FEDERAL TRADE COMMISSION

AUTOMOBILE FUEL ECONOMY CLAIMS

Notice of Public Hearing and Opportunity to Submit Data, Views, or Arguments Concerning Rulemaking Proceeding
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AUTOMOBILE FUEL ECONOMY CLAIMS

Notice of Public Hearing and Opportunity To Submit Data, Views or Arguments Concerning

The Federal Trade Commission, pursuant to the Federal Trade Commission Act, 15 U.S.C. 41 et seq., and the provisions of Part I, Subpart B of the Commission's procedures and Rules of Practice, 16 CFR, Parts 2, 3, and Section 553 of Subchapter II, Chapter 5, Title 5, U.S. Code (Administrative Procedure) hereby serves notice that it is initiating a rulemaking proceeding to consider the feasibility of developing a Trade Regulation Rule pertaining to the advertising and promotion of automobile fuel economy in interstate commerce.

This rulemaking proceeding is being initiated by the Commission after preliminary investigation by the Commission's staff into advertising and testing practices presently engaged in by the automobile industry. To describe the course of the investigation, Consumers Union filed a petition requesting a Trade Regulation Rule prescribing a uniform automobile test for new cars.

A. The importance of fuel economy information. Fifty-five percent of all energy consumed in this country by the transportation sector in 1970 was consumed by automobiles. The cost of this consumption is primarily borne by the consuming public in its purchases of gasoline. Shortages of the winter of 1972-1973 and the ensuing substantial rise in the cost of gasoline have made the level of gasoline consumption a critical issue for the American public, both in terms of the cost of obtaining gasoline for individual consumers and in terms of the cost to society of the depletion of the nation's resources.

In order for consumers to be able to distinguish among competing cars on the basis of fuel economy, they need adequate information. Traditionally, assumptions or "rules of thumb" about fuel economy are not a substitute for relevant and comparable numerical information with respect to fuel economy. For example, the apparent size of a car is not, contrary to public misconception, the best determinant of fuel economy; rather weight is more important, and weight cannot be visually measured. Also, the consumer cannot rely on previous experience even with small cars to determine fuel economy because the weights of small cars have been increasing steadily in the last few years. Some "small" cars popularly called compacts actually weigh as much as cars that are commonly referred to as "intermediate"
or "standard" due to the addition of heavy optional equipment such as eight cylinder engines, air conditioning, etc.

It is also becoming more difficult to purchase the smaller cars without heavy, gas-consuming, optional equipment, so that even the smallest car is becoming less efficient. The consumer who buys a "small" car strictly on apparent size, expecting "small" car fuel economy may not have his expectations fulfilled.

Prior to 1974, advertising was the principal source of information regarding fuel economy, and this consisted of a few general claims. In August 1973, the U.S. Environmental Protection Agency (hereinafter referred to as "EPA") in cooperation with most manufacturers and importers, announced a voluntary fuel economy labeling program. Co-operating companies (which included most but not all companies) agreed to post labels on their cars which displayed a range of expected fuel economy, indicated by EPA for each of the cars to which the specific car being sold belonged. For the first time the consumer was exposed to information derived from a uniform test as to the relative fuel economies of the various models of cars. Thus the consumer was provided with a rough yardstick for comparing the performance of various classes of cars in making his purchase decision.

Labeling, however, even if present on all cars (which is not the case), and even if a source of specific fuel economy information which is also not the case), cannot cure general deficiencies in the advertising of fuel economy. Claims concerning fuel economy have now emerged as a major feature of automobile advertising, raising substantial issues of deception and unfairness.

B. Current developments in the advertising of fuel economy. It is evident that as 1974 progressed, the number of fuel economy claims in automobile advertising increased dramatically, reflecting the growing importance of fuel economy information to prospective new car purchasers. The staff of the Commission has prepared a review of 915 different automobile advertisements randomly collected by the staff in the course of its monitoring functions since the introduction of 1973 model year automobiles. This review has revealed that

from January to March, 1974, 61 percent of all car advertisements made some sort of fuel economy claim, an increase of use at over equivalent period of 1973 and an increase of 17 percent over the last four months of 1973 (the first four months of the current model year of domestic automobiles). This trend in fuel economy claims is illustrated by the rate of increase of such claims in the last months of 1973 and first three months of 1974. Not only has the sheer number of such claims multiplied enormously, but the specificity of the claims also rose. Advertisements in which a specific miles per gallon figure was claimed increased from 5 percent of the ads run in the September-December 1972 period, to 7.6 percent, 12.9 percent and 35 percent of those run in January, February and March of 1974 respectively.

This increase in specific claims was accompanied by a proliferation of ads in which the test method on which the claim was purportedly based was referred to or described to some degree in the advertisement. Only one advertisement citing the test method used was counted between September 1972 and November 1973, but in March of this year, 35 percent of the automobile advertisements made some reference to a specific test method said to have generated the claimed fuel economy data. The utility to consumers of the test information in the ads is open to serious question. The tests are not comparable. Some tests used were conducted on interstate highways at or near the speed limit, others were on test tracks, at varying speeds, still others were simply termed "city", "suburban" or "highway" tests without further description. Test drivers ran the range from professional drivers, to employees of the manufacturer, to celebrities. Although the type of car tested is not always disclosed, cars varied by number of cylinders, type of transmission, and other features which affect fuel economy. None of the advertisements failed to note the average speed of the car tested, or the number of stops per mile, or the degree to which the car was warmed up. The disclosures were not sufficient to enable the consumer to determine the relevance of the claimed fuel economy figures to his own experience with the advertised car and they confirmed that variations in the tests render comparison by the consumer of competing mileage claims impossible. These difficulties cannot be entirely overcome solely through the efforts of the variety of independent organizations which have published test results that differ with the advertising claims and usually with each other. Consumers Union, the publishers of "Road and Track Magazine", and numerous other interested groups have issued mileage reports on different automobiles which differed from advertising claims made for the autos, from one another's figures and 1


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4 Weights of various automobiles equipped with a variety of optional equipment were published by the U.S. Environmental Protection Agency with "New Motor Vehicles and Engines: Air Pollution Control", 1974 Model Year Test Results, 1972-76, 7656 et seq. (February 27, 1976).
6 "38 FR 22944 (August 27, 1973)."
7 The survey included 915 different advertisements (i.e., although an advertisement may have appeared several times in several different magazines or on different networks, it was counted once in each medium) taken from a variety of national magazines, newspapers and the television and radio networks. All four of the principal domestic producers and various foreign manufacturers were represented in the sample.
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from figures published by EPA; due to the differences in test methods.

The general confusion resulting from this state of affairs has been the subject of several recent articles in the popular press including one entitled "Millage: What Does "You Believe" in the April 1974 issue of "Consumer Reports.""

C. Deception and unfairness in the advertising of fuel economy. Advertised mileage claims raise significant issues of unfairness and deception under section 5 of the Federal Trade Commission Act. The Commission has repeatedly recognized that when the seller describes the attributes of a product in terms relevant to the ordinary experience of consumers, the Commission's recently issued Rule on "Power Tests for Amphibious Utilized in Home Enterprises Products" provides that "no performance characteristics shall be represented or disclosed if they are not obtainable as represented or disclosed when the program is operated by the consumer in the usual and normal manner. To the extent that mileage claims may exaggerate the mileage that can be expected by the consumer under ordinary driving conditions, such claims are deceptive. Moreover, as the Commission has recognized in other areas, economic claims can constitute implicit comparisons to the cost of competing products. Where mileage claims are based on test conditions that are relatively favorable to the advertised car, the failure to reveal results that may be relatively less favorable to the advertised car may constitute a failure to reveal a material fact, thereby rendering the advertisement deceptive. Indeed, the very disparity between the various tests being cited as the bases for mileage claims is itself a source of potential deception in that consumers may compare at least certain advertised mileage figures for competing cars on the same economic bases. Frequently, mileage figures are the result of a standard test.

The absence of any recognized standard upon the basis of which consumers can evaluate the gas mileage of the car they buy may be unfair as well as deceptive. The Trade Regulation Rules re-

99 FR 7065 et seq. (February 27, 1974).
10 See also, "Picking a Car in a Pinch," The Marzella, Consumers Get Little Mileage from Tests," St. Petersburg Times, March 19, 1974, § D, at 1, col. 1. One Mercedes advertisement which has appeared in numerous periodicals notes the number of competing ads you’re seeing these days.
12 See, the Trade Regulation Rule relating to extension ladders, 16 C.F.R Part 418, and the Trade Regulation Rule Relating to Sleeping Bags, 16 C.F.R Part 400.
13 99 FR 15637, 15638 (May 3, 1974).
14 41 FTC 319 (1968).
15 41 FTC 387, 400 (1966).
16 15 C.F.R Part 422.
17 15 C.F.R Part 423.

pany figures to be used in advertising and other promotion efforts, what should such a test be? Specifically, should such a test procedure be a road, track or laboratory type?

5. Should such a single test procedure be designed to generate one or more fuel economy results, and a representative sample of fuel economy in (a) city and (b) open highway driving modes? or an (c) "overall" acceptable fuel economy figure? How are "city" and "highway" driving to be defined?

6. Who should actually conduct the testing of individual cars according to the procedure? If manufacturers are to conduct the tests, how can the results be adequately checked and confirmed?

7. With regard to advertisements that do not specify the precise car (with reference to the major variables affecting gas mileage e.g., engine size, weight, transmission, axle ratio, options) being advertised, (a) what mileage figure should be used, and how should that figure be derived? (b) Should the mileage be based on a representative sample of cars within the model, and make, advertised? (c) If so, how is that sample to be selected? (d) Should all available combinations of fuel economy claims be displayed? Would the test result for each combination be disclosed?

8. Should more than one test procedure be developed for determining fuel economy under conditions the test conditions be devised, the results of which should be required to appear in advertising or promotion of fuel economy? If so, what should such test procedures be? For example, would a laboratory test be utilized to measure fuel efficiency in city driving and a road test for fuel economy in highway driving? Consider specifically the issues numbered 6 and 7 above.

9. If a certain test procedure or procedures are to be prescribed by the Federal Trade Commission, should the results of the procedure(s) be the sole permitted basis for fuel economy claims in advertising and promotion, or should advertising and promotional materials be permitted to include fuel economy figures derived from other test procedures or claims as they may be? Shouldrows from the prescribed test procedure?

10. Without regard to claims made in advertising, should every automobile offered for sale be accompanied at point of purchase, by a disclosure indicating the anticipated fuel economy of such automobile under typical driving conditions? If so, how should such a figure be expressed and by what means should it be disclosed?

The Commission is advised that Congress is presently considering the question of assigning to a Federal agency the responsibility for the testing of fuel economy. The Commission does not consider this circumstance to be a reason for delaying an action pending the advertising and promotion of fuel economy. If during the pendency of this proceeding a final decision is reached concerning responsibility for fuel economy testing, the
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Commission will consider whether a modification of the present proceeding is warranted. If the proceeding is concluded after the completion of this proceeding, the record developed therein will, in addition to aiding the Commission in the discharge of its consumer protection functions, be available to any other Federal agency having responsibilities relating to fuel economy.

All interested parties are given notice of the present data, views or comments with respect to the issues at a public hearing to be held commencing at 10 a.m., e.d.t., Nov. 25, 1974, in Room 532 of the Federal Trade Commission Building, 6th and Pennsylvania Avenue NW., Washington, D.C.

Any person desiring to orally present his views at the hearing should so inform the Special Assistant Director for Rulemaking, Federal Trade Commission, Washington, D.C., 20580 not later than November 18, 1974, and state the estimated time required for his oral presentation. Reasonable limitations upon the length of time allotted to any person may be imposed. To the extent practicable, persons wishing to file written presentations in excess of two pages should submit twenty copies of such proposed statements to the Special Assistant Director for Rulemaking 48 hours before the first day of the hearing.

Written comments may also be submitted no later than November 25, 1974, to the Special Assistant Director for Rulemaking.

The data, views or arguments presented and written comments submitted with respect to the practices in question will be available for examination by interested parties in Room 130 of the Division of Legal and Public Records, Federal Trade Commission, Washington, D.C. and will be considered by the Commission.

Issued: September 24, 1974.

[SEAL] CHARLES A. TONIN, Secretary.

AUTOMOBILE FUEL ECONOMY: CONTRIBUTING FACTORS AND ADVERTISING DISCLOSURES

AN ANALYSIS BY THE STAFF OF THE FEDERAL TRADE COMMISSION

This Analysis Is A Staff Document and the Conclusions Contained Therein Have Neither Been Accepted Nor Rejected by the Commission.

INTRODUCTION

A. Scope and Limitations of the Analysis.

The Commission believes it is useful to publish this staff analysis of issues relating to the advertising of automobile fuel economy in order to apprise interested parties of the factors for consideration and understanding of the staff of the Commission of the very complex issues involved in the prevention and unfairness in such advertising. Such publication is intended to enhance the ability of interested parties to communicate to consumers and to disclose in the N.Y.C. specification and advertising of Rulemaking Proceeding Concerning Automobile Fuel Economy Claims published simultaneously also in the Report to the Congress. It must be read with two caveats in mind, however. It has been prepared by the Staff of the Commission and its conclusions must be read with the conclusions contained herein have neither been accepted or rejected by the Commission.

Second, though the preliminary inquiry of the Commission’s staff into automobile fuel economy was substantial, this analysis is not considered to be complete or exhaustive. The staff of the Commission has reviewed itself the expertise of the technical staff of the Department of Transportation’s Transportation Systems Center in Cambridge, Massachusetts (hereinafter referred to as “DOT”) and the Environmental Protection Agency’s Motor Vehicle Emissions Laboratory in Ann Arbor, Michigan (hereinafter referred to as “EPA”). In addition, reference has been made to numerous technical papers and other materials, including testimony and documents submitted to Congressional and state legislatures. Input has also been received from both foreign and domestic automobile manufacturers, independent trade groups, and the Society of Automotive Engineers’ Fuel Economy Measurement Procedures Task Force (hereinafter referred to as the “SAE Task Force”). However, new data is continuously emerging, hence, after analysis by the staff, it will be subject to review and consideration by the Commission in connection with future actions in this area.

B. The Need for Fuel Economy Testing and Information.

The need for fuel economy testing and information. Under actual driving conditions all drivers do not experience the same fuel economy in all different cars. If it were otherwise, there would be no need for the development of fuel economy data to enable a comparison between automobiles, since they would perform in the same respect. However, fuel economy experience does vary and this information is relevant and may be considered in the consumer’s purchase decision. In order to generate this data, testing becomes necessary, and in testing it is desirable or necessary to evaluate the validity of the data generated by a test, it becomes necessary to inquire into the reasons why drivers experience varying rates of fuel consumption.

The first step in this inquiry, therefore, will be to identify those variables which significantly contribute to variations in fuel consumption rates and, where possible, to quantify the net contribution. After this is determined, the interactions of the various factors must be analyzed. Thus data and experience from both actual driving experience and tests designed to measure the reasons for fuel economy differences between cars, must first be analyzed before any conclusions can be drawn as to tests which are indispensable to obtaining the fuel economy possible with a given vehicle under various conditions.

If no changes were made in cars from one year to the next, this type of inquiry might not be necessary. All that would be required would be an accurate compilation of fuel economy data for vehicles ready on the road, and since they would be the same as those subsequently offered for sale, potential buyers would not be misled by the data. If changes were made in cars and it was not possible to conveniently make changes to the existing data set on a broad range of actual driving conditions between the time a new model is developed and the model is sold. Consequently, tests are conducted in order to obtain information about the performance of vehicles on the road. Tests, however, can not duplicate actual driving conditions for all drivers. Rather, tests simulate actual driving conditions of some kind. To understand the correlation of test results to actual driving, the manner in which the tests are conducted on the road has a significant impact. For example, tests conducted on test tracks are not applicable to all drivers, since they are not representative of the different types of cars purchased.

C. Types of Variables Affecting Automotive Fuel Economy

To facilitate the analysis of the variables which most significantly affect fuel economy, the data will be divided into three broad categories as follows:

A. Driving condition variables. Some of the factors which cause drivers to experience differing rates of fuel consumption relate to the conditions under which the driving takes place. Those include ambient conditions (such as atmospheric or air temperature and air pressure), road conditions, and the type of vehicle used. Those include road conditions (such as the surface and the grade of the road) and driving environment or mode (i.e., whether the vehicle is city-, rural- or highway-use oriented). Varying these conditions significantly will result in different rates of fuel consumption. The driver, therefore, should be aware of the effects of the climate, road conditions, and the vehicle on the fuel consumption experienced while driving.

B. Differences between automobiles. This category includes all those variables affecting fuel economy that distinguish cars from

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one another, whether the cars are different makes, models, prices, different varieties of the same model. While many differences in cars can potentially affect fuel economy, certain differences between cars are significant. This analysis is primarily concerned with how the factors affecting fuel economy relate to the cars themselves. The discussion of changes in fuel economy due to the age or state of tune of the car or the inflation of the tire will be covered in a later section. For new cars, these factors are presumed to be according to specifications or constant. Not all differences in cars are significant, and the discussion is limited to differences that are significant. The discussion is limited to differences in fuel economy due to the age or state of tune of the car or the inflation of the tire.

If the driving conditions allowed to in sub-Section A, above, and the driver’s performance constant, differences between cars (same size, weight, engine power and size, and axle ratio) will yield differences, often significant, in fuel economy. These factors are discussed in Section III of this analysis.

C. Differences among drivers. Even if the car and driving conditions are identical, differences among drivers may have different fuel economy experience due solely to the manner in which the car is operated and maintained. The driver will use his car differently, and his tires properly inflated is wasting gasoline. Similarly, anyone who drives for a long time when the car is cold or races the engine rapidly is using unnecessarily wasting gasoline. Consequently, a person who exhibits these habits will realize fewer miles per gallon of gasoline than someone who does not.

The manner in which a car is driven will also affect fuel economy. For example, if the driver accelerates too fast, the car is likely to be pushed out of gear, and the engine will start up. This can cause the car to stop and sit in traffic, which can affect fuel economy. The results of this study are statistically the same as those in the previous study, and the factors that were significant in that study are also significant in this study.

This analysis is not addressed to this last category of variables since the driving habits of any driver are unique to him and solely under his control and therefore cannot be reasonably controlled in a test designed to produce valuable results of driving environment to the public at large. Just as idiosyncratic differences between vehicles could not reasonably be controlled, differences between drivers can only be tested by testing with each driver.

By controlling the other variables, tests can be conducted to compare cars, thus permitting consumer choice between cars on the basis of fuel economy and creating incentives for manufacturers to improve the fuel economy of their products. The issue then is choice between cars, not between drivers. Manufacturers cannot control the habits of drivers, but cars can be improved. Thus, factors unrelated to the performance of the car itself, as opposed to the performance of the driver, are not within the scope of this analysis.

Consequently, this inquiry is limited to the driving condition—vehicle-related factors which most significantly affect fuel economy and which could either be quantified or be the result of real driving conditions in order to provide a means of evaluating test results, or which could be specified (to the extent possible under the circumstances and to the greatest number of consumers).

Of these two types of factors, the most difficult to control are driving conditions. It is in the selection of these variables that the degree of correlation, if any, of the test results to actual driving conditions depends. Footnotes at end of analysis, p. 42931.

II. EFFECTS OF DRIVING CONDITION VARIABLES ON FUEL ECONOMY

Introduction. The discussion in this section concerns the effects of the real driving environment. However, the analysis is not restricted to the individual components of the driving conditions, as is the case in fuel economy testing. The discussion is limited to the fuel economy of the vehicle which is the result of the test, and the degree to which differences in fuel economy are attributable to the test conditions.

For example, while the fuel economy of the car represented in Figure 1 at a constant speed of 20 mph was 16.5 miles per gallon (mpg), under real driving conditions this speed could be an average speed in typical city stop and go driving. The resulting fuel economy at that average speed in such conditions would be only 14 mpg. This 8% variation between a constant and average speed of 20 mph, depending upon whether it is the result of steady stop and go driving, is attributable to speed transients (acceleration and deceleration) which are encountered under actual driving conditions and which increase significantly when driving is conducted under highly variable driving conditions, as in stop and go traffic.

These differences can be significant, and the discussion is limited to differences in fuel economy due to the age or state of tune of the car or the inflation of the tire.

A. The driving cycle—1. Speed. The effect of speed on fuel economy under real driving conditions is very difficult to assess since other factors are always at play. Nevertheless, it is clear that speed contributes significantly to the rate of fuel consumption. This can be shown by tests, not duplicable by most drivers under real driving conditions, which isolate speed as the only variable. These tests involve driving a car at various unwavering speeds under otherwise identical conditions. When tests of this type are performed, and the fuel economy at the various constant speeds is plotted on a chart, a curve of the type shown in Figure 1 is generated for an average car. From this graph it can be seen that peak fuel economy at constant speed is realized at about 40 miles per hour (mph) and most cars peak around 45 mph. From 40 to 60 mph, the fuel economy, however, is not realizable by the average driver, and the actual fuel economy a driver would realize in real driving would fall below the curve shown in Figure 1, even if the cars were identical.

For example, while the fuel economy of the car represented in Figure 1 at a constant speed of 20 mph was 16.5 miles per gallon (mpg), under real driving conditions this speed could be an average speed in typical city stop and go driving. The resulting fuel economy at that average speed in such conditions would be only 14 mpg. This 8% variation between a constant and average speed of 20 mph, depending upon whether it is the result of steady stop and go driving, is attributable to speed transients (acceleration and deceleration) which are encountered under actual driving conditions and which increase significantly when driving is conducted under highly variable driving conditions, as in stop and go traffic. These fluctuations result from a variety of causes, which cannot be avoided under most real driving conditions, e.g., traffic, other necessary stops, varying speed limits, differences in road grade and curvature, and shifting wind direction and speed.

These differences between constant speed driving and real driving are most pronounced and difficult to quantify in actual driving con- ditions which are characterized by fewer speed changes, the fuel economy realized is typically lower than that constant speeds. Staying from 50 mph but staying in a range of 45-55 mph—amounts to an average speed of 49 mph. At these speeds, a single 10 mph decrease in speed would have a significant impact on fuel economy. The effect of a 10 mph decrease in speed on fuel economy is substantial.

Therefore, the results of the test conducted at a constant speed of 50 mph are not unrealistic driving conditions, but even under these conditions, the effect of speed on fuel economy is significant. Moreover, real driving conditions are characterized by speed fluctuations, such as passing other cars, hills and curves and even driver inattention, which can affect fuel economy. These fluctuations would cause fuel economy to differ considerably from that generated by constant speed test speeds.

There are several factors that would cause fuel economy to differ considerably from that generated by constant speed test speeds. Staying from 50 mph but staying in a range of 45-55 mph—amounts to an average speed of 49 mph. At these speeds, a single 10 mph decrease in speed would have a significant impact on fuel economy. The effect of a 10 mph decrease in speed on fuel economy is substantial.
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speed closest to the range in which consumers can drive in a manner most closely approximating steady speed, would be misleading to consumers for two reasons.

First, as shown above, even on the highway, real driving involves very similar fuel economy—robust speed changes, so that the constant 55 mph test figure would be unrealistically high. Second, a constant 55 mph test might be biased against smaller cars. It can be seen by referring to Figure 2 that at 55 mph, a small car can obtain an approximately 15% lower rate of fuel economy than the optimum fuel economy at approximately 35 mph; while the intermediate car’s rate of fuel economy is reduced only about half as much, approximately 8% from the optimum achieved at 35 mph. Such a test tends to misleadingly depress the difference in fuel economies between smaller and larger cars which is so noticeable at the lower speed ranges. The lower speed ranges more closely approximate the city type driving patterns most experienced by the majority of the driving population. (While 35 mph steady speed driving is not a good approximation of the stops and go type driving pattern experienced in city driving, it may be reasonably expected that due to the predominantly inertial effects during stop and go driving, there would be an even greater gap between larger and smaller cars if the comparison was made under that circumstance.)

In a study for the National Research Council, it was reported that at 60 mph, a single acceleration (deceleration) of 10 mph during each mile increased fuel consumption by as much as 15%. Decelerations of 5 mph and 30 mph from the same base speed—as might result from passing another car—resulted in increased consumption of up to 25% and 35% respectively. Thus the size of the speed change increases, so did the rate of fuel consumption.

The rate of speed change also affects the weight of gasoline used to the extent that habitual acceleration may result in a 15% higher rate of fuel consumption than an acceleration at a more gentle rate, as noted earlier in the discussion of driver-related variables.

When acceleration and deceleration involve one or more full stops, fuel consumption increases even more due to idling, while the car is stopped, the amount of speed change involved in going to or from a full stop and the necessity of overcoming the inertia of the vehicle’s weight.

Thus, speed up, slowing down and stopping are significant factors in fuel economy. Typical values for these factors under various driving conditions can be measured by analyzing the values for these factors actually experienced in real driving as determined in tests done on actual roads of various types. For example, in several studies, the frequency of stopping and the duration of stops have been measured for various driving conditions. In a study done on various routes in five urban areas, idle time was found to constitute from 18–20% of total engine running time. The five-city composite (weighted for the number of vehicles registered in the five cities) yielded idle time of just over 18%. Frequency of idle time (expressed as a number of hours per mile) varies significantly depending upon the type of driving. Urban driving ranges from one to three stops per mile. Suburban driving involves one to two stops per mile and highway driving is typified from 0.1 to 0.5 stops per mile. See Figure 3.

By controlling the number of stops per mile in a test procedure, fuel economy data generated will either be raised or lowered, depending on the stopping rate chosen. As can be seen from the data noted above, the empirical data show ranges of stop frequency, depending upon the type of driving studied.

The speed ranges and average speeds found by various investigators in empirical investigations of different types of driving were as follows:

<table>
<thead>
<tr>
<th>Type of Driving</th>
<th>Average Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>City driving</td>
<td>5–30 mph</td>
</tr>
<tr>
<td>Suburban driving</td>
<td>20–40 mph</td>
</tr>
<tr>
<td>Highway driving</td>
<td>40–60 mph</td>
</tr>
</tbody>
</table>

These speeds can be seen to correlate with stop frequency on the curve in Figure 3 which is the curve presented by the President of General Motors Corporation in recent hearings before the Senate Committee on Public Works. See supra, note 12. Data independently developed in different geographic areas by BETAA showed average values for stops per mile vs. average speed which are in agreement with this curve, which suggests that the curve is valid in areas other than those in which the testing was done.

Footnotes at end of analyst’s, p. 3491.
represents some type of real driving can be assessed. However, knowing the values assigned to these factors—speed, acceleration, deceleration and stopping—does not necessarily mean that the data generated by the test can be evaluated in terms of real driving experience since still more factors, apart from the general type of driving, can affect fuel economy, as is discussed in the sections below.

3. Trip length and cold vs. warmed-up starting. Although there is some dispute over this point, it appears that the effect of cold starting (and the subsequent period during which the vehicle is warming up) is to significantly decrease fuel economy. The degree to which cold starting affects overall fuel economy decreases as trip length increases, since an increasingly larger proportion of the test is conducted with the engine warmed up.

The graph in Figure 4, infra, shows the effect on fuel economy of cold starting, expressed as a percentage of fully warmed-up ("hot start") fuel economy for different trip lengths. The national average for trip length is 80 miles and at the point on the curve corresponding to this trip length, the difference in fuel economy between starting cold and starting warmed up is about 14% (at 70°F). This suggests that the choice between cold start and hot start has a significant bearing on the relevance of test results to typical consumer expectations.

**FIGURE 4**

**WARM-UP ECONOMY**

<table>
<thead>
<tr>
<th>Trip Length—Miles</th>
<th>100% Warmed-Up City Economy</th>
<th>70°F Ambient Temperature</th>
<th>10°F Ambient Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>100</td>
<td>70°F</td>
<td>10°F</td>
</tr>
<tr>
<td>2</td>
<td>90</td>
<td>68</td>
<td>8</td>
</tr>
<tr>
<td>4</td>
<td>80</td>
<td>62</td>
<td>3</td>
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<tr>
<td>6</td>
<td>70</td>
<td>56</td>
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</tr>
<tr>
<td>16</td>
<td>20</td>
<td>24</td>
<td>0</td>
</tr>
</tbody>
</table>


Some of the experts with whom the Commission's staff conferred expressed the view that the 14% fuel economy penalty would be only typical of vehicles manufactured without emissions controls, i.e., those manufactured in model years prior to 1968. They reason that the advent of emission controls necessitated design changes in automobiles which reduce the effect of the warm-up period on fuel economy. Specifically, the time during which the choke is on has been reduced since "chokeing" (i.e., reducing the air-fuel mixture thus increasing the amount of fuel relative to air fed to the engine) tends to increase emissions as well as reducing fuel economy.

But in the Society of Automotive Engineers paper from which Figure 4 is reproduced, it was reported that choking apparently is not the determining factor causing the increase in fuel consumption during the warmup period. Rather, the report cites frictional losses due to cold components and lubricants and the need to bring the entire vehicle to stable operating temperature as causes of fuel economy loss during warm-up. These factors operate to reduce fuel economy irrespective of the action of the choke.

The data upon which these conclusions and the graph in Figure 4 are based were developed prior to 1968, but it is supported by more recent information from several sources. Figure 5 shows the same curve as Figure 4 with more recent data based on tests performed on 1973 model year vehicles by the SAE Task Force referred to at the beginning of this analysis. The circles represent data points reported in the paper Figure 4 is taken from; the triangles represent data points generated by the SAE Task Force's tests. This new data indicates that there has been virtually no change since the advent of emissions controls.
PRELIMINARY FIGURES

In a draft report dated January 1974, prepared for DOT and EPA, smaller fuel economy penalties attributed to cold starting were reported. However, the Department of Transportation did not pursue this approach. The data supplied by DOT on the impacts of cold starting showed that the majority of trips made in this country are under 8 miles long, and that these trips account for just over 11% of the vehicle miles accumulated. The significance attached to this by some critics of cold starting testing is that fuel consumption is a function of aggregate vehicle miles travelled, not of average trip length alone. By using cold starting tests, this argument goes, the effect of cold starting on a national basis is exaggerated. However, gasoline consumption is not directly proportional to vehicle miles accumulation, since cold starting during the shorter trips results in significantly higher gasoline consumption, and because longer trips tend to be made under conditions more favorable to good fuel consumption (fewer stops per mile, highway cruising, etc.). Thus, the argument contains a full, circular, and the indication is that cold starting does significantly contribute to this country's fuel consumption. Although not all trips begin cold, "the majority of day-to-day driving is composed of a succession of relatively short trips, and typically includes some degree of vehicle warm-up each time car is driven." (Italics added.)

Ideally, the degree to which cold starting affects the 1976 test fuel economy reflects actual driving. Most driving involves some warming up as noted above, but not all starts are cold. In a comprehensive study done in the Los Angeles area, it was found that average car use involved 4.7 trips per day. One of these trips begins after overnight idling so it is a cold start. Another begins after inactivity of a considerable period (such as during work for a commuting vehicle). Thus, two out of 4.7 starts were made when the vehicle was completely cold or virtually so. From this it is easily calculated that about 48% of all trips began with cold starts in Los Angeles. On a national basis, however, the ratio of cold starts to hot starts may be even higher, since the national average for daily trips is four in metropolitan areas. It would be reasonable to assume that this still includes two cold starts daily, yielding a one-to-one ratio for cold starts to hot starts.

To properly account for cold starting and warm-up, fuel economy test data should include a correction for cold starts. This can be done by running the test in two segments— one cold and one "hot"— and releasing the test results as a harmonic average of the results from the two segments.

B. Ambient conditions— 1. Temperature. As temperature falls, fuel economy becomes poorer. For example, at 50 mph, every 10°F drop in temperature results in a fuel economy reduction of 2%. Due to wide fluctuations in temperature, tests cannot be representative of all driving at all temperatures. Usually, the ambient temperature range is specified for outdoor tests. For indoor tests, ambient temperature can be closely controlled, thus by specifying or controlling temperature, there will be no variance between tests due to temperature fluctuations.

2. Humidity. High humidity tends to reduce fuel economy somewhat since there is a higher percentage of water vapor in the air-gasoline vapor mixture and water vapor does not contribute to combustion. This can be accounted for by specifying humidity tolerance limits for tests conducted indoors. When tests are performed in a laboratory which is heated in the winter and air conditioned during the summer, humidity tends to be relatively low and deviates less and therefore contributes less to test variance.

3. Precipitation. Rain severely reduces fuel economy, and since the rate and volume of rainfall cannot be controlled, outdoor tests are not representative of the rain. Naturally, this restricts time available for testing, a problem not experienced in indoor testing.

4. Wind. Wind significantly affects fuel economy in determining the direction of the car relative to the wind direction and the wind velocity. The effect of wind resistance, which is a product of wind speed and vehicle speed, is covered in the following section's discussion of vehicle size.

Outdoor tests usually specify maximum wind speed and are run in two directions in an attempt to nullify wind effects. Obviously, this is not an issue in indoor testing.

5. Altitude. At high altitudes (over 3,000 ft.), fuel economy decreases somewhat. Tests ordinarily are conducted at altitudes lower than this, so the tests are somewhat inaccurate as a reflection of fuel economy which would be realized by that part of the population which primarily drives at high altitudes.

C. Road conditions— 1. Road surface. Fuel economy is significantly better on smooth paved roads than on dirt or broken surface roads. Since most roads are paved, testing is done either on a paved road or in a manner which simulates a smooth road.

2. Road curvature and grade. Road curvatures and grade also affect fuel economy. Road curvature increases gasoline consumption depending upon the degree of curvature. Tests are either conducted on a straight course or a course with relatively gentle curvature. For example, a car going up a 7% grade at 50 mph is penalized 55% in its fuel economy compared to a car going 50 mph on a level road. On a 9% grade the fuel economy penalty is about 82%. Therefore, it is clear that tests should be conducted on a level surface.

D. Summary— driving condition variables. The most significant driving condition variables are speed, amount and rate of deceleration and acceleration, frequency of stopping, duration of stops (idling time), engine starting condition (cold or warmed-up), trip length, ambient conditions and road conditions.

Source: Prepared informally for the staff of the Federal Trade Commission by the staff of the U.S. Environmental Protection Agency's Ann Arbor Laboratory (March 1974).

Footnotes at end of analysis, p. 34391.
PROPOSED RULES

As a general rule when these factors are isolated from one another, the following relations between fuel economy and speed may be stated:

1. Fuel economy decreases at the rate and number of accelerations or decelerations increase.
2. Fuel economy decreases as the size, rate and number of accelerations or decelerations increase.
3. Fuel economy decreases as the range and duration of stops increase.
4. The fuel economy measured from a cold start is less than that measured when the car is warmed-up.
5. Fuel economy increases as trip length increases.

Under real driving conditions, these variables are not independent of one another, but exist in clearly defined relationships to one another and their values vary depending upon the general driving environment (e.g., city, suburban, highway) as follows:

1. Average speed increases as trip length increases.
2. Average speed and stopping frequency are such that as average speed increases, the number of stops per mile decreases and this tends to control the rate and frequency of deceleration.
3. The size of accelerations is reflected by the range of speeds and the average speed together with the fuel economy of the vehicle.

The effect of cold starting decreases as trip length increases.

2. The more constant speed is the better fuel economy and the degree of speed constancy depends upon acceleration, deceleration and stops so that driving at higher speeds on the highway tends to yield better fuel economy. As average speed decreases, highway conditions are not represented so that stopping and speed changes increase while length of trip decreases.

III. VEHICLE-RELATED VARIABLES

In selecting a new car, the consumer chooses between general types of automobiles (luxury, standard, intermediate, compact or subcompact, etc.), between packages of options and between models. Inevitably the choices the consumer makes lead to better or worse fuel economy, depending upon some of the particular characteristics of the car and the optional equipment selected.

The discussion which affect fuel economy and which consumers can control in their purchase selection are the subject of this section.

1. Vehicle size, the size of an automobile affects fuel economy in two ways. The weight of the vehicle increases both the power needed to move the car and the inertial resistance of the car to speed changes, particularly accelerations from stops. The exterior size of the car also may affect fuel economy, particularly in the design, because the larger a car is, the larger is the area of the front of the car (cross sectional area). At high speeds, increase in the cross sectional area increases the resistance to movement, with a dynamic drag, affecting fuel economy to varying degree depending upon speed and streamlining. As speeds become higher, this effect is inappreciable.

Vehicle weight is the single most important difference between different types of gasoline consumption at any speed. A 500 pound increase in vehicle weight, with all other factors equal, has been estimated to result in an average 14% fuel economy loss with a difference of 100% between a 2500 and 5000 lb. car. Consumers Union tests indicated a decrease of 0.5 mpg for every 500 lb. increase in weight. In addition, the effect of the weight itself, heavier cars also need power options and larger more powerful engines, which additionally increase gasoline consumption.

B. Horsepower. As the power of an engine increases, it tends to use more gasoline. One study reported that fuel economy decreased by one mpg for every 120 horsepower increase in engine output. However, power must be considered together with vehicle weight, since an underpowered, heavy car will perform relatively poorly on the highway, thereby losing fuel economy advantage of highway over city driving. Thus, the horse power of a car is significant, but to judge the car's performance involving some but not all driving conditions, e.g., highway but not city, the power to weight ratio must be known. Without this knowledge, the mpg number generated by a highway test would be considerably lower in the city and vice versa.

C. Engine size (displacement). Engine size is commonly noted merely in terms of the number of cylinders, but different engines with the same number of cylinders vary in size due to differences in the effective volume of the cylinders. Therefore, a more realistic and accurate measure of engine size is "displacement." Displacement is a measure of the maximum volume of a cylinder (when the piston is at the top of the cylinder) or the volume of the cylinder through which the piston acts. The total of all of the cylinders is the engine displacement, usually given in cubic inches (C.I.D.) or litres in the metric system.

As displacement increases, fuel economy decreases, a ratio of 0.3 mpg per 10 lb. engine displacement increase. Thus, a larger engine consumes more gasoline.

Additional fuel economy losses attributable to larger engines due to weight. The difference between a six and eight cylinder engine is often attributed to 10%.

D. Compression ratio. Compression ratio is a ratio of the volume of the air and gasoline mixture in the cylinder before compression by the piston to the volume after compression. Thus, if the initial volume is 10 cubic inches, the ratio is 10:1. Higher compression engines are generally more efficient. A 10% increase in compression ratio improves fuel economy by half an mpg in urban driving.

E. Weight weight. Weight is one of the octane requirements of the engine.

Thus, vehicles with high compression ratios may be more efficient and burn relatively less gasoline, but the fuel to power them costs more per gallon since high octane fuel is more expensive. There is a trade off here which the consumer would want to evaluate.

2. Axle ratio. The axle ratio is the number of revolutions of the driveshaft to the number of the rear wheels. The range of ratios available is from about 2.7 to 6.1.

Several different axle options might be available for the same motor car. For example, a higher ratio is often needed if the car is going to be used as a trailer, but a 10% lower axle ratio can improve fuel economy by more than 2 mpg on 0.1 mpg for an intermediate size car in urban traffic.

Weight and displacement, type of transmission, and the compression and axle ratios account for 90% of the variation in fuel economy between automobiles. Vehicle size alone accounts for 80% of the difference in urban driving taking into account the way heavier vehicles are actually sold, i.e., with larger more powerful engines.

In addition to these factors which might be considered descriptive of the basic car, the consumer must take into consideration that the equipment is power driven when the equipment is in use and due to the increased weight of the car attributable to the equipment.

The values attributed to the increase in power consumption caused by the most significant accessories and convenience devices are shown in Table 1.

<table>
<thead>
<tr>
<th>Accessory</th>
<th>Penalty (urban operation)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(11)</td>
<td>Power steering, air conditioning, power windows</td>
</tr>
<tr>
<td>(12) Air conditioning</td>
<td>13 percent (600 lb.)</td>
</tr>
<tr>
<td>(13)</td>
<td>Power steering, air conditioning, power windows</td>
</tr>
<tr>
<td>(14) Air conditioning</td>
<td>10 percent (250 lb.)</td>
</tr>
<tr>
<td>(15)</td>
<td>Automatic transmission</td>
</tr>
<tr>
<td>(16)</td>
<td>Automatic transmission</td>
</tr>
</tbody>
</table>

This paper does not consider the effect of weight.

Table 1: Effect of engine accessories and convenience devices

1 Reference cited in paper.

IV. DISCLOSURE OF TEST CONDITIONS

Introduction. In the preceding two sections of this paper the discussion focused on the contributions of various factors to an automobile's rate of gasoline consumption. Briefly, the most significant of these factors are as follows:

1. Speed (average and range).
2. Acceleration and deceleration (rate and number of mph increase or decrease and frequency of speed changes).
3. Stopping frequency.
4. Trip length.
5. Engine starting condition (cold or "hot").
6. Temperature.
8. Precipitation.
9. Wind.
10. Altitude.
11. Road surface.
12. Road curvature.
15. Vehicle weight.
17. Engine displacement.
18. Compression ratio.
19. Axle ratio.

In this section, the possibility of disclosing the values of these variables in tests used to support advertising claims is discussed. With respect to disclosure of conditions, two alternative policies are considered: disclosure of all the key test conditions, or disclosure of a few of the key test conditions.

A. Disclosure of test conditions. The first approach taken to disclosure of test conditions is to examine the possibility that just disclosure of only one or two significant facts might allow consumers to relate advertised fuel economy claims to the type of driving they personally do. If this were possible, consumers might be able to do the following:

1. Make a general decision as to the validity of the advertising claim.
2. Decide whether they would get more or fewer mpg based on a comparison of the way they drive to the way the test was conducted.

Footnotes at end of analysis, p. 34931.

References:

1 Reference cited in paper.

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Disclosure of more factors will of course give the consumer a fuller picture of how the advertised figure may give at least some idea of how that test compares with his own driving patterns. Such additional disclosures would be quite to permit meaningful comparisons between two advertised cars.

To illustrate the problems that might occur if five significant factors were disclosed in one advertisement, four examples should suffice.

Table 2, infra, shows the values that might be found in four different cars and four different tests; a high speed test, a city test and two arbitrary tests not representative of real driving.

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the relevance to the consumer of the claimed mpg may not render the advertisement deceptive or unfair. Such disclosure might, for example, in certain circumstances serve to apprise the consumer that he would not realize the advertised fuel economy.

V. CONCLUSION

This discussion has been intended to set forth staff’s present understanding of the major considerations bearing upon a sound technical underpinning for the avoidance of deception and unfairness in fuel economy claims for automobiles. It is expected that interested parties will, by reason of publication of this analysis, be better able to comment upon the issues currently before the staff, to bring to the staff’s attention further issues not reflected in this analysis, and to contribute to an informed and effective rulemaking.

Issued: September 24, 1974.

[SEAL]

CHARLES A. TRENK, Secretary.

FOOTNOTES—ANALYSIS


2 U.S. Environmental Protection Agency, Office of Air and Waste Programs, Mobile Source Air Pollution Control, A Report on Automotive Fuel Economy, at 29 (1973) [hereinafter cited as the EPA Report].

3 Obviously, driving conditions can be characterized in other ways than by these factors. City driving for example might be typified by a certain traffic density or number of traffic lights, but it is the effect of these characteristics on driving which are accounted for by the variables in the driving cycle.


6 C. Scheffer and G. Nieporth, Customer Fuel Economy Estimated from Engineering Tests, Society of Automotive Engineers Paper No. 650381, at 5 (1965) [hereinafter cited as Scheffer! (The authors are employed by General Motors).]

7 Id. at 5.

8 See Graffy supra note 5.

9 Id. at 51 (Table A-14).

10 Id. at 52 (Table A-18).

11 The consumer’s advertising claims monitored by the staff were in fact based on just such a test.

12 See, Hearings on "Compliance with Title II (Auto Emission Standards) of the Clean Air Act" before the Senate Comm. on Public Works, 93 Cong., 1st Sess., at 188, 189 (Nov. 1973) (Attachment 7 to the statement of E. N. Cole, President, General Motors Corporation) [hereinafter cited as the Clean Air Act Hearings]; See also, the discussion of stopping frequency and Figure 3, infra.

13 See, U.S. Dept. of Transportation, Federal Highway Administration, Office of Highway Planning, Program Management Division, Estimated Motor Vehicle Travel in the United States and Related Data—1972, Table VM-1 (1973) [hereinafter cited as the VM-1 Table].

14 Clean Air Act Hearings, supra note 11, at 196.


16 EPA Report, supra note 2, at 29.

17 Claffy, supra note 5.

18 Id. at 52 (Chart A-18).

19 Id. at 52 (Charts A-17 and A-18).

20 EPA Report, supra note 2, at 29.

21 Cf. Claffy, supra note 5, at 51 et seq.

22 Vehicle Operations Survey, supra note 15 Table 4-2.

23 Id.

24 Clean Air Act Hearing, supra note 11 at 186; See also Federal Test Procedure, 49 C.F.R. §5.1 (1973).

25 Clean Air Act Hearings, at 186.


27 Clean Air Act Hearings, at 192.

28 Id. at 186; Vehicle Operations Survey, supra note 15, Table 4-1; Federal Test Procedure, 49 C.F.R. § 85.075 (1973) [hereinafter cited as the 1975 FTP].

29 The FTP, developed in Los Angeles, has an average speed of 19.3 mph with 24 stops per mile. The 1975 FTP Highway Schedule developed in Michigan has an average speed of 49 mph with 2.3 stops per mile. Both tests show values consistent with the curve in Figure 3.


31 Scheffer, supra note 6.

32 Id. at 2.

33 Id.

34 Energy Conservation Systems Section, Dept. of Automotive Research, Southwest Research Institute, A Study of Technological Improvements to Automobile Fuel Consumption (contract DOT-FRC-623) at Appendix D, Note: This is a Jan. 1974 draft of a report prepared for D.O.T. and E.P.A. containing preliminary information subject to change [hereinafter cited as the SWRI Draft Report].

35 In each case the variance was calculated at a percentage of the smallest test result, thus maximizing the percentage difference.

36 Data derived from the NPTS, supra note 31.

37 See, supra note 6, at 1.


40 Senate Report on S. 2176, supra at 9.


42 Senate Report on S. 2176, supra note 52, at 10.

43 Scheffer, supra note 6, at 5.

44 Id.


46 Huenheber supra note 5, at 27.


48 Huenheber supra note 5, at 27.


51 Scheffer supra note 5, at 15.

52 Id.

53 Id at 26.

54 This data is drawn from actual ads.

55 See Figure 3, supra: Clean Air Act Hearings, supra note 11, at 192.

56 Austin supra note 49 at 15.

[FED. REG. 27: 7606 at et seq. (Feb. 27, 1974) wherein the axle ratios of tested cars were listed.

57 EPA Report, supra note 2, at 14.

58 Huenheber, supra note 5, at 25.

59 Id. at 25.

60 This data is drawn from actual ads.

61 See Figure 3, supra: Clean Air Act Hearings, supra note 11, at 192.]