satisfaction 50 percent of the time. This was the finding in a consumer survey published in the Harvard Business Review 4/.

1/ B.J. Schroer et al., "An Evaluation of Component Repair Costs for Auto Check Participants," Report No. 201, University of Alabama at Huntsville, 1977.

2/ D. Ancona, "Vehicle Repairs Following Diagnostic Inspection," Unpublished NHTSA paper, 1977.

3/ J.J. Innes and L.E. Eder, op. cit.

4/ A.R. Andreasen and A. Best, "Consumer Complain -- Does Business Respond?" Harvard Business Review, July-August 1977.

The results shown in Table C-1 must be viewed with a degree of caution, based as they are on a variety of imperfect data sources each of which may contain certain problems of definitions and bias. Existing data were conservatively interpreted (e.g., it was assumed that the overall incidence of possible fraudulent intent was only one-fourth to one-third the rate experienced in Blue Goose studies and the incidence of faulty repair was one-half the reinspection failure rate in the diagnostic projects). It was considered prudent, however, to perform two sensitivity tests with the model: First, the model was run using "lower-bound" assumptions that, for the most part, fell far below what is suggested by the existing data. Then, a higher estimate was made using, in a few places, somewhat more literal interpretations of the data than those employed in the baseline case. Some key inputs for the primary, lower and higher estimates are compared in Table C-2.

TABLE C-2

MODEL INPUTS FOR SENSITIVITY TESTS

Frequency of:	Primary Estimate	Lower Estimate	Higher Estimate
Improper diagnosis	10%	10%	20%
Possible attempted "fraud"	5%	2%	10%
Package deals	20%	10%	20%
Faulty repair	10%	5%	13%
Modularized, non-standard parts	4%	2%	4%
Improper maintenance intervals	20%	10%	20%

When the model was run with the lower inputs, consumer losses were estimated to be $13.4 billion, annuallly. The higher result was $23.3 billion. Table C-3 presents a somewhat more detailed comparison of the primary, lower and higher estimates.

TABLE C-3

RESULTS OF SENSITIVITY TESTS

Category	Repair Expenditures and Consumer Losses in $ Billions: Primary Estimate	Lower Estimate	Upper Estimate
Valid repair costs	30.4	36.6	26.7
1. Faulty repairs	3.8	2.5	4.7
2. Package deals	3.4	2.0	3.4
3. Unneeded repairs sold with possible fraudulent intent	2.3	1.4	4.1
4. Shotgun repairs - bad diagnosis	1.3	1.3	2.3
5. Overmaintenance	2.1	1.6	2.1
6. Undermaintenance	4.5	3.4	4.5
7. Modularized or non-standard parts	2.2	1.2	2.2
Total - Consumer losses	19.6	13.4	23.3
Total	50	50	50

What the "lower estimate" shows is that, even with assumptions about rates of unnecessary and improper repair that are far below what is suggested by existing data, one infers that annual consumer losses exceed $13 billion. Even if consumer losses were only $13.4 billion instead of the nominal $19.6 billion, nearly all of the remedies described in this paper would still be cost-effective and the conclusions of this study would be substantially the same.

Estimating benefits of remedies

The model is used for estimating benefits by employing the following procedure:

1. Estimate how much each of the baseline model inputs would be modified if the remedy were implemented.

2. Run the model with the modified inputs and with valid repair expenses the same as in the baseline case (minus any reduction in valid expenses that can be attributed to the remedy).

3. The model estimates wasted expenses and adds them to the valid expenses, yielding total consumer expenditures after the remedy is implemented.

4. That total is subtracted from $50 billion (the baseline total consumer expenditures) to determine the benefit due to the remedy.

The procedure for entering remedy effectiveness into the model has been simplified. All of the model inputs that would likely be modified by remedies have been grouped into 16 "consumer problem areas." It is required only that an estimate of a remedy's effectiveness against each of those areas be specified. The 16 problem areas are listed in Table C-4. Next to each problem area are listed the numbers of the Events in the model structure that are associated with the problem area, as will be explained below.

A remedy is said to be 10 percent effective against a specific problem area if it reduces by 10 percent the probability of taking the "bad" path after each of the events in the model associated with that problem area. (For example, a remedy 10 percent effective against "instances of faulty repair" would reduce by 10 percent the probability of taking the "bad" path after Event Nos. 5, 14, 21, 36, 37 and 41 in the model. Specifically, the remedy would reduce the rate of improper repair on ordinary jobs from 10 percent to nine percent and the rate of improper repair on package deals and routine maintenance from five percent to 4 1/2 percent.) Thus, the number that is entered to the model corresponds closely to a layman's intuition of what constitutes "remedy effectiveness."

As a result, using the model for estimating the effectiveness of a remedy requires the input of only 17 numbers (many of which are zero, for the typical remedy): The dollar reduction in valid expenses (if any) and the percent effectiveness in alleviating each of the 16 problem areas, respectively.

TABLE C-4

CONSUMER PROBLEM AREAS AND ASSOCIATED REPAIR EVENTS

		Associated repair event numbers in Baseline Model structure
1.	Failure to perform needed preventive maintenance	48
2.	Preventive replacement of a component for which it is better to wait until it fails	42
3.	Failure to detect faults before they become critical	45
4.	Too much time between maintenance work	51
5.	Superfluous maintenance	28, 52
6.	Inadequate diagnosis of the problem	2, 18
7.	Attempts to sell unneeded repairs with possible fraudulent intent	3, 23, 29, 30, 32
8.	Failure to detect possible intended fraud before repairs	15
9.	Failure to detect possible fraud after repairs	16
10.	Work charged for and never performed	17, 19
11.	Failure to resolve possible fraud	38, 39
12.	Package deals which are not in the consumers' interest	4
13.	Instances of faulty repair	5, 14, 21, 36, 37, 41
14.	Failure to detect faulty repair	9
15.	Failure to resolve faulty repair	10
16.	Vehicle design requiring use of modularized or non-standard parts	6

Introduction

The specific assumptions used in estimating current consumer losses are discussed here. The repair process can be logically subdivided into stages such as:

- Owner's approach to maintenance and repair
- Preventive maintenance
- Fault detection and diagnosis
- Sale of unneeded repairs with possible fraudulent intent
- Sale of package deals
- Repair quality
- Vehicle designs that may increase repair cost

Similarly, the model can be subdivided into relatively self-contained routines dealing with each of the stages. The documentation which follows discusses the stages one-by-one. Each subsection starts with general remarks on how the model structure simulates that stage of the repair process and concludes by listing the specific assumptions and the information on which they are based. Each subsection contains a miniature flowchart of the entire model structure in which the relevant blocks have been circled. This will help the reader locate the blocks under discussion in the large-scale flowchart (Figure C-2).

Owner's approach to maintenance and repair

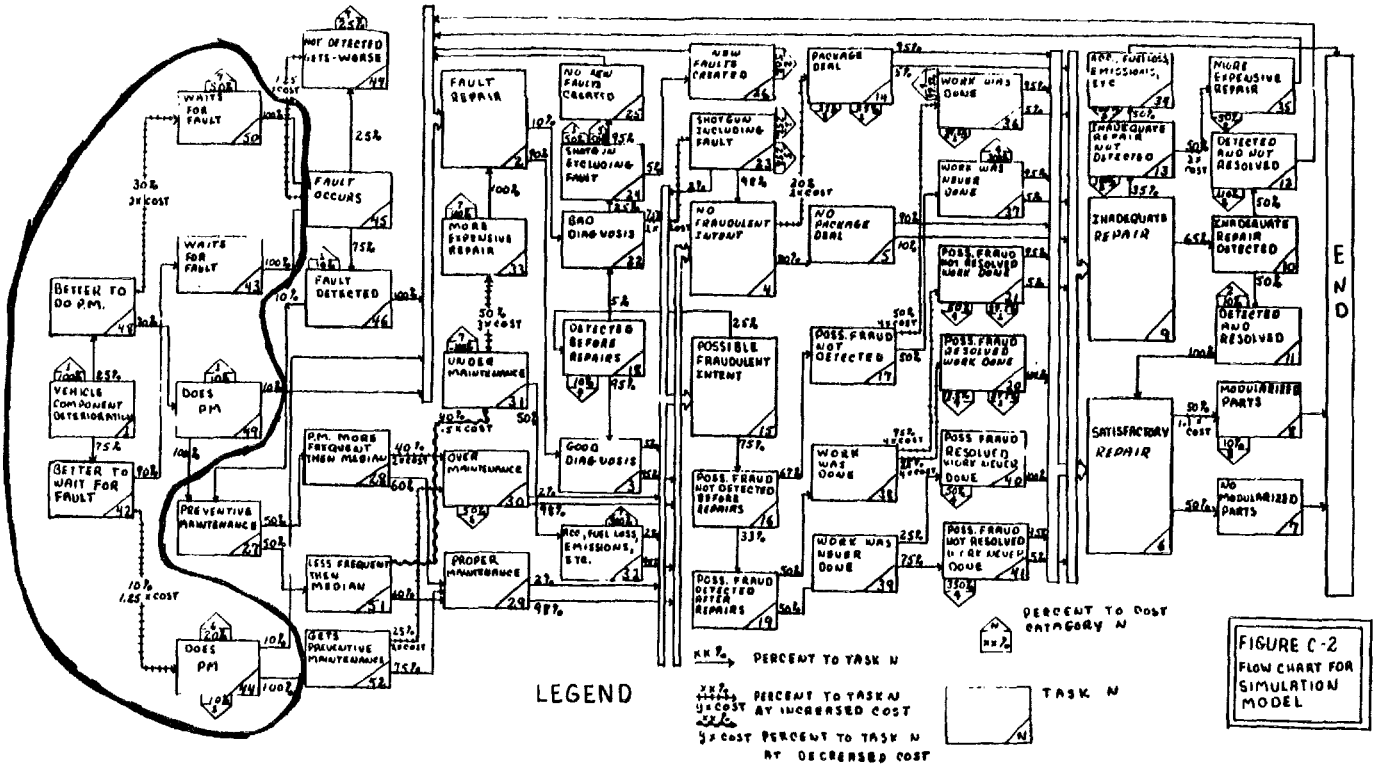


FIGURE C-2
FLOW CHART FOR SIMULATION MODEL

When a vehicle is in use, all of its components are in a process of deterioration. For each component, there is some point along the deterioration continuum which is the optimal time for repair or replacement in the life-cycle cost-benefit sense. There is another point on the continuum where, based on subjective/objective criteria, the component is commonly considered to be "at fault." If the former point comes before the latter, we say "it is better to perform preventive maintenance for that component." Otherwise, we say "it is better to wait until the component is at fault." Many owners, however, make the wrong decision on maintenance/wait-for-fault on at least some of their vehicle's components.

Performing preventive maintenance when it is better to wait for the component to be at fault results in unneeded repair expenditures. Waiting for a fault when a component should be preventively replaced may cause higher repair costs at a later date, on-the-road breakdowns, accidents, fuel waste, etc.

Specifically, it was assumed that:

- Waiting for a fault to occur appears to be more effective than preventive replacement in most cases - i.e. roughly 75 percent of valid repair expense should be for fault repair rather than preventive maintenance. This assumption was based on a system-by-system analysis of the Hunter Job Manual 1/, which lists what consumers are spending on various types of jobs.

- On about 30 percent of the occasions where owners should preferably perform preventive maintenance, they wait for a fault to occur. Vice versa, on 10 percent of occasions where it is better to wait for a fault, serviceable components are replaced. These rates were inferred from the results of a NHTSA survey on maintenance practices 2/, in which owners were asked how they maintain certain key vehicle components.

- Waiting for a fault to occur, when preventive maintenance would have been preferable, leads to repairs and other expenses that, in the long run, are roughly double what the preventive maintenance would have been. This estimate was made by a NHTSA panel that studied the consequences of failing to maintain selected component systems. The increased expenses constitute a consumer loss. The losses are tallied in the category of "undermaintenance."

- Performing preventive maintenance of components for which waiting for a fault would have been preferable, leads to a 25 percent increase in repair dollars spent on those components. The additional cost is a consumer loss categorized as "overmaintenance." The cost increase was calculated under the assumption that the preventive replacement took place when components had an average of 20 percent of their service life remaining.

1/ 1973 Service Job Analysis, Hunter Publ. Co., Chicago 1973.

2/ J.J. Dunstone et. al., Motor Vehicle Owner Maintenance Practices, DOT HS-801 278, NTIS 1970.

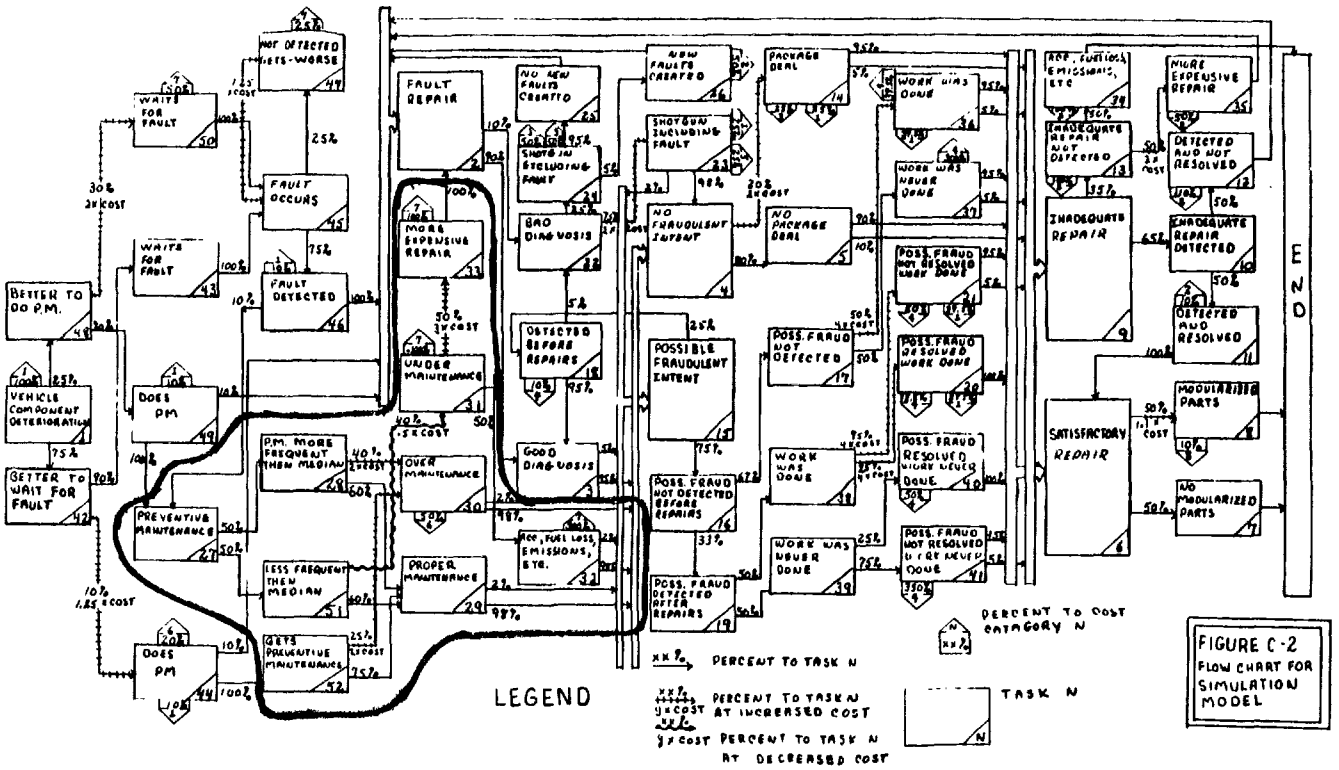


FIGURE C-2
FLOW CHART FOR SIMULATION MODEL

This section of the model deals with these components for which the owner (or the individual who makes the maintenance decisions for the owner) has decided on a policy of preventive replacement. At this point, he must decide on the interval between replacements - i.e. how many thousands of miles or months between maintenance jobs. Theoretically, there is a "best" maintenance interval for each type of component - an interval that provides for safe and efficient operation at minimum cost. Shorter intervals (overmaintenance) mean unneeded repair expenses. Longer ones (undermaintenance) may, in some cases, lead to serious problems and result in more expensive repairs, accidents, prematurely ruined vehicles, etc. It is assumed, in the model, that:

- Roughly 20 percent of owners perform considerably more preventive maintenance (about double) than needed for safe, economical operation. Twenty percent of owners perform so little preventive maintenance that they incur serious losses (prematurely ruined cars, more expensive repairs, accidents, etc.). The wide disparities in owner maintenance practices may be inferred from a DOT study on that subject. 1/

1/ J.J. Dunstone et. al., Motor Vehicle Owner Maintenance Practices, DOT HS-801 278, NTIS, 1970.

- When owners perform preventive maintenance twice as often as needed, they double their repair costs. The added cost constitutes consumer loss, categorized as "overmaintenance."

- When owners perform preventive maintenance half as often as needed, they temporarily halve their repair costs. But they may incur penalties at a later date: insufficient maintenance may result in serious repair problems, accidents, wasted fuel and pollution, or premature vehicle retirement. A NHTSA panel that studied the possible effects of insufficient maintenance of selected component systems estimated that the penalties, on the average, may be three times as large as the savings. The difference between the penalties and the savings constitutes consumer loss and is tallied as "undermaintenance."

The individual assumptions that have been made, so far, about the penalties that may result from insufficient maintenance or from failure to perform any maintenance are, admittedly, somewhat tenuous. But the consumer losses estimated by the model on the basis of these assumptions agree rather well with evidence collected in other studies on losses due to maintenance-related accidents, fuel waste, pollution and premature vehicle retirement. The other studies were the following: accidents - an AVCO study 1/ based in part on the Indiana accident causation study 2/; fuel waste and pollution - the NHTSA diagnostic demonstration projects 3/; premature vehicle retirement - Sweden's experience with diagnostic inspection 4/.

1/ K.P. Joncas et. al., Diagnostic Motor Vehicle Inspection Demonstration Projects, Program Engineering Support, Volume 8, DOT HS-802 497, NTIS, 1977.

2/ Tri-Level Study of the Causes of Accidents. Vol. 1 - Research Findings, DOT HS-801 334, NTIS, 1974.

3/ J.J. Innes and L.E. Eder, Motor Vehicle Diagnostic Inspection Demonstration Projects, DOT HS-802 760, NTIS, 1977.

4/ Weak Points of Cars, A.B. Svensk Bilproving, 1976.

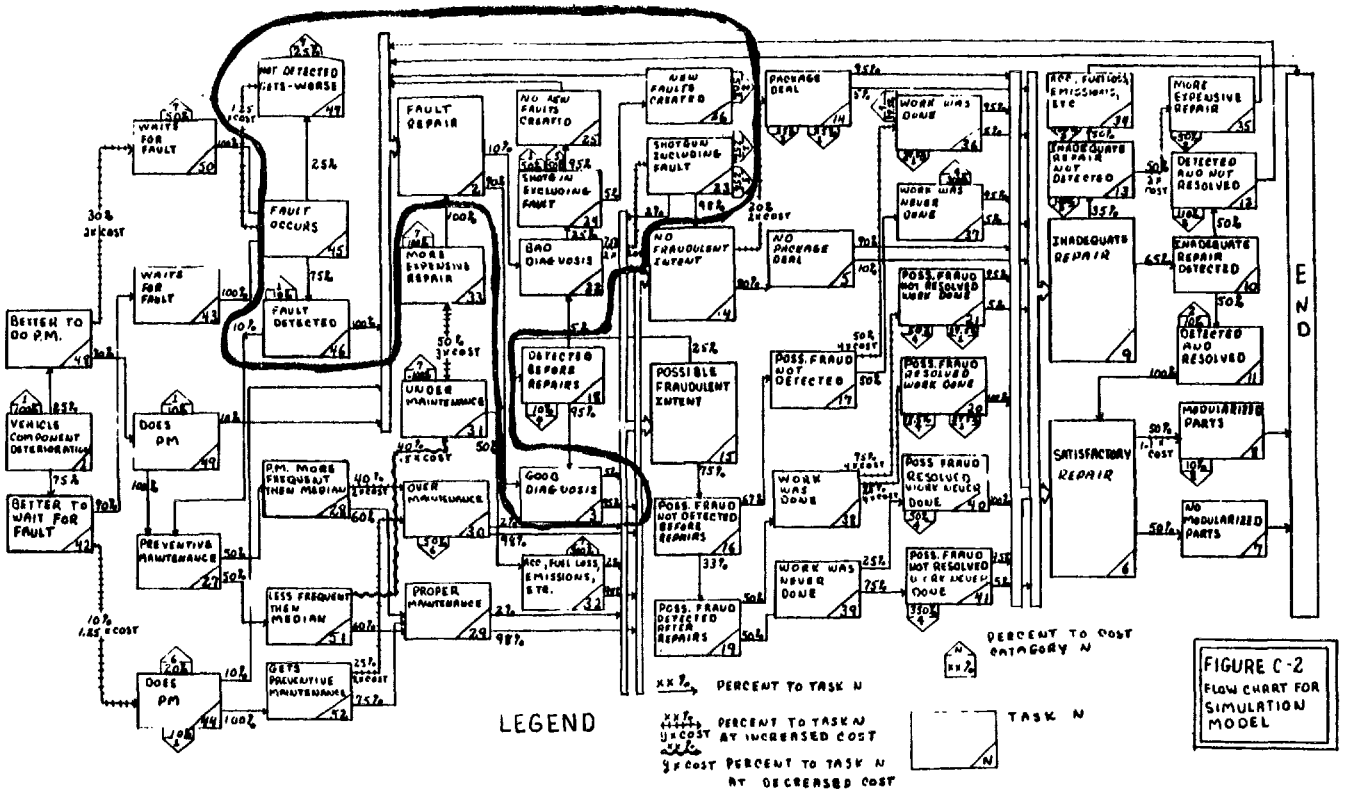


FIGURE C-2
FLOW CHART FOR SIMULATION MODEL

Owners often do not have adequate knowledge of the condition of their car's components - i.e. they may not be aware when certain components are at fault. If a component is at fault and the owner does not notice it, deterioration is likely to continue until a qualitative worsening of the fault takes place. For most components, the worsening of the fault may result in escalated repair costs or other penalties. Worsening of the fault takes place, step by qualitative step, unitl the fault is finally brought to the owner's attention.

After the owner becomes aware of a fault he may bring his car to a repair facility and ask them for a diagnosis of what specific component is at fault. A "bad" diagnosis, operationally speaking, is a decision by the repair facility to repair or replace components not at fault because they did not identify the specific component at fault. Often, bad diagnoses lead to "shotgun repairs," i.e., putting in new parts till the car "works." The repair facility's diagnosis may or may not result in repairing the original fault and their subsequent repair work may or may not result in additional faults being created.

The following specific assumptions were used in the model:

- Approximately 25 percent of faults are not detected by owners in time before they become qualitatively more severe. That rate is inferred from a survey of owners' abilities to perform basic troubleshooting. The survey was a part of NHTSA's study of owner maintenance practices 1/. The assumption used in the model is also supported by another data source: the rate of component system failure of somewhat older cars on the first diagnostic inspection is related to owners' ability to detect faults (this is explained in a report on failure rates by the University of Alabama 2/). That rate was near 25 percent in the five NHTSA diagnostic demonstrations 3/.

- Failure to detect faults before they become worse may result in escalated repair costs or other penalties. A NHTSA panel estimated that the penalty, on the average, is about 25 percent of what the repair would have cost if the fault had been detected in time. The model adds the losses to the "undermaintenance" category.

- Approximately 10 percent of diagnoses by repair facilities are "bad" ones, as operationally defined above. The incidence of improper diagnosis has been assumed roughly equal to the rate of improper repair (See the subsection on "Repair Quality").

- Bad diagnoses typically (it was assumed 75 percent of the time) lead to "shotgun" repairs that include both the needed repair and some unneeded repairs. The assumption that the needed repair is usually performed, even when improperly diagnosed, is based on the results of the control group in the NHTSA diagnostic projects 4/ as well as a review of Blue Goose study results 5/, 6/.

1/ J.J. Dunstone et. al., Motor Vehicle Owner Maintenance Practices, DOT HS-801 278, NTIS 1970.

2/ B.J. Schroer et al., "The Effects of Vehicle Mileage on Component Outage Rates," Report No. 211, University of Alabama at Huntsville, 1978.

3/ J.J. Innes and L.E. Eder, Motor Vehicle Diagnostic Inspection Demonstration Projects, DOT HS-802 760, NTIS, 1977.

4/ See 3/ above.

5/ Unpublished staff paper, Division of Professional Services, FTC, 1977.

6/ W. Gaines, M. Anderson and E. Baumann, Articles in the Chicago Tribune, June 20-24, 1976.

- "Shotgun" repairs that include the needed repair typically result in a repair bill twice as high as it would have been if only the needed repair had been performed. One half the value of the unneeded repairs (i.e., one-fourth the value of the total repair bill) constitutes consumer loss. The above assumptions are identical to the ones made about package deals (See the subsection by that name), which closely resemble "shotgun" repairs. The loss is tallied in the category of "Shotgun repairs - bad diagnosis."

- When the bad diagnosis leads to repairs that do not fix the original fault, the consumer receives a bill for unneeded repairs roughly equal to what he would have paid if only the needed repair had been made. Half of the value of the unneeded repairs consitutes consumer loss. The owner still has a faulty car. Moreover, in 5 percent of the cases, additional faults may have been created as a result of improper performance of the unneeded repairs. (5 percent is the faulty repair rate assumed for package deals, which resemble shotgun repairs).

Sale of unneeded repairs with possible fraudulent intent

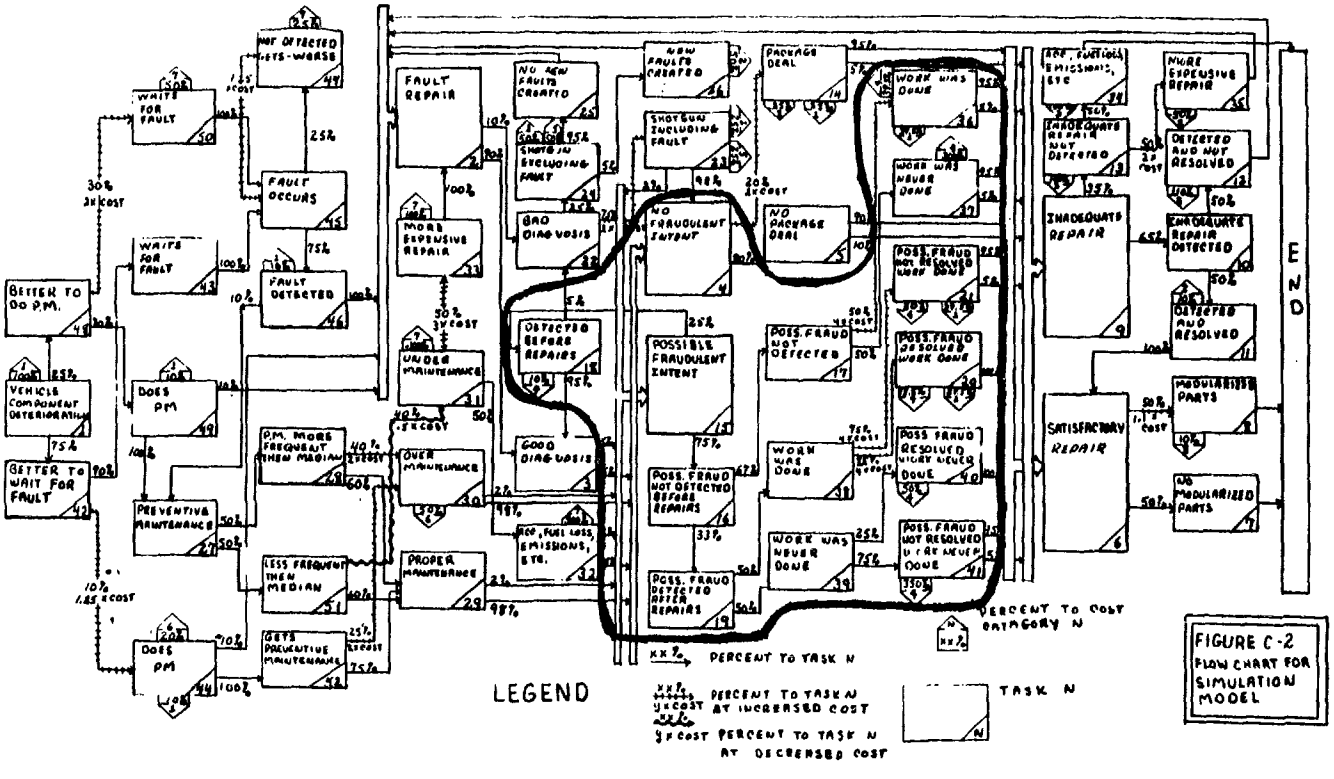


FIGURE C-2
FLOW CHART FOR SIMULATION MODEL

This subsection deals with cases in which: (1) a repair facility sells more work than is actually necessary or makes charges for such work without actually performing it; and (2) the extraneous work would not be normally performed by most repair facilities, is not highly related to the actual fault and would not be recommended by vehicle manufacturers or relatively knowledgeable owners. It does not deal with cases of unnecessary repairs sold as part of a common type of package deal, or as a result of improper diagnosis, or because the owner asked for maintenance he didn't really need.

If the owner quickly detects that he is being sold unneeded work, he may refuse to authorize the repairs and avoid significant losses. If he detects the unneeded sales only after work has been authorized or performed, he will find it much harder to avoid losses since, in many cases, it is difficult to provide evidence that work was unneeded and/or not performed.

In the model, it was assumed that:

- Sale of unneeded repairs with possible fraudulent intent occurs on about five percent of repair transactions. The best source of data on this problem are the "Blue Goose" studies that were conducted in Chicago 1/ and eight other cities 2/ a few years ago. In those studies, what appeared to be fraud occurred on 15-20 percent of transactions. That range, however, probably should not be taken literally for use in the model, since the Blue Goose studies were performed under conditions that may have encouraged fraud.

- Sale of unneeded repairs with possible fraudulent intent occurs on about two percent of preventive maintenance transactions. When an owner brings his car in for specific maintenance work, rather than for the repair of some fault whose cause he might not understand, he would be less likely to authorize extraneous repairs.

- About 50 percent of owners detect that they are being sold unneeded work. This estimate was made on the basis of a survey of owner understanding of vehicle repair needs, conducted as part of a NHTSA study on owner maintenance practice 3/. Only half of these owners detect the problem before they have authorized the repairs. This assumption was made because most States do not require shops to provide clear, binding written estimates of repair costs 4/. Without them, the sale of unneeded repairs may not be evident until the time comes to pay the bill.

1/ W. Gaines, M. Anderson and E. Baumann, Articles in the Chicago Tribune, June 20-24, 1976.

2/ Unpublished staff paper, Division of Professional Services, FTC, 1977.

3/ J.J. Dunstone et. al., Motor Vehicle Owner Maintenance Practices, DOT HS-801 278, NTIS 1970.

4/ Legislation Regulating Auto Repair, The National Association of Attorneys General, Raleigh, 1976.

- An owner who detects the sale of unneeded work before he authorizes repairs suffers no loss except a "nuisance" cost of 10 percent of the value of the work he really needs. This "nuisance" cost ($5-$10 for a typical job) covers, for example, the time required for him to take his car to an alternate shop that does not attempt to sell him unneeded repairs.

The remaining assumptions deal with cases where the owner did not detect the sale of unneeded work before he authorized repairs:

- In half of these cases, the repair facility did not actually perform the unneeded work that they charged for. This is what happened in the Blue Goose studies conducted in eight cities 1/.

- The owner receives a repair bill four times as high as it would have been if he had only been charged for needed repairs. This assumption is based on an analysis of the Chicago Blue Goose study 2/. In Chicago, the repair bills in cases of apparent fraud averaged roughly double the bills in cases of package deals or "shotgun" repairs. Package deals in turn, cost twice as much, on the average as needed repairs (See the next subsection).

- If the owner never detects that he was sold unneeded repairs, a substantial part of the bill he pays represents consumer loss. If the unneeded repairs were paid for but not actually performed, their entire cost i.e., 75 percent of the bill (since 25 percent of the bill covers needed repairs), is lost. If they were performed, half their cost, i.e., 37.5 percent of the bill, is lost. The latter estimate is based on the assumption that the unnecessarily replaced parts still had half their lifetime remaining. The loss is classified under "unneeded repairs sold with possible fraudulent intent."

- If the owner did detect that he was sold unneeded repairs, he presumably seeks some form of satisfaction - e.g. a refund for the repairs he didn't need. It was assumed that consumers are successful in obtaining satisfaction in 25 percent of these cases. This is half the rate of consumer satisfaction in resolving faulty repair (See "Repair Quality"). It is much easier to prove repairs were faulty then to shown they were unneeded or never performed.

1/ Unpublished staff paper, Division of Professional Services, FTC, 1977.
2/ W. Gaines, M. Anderson and E. Baumann, Articles in the Chicago Tribune, June 20-24,1976.

- If the owner did obtain the satisfaction he sought, his only loss is a "nuisance" cost of 50 percent of the value of the work he originally needed. This nuisance cost ($25-50 for a typical job) covers the time lost in trips to the repair shop and other inconveniences sometimes associated with these cases.

- If the owner did not obtain the satisfaction he sought he loses <u>both</u> the nuisance cost and the losses he would have incurred if he had not detected the sale of unneeded repairs.

Sale of package deals

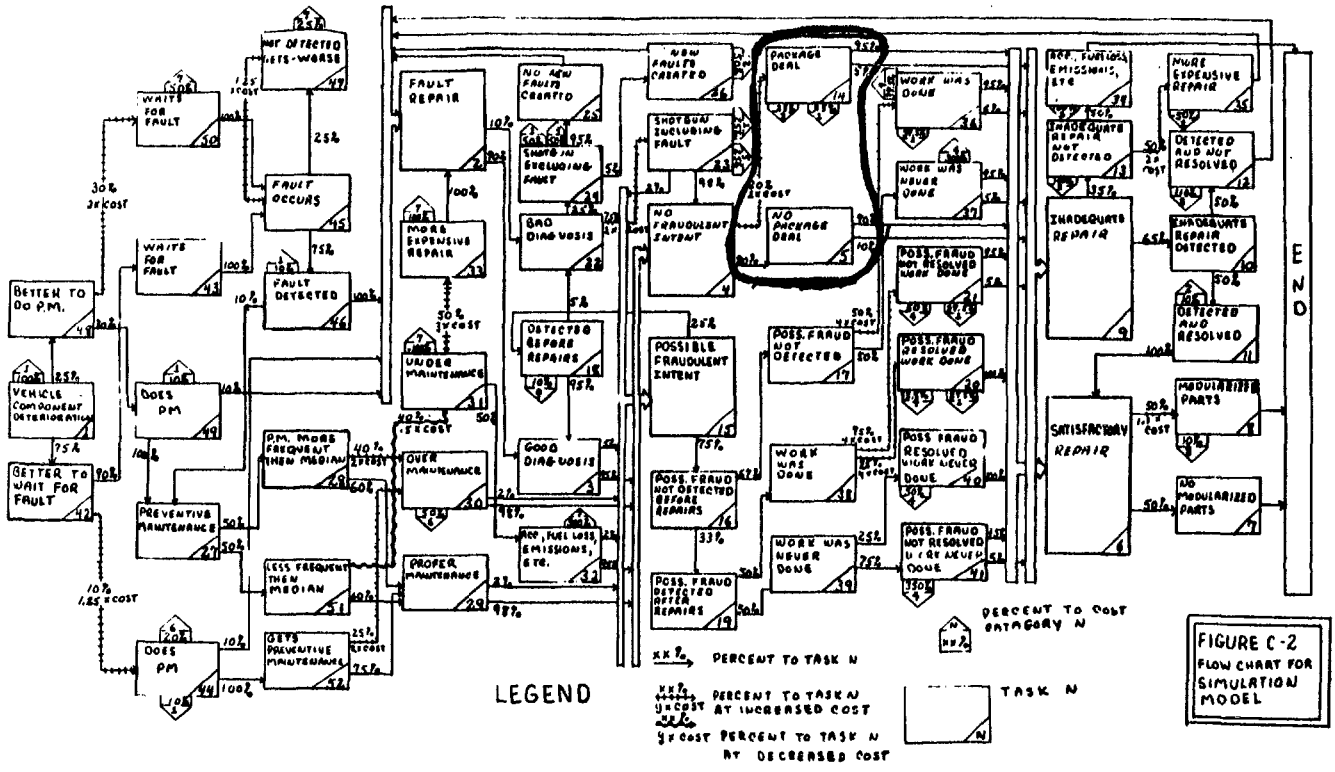


FIGURE C-2
FLOW CHART FOR SIMULATION MODEL

The repair facility knowingly replaced more parts than, strictly speaking, need to be replaced. The extraneous repairs, however, are related to the minimally needed repairs, are normally performed by repair facilities and have the tacit or active approval of owners and vehicle manufacturers.

Package deals are generally convenient for the consumer and easy for the repair facility to perform and, in some cases, may save the consumer some money. But in many cases (especially "complete" brake jobs, front-end jobs and tune ups) they can result in substantial consumer losses.

Specifically, it was assumed that:

- Package deals are performed on approximately 20 percent of transactions. When an owner buys a package deal, his repair bill is, on the average, double what it would have been if he had bought only the repairs he needed. Both these assumptions are based on an analysis of the Alabama diagnostic project data 1/. The analysis showed that nearly 30 percent of repairs purchased by participants were "unnecessary." Most of the unnecessary repairs were part of a package deal. The Missouri Auto Club had similar findings 2/.

- On the average, about one fourth of the value of the resultant repair bill constitutes consumer loss. This is based on the assumption that the parts unnecessarily replaced (which account for half of the bill), on the average, still had half of their recommended service life remaining.

Repair quality

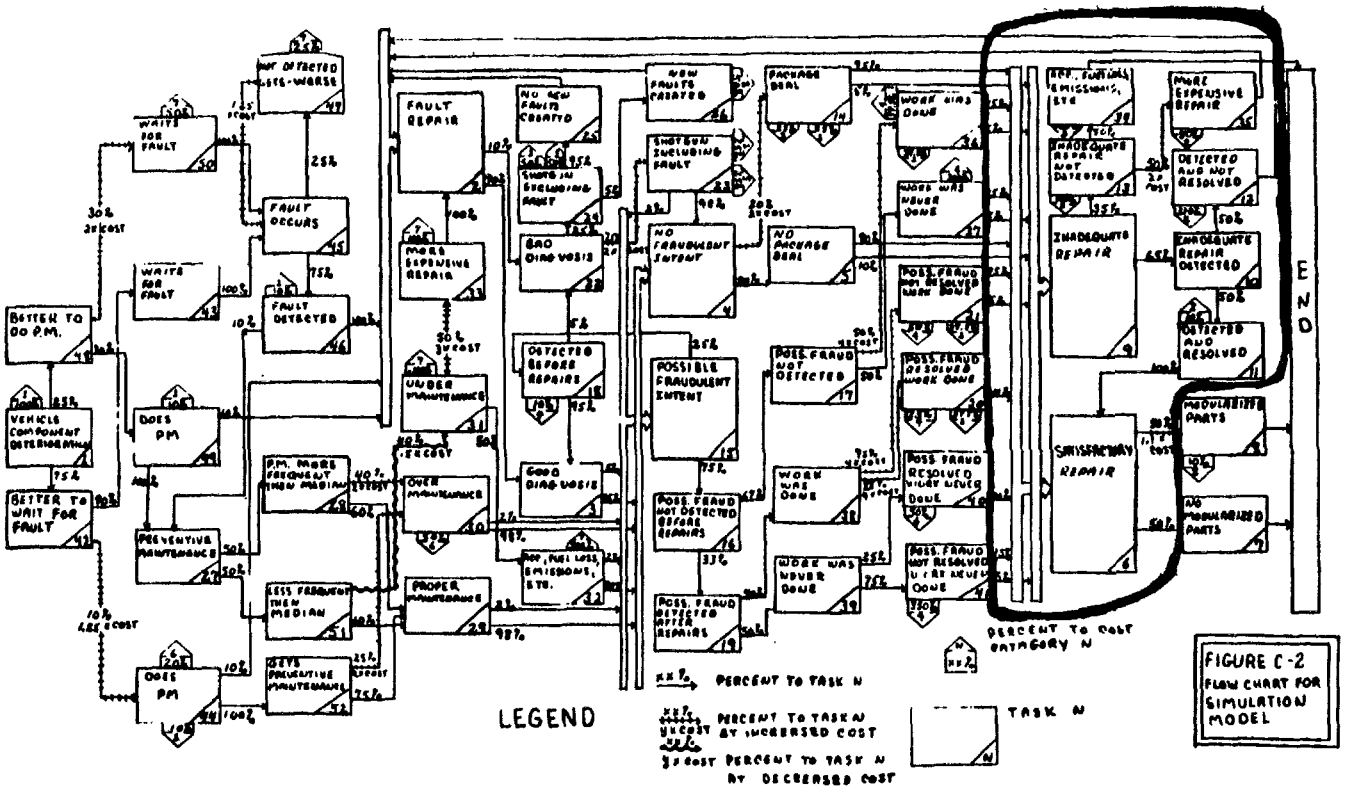


FIGURE C-2
FLOW CHART FOR SIMULATION MODEL

1/ B.J. Schroer et al., "An Evaluation of Component Repair Costs for Auto Check Participants," Report No. 201, University of Alabama at Huntsville, 1977.

2/ D. Ancona, "Vehicle Repairs Following Diagnostic Inspection," Unpublished paper, Office of State Vehicle Programs, NHTSA, 1977.

A repair job is said to have been of "inadequate quality" only if errors were made in the actual repairs performed. An error in repair has taken place if (1) the component causing the fault was found and repaired but the fault remains or (2) new faults are created. In assessing the quality of a repair, it is irrelevant whether that repair was necessary or whether a good diagnosis had preceded the repairs.

An inadequate repair is said to have been "detected" if at any time after the repair facility states it has completed the repair, someone brings to the owner's attention that the car is at fault, and the fault is the one that was present after the inadequate repair.

An owner who fails to detect that a repair was inadequate is in the same position as one who fails to detect that his car is at fault. The faults remaining in his car as a result of the inadequate repair are likely to become qualitatively worse until the owner does detect them. As a result of the faults, he may incur losses such as higher repair costs at a later date, accidents, fuel waste, etc.

An inadequate repair is said to have been "resolved" if the owner succeeds, for instance, in getting the repair facility that originally performed the repairs on his car redo or correct that portion of the repairs which were faulty at no significant out-of-pocket cost to him. Another acceptable resolution would be for the shop to refund the charge for the repairs not properly performed. Resolution is obtained, in some cases, solely at the owner's initiative; in others, the owner is assisted by a public or private consumer protection organization.

In the model, it was assumed that:

- Approximately five percent of package deal repairs, five percent of preventive maintenance jobs and 10 percent of all other repair jobs are not correctly performed. These assumptions are based on the reinspection failure rate experienced by participants in the five NHTSA diagnostic demonstration projects 1/. (Reinspection failure is an indication that a repair was not fully satisfactory.) In those projects, 13 percent of subsystems repaired failed reinspection. Rates lower than 13 percent were used in the model because, in the projects, vehicles were required to meet rather tight specifications to pass reinspection. Thus some vehicles that failed reinspection may have been, for practical purposes, adequately repaired.

1/ J.J. Innes and L.E. Eder, Motor Vehicle Diagnostic Inspection Demonstration Projects, DOT HS-802 760, NTIS, 1977.

- About 35 percent of faulty repairs go undetected. It was explained elsewhere that owners fail to detect 25 percent of the faults that develop with ordinary vehicle usage (See "Fault Detection and Diagnosis"). The latter include some rather obvious faults that would be unlikely to escape the owner's attention. Here, however, one would assume that the repair shop would generally not return a vehicle with obvious faults to the owner. The types of faults remaining after inadequate repair, then, would be on the average harder to detect than the faults created in ordinary vehicle usage.

- When an owner fails to detect that repairs are faulty, he may suffer substantial losses. First, the money he has spent repairing the car is lost, since the repairs were not successful. Additionally, the penalties he may incur are estimated, on the average to be roughly equal to what he spent on the repairs. The latter assumption is the same as was made in the case of the owner who waits for the failure of a component that ought to have been preventively replaced (See "Owner's Approach to Maintenance and Repair.") All losses are tallied under the category of "Faulty Repairs."

- When an owner does detect that repairs were faulty, his attempts to resolve the problem are successful 50 percent of the time. This was the finding in a consumer survey published in the Harvard Business Review 1/.

- If the owner does obtain successful resolution, his only loss is a "nuisance cost" estimated to be about 10 percent of his repair bill (about $5-10) for the value of his time used when he brings his car back to the repair shop to correct the faulty repair.

- If he does not obtain successful resolution, he has lost both what he paid for the unsuccessful repair and a nuisance cost for his attempt to rectify it. His car is still at fault and, essentially, he must reenter the repair process.

1/ A.R. Andreasen and A. Best, "Consumers Complain -- Does Business Respond?" Harvard Business Review, July-August 1977.

Vehicle designs that may increase repair costs

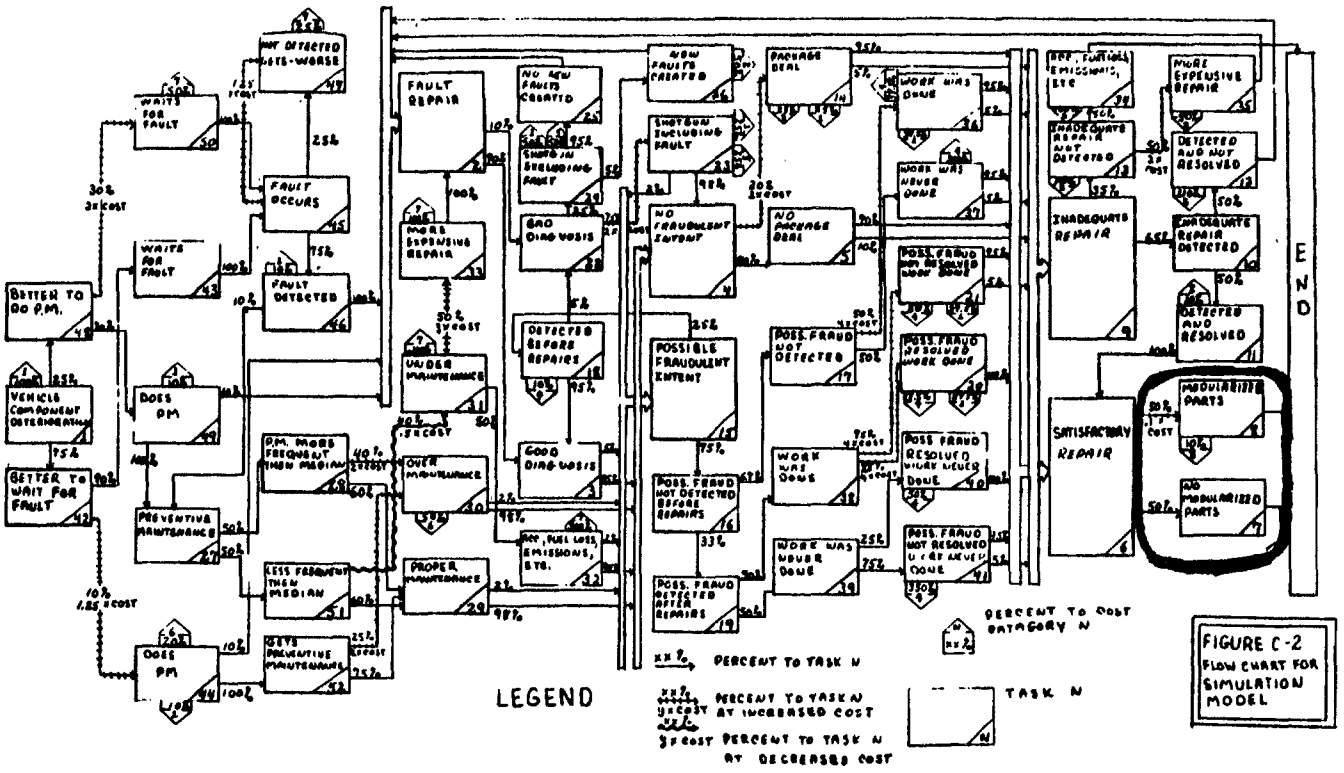


FIGURE C-2
FLOW CHART FOR SIMULATION MODEL

This subsection addresses problems of excessively expensive replacement parts or repair techniques which could have been avoided by vehicle design modifications possible within present technology and with minimal retooling. It is not easy to define what constitutes "excessive" expenses or "minimal" retooling but there are evidently possibilities for vehicle and component redesign whose resultant savings in repair expense would easily offset increase in initial vehicle cost or other disadvantages. NHTSA invites comments from readers on this topic. Specifically, it was assumed that:

- A reduction of perhaps 4-5 percent in the nation's repair bill can be achieved by cost-effective and relatively simple redesign of vehicles and component systems. That rather tentative conclusion is based on a study performed in the context of vehicle repairability ratings. 1/

1/ L. Emery, "The Role of Vehicle Design in Maintenance and Repair," Unpublished paper, Office of Passenger Vehicle Research, NHTSA, 1977.

A PLAN FOR BETTER DATA ON REPAIR AND MAINTENANCE

The Need

But if any remedy program is seriously contemplated, it is critical that it be accompanied by the establishment of a well-planned on-going data system on auto repairs. Without consistent year-to-year estimates of loss, one cannot determine if the program is achieving its goals. Without consistent comparisons of losses by persons using and not using a specific remedy, it would be impossible to sort out the effective remedies from the ineffective ones.

The model structure was designed in a manner so that each assumption, each number that is entered, could likely be derived from hard data - from data collected by techniques already shown feasible. Listed below are studies needed to document the model's assumptions. If all of the listed studies are undertaken, they will, between them, yield each of the numbers that must be entered in the model. If they are undertaken on a continuous, year-to-year basis with a consistent approach, they will yield year-to-year trends of loss. If the data are collected on a nationally representative sampling basis, including States and communities that have and have not implemented various remedies, it will provide a chance of singling out the effectiveness of specific remedies.

Plan for data system

Six broad groups of study techniques would tentatively be included in the system:

Owner surveys would be used to obtain information in three general areas. First, owners would be asked how they make maintenance/repair decisions on specific vehicle components and how frequently, if at all, they perform preventive maintenance on various components. Next, owners' knowledge would be tested: an owner's ability to detect that his car is at fault would be tested by showing him videotapes (with sound track) of vehicles that appear to have possible malfunctions and asking him, in each case, what he would do if it were his vehicle. (There would be included cases of vehicles that do not actually need repairs). He would be tested on his ability to detect possible fraudulent intent by repair shops to sell unneeded work: he would be shown videotapes of common sales pitches (some of which are, in fact, entirely reasonable and others not) and asked to identify which ones are attempts to sell unneeded work. Third, owners would be asked if they felt they had recently obtained faulty or unneeded repairs, if they had made any attempts to obtain some form of compensation for the improper work, and whether the attempts were successful or not. There would be a strong effort to obtain an unbiased sample for the surveys: appropriate incentives would be used to encourage participation by a high percentage of the owners initially selected for inclusion in the sample.

Vehicle tracking would be conducted on a continuous basis for a nationally representative sample of owners. Owners would maintain diary records of faults detected and work performed on their cars. They would retain repair receipts. Their cars would be diagnostically inspected at appropriate times (especially before and after major repairs). In order that this effort provide unbiased results, it would be desirable that owners not be informed of the inspection results except when failure to do so might endanger their safety. (A sample of owners that have been provided with diagnostic information to help them decide what repairs they need is hardly representative.) Owners would also be debriefed on why they purchased various repairs and whether they thought the repairs were satisfactory. The diary records, repair receipts, inspection results and debriefing results would be analyzed to determine the incidence of faulty repair and the frequency of various types of unneeded repair, especially package deals and "shotgun" repairs due to inadequate diagnosis of the problem. The survey would be conducted using techniques that minimize inconvenience to participants and a strong incentive would be offered to encourage participation by owners selected for inclusion in the sample.

Realistic "Blue Goose" studies would supplement the vehicle tracking surveys for the purpose of estimating incidence of unneeded repairs, especially ones that may have been sold with possible fraudulent intent. In the traditional Blue Goose study, vehicles with contrived defects are brought to repair shops under circumstances that seem to stimulate the sale of unneeded repairs. It is doubtful whether this provides an unbiased estimate of the size of the problem. By contrast, in the proposed studies, pre-inspected vehicles in their natural condition would be brought in by owners under normal circumstances. The studies would include an attempt to determine how often owners are charged for work that is not actually performed. There would be appropriate incentives to encourage participation by owners.

Life-cycle studies of component deterioration would provide information on the effects of alternative maintenance policies on repair costs, fuel consumption and vehicle life expectancy. The vehicle tracking studies, alone, would not provide adequate information on these important topics. (It would not be possible to enroll volunteer participants for the lifetime of their vehicles, nor would it be possible to control their maintenance policies.) In one of the proposed studies, selected large vehicle fleets would be used. A fleet would be randomly subdivided into groups. Different maintenance policies would be applied to different groups. The life-cycle costs would be compared. In other possible studies, vehicles sujected to various maintenance policies would be operated on test tracks that simulate normal usage or component systems might be tested with laboratory devices that simulate usage.

Studies of vehicle design would be conducted to determine, in specific instances, the savings of labor or parts cost that could potentially be achieved by relocating component systems, demodularizing assemblies, standardizing parts and, generally, designing systems for repairability. The capital and manufacturing costs of such modifications would be estimated. The survey would be conducted each year on the latest models.

Baseline information on consumers' repair expenditures would be collected on a continuing basis. The information is needed to support all of the above studies. Frequency and cost of repair jobs would be collected by component and by vehicle make and model. This effort would, to a large extent, draw on existing on-going systems such as the Hunter job manual 1/ and the Chilton flat rate books 2/.

1/ Service Job Analysis, Hunter Publishing Company, Chicago, annual publication.

2/ Chilton's Labor Guide and Parts Manual, Chilton Company, Philadelphia, annual publication.

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