FLEET OPERATOR STUDY: GEOGRAPHIC ASPECTS

Joseph R. Wagner
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July, 1978

Prepared for the

Division of Transportation Energy Conservation

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by the

Department of Energy and Environment
Economic Analysis Division

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Introduction

The National Center for Analysis of Energy Systems at Brookhaven National Laboratory (BNL) is currently performing a study of light-duty highway fleets (i.e. passenger cars and light trucks), under the sponsorship of DOE's Division of Transportation Energy Conservation. In this context, "fleets" refers to vehicles that are owned and/or operated by businesses, state governments, or local governments. The Fleet Operator Study, as it is called, currently has three basic objectives:

(1) development of a statistical profile of fleet vehicles, and identification of factors affecting technological penetration rates

(2) development of a systematic framework for estimating the rate at which new technologies can penetrate the fleet vehicle market

(3) generation of a formal set of scenarios to illustrate the relationships between technological options, the requirements of fleet vehicles, and technological penetration rates.

Pursuit of the first objective has resulted in compilation of the BNL Fleet Vehicle Data Base. The data base consists of survey data collected in August-September, 1977. Questionnaires were sent to 10,774 fleet operators throughout the United States. Responses were received from 1,147 operators who operate a total of 362,205 vehicles. The questionnaire was primarily designed to collect data on the types of vehicle missions that fleet vehicles must fulfill. Additional information is being developed for later inclusion in the data base. This report is a preliminary description and analysis of the regional characteristics of the data base.

Geographic Distribution of Sample

The sample contains 248,947 fleet cars. Two-third of these can be allocated to the geographic regions shown in Exhibit 1, based on information supplied by the vehicle operators. The distribution of the cars across market sectors and geographic regions is shown in Exhibit 2.

Fleet Vehicle Geographic Regions

EXHIBIT 1

*Includes Hawaii

EXHIBIT 2

Geographic Distribution of Cars and
Automotive Fleet Subscribers
(dashes indicate negligible values)

Region ¹ Distribution	East North Central	South Atlantic	Middle Atlantic	Pacific	West South Central	West North Central	East South Central	New England	Mountain	United States	Cars W/Region Unreported	Total Cars in Sample
Cars in Sample (1977):												
Police	3406 (8%)	4930 (12%)	15974 (39%)	7150 (17%)	3574 (9%)	3532 (9%)	1481 (4%)	76 (-%)	1353 (3%)	41476 (100%)	52	41528
Government ²	4463 (17%)	2484 (10%)	10077 (39%)	4889 (19%)	632 (2%)	454 (2%)	0 (0%)	2307 (9%)	392 (2%)	25698 (100%)	0	25698
Utility	5195 (15%)	3067 (9%)	10945 (30%)	5578 (16%)	2674 (7%)	2900 (8%)	1203 (3%)	2499 (7%)	1899 (5%)	35960 (100%)	1383	37343
Taxi	448 (21%)	434 (21%)	603 (29%)	161 (8%)	203 (10%)	86 (4%)	0 (0%)	121 (6%)	15 (1%)	2071 (100%)	0	2071
Rental	118 (1%)	50 (-%)	2 (-%)	221 (2%)	11840 (97%)	0 (0%)	1 (-%)	0 (0%)	0 (0%)	12232 (100%)	250	12482
Business 25+	15165 (30%)	5552 (11%)	9497 (18%)	4953 (10%)	5471 (11%)	2791 (5%)	738 (1%)	5143 (10%)	1792 (4%)	51102 (100%)	75144	126246
Business 4-24	261 (22%)	175 (15%)	208 (18%)	163 (13%)	85 (7%)	160 (14%)	25 (2%)	55 (5%)	44 (4%)	1176 (100%)	2403	3579
All Sectors	29056 (17%)	16692 (10%)	47306 (28%)	23115 (14%)	24479 (14%)	9923 (6%)	3448 (2%)	10201 (6%)	5495 (3%)	169715 (100%)	79232	248947
Automotive Fleet Subscribers ³	23%	13%	17%	13%	8%	11%	4%	6%	5%	100%		
Total U.S. Passenger Car Registration ⁴	20%	16%	16%	14%	10%	8%	6%	6%	5%	100%		

1. Location of fleet administrator.

2. State and local non-police

3. Percent of Automotive Fleet subscribers (not cars) in each region.

Bobit Publishing Co., Publisher's Statement for 6 Month Period Ending June 1977.

4. Federal Highway Administration, Highway Statistics, 1975.

The bottom row of Exhibit 2 shows the geographic distribution of all automobiles registered in the United States in 1975. The numbers represent each region's percentage share of the national stock of automobiles. The exhibit has been arranged such that these percentages are in descending order from left to right. The geographic distribution of the total BNL fleet automobile sample appears in the "All Sectors" row. Each region's percentage share of the BNL sample is indicated in parentheses. A definitive explanation has not yet been developed to explain the differences that exist between the two distributions. Alternative explanations include the following possibilities:

- (1) The differences accurately reflect the real world, with the distribution of fleet automobiles differing from the distribution of all automobiles. *Comment:* An independent estimate of the geographic distribution of fleet automobiles has not yet been identified.
- (2) The location of BNL in the Middle Atlantic region resulted in an overrepresentation of this region in the sample. *Comment:* The data collection procedure required fleet administrators to return a mailed questionnaire to BNL. The incentive to do this was perhaps greater if the questioner was perceived as a "local".
- (3) In some cases cars were assigned to the wrong region. *Comment:* Some fleets operate in more than one region. The questionnaire asked the respondent to identify the region in which their organization was located. The result is that a multi-regional fleet could conceivably have been fully assigned to one region.
- (4) The mailing list used by BNL contained a geographic bias. *Comment:* The mailing list used by BNL was purchased from the Bobit Publishing Company and it is essentially a list of subscribers to Automotive Fleet magazine. The geographic distribution of these subscribers is shown in Exhibit 2.

- (5) From region to region there is a difference in the percentage of cars in large fleets versus small fleets. *Comment:* This involves a special case of alternative (4) above. The probability of having a subscription to Automobile Fleet is probably greater for an administrator of a large fleet than it is for the administrator of a small fleet. If a given region tended to have larger fleets than other regions, then that region would tend to have more automobiles administered by Automotive Fleet subscribers, even if all regions had the same total number of fleet automobiles. It follows then that the given region would tend to have disproportionately high representation in the BNL data base. This effect is heightened by the supposition that administrators of large fleets were probably more likely to respond to the questionnaire, once received, than were administrators of small fleets. This supposition rests on the assumption that larger fleets support larger staffs, which can more readily absorb the additional work needed to complete the questionnaire. A region characterized by small fleets therefore tends to be underrepresented in the BNL data base for two reasons. First, fleet administrators in the region were less likely to have received a questionnaire. Secondly, the administrators were less likely to respond.

Exhibit 3 shows graphically the geographic distribution of Automotive Fleet subscribers, plus the geographic distributions of the BNL fleet car sample and of total car registrations. The correlation coefficient between the regional shares of subscribers and the regional shares of total registration is .93. The correlation coefficient between the BNL car sample distribution and the distribution of total car registrations is .75. Thus the subscriber list adheres more closely to the pattern

EXHIBIT 3

Regional Distributions of Cars and
Automotive Fleet Subscribers

of total registrations than does the BNL car sample. The correlation coefficient between the regional shares of subscribers and the BNL car sample is also .75.

One should be careful about drawing conclusions from the foregoing data. In the first place, the actual distribution of fleet cars is unknown. Total car registrations is used as a surrogate with unknown relevance. Also, the actual distribution of cars held by Automotive Fleet subscribers is unknown. The location of the subscribers is shown in Exhibit 3, but it is not known how many cars these subscribers operate in various regions.

Having examined the geographic distribution of the total BNL fleet car sample, one may now wish to examine the geographic distribution of individual sectors. These data are also contained in Exhibit 2. Perhaps the most noteworthy observation is that rental vehicle sampling apparently suffered significant regional bias. Rental and government vehicles (both cars and light trucks) are being resampled and regional aberrations will hopefully be eliminated.

Light truck data comparable to the preceding car data are presented in Exhibit 4. The data in the bottom rows are displayed graphically in Exhibit 5. There is a much lower level of correlation among the distributions of Exhibit 5 than there is among the distributions of Exhibit 3. The correlation coefficient between the subscriber distribution and the distribution of total light truck registrations is .42. Between the BNL light truck sample distribution and the registration distribution the correlation coefficient is .31, and between the subscriber distribution and the BNL sample the coefficient is .73. Note that again the subscriber list adheres more closely to the pattern of total registrations than does the BNL sample.

EXHIBIT 4

Geographic Distribution of Light Trucks and
Automotive Fleet Subscribers

(dashes indicate negligible values)

Distribution \ Region ¹	Pacific	West South Central	South Atlantic	East North Central	West North Central	Mountain	East South Central	Middle Atlantic	New England	United States	Light Trucks with Region Unreported	Total Light Trucks In Sample
Light Trucks in Sample (1977):												
State & Local Government ²	1159 (14%)	368 (4%)	1453 (17%)	849 (10%)	309 (4%)	377 (4%)	49 (1%)	3844 (45%)	112 (1%)	8520 (100%)	51	8571
Utility	10610 (18%)	4422 (8%)	5037 (9%)	8679 (15%)	4690 (8%)	3528 (6%)	1661 (3%)	16388 (28%)	2632 (5%)	57647 (100%)	1356	59003
Taxi	17 (6%)	10 (4%)	51 (19%)	20 (8%)	7 (3%)	2 (1%)	0 (0%)	149 (56%)	8 (3%)	264 (100%)	0	264
Rental	15 (3%)	480 (92%)	1 (-%)	22 (4%)	0 (0%)	0 (0%)	2 (-%)	1 (-%)	0 (0%)	521 (100%)	0	521
Business	2125 (11%)	5070 (28%)	2224 (12%)	3007 (17%)	643 (4%)	716 (4%)	1306 (7%)	2079 (12%)	787 (4%)	17957 (100%)	26942	44899
All Sectors	13926 (16%)	10350 (12%)	8766 (10%)	12577 (15%)	5649 (7%)	4623 (5%)	3018 (4%)	22461 (27%)	3539 (4%)	84909 (100%)	28349	113258
Automotive Fleet Subscribers ³	13%	8%	13%	23%	11%	5%	4%	17%	6%	100%		
Total U.S. Light Truck Registration ⁴	16%	16%	15%	14%	11%	9%	8%	8%	3%	100%		

1. Location of fleet administrator.

2. Includes police.

3. Percent of subscribers (not light trucks) in each region. Bobit Publishing Company, Publisher's Statement for 6 Month Period Ending June 1977.

4. U.S. Bureau of the Census, 1972 Census of Transportation, Volume II, Truck Inventory and Use Survey.

EXHIBIT 5

Regional Distributions of Light Trucks
and Automotive Fleet Subscribers

Regional Applicability Rates

BNL has developed a Fleet Applicability Simulator (FLEETSIM) which uses the BNL fleet data base to estimate the degree to which hypothetical vehicle technologies would be applicable to the fleet market. The data base contains information about the physical mission requirements of fleet vehicles. This includes information about required driving range, required passenger capacity, types of roads used, and other parameters. FLEETSIM compares the physical capabilities required of the data base vehicles to the physical capabilities of a hypothetical vehicle specified by the FLEETSIM user. FLEETSIM then determines an applicability rate for the hypothetical vehicle. The applicability rate is the percentage of fleet vehicles having vehicle missions within the physical capabilities of the hypothetical vehicle.

Presently the user cannot specify absolute economic characteristics (price, maintenance costs, etc.) of the hypothetical vehicle. Instead the vehicle can only be described in general economic terms relative to a conventional vehicle. That is, the hypothetical vehicle is described as "better than," "worse than" or "equivalent to" conventional vehicles for a variety of economic variables. FLEETSIM therefore does not estimate market penetration, since it has no firm economic basis for doing so. Eventually FLEETSIM will be modified to incorporate better economic detail so that penetration rates can be estimated.

FLEETSIM has thus far been used to evaluate 20 scenarios. Each scenario corresponds to a unique hypothetical vehicle. In each scenario, applicability rates have been calculated on a national level only. The first of these scenarios was designated Scenario 1. The purpose of the present discussion is to outline results obtained by using FLEETSIM to calculate regional applicability rates, using the hypothetical vehicle description from Scenario 1. This description is shown in Exhibit 6.

The resultant regional applicability rates for cars appear in Exhibit 7. Rental cars show the highest applicability rate of any sector but this finding should be discounted due to sampling problems now being corrected. Utilities are next highest,

EXHIBIT 6

Characteristics of Hypothetical Vehicle in Scenario 1

Absolute Characteristics:

Range (miles)	100
Needs 8-hour Recharge	Yes
Interstate Highway Capabilities	Yes
Passenger Capacity	4
Air Conditioning	Yes
Trailer-Towing Ability	Yes
Automatic Transmission	Yes
Power Steering	Yes
Power Brakes	Yes

Characteristics Relative to
Conventional Vehicles:*

Purchase Price	-
Resale Value	+
Maintenance Costs	+
Life-Cycle Costs	+
Reliability	-
Running Lifetime	+
Tradition	-
Fuel Costs	+

*Negative sign indicates vehicle is worse than conventional vehicle.

Plus sign indicates vehicle is better than conventional vehicle.

Zero indicates vehicle is equivalent to conventional vehicle.

EXHIBIT 7

Applicability Rates for Cars in Scenario 1

(dashes indicate negligible values)

Sector \ Region ¹	East North Central	South Atlantic	Middle Atlantic	Pacific	West South Central	West North Central	East South Central	New England	Mountain	All Regions	Cars W/Region Unreported	Total
Police	-%	0%	-%	2%	-%	0%	4%	0%	0%	-%	-%	-%
Government ²	0%	0%	0%	3%	0%	0%	0%	0%	4%	1%	1%	1%
Utility	8%	-%	41%	4%	-%	8%	16%	2%	1%	16%	16%	16%
Taxi	0%	0%	1%	1%	0%	0%	0%	0%	0%	-%	-%	-%
Rental	0%	0%	0%	5%	24%	0%	0%	0%	0%	24%	0%	23%
Business 25+	3%	-%	-%	3%	-%	2%	0%	-%	3%	1%	1%	1%
Business 4-24	3%	2%	3%	0%	0%	2%	0%	-%	0%	2%	-%	1%
All Sectors	3%	-%	10%	3%	12%	3%	7%	1%	2%	6%	-%	4%

1. Location of fleet administrator.

2. State and local non-police.

but there are large variations from region to region. Sensitivity tests can be conducted to isolate the particular vehicle characteristics responsible for these variations. For the present it can be said that the hypothetical vehicle of Scenario 1 can satisfy an estimated 41% of the vehicle missions of cars used by Middle Atlantic utilities. Further, the applicability rate for utilities is much lower in all other regions. All other sectors exhibit very low applicability rates in all regions.

Regional applicability rates for light trucks are shown in Exhibit 8. Note that, as is the case for cars, rental and government vehicles are being resampled. This is important to remember before examining estimates derived from the small and regionally lopsided rental sample. In the case of light trucks it is also important to note that the respondents were never asked to specify the cargo capacities needed by their trucks. The implicit assumption is that, when being considered as a light truck substitute, the hypothetical vehicle has cargo capacity comparable to a conventional van or pickup. Otherwise it has the characteristics specified in Exhibit 6.

Utilities display relatively high applicability rates for light trucks with the characteristics of the hypothetical vehicle. As was the case with cars, the Middle Atlantic utilities have the highest applicability rates, and again there is great variability from region to region. Rental trucks also show high applicability rates but this data is likely to be modified. The other sectors all demonstrate low applicability, but some sectors have high applicability in specific regions. Except in the case of business trucks, these high regional rates appear to be unreliable due to sparse samples.

Further Research

There is a large amount of potentially useful regional fleet information that remains to be developed. Following is a list of some of the more important future research tasks.

- (1) Acquisition of a reliable estimate of the regional distribution of fleet vehicles.

EXHIBIT 8

Applicability Rates for Light Trucks in Scenario 1

(dashes indicate negligible values)

Sector \ Region ¹	Pacific	West South Central	South Atlantic	East North Central	West North Central	Mountain	East South Central	Middle Atlantic	New England	All Regions	Light Trucks W/Region Unreported	Total
State and Local Government ²	6%	0%	-%	-%	-%	1%	60%	1%	0%	2%	2%	2%
Utility	25%	10%	3%	24%	8%	1%	15%	55%	0%	26%	26%	26%
Taxi	0%	0%	0%	0%	0%	25% ³	0%	2%	0%	1%	1%	1%
Rental	8%	20%	0%	0%	0%	0%	0%	0%	0%	19%	19%	19%
Business	27%	-%	9%	5%	42%	8%	1%	1%	3%	7%	-%	3%
All Sectors	23%	5%	4%	18%	12%	2%	10%	41%	1%	19%	3%	15%

1. Location of fleet administrator.

2. Includes police.

3. May be unrepresentative, due to small number of sample vehicles from this region.

- (2) Development of statistical techniques to correct the data base for any overrepresentation or underrepresentation of regions.
- (3) Improvement of the data base and FLEETSIM so that calculated applicability rates will reflect:
 - (a) the effect that cold weather has on the starting time and driveability of various vehicles
 - (b) The explicit cargo capacity needs of light truck fleets.
- (4) Improvement of the data base to more accurately identify the region in which a given sample vehicle is operated.
- (5) Parametric studies to determine the sensitivity of regional applicability rates to changes in capabilities of hypothetical vehicles.