Market Assessment For Traveler Services

A Choice Modeling Study

Phase III
FAST-TRAC
Deliverable

#16B: Final Choice Modeling Report

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Abstract

This report describes the choice model study of the FAST-TRAC (Faster and Safer Travel through Traffic Routing and Advanced Controls) Operational Test in Southeast Michigan. Choice modeling is a stated-preference approach in which respondents are asked to choose among differentially priced (potential or actual) implementations of a product or service. In this study, subjects were presented market packages composed of various implementations of three classes of traveler services: traffic reports, route advice, and emergency roadside assistance. Choice data were obtained from 282 subjects via mail-out survey. These subjects, each of whom had prior experience with a route guidance device, were divided into six age-gender groups (male and female; under 30, 30 to 64, and over 64). The data were used to develop a series of four "choice models", which describe the likelihood that the participants would purchase variously priced market packages composed of combinations of the aforementioned traveler services.

Each of the four choice models is included in this report for reference. Perhaps the most appealing of the models, the one that perhaps best balances explanatory power with simplicity, is Model III, which includes main and interaction effects of age, gender and attributes describing the tested traveler services.

The actual form of Model III can be seen in the body of the report. The effects identified in the model are intuitively reasonable and are introduced here:

- The probability of choosing traveler services is inversely and strongly related to price.
- The effect of having a monthly service fee is large and negative, even for a fee of $5 per month.
- Respondents state a strong desire for "Emergency Roadside Assistance".
- Subjects desire "Dynamic Turn-by-turn Route Advice" and value it almost as much as "Emergency Roadside Assistance".
- Respondents state a strong desire for the traveler service combination of "Customized traffic reports on demand" and "Dynamic Turn-by-turn Route Advice".
- All else being equal, members of the 18 to 29 year-old subject group are somewhat more likely to find Emergency Assistance appealing than members of the 30 to 64 year-old subject group, while there is no difference between the 30 to 64 year-old group and the 65 and over group in this regard.
- All else being equal, female subjects are moderately more likely than males to choose a market package containing an Emergency Assistance feature.
- All else being equal, females in the 65 and over age group and the 18 to 29 age group are moderately more likely and much more likely, respectively, to choose a market package than are either males or females in the 30 to 64 year old group.

In addition to these general observations, decision makers can also make specific observations for individual market segments by plotting market share in response to given market packages.

Decision makers can use the choice models, combined with production and marketing cost data, to guide the development and marketing of products or services.

Introduction

FAST-TRAC (Faster and Safer Travel through Traffic Routing and Advanced Controls) is an operational test of new transportation technologies. The early stage of FAST-TRAC, which is being carried out in Oakland County, Michigan, combined the SCATS™ coordinated traffic signal control system, the Autoscope™ video traffic detection system, and the ALI-Scout™ route guidance system with the goal of improving traffic flow and salty.

One component of FAST-TRAC is a choice modeling study. The objective of the choicestudy is to elicit quantitative data to describe traveler preferences regarding three classes of traveler services: traffic reports, route advice, and emergency roadside assistance. The choice modeling study objective was pursued by presenting people (using a questionnaire) with a series of carefully selected, differentially priced (potential or actual) "market packages" of the three traveler services and asking them to respond to each, i.e., to state their preference by saying

whether or not they would buy the market package if it were available to them. Logistic regression was then applied to the data to develop a series of equations describing the probability that consumers will choose a market package composed of various implementations of the route advice, traffic reports, and emergency assistance "traveler services" and price.

The body of the report contains sections that introduce choice modeling methodology, describe the implementation of the method in this particular study, present an analysis of the data collected, and provide some perspective on applying the resulting choice models. The Choice Questionnaire is presented in Appendix A. Since implementing a questionnaire requires a good deal of resources and the marginal cost of adding a limited number of questions is low, an Opinion Questionnaire was added to the Choice Questionnaire. The Opinion Questionnaire, which addresses topics that are of significant interest but that are not essential to the choice study, is presented in Appendix B along with a brief analysis of the associated data. Demographic questions in support of the Choice Questionnaire were folded into the Opinion, Questionnaire.

Methodology

Choice modeling is one of several stated-preference techniques that have been used to evaluate aggregate consumer preference or utility for products and services [Louviere, 1984; Etrod. Louviere. a n d D a v e y , 1992; Louviere, 1988; Green 1974] These techniques have been used in previous studies of travel behavior [Kocur, Adler, Hyman, . and Aunet, 1982; Louviere, Henley. Woodworth, Meyer, Levin, Stoner, Curry, and Anderson 1981].

Choice modeling is based on the assumption that a product or service can be described in terms of a "bundle" of attributes that can take on two or more values or levels. Each attribute, and associated levels, is selected to characterize some aspect of the product or service under study. e.g., the attribute of purchase price at levels of $250, $750, $1250, and $ 1750. The attribute list should include features that are 1) commonly found to be, or thought to be, important to consumers and 2) measurable and appropriate for the purposes of the study, e.g., descriptive of products or services that exist or could soon exist in the marketplace. Each bundle of attribute-levels can be considered as a potential implementation of the product or service, i.e., a market package.

In the most basic form of choice modeling, data describing consumer preferences are obtained by presenting people with a series of carefully selected product/service bundles and asking them to respond to each, i.e., to state their preference by saying whether or not they would buy the market package if it were available to them. In this case, only one market package is considered at a time and the choice is between that implementation of the product or service and the status quo. Note that subjects responding to a choice model study are given the realistic task of evaluating a product or service in its entirety; subjects are not asked to evaluate attributes individually.

If the researcher develops the series of market packages according to proper experimental design, and if study participants can be assumed to choose market packages rationally, i.e., will choose a package only if it provides more benefit than the status quo, then the degree to which each attribute- level influences aggregate respondent preference can be determined from the choice data. That is, aggregate coefficients for each attribute-level can be estimated from the choice data. Positive (negative) coefficients indicate positive (negative) utility.The greater (lesser) the magnitude of the coefficient, the greater (lesser) the impact the attribute-level should have on participants' decision making, i.e., a large (small) coefficient for an attribute-level implies that the consumer is (is not) making significant use of the attribute-level to discriminate between a product/service market package and the status quo.

The attribute-level coefficients form a "choice model" that describes the likelihood that consumers will purchase variously priced market packages composed of combinations of the attribute-levels. The choice model can be used either to reproduce the original judgments or to predict choice among new combinations of attribute-levels, i.e., to predict the probability that people will purchase product or service implementations that were not included in the study but which can be described in terms of the attribute-levels tested. In this manner, design issues, such as which attributes and what levels to include in a product or service, may be addressed and market share may be estimated, prior to expending a great effort developing the product or service.

A primary advantage of the stated-preference choice model method, in contrast to a revealed preference approach, is that the market packages tested can represent products or services that are not yet available in the marketplace. That is, the technique can be utilized to explore the effectiveness of, and evaluate traveler response to, (various implementations of) emerging products on services prior to implementation. Furthermore, decision makers can use the resulting choice model, combined with production and marketing cost data, to guide both the development and marketing of products or services, i.e., as a type of pre-development analysis methodology. Choice methodology can thus serve as background for actual implementations, as well as guidance for further study aimed at determining changes in consumer behavior due to improvements in product/service characteristics.

Implementation

This section introduces the choice model instrument, as implemented in this study, in terms of selection of attributes and levels, questionnaire design, subjects, and data collection.

Attributes & Levels - The basic approach in selecting attributes for this study was to consider the traveler service that could answer each of the most basic questions that a traveler might ask when considering a trip.

Question	Traveler Service
What destination will best suit your needs?	electronic yellow pages and tour book
What is the best way to get to your destination?	route/mode advice
What are current traffic conditions?	traffic information
How can I get help quickly when on the road?	emergency assistance
What does all this cost?	price (obviously, not a service)

Thus, in terms of this study, an attribute is a traveler service or price and the bundles are market packages or traveler services.

In selecting the attributes and levels for a choice model, the researcher must consider that the bundles used to collect data for the model are developed from combinations of attribute-levels. Thus, each attribute-level greatly increases the number of potential product/service implementations that need to be tested, which in turn raises the danger of overwhelming the cognitive capacity of respondents. In short, the number of attribute-levels should be as few as possible, while still providing an adequate description of the product or service under investigation.

Five attributes, those deemed to be those most essential to definition of a traveler service package in the context of this study, were selected. The first two attributes were purchase price and monthly fee. The remaining three attributes represent three services intended to help travelers get where they want to go faster, more safely, and with less stress:

- Route Advice service (tells you which are the – best roads to take),
- Traffic Report service (tells you about unexpected delays on roadways)
- Emergency Roadside Assistance service (an automated mayday that calls for help when you need it.)

The concept of an electronic directory was not included in the study because existing route guidance systems have for the most part included it within the scope of the guidance service. Other potential attributes, specifically mode choice, and tolling, were not included either, i.e..were traded off for greater statistical power on the five attributes chosen, because they were thought to be low priority issues given the nature of the audience for the study. The chosen design attributes, along with the levels associated with them are:

Route Advice:
Level 1: Historic General route advice
Level 2: Dynamic General route advice
Level 3: Historic Turn-by-turn instructions
Level 4: Dynamic Turn-by-turn instructions

Traffic Reports:
Level 1: Metrowide traffic reports, once every 10 minutes
Level 2: Customized traffic reports on demand

Emergency Roadside Assistance (Mayday):
Level 1: No assistance
Level 2: Emergency assistance

Purchase Price
Level 1: $250
Level 2: $750
Level 3: $1250
Level 4: $1750

Monthly Fee
Level 1: $5 per month
Level 2: No fee

The traveler services and associated levels, which can be thought of as various implementations of the respective traveler services, were described in more detail in a write-up accompanying the Choice Questionnaire, which is introduced in the next section.

Questionnaire Design - The levels for the attributes chosen for the study can be combined into 128 potential market packages (4*2*2*4*2). Responding to such a large number of "products" may prove to be too formidable a task for respondents to tackle. In fact, such a situation might lead respondents to use simpler rules, such as a priori elimination of some attributes from consideration, thereby degrading the quality of the data. Therefore, the fractional-factorial plan shown in Table 1 was designed to reduce the number of market packages presented to subjects to 32, at the expense of the ability to detect some interaction effects. The particular design in Table 1 is such that one of the design attribute levels are aliased (confounded) with less than a third-order interaction. The S-PLUS statistical software package was used to carry out this task [S-PLUS, 1996].

The actual Choice Questionnaire, shown in Appendix A. included a cover letter, a description of the traveler services investigated, and 32 market packages to be chosen or not. As evident from the market packages shown in the instrument, a full-concept method, in contrast to a two-factor-at-a-time or paired tradeoff method, was used in each case. That is, respondents were asked to rate market packages that are defined by given levels of all traveler services presented simultaneously. This approach gives a more realistic description of each market package and also entails fewer judgments by the respondent. Each single judgment however, more complex because it involves considering several traveler services at one time.

Additional questions intended to elicit subject views on a variety of transportation-related topics were included in an Opinion Questionnaire, shown in Appendix B. Questions regarding subject demographics were also included in the Opinion Questionnaire. The parameters from these questionnaires that are of interest to this study are:

Demographic Parameters
Age
Gender
Income
Carphone ownership
Miles driven annually
Job type (work at home or away from home)

Opinion Parameters
Degree to which unexpected delays are a problem
Level of familiarity with travel area
Satisfaction with existing traffic reports
Satisfaction with existing route advice
Satisfaction with existing emergency assistance

Subjects - Drivers with at least a minimum of previous exposure to driving a vehicle equipped with a route guidance system were considered potential subjects for this study. This pool of subjects was targeted to address a weakness in the choice model method: consumer response to a new category of product or service may be difficult to gauge because consumers, by definition, have had no prior experience with the type of product or service and so might not readily understand its use and potential benefits. Thus, careful description of the product or service, and, if at all possible, some interaction with a prototype, is needed prior to asking subjects to respond to the choice questionnaire. This study primarily deals with route advice, traffic information, and emergency roadside assistance. The latter two categories of traveler service are extensions of types of services that most travelers are already familiar with. As a result, these services are relatively easily understood. However, route advice, in the form of route guidance systems, is a traveler service that is relatively new to travelers. Thus the benefits of a route advice service are potentially more difficult for travelers to envision. Again, subjects with at least a minimum of previous exposure to driving a vehicle equipped with a route guidance system were selected with the goal of overcoming this potential difficulty.

Table 1: Choice Model Questionnaire Design[1]

Market Package	Traffic Reports (G)	Route Advice (D, E)	Emergency Assistance (H)	Purchase Price (A, B)	Monthly Fee (C)
1	1	1	1	1	1
2	1	1	1	4	2
3	2	4	2	3	1
4	2	4	2	2	2
5	1	3	1	2	1
6	1	3	1	3	2
7	2	2	2	4	1
8	2	2	2	1	2
9	1	2	1	3	1
10	1	2	1	2	2
11	2	3	2	1	1
12	2	3	2	4	2
13	1	4	1	4	1
14	1	4	1	1	2
15	2	1	2	2	1
16	2	1	3	3	2
17	2	1	1	4	1
18	2	1	1	1	2
19	1	4	2	2	1
20	1	4	2	3	2
21	2	3	1	3	1
22	2	3	1	2	2
23	1	2		1	1
24	1	2	2	4	2
25	2	3	1	2	1
26	2	2	1	3	2
27	1	3	2	4	1
28	1	3	2	1	2
29	2	4	1	1	1
30	2	4	1	4	3
31	1	1	2	3	1
32	1	1	2	2	2

[1] Complete defining relation [determines which interactions are estimable]: ACDG; BDEH; ABCEGH

A list of potential subjects (name, home address, gender, and, in many cases, age) was obtained from the subject pool previously recruited by the University of Michigan Transportation Research Institute (UMTRI) as part of the FAST-TRAC User Perception and Behavior study. Specifically, the pool of subjects (or this study was composed of people who had already participated in either the ALI-Scout™ Natural Use Leased Vehicle Study [Kostyniuk, et al., 1997]or the ALI-Scout™ Natural Use Personal Vehicle Study [Eby, et al., 1997a], both of which involved driving a vehicle equipped with a route guidance device. Some of those in the leased vehicle study subsequently also participated in the Tetra-Star™ Natural Use Study [Eby, et al., 1997b]. The exact means by which subjects were recruited in these studies can be found in the aforementioned reports. During their recruitment effort, UMTRI informed these subjects that they might be asked to respond to a separate questionnaire, this one, at a later date.

For compatibility with the aforementioned studies, subjects were recruited to fill 6 experimental "age-gender cells":

males age: 18-29
females age 18-29
males age 30-64
females age 30-64
males age 65 and over
females age 65 and over

The goal was to recruit approximately 30 subjects in each cell (an empirically-based and often used "rule of thumb" for studies of this type, for ISO subjects total.

Data Collection - Names and addresses of 473 potential subjects were obtained in electronic format from CMTRI. The age of 383 of these people were also known. Four of the names were eliminated due to incomplete mailing addresses. Two more names were eliminated to avoid sending the survey to more than one member of a family unit. The Choice and Opinion Questionnaires were mailed with a cover letter via first class U.S. mail to the home address of each of the remaining 467 potential subjects. The respondents number of potential in the younger and older age categories was known to be low prior to the study so a reminder was sent to members of the younger and older groups who had not responded within a few weeks to increase the data in these categories. A pre-addressed, stamped envelope was included for return of the questionnaire. Responding to the survey required approximately 20 minutes of a participant's time. To boost the response rate, potential respondents were informed that those returning the survey would receive $5 in appreciation. A note expressing gratitude for participation was mailed with the $5.

One dozen questionnaire packets were returned by the Post Office as undeliverable, leaving an assumed total of 455 valid addresses. 287 completed questionnaires were returned. Four questionnaires were obviously completed by a person other than the intended subject and were thus dropped. 16 Choice Questionnaires had missing data; 15 were resent to the subject for completion (all 15 were eventually completed). 1 arrived too late for this action and was thus not included in the choice data, but was included in the Opinion data. No action was taken to obtain missing data for the Opinion Questionnaire. Taking all of this into consideration, the overall effective response rate for the Choice Study was 282 of 455 or 62.0 percent. This response is divided as shown in Table 2, percentages do not sum exactly due to rounding.

Table 2: Description of Study Respondents

Age	Gender		
	Female	male	
18 – 29	72 (7.8%)	36 (12.8%)	58 (20.6%)
30 – 64	55 (19.5%)[2]	135 (47.9%)	190 (67.4%)
65 and over	12 (4.3%)	22 (7.8%)	34 (12.1%)
	89 (31.6%)	193 (68.4%)	282 (100.0%)

[2] Data from an additional 30-64 year old female respondent is included in the Opinion Study.

Choice Model Results

Many models of subject choice are possible. Selecting the "best" model is not always a straightforward task and depends somewhat on the purpose to which the model will be put and the ease of gathering demographic and opinion data on potential consumers. In essence, the choice of model is based upon a tradeoff between model simplicity and elegance, model explanatory or predictive power, and the intuitive appeal of the model. In this study, coefficients for models of subject choice among the tested traveler services were estimated from the data collected, i.e., from subject response to the 32 potential traveler service packages presented in the choice questionnaire along with the demographic and opinion data, via binary logistic regression [SAS, 1996]. Note that, in general, regression procedures are based on the assumption that all of the data points are independent, which is not the case here as each respondent provided 32 data points. The potential bias due to this situation was controlled for through procedures available in the SAS statistical analysis software application.

A good number of models were fit to the data: four of these models are introduced in this report. In each case, the model was developed by analyses to determine the parameters that influence the probability that a subject would choose a market package. The four models, and the parameters tested are:

- Model I - the main effects of the choice model design attributes
- Model II - the main plus interaction effects of the choice model design attributes
- Model III - the main plus interaction effects of the choice model design attributes and the demographic factors of age and gender.
- Model IV - the main plus interaction effects of the choice model design attributes and the demographic factors of age and gender and the main effects of select other demographic parameters and select responses to the Opinion Questionnaire.

Table 3 presents the models as well, showing the specific parameters included in the analyses for each model. The models actually estimated from the analyses are discussed in the following pages.

Since some of the parameters turned out to be not significant for particular models, not all of the parameters indicated in Table 3 show up in the actual models.

The models are ordered, I to IV, by progressively increasing complexity. That is, Model II has more terms than Model I and also includes interactions effects, and so on. With these models, increasing complexity also corresponds to greater explanatory power in term5 of the Log Likelihood criterion for assessing the "goodness of fit" of a logistic regression model.

Recall that missing data for Choice Questionnaires were collected by re-sending the questionnaires to subjects. However, no second attempt was made to collect missing data for the Opinion Questionnaire as this portion of the study was considered less essential than the Choice Questionnaire. Moreover, many people are less willing to respond to demographic and opinion questions than to the choice-type questions presented. As a result, some demographic and opinion data is missing for some subjects. The amount of missing data is evident from Table 4. Inspection of the table shows that Models I, II, and III can be estimated based on data from all of the 282 subjects who responded to the study. Model IV, however, is based upon a slightly smaller data set due to missing values.

Model I

Analyses for Model I included only the main effects of the choice model design attributes. The attribute-level coefficients for the "best" version of Model I are presented in Table 5. Only one attribute-level per grouping in the table would be included in any given market package. The same information is also presented in Figure 2, which may facilitate comparison of the impact of the various effects. The coefficients are provided in terms of comparison to a baseline for the model, where the baseline consists of the attribute levels, one per attribute, that have been assigned a coefficient of 0.0000. For example, the coefficient of 0.4676 for "Customized traffic reports on demand" represents the influence of this attribute level on the probability of choosing a market package with respect to a baseline consisting of "Metrowide traffic reports once every 10 minutes", "Historic General route advice", "No Emergency Assistance", and "No Monthly Fee".

Table 3: Parameters Included in the Analyses for the Four Models Tested[1]

	Model I	Model II	Model III	Model IV
Design Parameters				
Price (P)	P	P P*F P*TR P*RA P*EA	P P*F P*TR P*RA P*EA P*A P*G	P P*F P*TR P*RA P*EA P*A P*G
Fee (F)	F	F F*TR F*RA F*EA	F F*TR F*RA F*EA F*A F*G	F F*TR F*RA F*EA F*A F*G
Traffic Report (TR)	TR	TR TR*RA TR*EA	TR TR*RA TR*EA TR*A TR*G	TR TR*RA TR*EA TR*A TR*G
Route Advice (RA)	RA	RA RA*EA	RA RA*EA RA*A RA*G	RA RA*EA RA*A RA*G
Emergency Assistance (EA)	EA	EA	EA EA*A EA*G	EA EA*A EA*G
Demographic Parameters				
Age (A)			A A*G	A A*G
Gender (G)			G	G
Income (I)				I
Job Type (JT)				JT
Car-phone ownership (C)				C
Miles driven annually (M)				M
Opinion Parameters				
Degree to which unexpected Delays are a Problem (DP)				DP
Level of Familiarity with travel Area (FA)				FA
Satisfaction with existing Traffic Reports (STR)				STR
Satisfaction with existing Route Advice (SRA)				SRA
Satisfaction with existing Emergency Assistance (SEA)				SEA

[1] A single parameter represents a main effect. Two parameters separated by a "*" represent an interaction effect. Only second order interaction effects were considered.

Table 4: Missing Data

Parameter	Number of Subjects (282 total per Table 2)	
	With no missing data	With missing data
Choice Data (complete sets of 32 responses each)	282	None
Age	282	None
Gender	282	None
Income	245	37
Job Type (work at home or away from home)	279	3
Carphone Ownership	282	None
Miles Driven Annually	282	None
Degree to which Unexpected Delays are a Problem	281	1
Level of Familiarity with Travel Area	282	None
Satisfaction with Existing Traffic Reports	280	2
Satisfaction with Existing Route Advice	279	3
Satisfaction with Existing Emergency Assistance	279	3
Number of subjects with no missing data	240	

Table 5: Model I Coefficients
(Analysis included main effects of the choice model design attributes.)

Attribute	Level	Coef	Std Err	Prob
Constant	not applicable	-0.3383	0.0929	0.0003
Price	Rate per 100 for range of $250 to $1750	-0.2371	0.0069	0.0001
Monthly	Yes ($5)	-0.8561	0.0623	0.0001
Fee	No	0.0000	0.0000	--
Traffic	Customized traffic reports on demand	0.4676	0.0615	0.0001
Reports	Metrowide traffic reports once every 10 minutes	0.0000	0.0000	--
Route	Dynamic Turn-by-turn instructions	0.9552	0.0835	0.0001
Advice	Historic Turn-by-turn instructions	0.1947	0.0917	0.0342
	Dynamic General route advice	0.6200	0.0904	0.0001
	Historic General route advice	0.0000	0.0000	--
Emergency	Emergency roadside assistance	0.9832	0.0630	0.0001
Assitance	No assistance	0.0000	0.0000	--
Criterion For Assessing Goodness Of Fit for Model: Log Likelihood = -3432.7951				

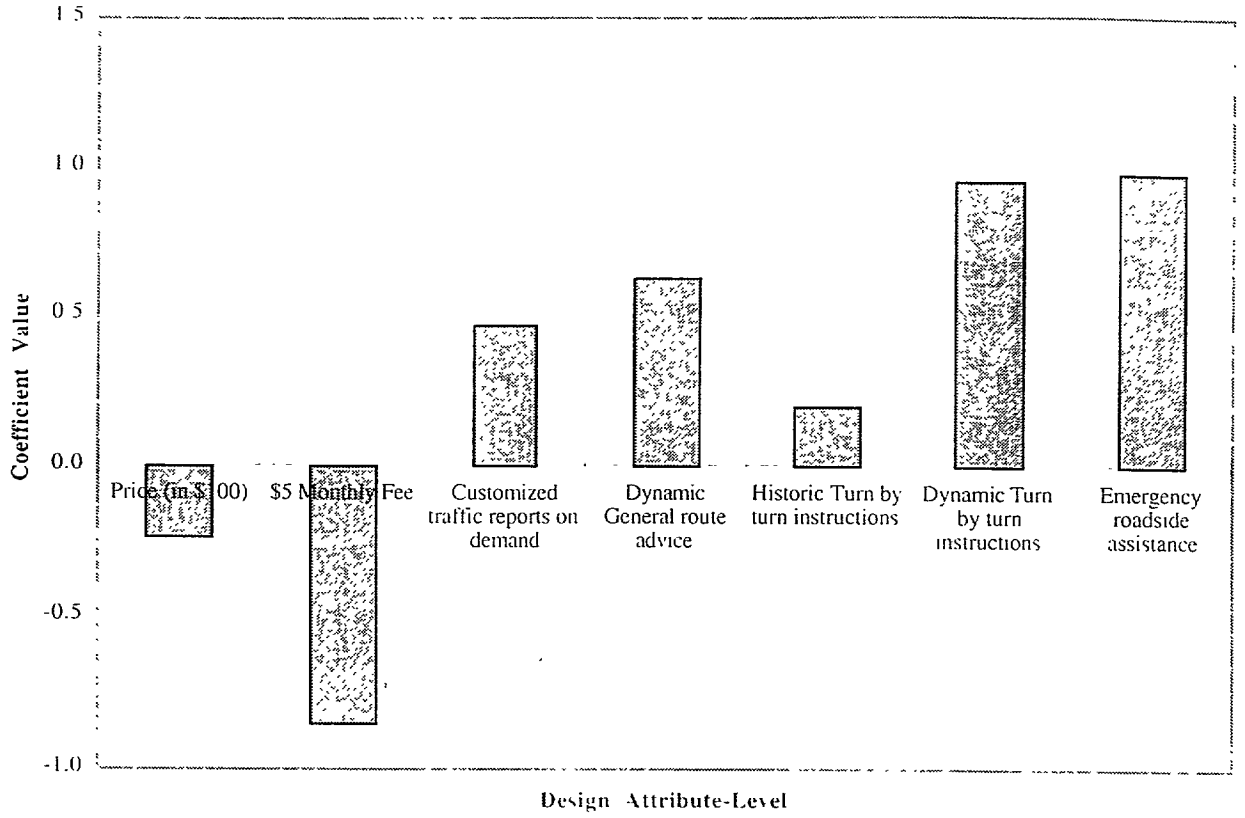

Figure 2: Model I Choice Model Coefficients (Design Attributes; Main Effects)

Positive coefficients in the table and figure are interpreted as contributing to a subject's choice of the market package over the status quo; negative coefficients argue against choice, i.e. for accepting the status quo. Again, the larger the coefficient, the greater the effect. The reader is advised to remember that the model is valid only within the price range of $250 to $1750; the model may prove erroneous for extrapolation outside of this price range. Furthermore, it must be understood that although the baseline for Model I was intended to approximate the status quo, not every subject can be expected to perceive the baseline and status quo as being the same. In fact, in aggregate, the subjects perceived the baseline as of more value than the status quo, as will be described later.

Inspection of the coefficients in Table 5 and Figure 2 reveals that the coefficient for each attribute in the study is statistically significant at the .05 level. Moreover, the identified effects are intuitively reasonable:

- First, the probability of choosing a market package is inversely related to price. The effect of price is also relatively large: a $500 increase in price represents a negative effect of over .1, which is larger than the effect of any of the other "services" under consideration.

- Similarly, the effect of having a monthly fee is large and negative, even for a fee of $5.

- Respondents in this study preferred "Customized traffic reports on demand" to "Metrowide traffic reports once every 10 minutes".

- Similarly, study respondents preferred "Emergency roadside assistance" to "no assistance", with this attribute being the most influential of the non-price features in the study.

- Finally, in comparison to "Historic General route advice", subjects preferred, in order of increasing preference, "Historic Turn-by-turn instructions", "Dynamic General route advice", and "Dynamic Turn-by-turn instructions". Subjects clearly desire dynamic route advice and value such advice almost as much as an emergency assistance feature.

As noted earlier, the model describes the probability that an individual subject in the study would choose the offered market package over the status quo. This can also be interpreted as the market share that the offered market package would achieve within the larger group of subjects. The boundaries of the probability of choosing/market share are shown in Figure 3, which compares market share for a "basic" market package, which represents the Model I baseline, with that for three other potential market packages for a range of price levels. The four market packages depicted are defined in Table 6. Such a plot can be easily generated for any market package that can be developed from the tested attributes and levels.

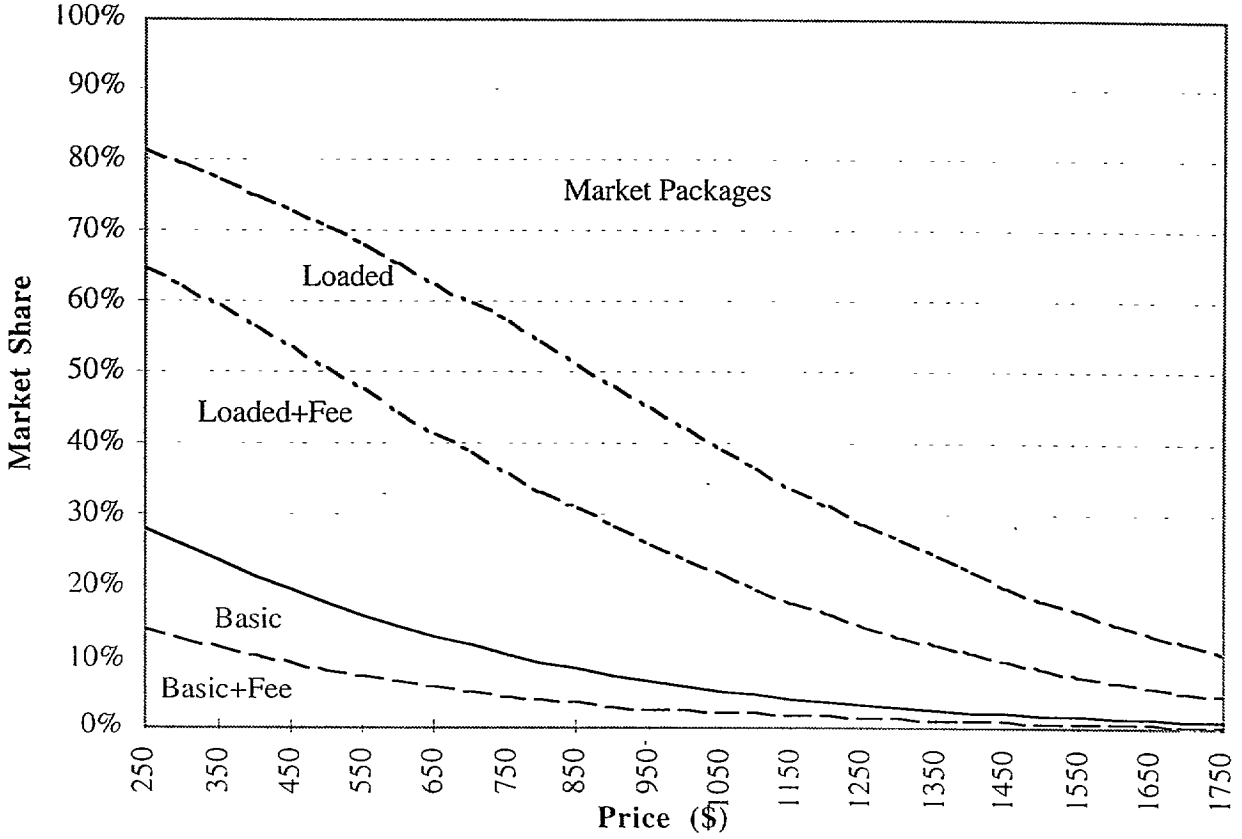

Figure 3: Illustrative Boundaries on Market Package Market Share from Model I (Choice Model Output; Design Attributes, Main Effects)

Table 6: Definition of Illustrative Market Packages of Traveler Services

Potential Market Package	Attribute levels			
	Traffic Reports	**Route Advice**	**Emergency Assistance**	**Monthly Fee**
Basic	Metrowide traffic reports once every 10 minutes	Historic General route advice	No Emergency roadside assistance	no monthly fee
Basic+Fee	Metrowide traffic reports once every 10 minutes	Historic General route advice	No Emergency roadside assistance	$5 monthly fee
Loaded	Customized traffic reports on demand	Dynamic Turn-by-turn instructions	Emergency roadside assistance	no monthly fee
Loaded+Fee	Customized traffic reports on demand	Dynamic Turn-by-turn instructions	Emergency roadside assistance	$5 monthly fee

To better utilize diagrams such as Figure 3, one should have a grasp on the method for determining the market share for a traveler service package, i.e., how to apply Equation 1, which was described earlier. This process is not difficult and will be illustrated shortly. However, prior to that the reader must understand that the market share estimates are valid only for people within the given market segment, e.g., young males, and only if the market package in question is the only alternative to the status quo, i.e., the market share for multiple packages cannot be summed to get a total market share for traveler service market packages in the situation where two or more packages are simultaneously in the market place. The market share for the Loaded+Fee market package of Table 6 is estimated here for a price of $500 as way of illustrating the procedure. First, combining the attribute levels from Model I with Equation 2, where "coef' refers to the coefficient appropriate to the associated attribute level and where the coefficients for the baseline attribute levels have already been assigned the baseline value of 0, leads to:

$\lambda\beta`X_{Loaded+Fee}$=

(constant) +

(coef)(price of $500) +

(coef)($5 monthly fee) +

(0)(no monthly fee) +

(coef)(Customized traffic reports on demand) +

(0)(Metrowide traffic reports every10 min) +

(coef)(Dynamic Turn-by-turn instructions) +

(coef)(Historic Turn-by-turn instructions) +

(coef)(Dynamic General route advice) +

(0)(Historic General route advice) +

(coef)(Emergency roadside assistance) +

(0)(No Emergency assistance)

Second, inserting the constant and appropriate coefficients from Table 5 leads to:

$\lambda\beta`X_{Loaded+Fee}$ =

(-0.3383) +

(-0.3374)(5) +

(-0.8561)(1) +

(0)(0) +

(0.4676)(1) +

(0)(0) +

(0.9552)(1) +

(0.1942)(0) +

(0.6200)(0) +

(0)(0) +

(0.9832)(1) +

(0)(0)

= 0.0246

where price is expressed in $100 and the remaining attribute level terms are 1 if the attribute level is in the market package and 0 if not.

Finally, the probability that subjects will choose the Loaded+Fee market package, i.e., the market share, can be estimated by placing the value from Equation 2 into Equation 1, which leads to:

Probability of choosing Loaded+Fee market package instead of the status quo =

$$\frac{\exp(\lambda\beta`X_{Loaded+Fee})}{[1 + \exp(\lambda\beta`X_{Loaded+Fee})]}$$

$$= \frac{\exp(0.0246)}{[1 + \exp(0.0246)]}$$

= .5061 or about 51% market share.

The market share for a market package composed of any combination of the tested attribute levels can be estimated in the manner just described. The mean willingness to pay for a market package can also be estimated using the model by integrating the product of price by incremental market share. For example, summing the product of price by incremental market share at 550 price increments from $250 to $1750 for a market package with attributes of "Historic Turn-by-turn instructions", "No Monthly Fee", "Metrowide traffic reports once every 10 minutes", and "No Emergency Assistance" generates a mean willingness to pay of $328. This willingness to pay value is, however, only valid for percentage of subjects whose willingness to pay falls in the S250 to $1750 price range of the model, whichis roughly 31 percent in this example. Estimating a willingness to pay for the entire study group would require assumption?; as to the willingness to pay of the 2 percent of people willing to pay more than $1750 and the nearly 57% only willing to pay some value less

than $250. One pair of assumptions would be that those in the former group would not be willing to pay any more than $1750 and those any the latter group would not pay anything, i.e., would pay $0. Under such assumptions, the mean willingness to pay for the service package under discussion would be about $169 (.57*0+.41*328+.02*1750). But then, segmenting the willingness to pay by market segment would be more informative. Moreover, the curves for various market segments used to generate the willingness to pay information may already be considered more informative.

Observation of Figure 3 reveals that the shape of the curves is in line with what could a priori be expected, thus giving some validity to the model. First, as price increases, the probability that a person will choose a given market package decreases. Second, the desirability of the market package increases with the number of services provided in the market package. Third, the addition of a fee decreases the probability that a person will choose a market package.

Two additional interesting observations can be made from Figure 3. First, it is evident that a majority of subjects in the study would choose the "loaded" market package for costs up to many hundreds of dollars. Second, it is also evident that many subjects in the study perceived the "basic" market package, which, again, is the Model I baseline, as of more value than the status quo, which is an individual subject's perception of currently available traveler services. Stated more accurately, the model indicates that these subjects are more likely to choose the basic market package over what they perceive to be the status quo, even when the basic package costs $350 or more, in contrast to the status quo, which is free. As shown in Table 6, the basic package provides "metrowide traffic reports once every 10 minutes", and "historic general route advice".Since the traffic reports included in the basic package are available via status quo commercial radio broadcast, i.e., since the basic package approximates the status quo, it is likely that subject willingness to choose the basic market package, thus their willingness to pay for that package, was likely influenced by the inclusion of the route advice service, which was defined as 1) heading a traveler in the right direction but not guiding them to a specific location and 2) indicating the traffic conditions that usually exist at the time of day that the person is traveling. Alternatively, study respondents could have been unavailable of, or unappreciative of, the commercial radio service or unaware that the definition of traffic reports in the survey instrument included such service, in which case the willingness to choose the basic package over the status quo would also be affected by the traffic report service.

To wrap up this discussion, note that the purpose of this exercise is not to determine the "best" market package, which will always be represented by the top curve, but rather to determine potential market share at a given purchase price. The other main decision element then is cost. That is, given the potential market share, can a given market package be produced and sold at a profit? The combination of these two pieces of information, essentially the estimation of the supply and demand curve for this market, is useful in determining policy regarding the attribute levels of the product or service under consideration.

Model II

Analyses for Model II included both main effects, of the design attributes and interaction effects among these parameters. The attribute-level coefficients for the "best" version of Model II are presented in Table 7. Only one attribute-level per grouping in the table would be included in any given market package. As previously noted, the study was developed so that none of the design attribute levels were aliased (confounded) with less than a third-order interaction. As interactions of third order or higher rate are commonly assumed to be negligible, the coefficients estimated through this study are assumed to be unbiased. As with Model I, the coefficients are provided in terms of comparison to a baseline composd of a set of attribute levels, one per attribute, that have been assigned to coefficient of 0.0000. Since the elements of Model II differ from those of Model I, the baseline for Model II also differs from that for Model I. Moreover, it is evident that as the complexity of a model increases, the complexity of the baseline similarly increases. Nevertheless, estimates of market share based upon Model I are determined in the same manner followed in the discussion regarding Model I. That is, the market package is first defined in terms of attribute levels, which are then inserted into equation 1, along with the appropriate coefficients taken from Table 7.

Table 7: Model II Coefficients
(Analysis included main plus interaction effects of the choice model design attributes.)

Attribute	Level[1]		Coef[2]	SE[3]	Prob
Constant	Not applicable		~~0.0745~~	0.1304	0.5676
Price	Rate per 100 ($250 to $1750)		-0.2152	0.0071	0.0001
Monthly Fee	Yes ($5)		-0.8753	0.0653	0.0001
	No		0.0000	0.0000	--
Traffic Reports x Route Advice	Customized on demand x	Dynamic Turn-by-turn	0.9778	0.1645	0.0001
	Customized on demand x	Historic Turn-by-turn	~~0.1639~~	0.1914	0.3918
	Customized on demand x	Dynamic General	~~0.0783~~	0.1935	0.6558
	Customized on demand x	Historic General	~~0.1238~~	0.1445	0.3915
	Metrowide once 10 min every x	Dynamic Turn-by-turn	0.5573	0.1521	0.0002
	Metrowide once 10 min every x	Historic Turn-by-turn	-0.3882	0.1899	0.0409
	Metrowide once 10 min every x	Dynamic General	~~-0.2855~~	0.1779	0.1085
	Metrowide once 10 min every x	Historic General	0.0000	0.0000	--
Traffic Reports x Emergency Assistance	Customized on demand x	Yes, Assitance	0.4405	0.1464	0.0026
	Customized on demand x	No assistance	0.0000	0.0000	--
	Metrowide once 10 min every x	Yes, Assitance	~~0.1621~~	0.1515	0.2847
	Metrowide once 10 min every x	No assistance	0.0000	0.0000	--
Route Advice x Emergency Assistance	Dynamic Turn-by-turn x	Yes, Assitance	0.4236	0.1672	0.0113
	Dynamic Turn-by-turn x	No assistance	0.0000	0.0000	--
	Historic Turn-by-turn x	Yes, Assitance	0.9417	0.2030	0.0001
	Historic Turn-by-turn x	No assistance	0.0000	0.0000	--
	Dynamic General	Yes, Assitance	1.3536	0.1980	0.0001
	Dynamic General	No assistance	0.0000	0.0000	--
	Historic General	Yes, Assitance	0.0000	0.0000	--
	Historic General	No assistance	0.0000	0.0000	--
Criterion for Assessing Goodness of Fit for Model: Log Likelihood = -3404.0718					

[1] Two attributes in this column separated by an "x" indicates an interaction between the two attributes listed
[2] Coefficients with a strike through are not significant at the 0.06 level, and are thus not included in the model
* Standard Error

- Inspection of the Table 7 coefficients reveals that in contract to Model I, the "best" Model included no main effect for traffic reports, route advice, and emergency assistance. Rather, Model II is defined as the main effects of the price and fee attributes along with the three interaction terms involving the traffic report, route advice, and emergency assistance attributes. Model II also predicts outcome better than Model I as seen by the better, ie., less negative, log likelihood value.

- The Price and Fee coefficients for Model II are quite similar to those for Model I. Also, as in Model I, the monthly fee was the most negative of all the attribute levels in Model II and close in magnitude to the most positive features.

- The attribute interactions, or combinations, that most appealed to subjects in the study, i.e., that most increased the probability that a market package would be chosen. In order of decreasing appeal are:

  Dynamic General Route Advice provided with Emergency Assistance.

  Dynamic Turn-by-turn Route Advice provided with Customized on-demand Traffic Reports.

and Historic Turn-by-turn Route Advice provided with Emergency Assistance.

Clearly, subjects place a premium on dynamic information and on assistance in case of need. Other attribute interactions, or combinations, with significant but somewhat less appeal, in order of decreasing appeal, are:

Dynamic Turn-by-turn Route Advice provided with Metrowide Traffic Reports once every 10 minutes.

Customized on-demand Traffic Reports provided with Emergency Assistance, and

Dynamic Turn-by-turn Route Advice provided with Emergency Assistance.

Interestingly, in contrast to the results of Model I, Dynamic General Route Advice provided with Emergency Assistance was preferred to Dynamic Turn-by-turn Route Advice provided with Emergency Assistance. This preference also shows up in that the coefficient for the attribute interaction ofMetrowide Traffic Reports once every 10 minutes provided with Historic Turn-by-turn Route Advice is somewhat negative, i.e., less appealing than the baseline of the same Traffic Reports provided with Historic General Route Advice.

Although a few subjects commented that they would choose a traveler service with an associated fee over the same service without a fee, on the assumption that the quality of the former service would be higher or more uniform, e.g., emergency assistance with an attendant on duty 24 hours a day, this fee by quality interaction did not appear in the model. The lack of this interaction could be because so few subjects felt this way and/or because the study instructions implied that the quality of a service was the same with and without a fee.

Model III

Analyses for Model III included age and gender values in addition to the choice model design attributes. The model also considered all interactions among these parameters. The attribute-level coefficients for the "best" version of Model III are given in Table 8, where the baseline is composed of a set of attribute levels, one per attribute, that have been assigned a coefficient of 00000, as was the case for Models I and II. Only one attribute-level per grouping in the table would be included in any given market package. Note that the age and gender data were not "designed", as were the attributes for the traveler services, but are rather covariates. Thus interaction effects involving age and gender might be confounded at less than a third order level.

Inspection of the coefficients in Table 8 reveals:

- With the exception of the interaction effect of the Traffic Reports and Emergency Assistance attributes, which is contained in Model II, Model III contains all of the parameters of Model II, plus additional parameters representing the interaction effect of the Emergency Assistance and Age attributes, the interaction effect of the Emergency Assistance and Gender attributes, and the interaction effect of the Age and Gender attributes. Model III also predicts outcome better than Model II as evidence by the better, i.e., less negative, log likelihood value.

- The coefficients that are represented in both Model II and Model III are similar in magnitude for the two models.

- All else being equal, members of the 18 to 29 year old subject group are somewhat more likely to find Emergency Assistance appealing than members of the 30 to 64 year old subject group, while there is no difference between the 30 to 64 year old group and the 65 and over group in this regard.

- All else being equal, female in the 65 and over age group and the 18 to 29 age group are moderately more likely respectively, to choose a market package than either males or women in the 30 to 64 year old age group.

Observations can be made from plots of market share, as was done in Figure 3 for Model I. Figures 4, 5, and 6 present the market share for each of the "basic" and "loaded, no fee" market packages, previously defined in Table 6, as estimated from Model III by age group, by gender and by age-gender group, respectively. Note that each figure portrays the probability that people within a particular market segment, e.g., young males in Figure 6, would choose a market package, or equivalently, the share of a specific

market segment that the market package could enjoy. This is in contrast to Figure 3, which presents the market share of the entire market, as represented by the subjects in the study. Recall also, as described in regards to Figure 3, that the market share estimates are valid only if the market package in question is the only alternative to the status quo.

Figure 4 indicates that the younger the group of subjects, the more apt they are to buy either of the traveler service packages. Moreover, the gap between the younger age group and the other two age groups is much wider for the loaded, no fee package. Figure 5 shows that males and females are about equally likely to choose the basic package, but that females are somewhat more likely to choose the loaded, no fee package. Figure 6 shows that the probability of a male choosing a market package does not vary much by age group, in contrast to the probability that a female will choose a package, which varies widely by age group. Comparing the figures, the noticeable gap in Figures 4 and 5 between curves for the loaded, no fee package appears due to the good probability that females in the younger age group will choosethe loaded, no fee package.

Table 8: Model III Coefficients

(Analysis included main plus interaction effects of choice model design attributes plus age and gender.)

Attribute[1]	Level		Coef[2]	SE[3]	Prob
Constant	not applicable		~~0.1371~~	0.1385	0.3223
Price	Rate per 100 ($250 to $1750)		-0.2204	0.0073	0.0001
Monthly	Yes ($5)		-0.8976	0.0661	0.0001
Fee	No		0.0000	0.0000	--
Traffic	Customized on demand x	Dynamic Turn-by-turn	1.1524	0.1578	0.0001
Reports	Customized on demand x	Historic Turn-by-turn	~~-0.0060~~	0.1843	0.9742
x	Customized on demand x	Dynamic General	~~0.2546~~	0.1838	0.1661
Route	Customized on demand x	Historic General	~~0.2580~~	0.1399	0.0652
Advice	Metrowide once every 10 min x	Dynamic Turn-by-turn	0.5582	0.1554	0.0003
	Metrowide once every 10 min x	Historic Turn-by-turn	-0.4278	0.1947	0.0280
	Metrowide once every 10 min x	Dynamic General	~~-0.2995~~	0.1823	0.1004
	Metrowide once every 10 min x	Historic General	0.0000	0.0000	--
Traffic	Customized on demand x	Female	-0.7672	0.1376	0.0001
Reports	Customized on demand x	Male	0.0000	0.0000	--
x	Metrowide once every 10 min x	Female	-0.7698	0.1473	0.0001
Gender	Metrowide once every 10 min x	Male	0.0000	0.0000	--
Route	Dynamic Turn-by-turn x	Yes, Assistance	0.4760	0.1261	0.0002
Advice	Dynamic Turn-by-turn x	No assistance	0.0000	0.0000	--
x	Historic Turn-by-turn x	Yes, Assistance	1.0183	0.1577	0.0001
Emergency	Historic Turn-by-turn x	No assistance	0.0000	0.0000	--
Assistance	Dynamic General x	Yes, Assistance	1.4046	0.1520	0.0001
	Dynamic General x	No assistance	0.0000	0.0000	--
	Historic General x	Yes, Assistance	~~0.0345~~	0.1495	0.8176
	Historic General x	No assistance	0.0000	0.0000	--
Emergency	Yes, Assistance x	18 to 29	0.2965	0.1153	0.0101
Assistance	Yes, Assistance x	65 and over	~~-0.0168~~	0.1461	0.9085
x	Yes, Assistance x	30 to 64	0.0000	0.0000	--
Age	No assistance x	18 to 29	~~-0.1060~~	0.1331	0.4258
	No assistance x	65 and over	~~0.1215~~	0.1600	0.4476
	No assistance x	30 to 64	0.0000	0.0000	--

Table 8: Model III Coefficients (continued)

Attribute [1]	Level		Coef [2]	SE [3]	Prob
Emergency	Yes, Assistance x	Female	0.6583	0.1404	0.0001
Assistance	Yes, Assistance x	Male	0.0000	0.0000	—
x	No assistance x	Female	0.0000	0.0000	—
Gender	No assistance x	Male	0.0000	0.0000	—
Age	18 to 29 x	Female	1.1837	0.1587	0.0001
x	18 to 29 x	Male	0.0000	0.0000	—
Gender	65 and over x	Female	0.5490	0.2029	0.0068
	65 and over x	Male	0.0000	0.0000	—
	30 to 64 x	Female	0.0000	0.0000	—
	30 to 64 x	Male	0.0000	0.0000	—
Criterion For Assessing Goodness Of Fit for Model: Log Likelihood = -3333.8906					

[1] Two attributes in this column separated by an "x" indicates an interaction between the two attributes listed.

[2] Coefficients with a strike through are not significant at the 0.05 level, and are thus not included in the model.

[3] Standard Error.

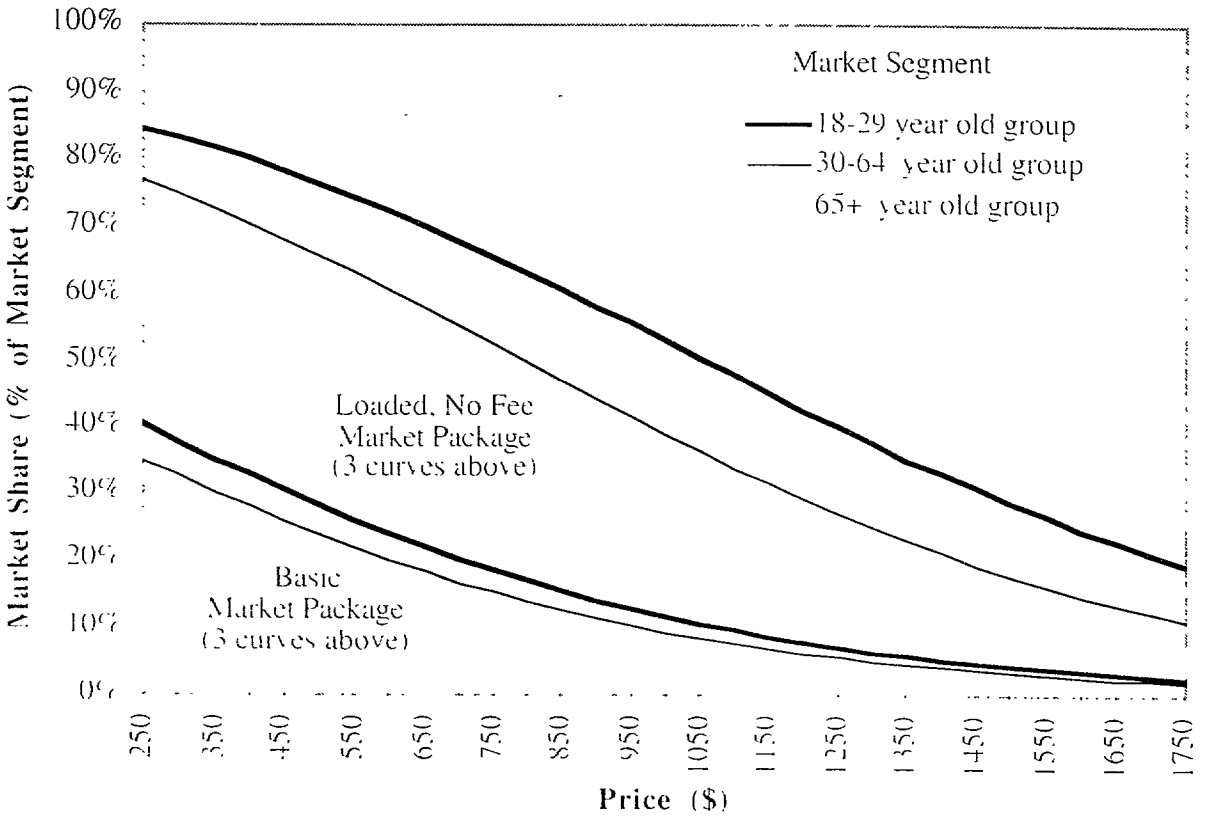

Figure 4: Comparison of Market Share by Age Market Segment (Model III)

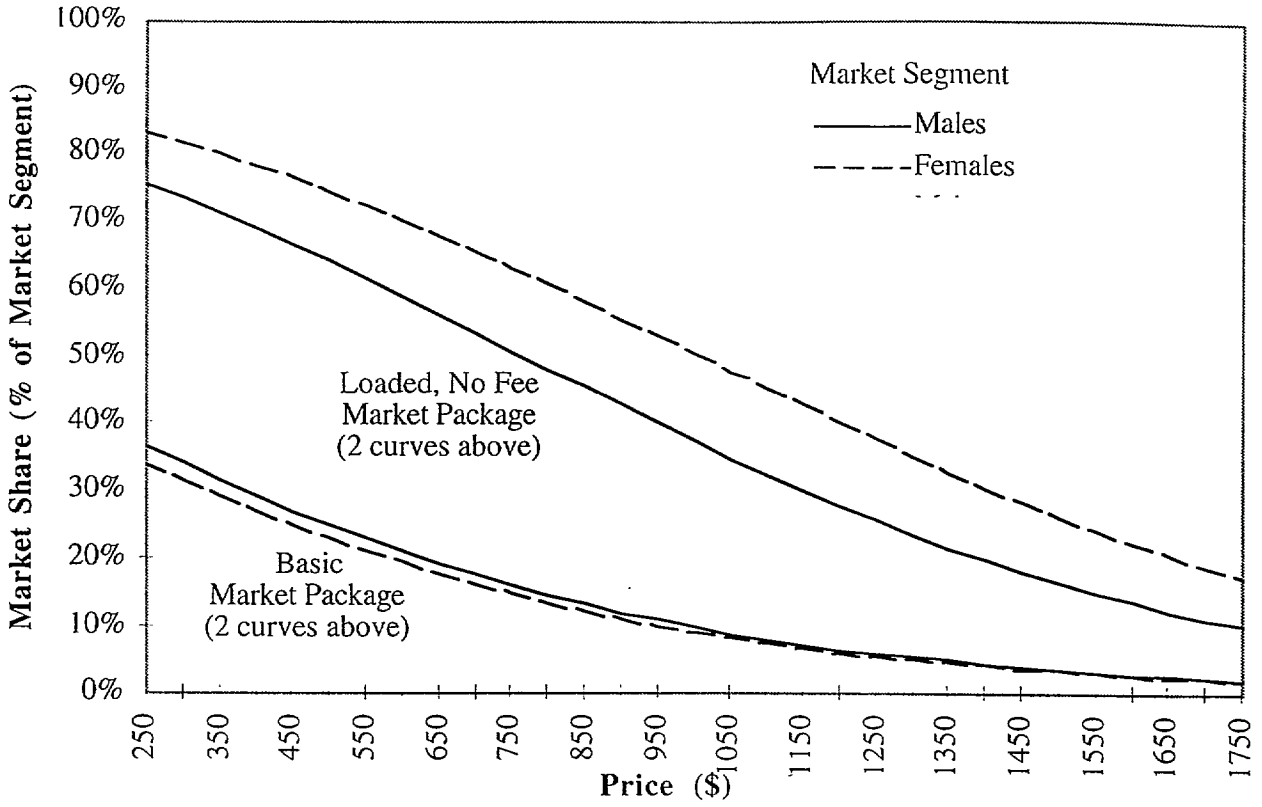

Figure 5: Comparison of Market Share by Gender Market Segment (Model III)

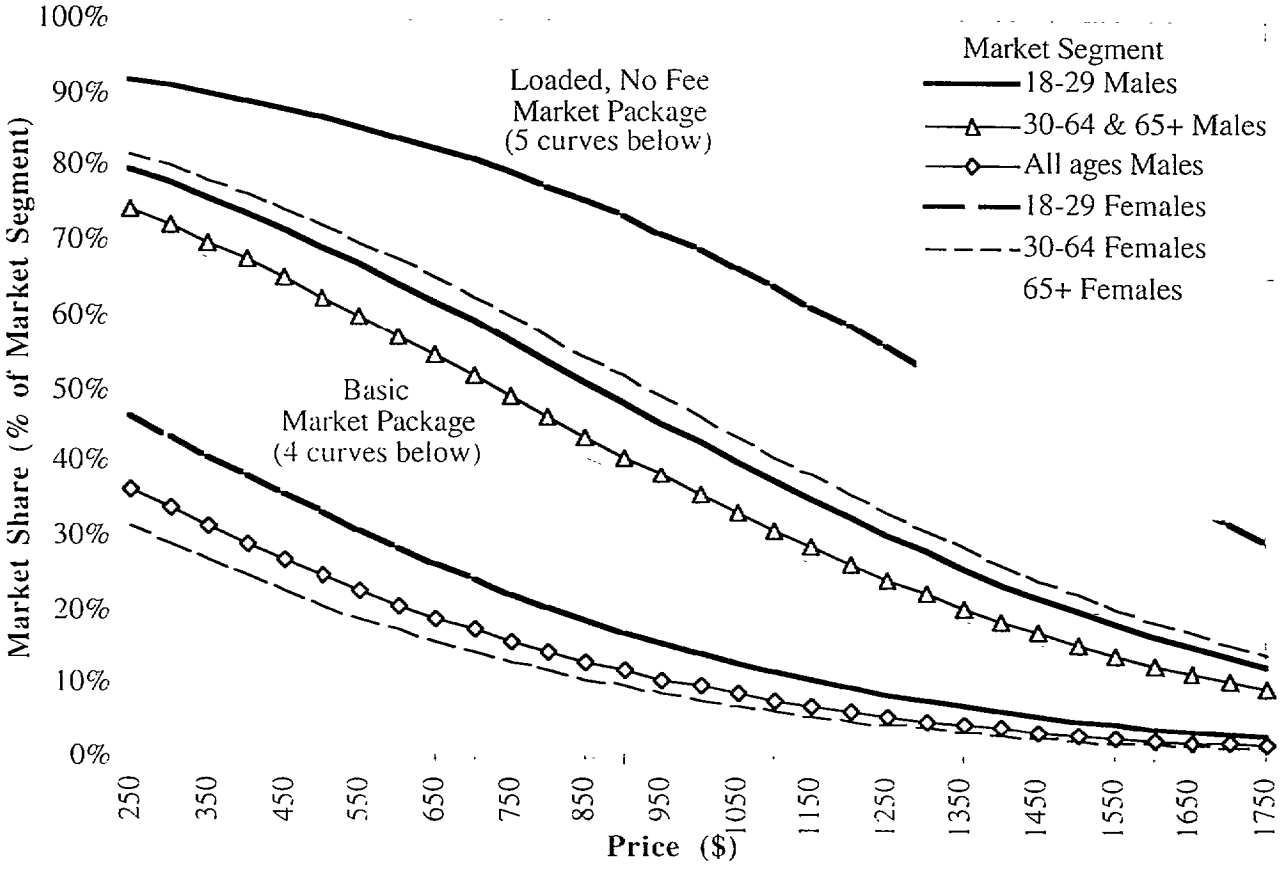

Figure 6: Comparison of Market Share by Age-Gender Market Segment (Model III)

Model IV

Analyses for Model IV included all of the parameters and interactions of Model III as well as the main effects of select other demographic parameters and select responses to the Opinion Questionnaire. The specific demographic and opinion data included in the analysis are shown in Table 9. Only one attribute-level per grouping in the table would be included in any given market package. With the exception of "income" and "carphone ownership" the parameter values used in the regression analyses represent a pre-analyses recategorization of the values collected on the questionnaire. The recategorization was performed to facilitate the analysis, primarily by greatly reducing the number of terms involved.

The attribute-level coefficients for the "best" version of Model IV are given in Table 10, where, again, the baseline is composed of a set of attribute levels, one per attribute, that have been assigned a coefficient of 0.0000. Note, as with Model III, that demographic and opinion data were not "designed", as were the attributes for the traveler services, but are rather covariates, and thus interaction effects involving these variables be confounded at less than a third order level, might

Table 9: Recategorized Opinion Responses Considered in Final Version of Model IV

Parameter	Baseline	2nd Level	3rd Level
Income	8 levels: treated as continuous	not applicable	not applicable
Job Type[1]	Work away from home	Work at home	not applicable
Carphone Ownership	No	Yes	not applicable
Miles Driven Annually[2]	More than 10,000	10,000 or less	not applicable
Unexpected Delays are a Problem	Strongly or Somewhat Disagree	Neither Agree nor Disagree	Somewhat or Strongly Agree
Level of Familiarity with Travel Area	Familiar with 90% to 100% of roads	Familiar with 75% to 89% of roads	Familiar with less than 75% of roads
Satisfaction with Existing Traffic Reports	Somewhat or Very Satisfied	Neither Satisfied not Dissatisfied	Very or Somewhat Dissatisfied
Satisfaction with Existing Route Advice	Somewhat or Very Satisfied	Neither Satisfied nor Dissatisfied	Very or Somewhat Dissatisfied
Satisfaction with Existing Emergency Assistance	Somewhat or Very Satisfied	Neither Satisfied nor Dissatisfied	Very or Somewhat Dissatisfied

[1]The parameter "Job Type" was initially included in the analyses with four levels. The parameter was collapsed to two levels to reduce a problem with multicolinearity.

[2]The parameter "Miles Driven Annually" was initially included in the analyses with three levels. The parameter was collapsed to two levels after initial analysis determined that no statistically significant difference existed between the second and third levels, which were 10,001 to 15,000 miles annually, and over 15,000 miles annually respectively.

Table 10: Model IV Coefficients

(Analysis included main plus interaction effects of choice model design attributes plus age and gender and main effects of select other demographic parameters and select responses to the Opinion Questionnaire.

Attribute[1]	Level		Coef[2]	SE[3]	Prob
Constant	Not applicable		-0.5206	0.1685	0.0001
Price	Rate per 100 ($250 to $1750)		-0.7361	0.0076	0.0001
Monthly	**Yes ($5)**		-0.9615	0.0690	0.0001
Fee	No		0.0000	0.0000	--
Traffic	Customized on demand x	Dynamic Turn-by-turn	1.2540	0.1642	0.0001
Reports	Customized on demand x	Historic Turn-by-turn	~~-0.0192~~	0.1904	0.9197
x	Customized on demand x	Dynamic General	~~0.2841~~	0.1890	0.1328
Route	Customized on demand x	Historic General	~~0.2664~~	0.1454	0.0668
Advice	Metrowide once every 10 min x	Dynamic Turn-by-turn	0.6088	0.1621	0.0002
	Metrowide once every 10 min x	Historic Turn-by-turn	-0.4230	0.2001	0.0345
	Metrowide once every 10 min x	Dynamic General	~~-0.3409~~	0.1884	0.0704
	Metrowide once every 10 min x	Historic General	0.0000	0.0000	--
Traffic	Customized on demand x	Female	-0.6536	0.1444	0.0001
Reports	Customized on demand x	Male	0.0000	0.0000	--
x	Metrowide once every 10 min x	Female	-0.6645	0.1545	0.0001
Gender	Metrowide once every 10 min x	Male	0.0000	0.0000	--
Route	Dynamic Turn-by-turn x	Yes, Assistance	0.4991	0.1313	0.0001
Advice	Dynamic Turn-by-turn x	No Assistance	0.0000	0.0000	--
x	Historic Turn-by-turn x	Yes, Assistance	1.1036	0.1628	0.0001
Emergency	Historic Turn-by-turn x	No Assistance	0.0000	0.0000	--
Assistance	Dynamic General x	Yes, Assistance	1.5482	0.1572	0.0001
	Dynamic General x	No Assistance	0.0000	0.0000	--
	Historic General x	Yes, Assistance	~~0.0334~~	0.1551	0.8297
	Historic General x	No Assistance	0.0000	0.0000	--
Emergency	Yes, Assistance x	18 to 29	0.3033	0.1230	0.0136
Assistance	Yes, Assistance x	30 to 64	1.1941	0.1997	0.0001
x	Yes, Assistance x	65 and over	0.0000	0.0000	--
Age	No Assistance x	18 to 29	~~-0.0714~~	0.1399	0.6098
	No Assistance x	30 to 64	1.3256	0.7090	0.0001
	No Assistance x	65 and over	0.0000	0.0000	--
Emergency	Yes, Assistance x	Female	0.6657	0.1466	0.0001
Assistance	Yes, Assistance x	Male	0.0000	0.0000	--
x	No Assistance x	Female	0.0000	0.0000	--
Gender	No Assistance x	Male	0.0000	0.0000	--
Age	18 to 29 x	Female	1.0906	0.1704	0.0001
x	18 to 29 x	Male	0.0000	0.0000	--
Gender	65 and over x	Female	~~0.0259~~	0.3231	0.9084
	65 and over x	Male	0.0000	0.0000	--
	30 to 64 x	Female	0.0000	0.0000	--
	30 to 64 x	Male	0.0000	0.0000	--

Table 10: Model IV Coefficients (continued)

Attribute[1]	Level	Coef[2]	SE[3]	Prob
Job Type	Work at home	-1.3782	0.1537	0.0001
	Work away from home	0.0000	0.0000	--
Miles Driven Annually	10,000 or less	0.3870	0.1139	0.0007
	More than 10,000	0.0000	0.0000	--
Unexpected Delays are a Problem	Somewhat or Strongly Agree	0.5883	0.821	0.0001
	Neither Agree nor Disagree	0.7541	0.1006	0.0115
	Strongly or Somewhat Disagree	0.0000	0.0000	--
Level of Familiarity with roads in Travel Area	Familiar with less than 75%	0.1479	0.1043	0.0001
	Familiar with 75% to 89%	0.1970	0.0770	0.0106
	Familiar with 90% to 100%	0.0000	0.0000	--
Satisfaction with Existing Traffic Reports	Very or Somewhat Dissatisfied	~~-0.0375~~	0.0870	0.6666
	Neither Satisfied nor Dissatisfied	-0.4838	0.0886	0.0001
	Somewhat or Very Satisfied	0.0000	0.0000	--
Satisfaction with Existing Route Advice	Very or Somewhat Dissatisfied	0.4614	0.0939	0.0001
	Neither Satisfied nor Dissatisfied	0.4210	0.0811	0.0001
	Somewhat or Very Satisfied	0.0000	0.0000	--
Satisfaction with Existing Emergency Assistance	Very or Somewhat Dissatisfied	0.7281	0.0843	0.0001
	Neither Satisfied nor Dissatisfied	0.3724	0.0926	0.0033
	Somewhat or Very Satisfied	0.0000	0.0000	--
Criterion For Assessing Goodness Of Fit for Model: Log Likelihood = -3073.3932				

[1] Two attributes in this column separated by an "x" indicates an interaction between the two attributes listed
[2] Coefficients with a strike through are not significant at the 0.05 level, and are thus not included in this model
[3] Standard Error

Inspection of the coefficients in Table 10 reveals:

- Model II contains all of the parameters of Model III, plus the additional parameters in Table 8, with the exception of carphone ownership and income. Potential reasons supporting the exclusion of the income and carphone ownership attributes will be discussed in the following. Model IV also predicts outcome better than Model III as evidenced by the better, i.e., less negative, log likelihood value.

- The coefficients that are represented in both Model III and Model IV are similar in magnitude for the two models, with the exception of the constant and interactions involving the older age group. The difference in the age group coefficients is due to interactions involving the newly added set of parameters.

- During analysis it became apparent that the parameters of age, job, and income could not be included in the analysis at the same time. The parameters age and job appear to be much better predictors than income and so income was not used in the final model. Potential reasons for this effect are multicolinearity (correlation) among the attributes, missing data (largely for the income attribute[1], masking by interaction effects, which were not included in the analyses, and/or a study artifact because subjects were not actually buying any product with actual money out of their own pocket.

- Carphone ownership did not prove to be a statistically significant parameter in the model, perhaps because of interaction with other parameters. These potential interactions were not included in the model.

Further inspection of Table 10 reveals home brief observations on the correlation between a subject's response to the non-age non-gender demographic questions and the opinion questions. The general conclusion is that as level of "need" for a traveler service grows, so will the likelihood of choosing it. Specifically:

- If a person works at home, they are much less likely to choose these traveler services than if they work away from home.

- Subjects who are less familiar with roads in the area that they commonly travel are more likely to choose a market package of traveler services than subjects who are more familiar with roads in the area that they commonly travel.

- If a person travels less than 10,000 miles per year they are somewhat more likely to choose these traveler services than someone who travels more than 10,000 miles per year. A possible reason for this is that those who travel more miles are also more familiar with the area (see previous point).

- Subjects who perceive unexpected traffic delays as a problem are more likely to choose it marker package of traveler services than subjects who do not perceive unexpected traffic delays as a problem.

- Subjects who are less satisfied with existing traffic reports are less likely to choose a market package of traveler services than subjects who are more satisfied with existing traffic reports. Perhaps people of this opinion have somewhat "given up" on the prospect of good information. The effect is not strong, however, as the coefficient for the third level of the attribute, representing subjects who are strongly or somewhat dissatisfied with existing traffic reports is not statistically significant.

- Subjects who are less satisfied with existing route advice are more likely to choose a market package of traveler services than subjects who are more satisfied with existing route advice

- Subjects who are less satisfied with existing emergency assistance are more likely to choose a market package of traveler services than subjects who are more satisfied with existing emergency assistance

Finally, although not included in the "best" version of Model IV and thus not evident from Table 10, all of the second order interaction effects involving the demographic and opinion data added in the change from Model III to Model IV were tested: the majority of these interaction effects brought about errors in the analyses, likely due to missing data and multicolinearity within the data set. The initial indications of these analyses, however, bean with intuition regarding potential interactions. Model IV could potentially be further developed if more data were collected, especially in the older and younger age groups, and if significant further efforts were undertaken to circumvent the suspected multicolinearity.

Perspective on Applying the Choice Models

Decision makers can use the choice models developed through this study, combined with production and marketing cost data, to guide the development and marketing of products or services. Specifically, the models can be used in an exploratory mode where various market packages are tested with various segments of the target population. To accomplish this, the reader can take the coefficients from the desired model, and plus these into Equation 2 and then Equation 1 to generate market share plots, as illustrated earlier in this report.

In applying the results of the market share analysis, one must remember that the underlying data come from a convenience sample of subjects, i.e., the subjects were not randomly selected but rather were self-selected. The extent to which the models are valid for any population other than the "population" of people who participated in the study is controlled by the extent to which the subjects in the study effect the population of interest.

So, who were the subjects who responded in the study. As shown in Figure 7, which depicts the information previously given in Table 2, the majority of respondents were men in the 30 to 64 year old age group. Moreover, nearly 99 percent of the respondents had a vehicle that was primarily for their own use. In addition, over 60 percent had a car phone that was primarily for their own use. Figure 8 reveals that nearly half of respondents live in households of only 1 or 2 members and that about 40 percent live in households with 3 or 4

members. Figure 9 shows that the group of respondents are highly educated with over 90 percent having at least had some college education and about 2 in 5 of those also having had graduate school experience. Figure 10 shows that nearly 80 percent of the respondents work away from home, indicating a need to commute to work. Figure 11 shows that 86 percent of the 86.9 percent of respondents reporting their income listed a pre-tax annual household income of over $40,000 while 46.5 percent reported a household income of over $80,000. Figure 12 shows that 2 percent of the respondents drive less than 5,000 miles per year, roughly 36 percent drive between 5,000 and 15,000 miles per year, and about 62 percent drive over 15,000 miles per year. Furthermore, as shown in Figure 13, the majority of study participants report that between 80 and 100 percent of their driving takes place in areas familiar to them. The respondents are further described by their responses to the Opinion Questionnaire, which are presented in Appendix B.

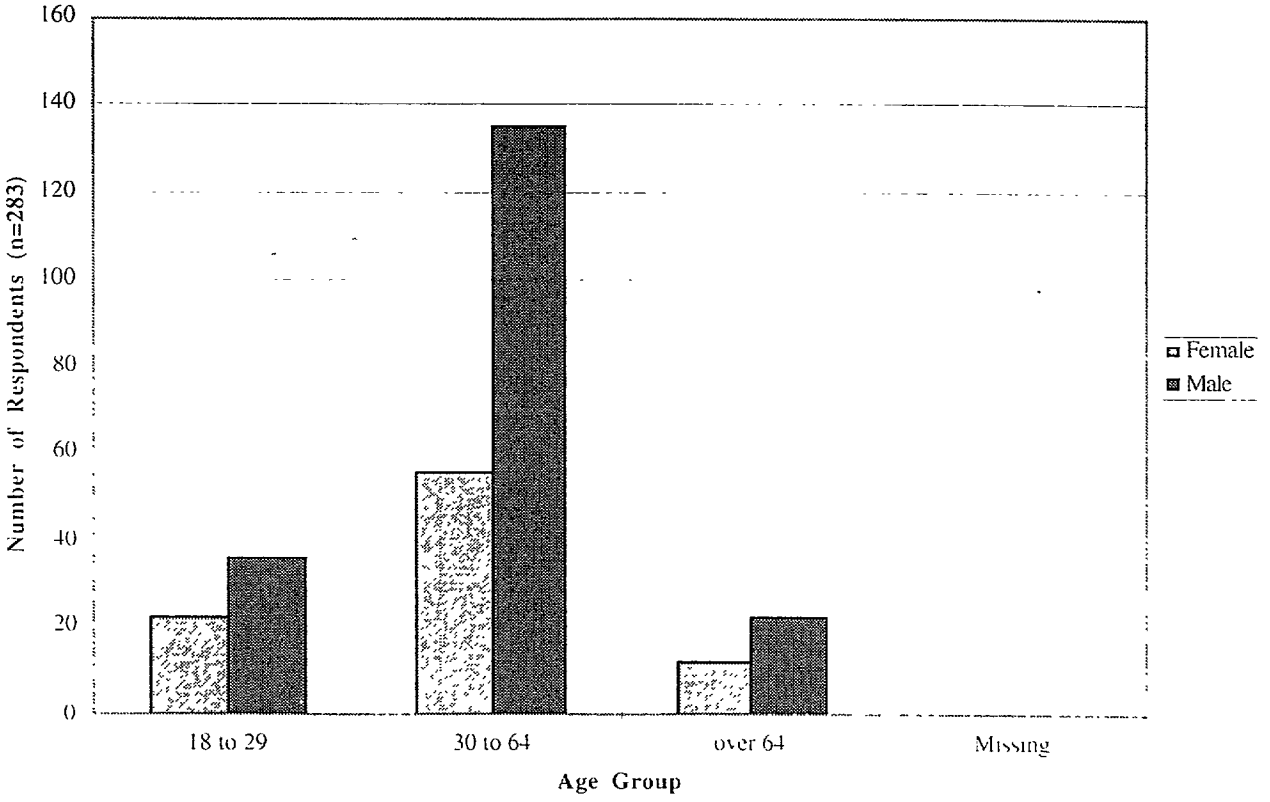

Figure 7: Respondent Age and Gender

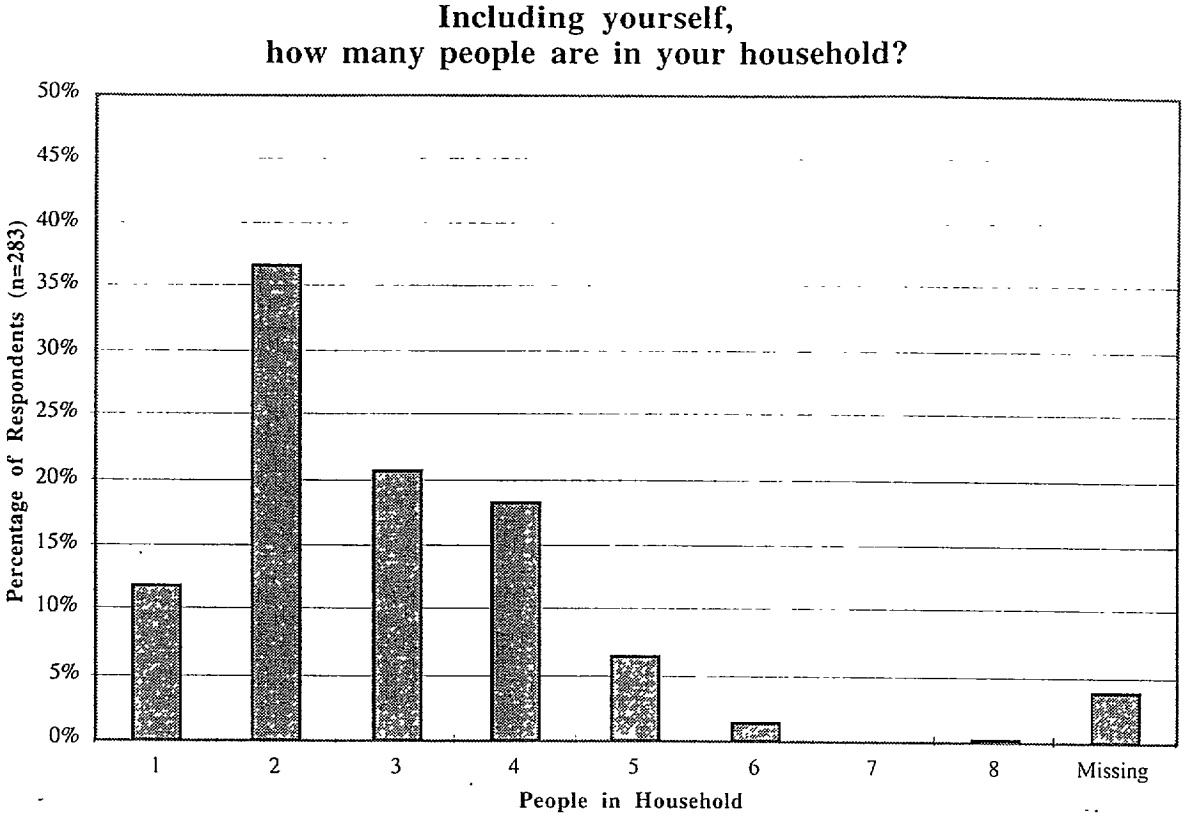

Figure 8: Respondent Household Size

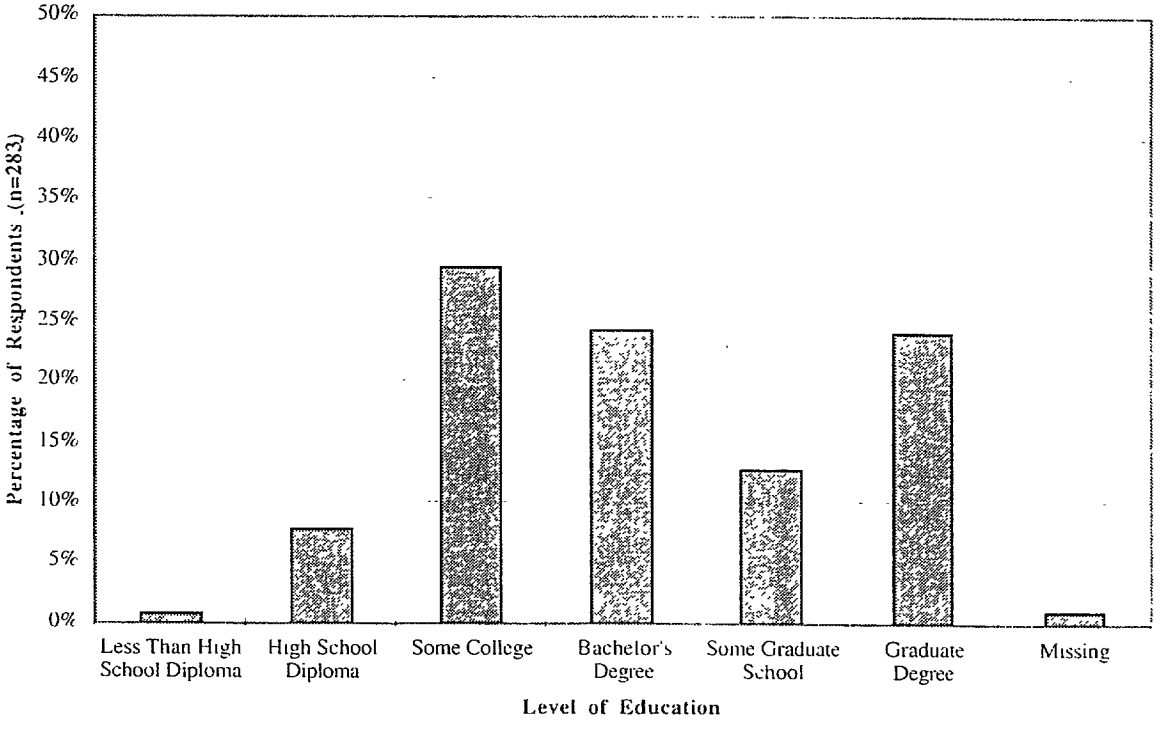

Figure 9: Respondent Education Level

Which description best fits you?

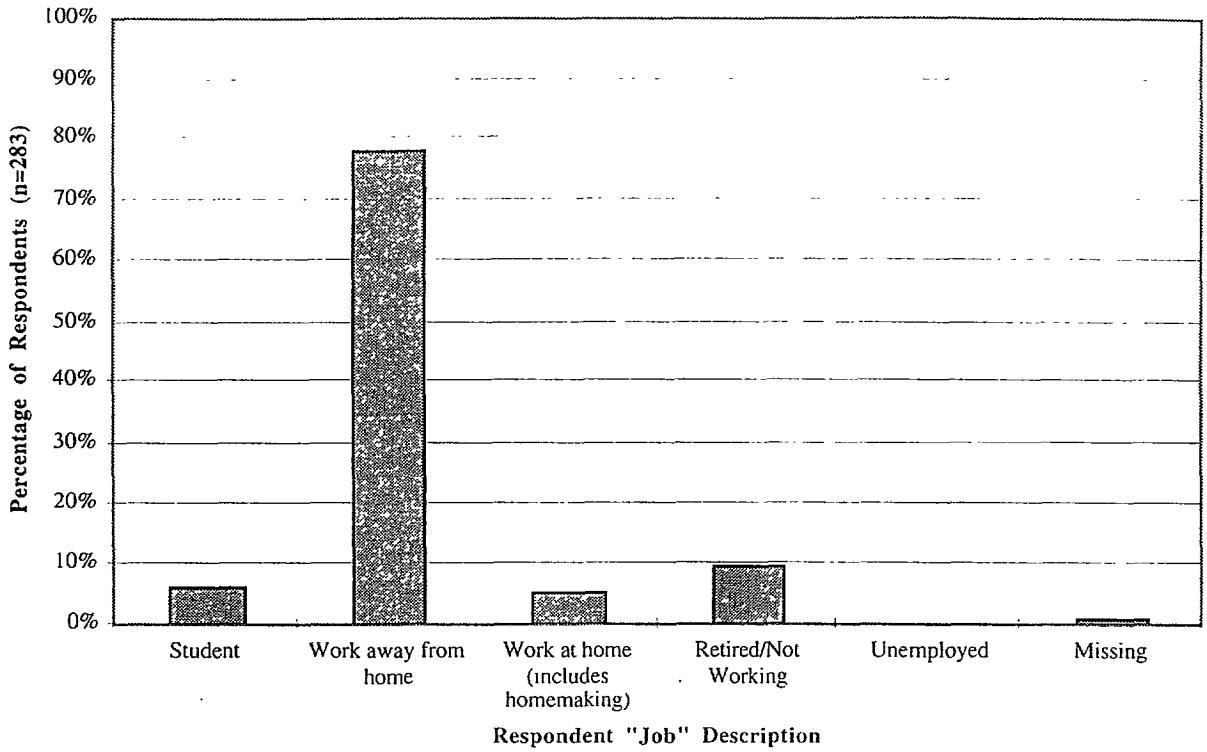

Figure 10: Respondent Occupation

What was your household's income last year (before taxes)?

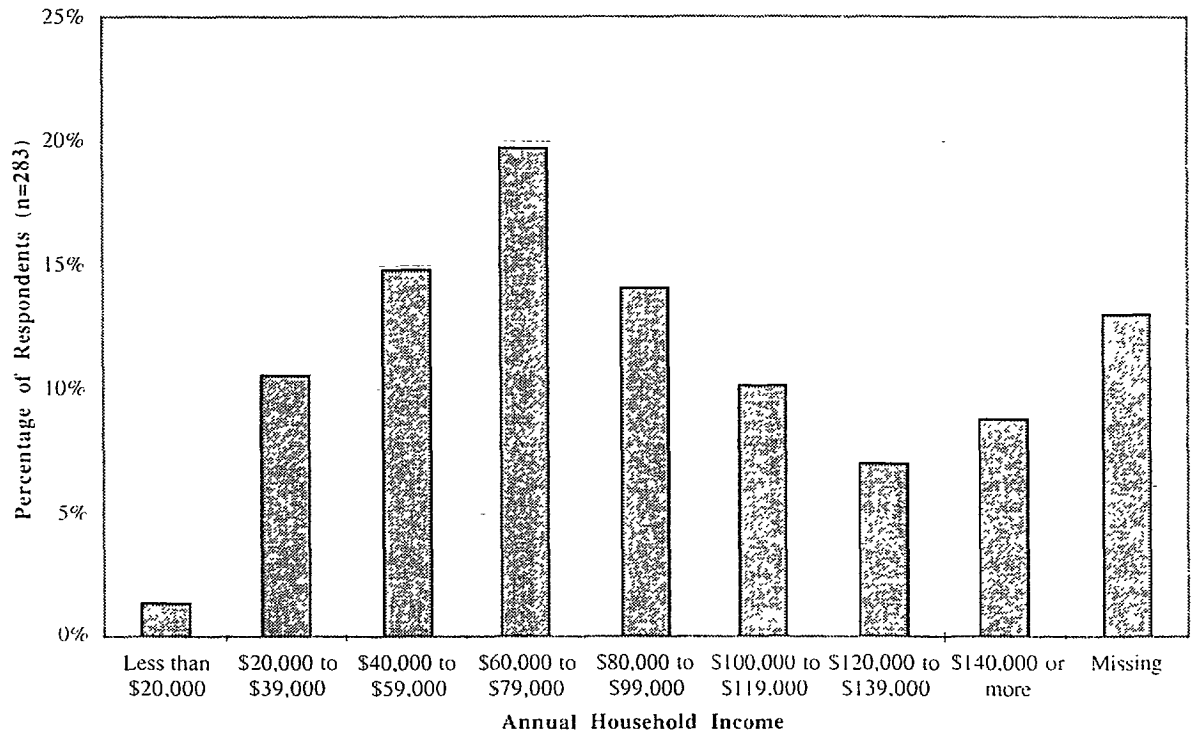

Figure 11: Respondent Annual Household Income

On average, how many miles do you drive in a year?

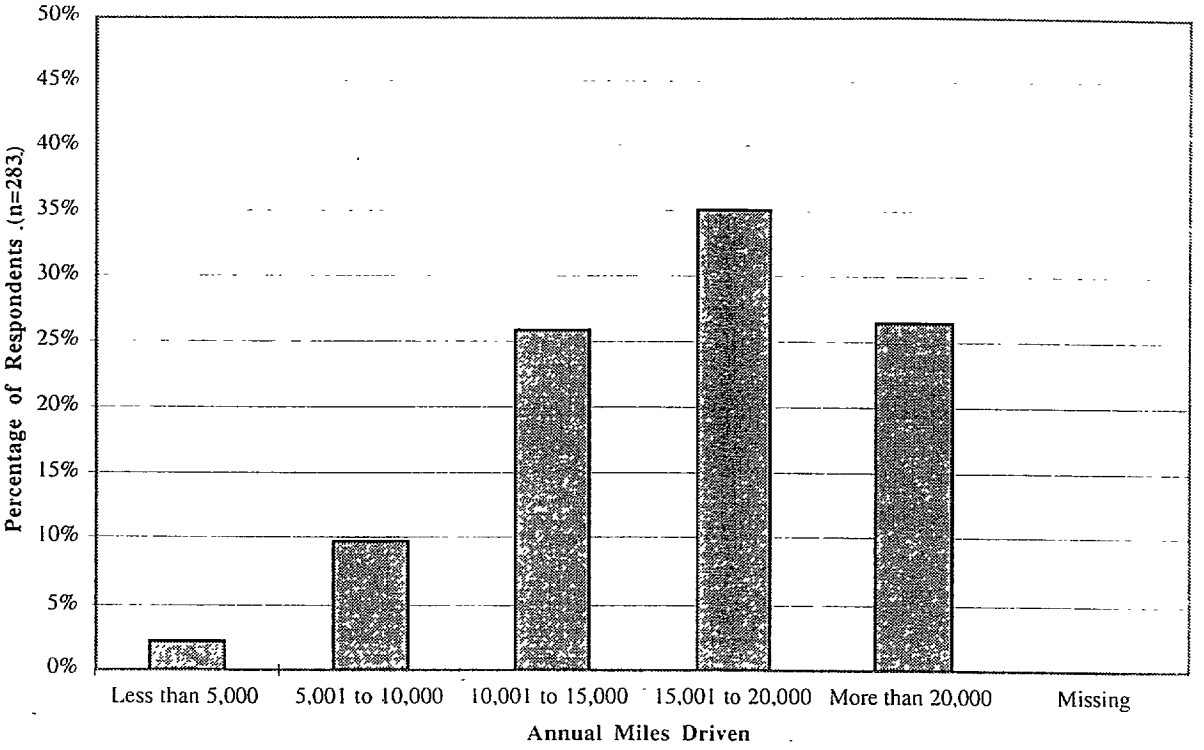

Figure 12: Annual Mileage Driven

What percentage of your driving is in areas familiar to you?

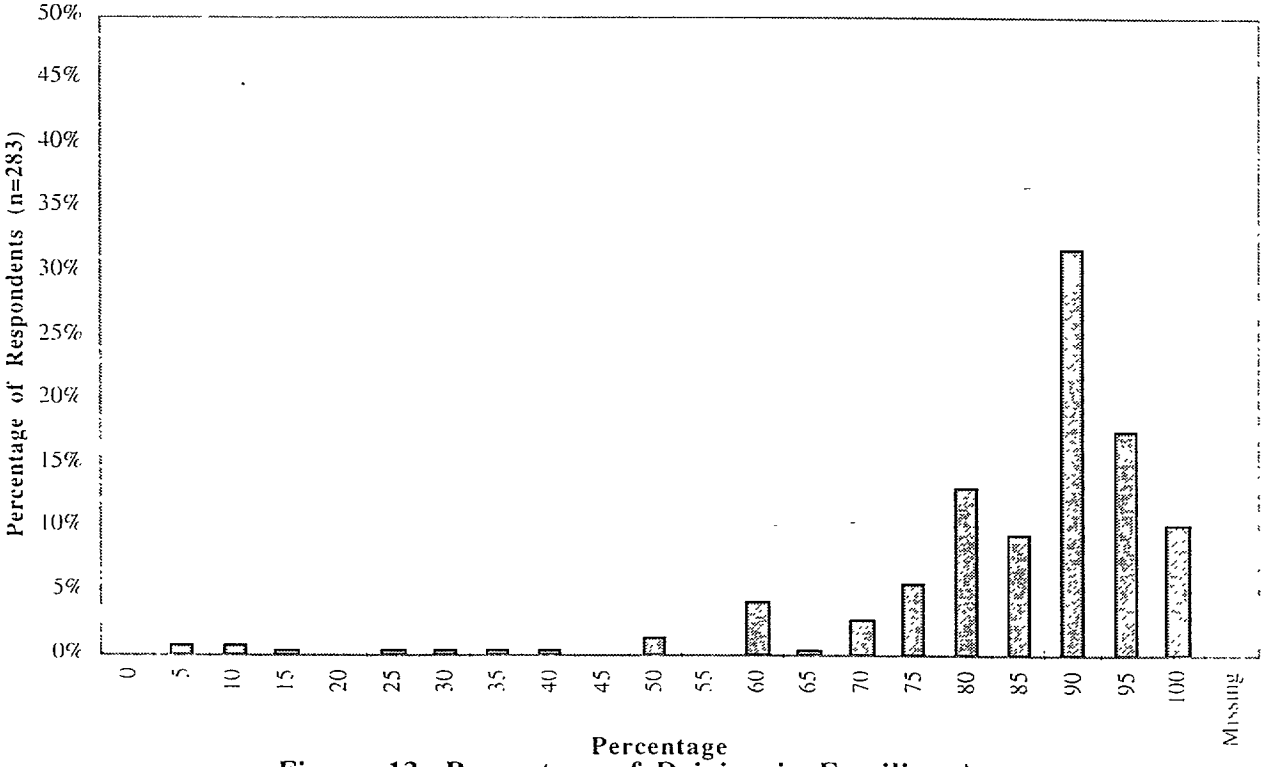

Figure 13: Percentage of Driving in Familiar Areas

Acknowledgment

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S-PLUS: MathSoft, Inc., Copyright AT&T. Version 3.4 Release 1 for Sun SPARC. SunOS 5.3: 1996, Copyright © 1988, 1996.

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Appendix A: Choice Questionnaire

The questionnaire presented to subjects was accompanied by a cover letter, shown in Figure Al. Those people who responded to the questionnaire received a thank-you letter, shown in Figure A2. The cover letter was followed by a description of the traveler services to be considered, shown in Figure A3. The questionnaire itself consisted of two parts, a Choice Questionnaire, which is presented in Figure A4, and an Opinion Questionnaire, which is described in Appendix B. For convenience, questions relating to demographics were included in the Opinion Questionnaire. Note that the various portions of the survey instrument presented here have been reduced in size somewhat to maintain a standard margin for the pages and to facilitate addition of the “figure” title. The cover letter, description of traveler services, and questionnaire were folded in half and enclosed in a 7.5 x 10.5 inch manila envelop along with a stamped, addressed return envelop and a signature card, required for disbursing the $5 gift of appreciation. Analysis regarding the Choice Questionnaire is presented in the body of the report.

TECHNOLOGY PLANNING AND EVALUATION GROUP
THE UNIVERSITY OF MICHIGAN

February 1997

<title> <name1> <name2>
<street>
<city>, <state> <zip>

Dear <title> <name2>:

Advancements in technology have made it possible to get some interesting options on new cars. For example, you can now buy advanced radios, computers, vehicle location systems, and display devices that allow you to tie into a number of "traveler services." These services are intended to help you get where you want to go faster, more safely, and with less stress. The University of Michigan is investigating three categories of new services:

(1) Advanced Emergency Roadside Assistance service (calls for help when you need it)
(2) Traffic Report service (tells you about unexpected delays on roadways)
(3) Route Advice service (tells you which are the best roads to take)

I ask YOU to help UM determine the value of these services to drivers by completing and returning both Part I and Part II of the enclosed questionnaire.

For the research to be a success, please read each question carefully and be sure to answer all of the questions. However, you do not have to respond to any questions you do not wish to answer, or any questions that make you feel uncomfortable. Moreover, there are no right or wrong answers: only your personal preferences matter in this task, which rakes about 20 minutes.

I greatly appreciate your time and assistance and assure you that your responses are confidential.**As a token of gratitude, UM offers $5 for returning a completed questionnaire by April 30.** To receive your $5, I need you to sign the enclosed yellow form and return it with your completed questionnaire. For administrative reasons, we need this form from you before we can send you the money.

Sincerely,

Thomas B. Reed, Ph.D.
Assistant Research Scientist

Enclosed:
- Description of Traveler Services (1 page)
- Questionnaire Part I (4 pages)
- Questionnaire: Part II (2 pages)
- Yellow response form to receive $5
- Self-Addressed Stamped Envelope

Figure A1: Cover Letter for Questionnaire

TECHNOLOGY PLANNING AND EVALUATION GROUP
THE UNIVERSITY OF MICHIGAN

March 1997

Dear Respondent,

I would like to thank you for responding to the UM Traveler Services Questionnaire. I am sure that you have many demands placed on your time and am grateful that you made an effort to help us better understand consumer desires in this area.

If you have questions about the study, please contact me.

I have enclosed a $5 bill as a token of thanks.

Sincerely,

Thomas B. Reed, Ph.D.
Assistant Research Scientist

Enclosed: $5 bill.

200 ENGINEERING PROGRAMS BUILDING - 2609 DRAPER DRIVE - ANN ARBOR, MICHIGAN

Figure A2: Thank-You Letter for Questionnaire

Please read the following descriptions of three types of new traveler services. Then answer Parts I and II of the questionnaire with these descriptions in mind.

Advanced Emergency Roadside Assistance Service

The advanced emergency roadside assistance service is perhaps the easiest of all to understand. Simply put, this service automatically calls the police and notifies them of your location when you are in a serious accident. You can also press a "panic button" in the car to call for assistance in case you get sick, or the car breaks down, or runs out of gas, etc.

Traffic Report Service

Some aspects of the traffic report service are similar to traffic reports that you have heard before. Simply put, the service tells you about unexpected delays on roadways. For example, a message might say that there is a 15-minute backup on Southbound I-75 due to an accident at the intersection of I-75 and I-696.

Two types of traffic reports are available:

1) Metrowide traffic reports once every 10 minutes: that is, you can listen in to traffic reports once every 10 minutes for the entire metropolitan area that you are in.
2) Customized traffic reports on demand: that is, you can get a traffic report whenever you ask for one and for any route you ask about in the metro area that you are in.

The message content is the same for both report types. The reports are available in all major metropolitan areas in the United States (but you only get reports for the area you are actually in).

Route Advice Service

The route advice service provides information that could help you decide which roads to take to get where you want to go. Simply put, the service tells you which are the best roads to take.

Two major types of route advice are available:

1) General route advice. This advice heads you in the right direction butdoes not guide you to a specific location, such as a store. For example, this service will tell you which roads to take to get from Ann Arbor to Troy.

2) Turn-by-turn instructions. These instructions prompt you as you travel and guide you to a specific location, such as 3 store. For example, this service will tell you totu-n left at the next corner: after you do turn left, the service will tell you to go straight for one mile: and so on, until you reach the location you chose.

Both general route advice and turn-by-turn instructions are available in two versions, depending on whether the route advice is based on historic traffic conditions or dynamic traffic conditions.

1) Historic traffic conditions are those that *usually* exist at the time of day that you are traveling. For, example, say you are traveling on I-75 at 5 PM on a Friday. Route Advice using historic traffic conditions would take into account the fact that you will usually experience, say, a 10 minute delay at that time of day due to heavy traffic.

2) Dynamic traffic conditions are those that *actually* exist at the time that you are traveling. For example, say you are traveling on I-75 at 5 PM on a Friday, as in the above example. Route advice using dynamic traffic conditions would take into account the fact that, due to an accident a while ago, the delay right now is really 25 minutes instead of the usual 10. As a result, the route advice might tell you to take a different road.

Figure A3: Description of Traveler Services (Included with Questionnaire)

Figure A4: Choice Questionnaire

Assume that you are buying a new car. You will use this car both for day-to-day driving and for trips to unfamiliar places, such as for leisure or vacation travel. Also assume that you have a car phone.

Given these assumptions

Please look at *each* row below and check either "yes" or "no"
to show whether or not you would buy that package of traveler services.

(Refer to the previous page for definitions of terms.)

Some of the 32 rows appear quite similar,
but they are not identical and it is important that you answer each. That is,

Please read carefully and do not skip any row.

At the same time

Consider the rows one at a time, that is, do not compare rows.

			Traffic Reports (unexpected delays?)	Route Advice (Best Roads to Take?)	Emergency Assistance	Purchase Price	Monthly Fee	Would You Buy This
1	Would You Buy This?	➤	Metrowide traffic reports once every 10 minutes	Historic General route advice	No assistance	$250	$5 per month	Yes No
2	Would You Buy This?	➤	Metrowide traffic reports once every 10 minutes	Historic General route advice	No assistance	$1750	No fee	Yes No
3	Would You Buy This?	➤	Customized traffic reports on demand	Dynamic Turn-by-turn instructions	Emergency assistance	$1250	$5 per month	Yes No
4	Would You Buy This?	➤	Customized traffic reports on demand	Dynamic Turn-by-turn instructions	Emergency assistance	$750	No fee	Yes No
5	Would You Buy This?	➤	Metrowide traffic reports once every 10 minutes	Historic Turn-by-turn instructions	No assistance	$750	$5 per month	Yes No

Figure A4: Choice Questionnaire (continued)

			Traffic Reports (unexpected delays?)	Route Advice (Best Roads to Take?)	Emergency Assistance	Purchase Price	Monthly Fee	Would You Buy This
6	Would You Buy This?	➤	Metrowide traffic reports once every 10 minutes	Historic Turn-by-turn instructions	No assistance	$1250	No fee	Yes No
7	Would You Buy This?	➤	Customized traffic reports on demand	Dynamic General route advice	Emergency assistance	$1750	$5 per month	Yes No
8	Would You Buy This?	➤	Customized traffic reports on demand	Dynamic General route advice	Emergency assistance	$250	No fee	Yes No
9	Would You Buy This?	➤	Metrowide traffic reports once every 10 minutes	Dynamic General route advice	No assistance	$1250	$5 per month	Yes No
10	Would You Buy This?	➤	Metrowide traffic reports once every 10 minutes	Dynamic General route advice	No assistance	$750	No fee	Yes No
11	Would You Buy This?	➤	Customized traffic reports on demand	Historic Turn-by-turn instructions	Emergency assistance	$250	$5 per month	Yes No
12	Would You Buy This?	➤	Customized traffic reports on demand	Historic Turn-by-turn instructions	Emergency assistance	$1750	No fee	Yes No
13	Would You Buy This?	➤	Metrowide traffic reports once every 10 minutes	Dynamic Turn-by-turn instructions	No assistance	$1750	$5 per month	Yes No
14	Would You Buy This?	➤	Metrowide traffic reports once every 10 minutes	Dynamic Turn-by-turn instructions	No assistance	$250	No fee	Yes No

Figure A4: Choice Questionnaire (continued)

			Traffic Reports (unexpected delays?)	Route Advice (Best Roads to Take?)	Emergency Assistance	Purchase Price	Monthly Fee	Would You Buy This
15	Would You Buy This?	➤	Customized traffic reports on demand	Historic General route advice	Emergency assistance	$750	$5 per month	Yes No
16	Would You Buy This?	➤	Customized traffic reports on demand	Historic General route advice	Emergency assistance	$1250	No fee	Yes No
17	Would You Buy This?	➤	Customized traffic reports on demand	Historic General route advice	No assistance	$1750	$5 per month	Yes No
18	Would You Buy This?	➤	Customized traffic reports on demand	Historic General route advice	No assistance	$250	No fee	Yes No
19	Would You Buy This?	➤	Metrowide traffic reports once every 10 minutes	Dynamic Turn-by-turn instructions	Emergency assistance	$750	$5 per month	Yes No
20	Would You Buy This?	➤	Metrowide traffic reports once every 10 minutes	Dynamic Turn-by-turn instructions	Emergency assistance	$1250	No fee	Yes No
21	Would You Buy This?	➤	Customized traffic reports on demand	Historic Turn-by-turn instructions	No assistance	$1250	$5 per month	Yes No
22	Would You Buy This?	➤	Customized traffic reports on demand	Historic Turn-by-turn instructions	No assistance	$750	No fee	Yes No
23	Would You Buy This?	➤	Metrowide traffic reports once every 10 minutes	Dynamic General route advice	Emergency assistance	$250	$5 per month	Yes No

Figure A4: Choice Questionnaire (continued)

			Traffic Reports (unexpected delays?)	Route Advice (Best Roads to Take?)	Emergency Assistance	Purchase Price	Monthly Fee	Would You Buy This
24	Would You Buy This?	➤	Metrowide traffic reports once every 10 minutes	Dynamic General route advice	Emergency assistance	$1750	No fee	Yes No
25	Would You Buy This?	➤	Customized traffic reports on demand	Dynamic General route advice	No assistance	$750	$5 per month	Yes No
26	Would You Buy This?	➤	Customized traffic reports on demand	Dynamic General route advice	No assistance	$1250	No fee	Yes No
27	Would You Buy This?	➤	Metrowide traffic reports once every 10 minutes	Historic Turn-by-turn instructions	Emergency assistance	$1750	$5 per month	Yes No
28	Would You Buy This?	➤	Metrowide traffic reports once every 10 minutes	Historic Turn-by-turn instructions	Emergency assistance	$250	No fee	Yes No
29	Would You Buy This?	➤	Customized traffic reports on demand	Dynamic Turn-by-turn instructions	No assistance	$250	$5 per month	Yes No
30	Would You Buy This?	➤	Customized traffic reports on demand	Dynamic Turn-by-turn instructions	No assistance	$1750	No fee	Yes No
31	Would You Buy This?	➤	Metrowide traffic reports once every 10 minutes	Historic General route advice	Emergency assistance	$1250	$5 per month	Yes No
32	Would You Buy This?	➤	Metrowide traffic reports once every 10 minutes	Historic General route advice	Emergency assistance	$750	No fee	Yes No

Appendix B: Opinion Questionnaire

Implementing a questionnaire requires it good deal of resources. Thus, additional questions are often added to questionnaires when this can be done without degrading either data quality of response rate. A number of such questions, called the "Opinion Questionnaire" and shown as Figure B1, were attached to the Choice Questionnaire, which is presented in Appendix A. For convenience, demographics-related questions relevant to the Choice Questionnaire were included within the Opinion Questionnaire. The results of the demographics questions are described in the body of the main report. As in Appendix A, the Questionnaire has been reduced in size somewhat to accommodate the standard margins used in this report. The data for these questions, which are of significant interest but which are less than essential to the choice study, are presented in Figures B2 through B7b and List B1. The results were not analyzed extensively as part of this study, but a few comments on each figure are provided below.

Figure B2 shows that a majority of respondents agree with the statement that unexpected traffic delays are a serious problem on the trips that they most commonly make, whereas less than a third disagree with this statement. Figure B3a shows that subjects are more satisfied with existing traffic reports than with existing route advice and also less satisfied with "existing ways to call for help" than with either traffic reports or route advice. Figure B3b also makes it clear that subjects response is slightly above the midpoint of the satisfied-dissatisfied scale for existing traffic reports and existing route advice, but slightly below the midpoint for "existing ways to call for help". Figures B4a and B4b show that without considering cost, subjects say that traffic reports are of greatest importance to them, followed by ways to call for help, which is followed by route advice. An interesting dichotomy exists in Figure B4s in that a near-equal number of subjects picked ways to call for help as most and least important. Note that the scale is reversed in Figure B4b, with "1" being the high value. Figures B5a and B5b give an indication that a majority of respondents are willing to accept advertising on traffic reports and route advice services so that they would not have to pay a fee for these services.

the government should provide the three services being discussed. The response for traffic reports and route advice were quite similar and biased toward provision by for-profit companies. However, roughly a quarter of the subjects felt that provision of ways to call for help was the exclusive job of the government.

Some caution should be exercised in interpreting Figure B6. The figure does not indicate that subjects do not wish any government involvement in provision of the traffic reports and route advice traveler services. In fact, if the question were reworded or prefaced with a statement to the effect that government currently collects traffic data to support efforts to improve traffic conditions and that this data could easily be provided to the public as traffic information, then a majority of respondents may well suggest that the government should provide these services. Further questions should be asked to clarify subject response on this topic.

Figures B7a and B7b indicate that subjects feel the primary focus of government transportation tax expenditures should be to repave roadways and construct more roadways and perhaps to improve ways to call for help. Actions such as providing better traffic reports and better route advice were scored as not very important. Note that the scale is reversed in Figure B7b, with "1" being the high value.

As with Figure 6, caution should be exercised in interpreting Figures B7a and B7b. First, the figures are not indicative that people do not want improvements in traveler services such as traffic reports, route advice, and ways to call for help. Rather, the figures simply indicate that subjects do think that it is a governmental task to bring about such improvements. Second, the figures do not indicate that the government should be involved in providing the services at existing levels, e.g., the figures do not indicate that the government should withdraw from current at providing traffic information. Third, it could be that roads in the areas traveled by subjects are in major disrepair. In this case, the response shown in the figures might be quite different once the need for road repair were satisfied. Overall, Figures B7a and B7b do show a need for further questions to clarify the desires of the public on these issues.

The final section of this appendix provides the comments given in response to the open-ended question on the questionnaire. These comments, given in List B1, are divided into categories representing Cost, Emergency Assistance, Traffic Reports, Route Advice, Government Involvement, ALI-Scout™, Design of Study, and General Topics. As is often the case, the comments cover a broad spectrum of beliefs and concerns. The comments are put forth without other interpretation.

Figure B1: Opinion Questionnaire

Please read each question carefully.

1. How satisfied are you with existing versions of the following services?

(check one box in each row)	Very Dissatisfied	Somewhat Dissatisfied	Neither Satisfied nor Dissatisfied	Somewhat Satisfied	Very Satisfied
1. Traffic Reports (from radio, TV, newspapers, etc.)	□1	□2	□3	□4	□5
2. Route Advice (from radio, TV, friends, auto club, etc.)	□1	□2	□3	□4	□5
3. Ways to call for Emergency Roadside Assistance (phone, roadside callboxes, etc.)	□1	□2	□3	□4	□5

2. Using the definitions provided in the front part of this questionnaire, and without considering cost, rank the following in order of importance to you
(1 is most important, 2 the next most important, 3 the least important).
___Reliable and timely Traffic Reports
___Reliable and timely Route Advice
___An effective, easy way to call for Emergency Roadside Assistance

3. Using the definitions provided in the front part of this questionnaire,
Who should provide each of the following services? (*check one box in each row*)

	Item is not needed	Govern-ment	For profit companies	Government & companies	Other (specify)
1. Traffic Reports	□1	□2	□3	□4	_____5
2. Route Advice	□1	□2	□3	□4	_____5
3. Advanced Emergency Roadside Assistance	□1	□2	□3	□4	_____5

4. How willing are you to accept advertising so that you will not have to pay a fee for information?
(*check one box in each row*)

	Very Unwilling	Unwilling	Neither Willing nor Unwilling	Willing	Very Willing
1. On Traffic Reports	□1	□2	□3	□4	□5
2. On Route Advice	□1	□2	□3	□4	□5

5. What are the top five things that the government should do with transportation tax dollars? (*check 5 boxes, no more, no less*)

___□1 Repair roadways (Fill potholes, fix bridges, etc.)
___□2 Construct more roadways (add lanes, build new roads, etc.)
___□3 Provide better traffic reports
___□4 Provide better route advice
___□5 Improve ways to call for Emergency Roadside Assistance
___□6 Provide faster aid to motorists in need (once help has been called)
___□7 Clear incidents from roadways faster
___□8 Provide more public transit
___□9 Provide rideshare coordination
___□10 Other (please specify):_____

➢ Now, please rank the 5 boxes you checked. Write a 1 on the line next to the check you think is most important, 2 next to the check you think is second most important, and so on.

Figure Bl: Opinion Questionnaire (continued)

6. Do you have a vehicle that is primarily for your own use? (*check one*)
   □0 No □1 Yes

7. Do you have a car phone that is primarily for your own use? (*check one*)
   □0 No □1 Yes

8. On average, how many miles do you drive in a year? *(check one)*
   □1 Less than 5,000 □4 15,000-20,000
   □2 5,001-10,000 □5 More than 20,000
   □3 10,001-15,000

9. What percentage of your driving falls in each of the categories below?
   (fill in all 3 blanks, the sum of the 3 should be 100%)
   _____% work related driving (include driving to school if you are a student)
   _____% life-task related driving (taking children to school, shopping, repairing the car, etc.)
   _____% leisure related driving (sports, outings, vacations, etc.)
   100 %

10. What percentage of your driving is in areas familiar to you? *(fill in the blank)*
    _____%

11. Unexpected traffic delays are a serious problem on the trips that I most commonly make. *(check one)*
    □1 Strongly Disagree □2 Somewhat Disagree □3 Neither Agree nor Disagree □4 Somewhat Agree □5 Strongly Agree

12. Which description best fits you? *(check one)*
    □1 Student
    □2 Work away from home
    □3 Work at home (includes homemaking)
    □4 Retired/Not working
    □5 Unemployed

13. Please check one.
    □0 Female □1 Male

14. In what year were you born? *(fill in the blank)*
    19____

15. What is the highest level of education you have completed? *(check one)*
    □1 Less Than High School Diploma
    □2 High School Diploma (or equivalent)
    □3 Some College
    □4 Bachelor's Degree
    □5 Some Graduate School
    □6 Graduate Degree

16. Including yourself, how many people are in your household? *(fill in the blank)*
    _____people

17. What was your household's income last year (before taxes)? *(check one)*
    □1 Less than $20,000
    □2 $20,000 to $39,999
    □3 $40,000 to $59,999
    □4 $60,000 to $79,999
    □5 $80,000 to $99,999
    □6 $100,000 to $119,999
    □7 $120,000 to $139,999
    □8 $140,000 or more

18. Please write any additional comments on the back of this page.

==========

Thank you for filling out this questionnaire. Please return the questionnaire in the enclosed pre-addressed, stamped envelope. Your responses are confidential. If you also fill out and return the colored form, we can send you $5 in appreciation.

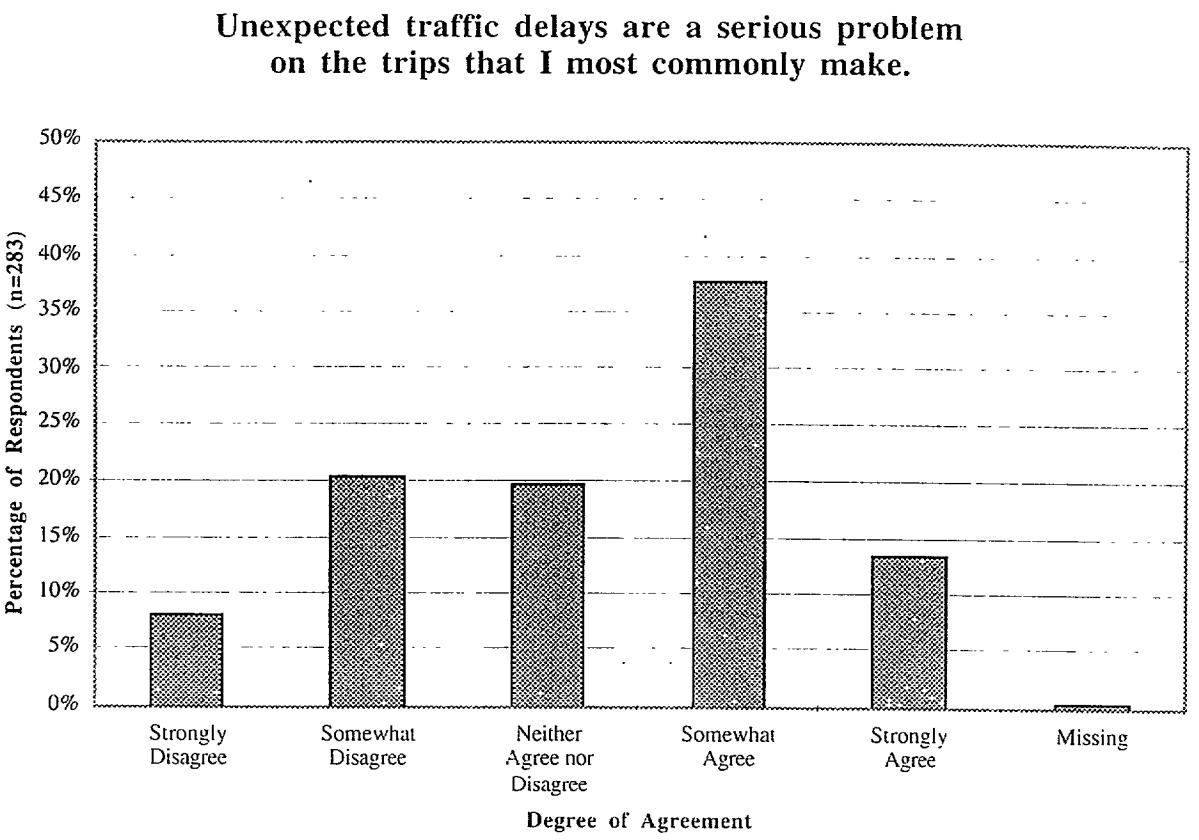


Figure B2: Perceived Burden of Unexpected Traffic Delays (Question 11)

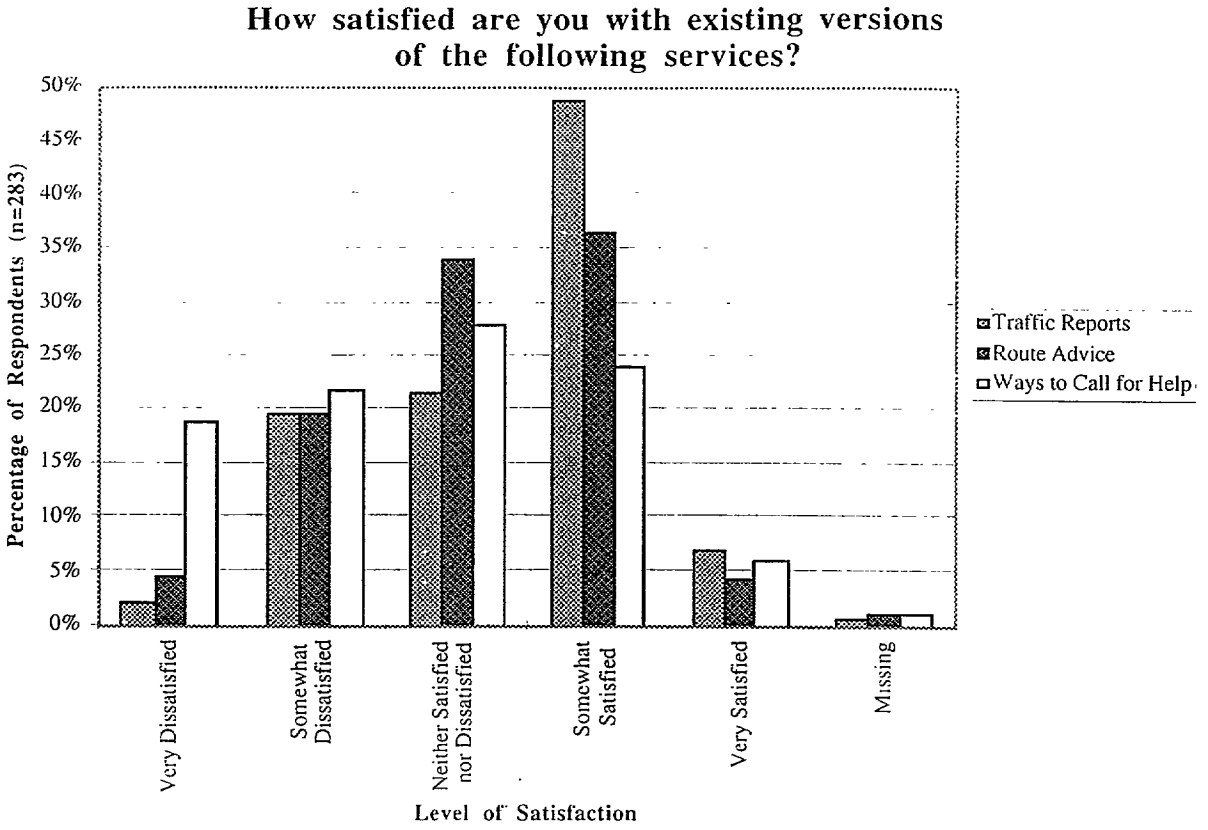


Figure B3a: Satisfaction with Existing Versions of Traveler Services (Question 1)

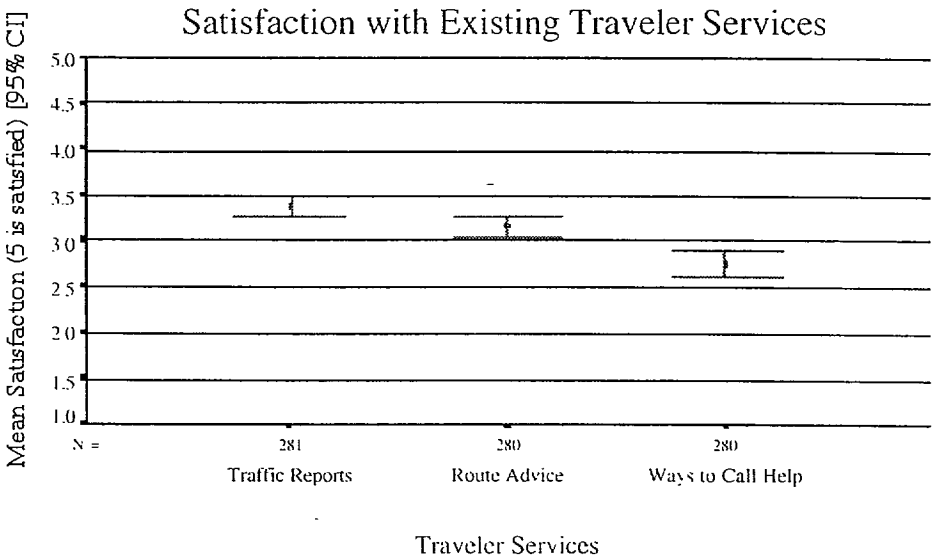


Figure B3b: Mean Response to Satisfaction with Traveler Services Question (Question 1)

**[Using the definitions in the questionnaire, and]
without considering cost,
rank the following in order of importance to you.**

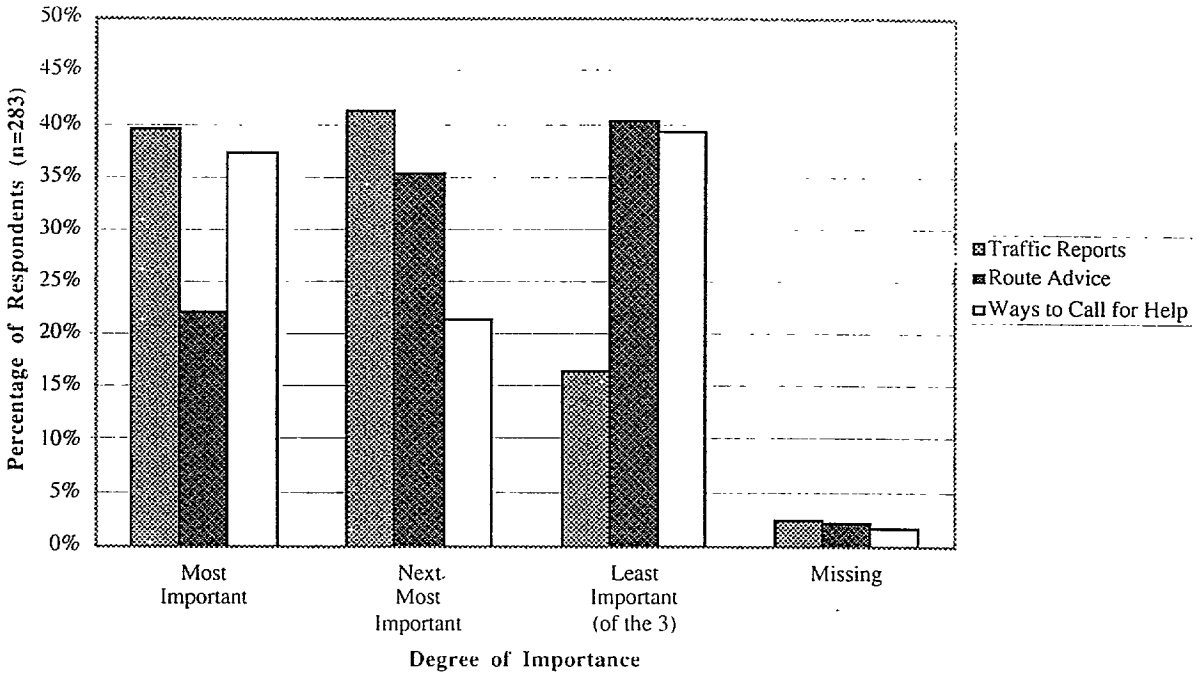


Figure B4a: Importance Rank of Traveler Services (without considering cost) (Question 2)

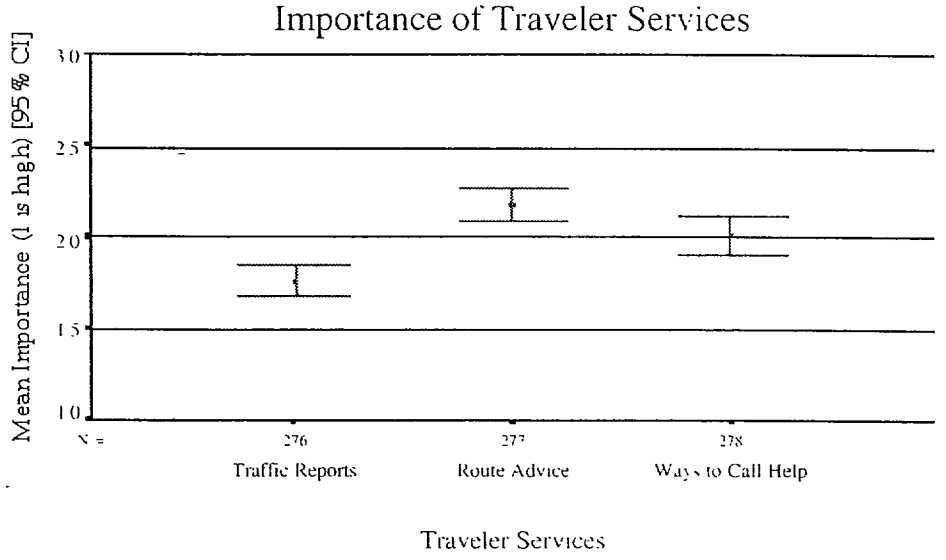


Figure B4b: Mean Response to Importance Rank of Traveler Services Question (Question 2)

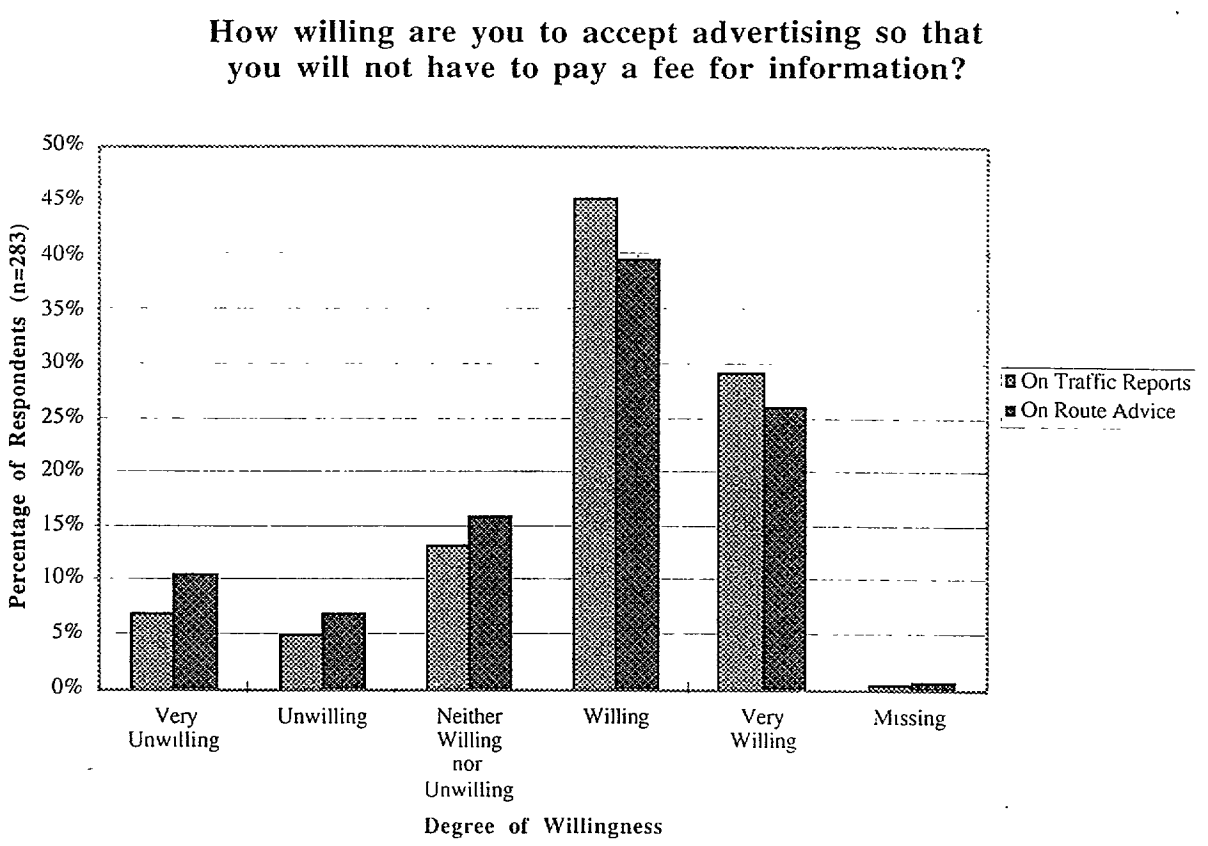


Figure B5a: Willingness to Accept Advertising on Traveler Service (Question 4) (to avoid paying a fee for information)

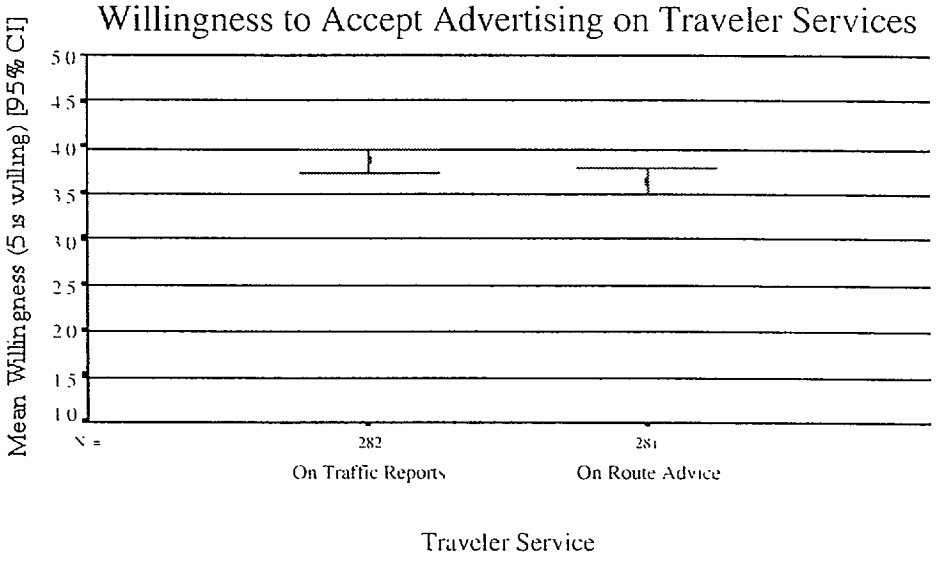
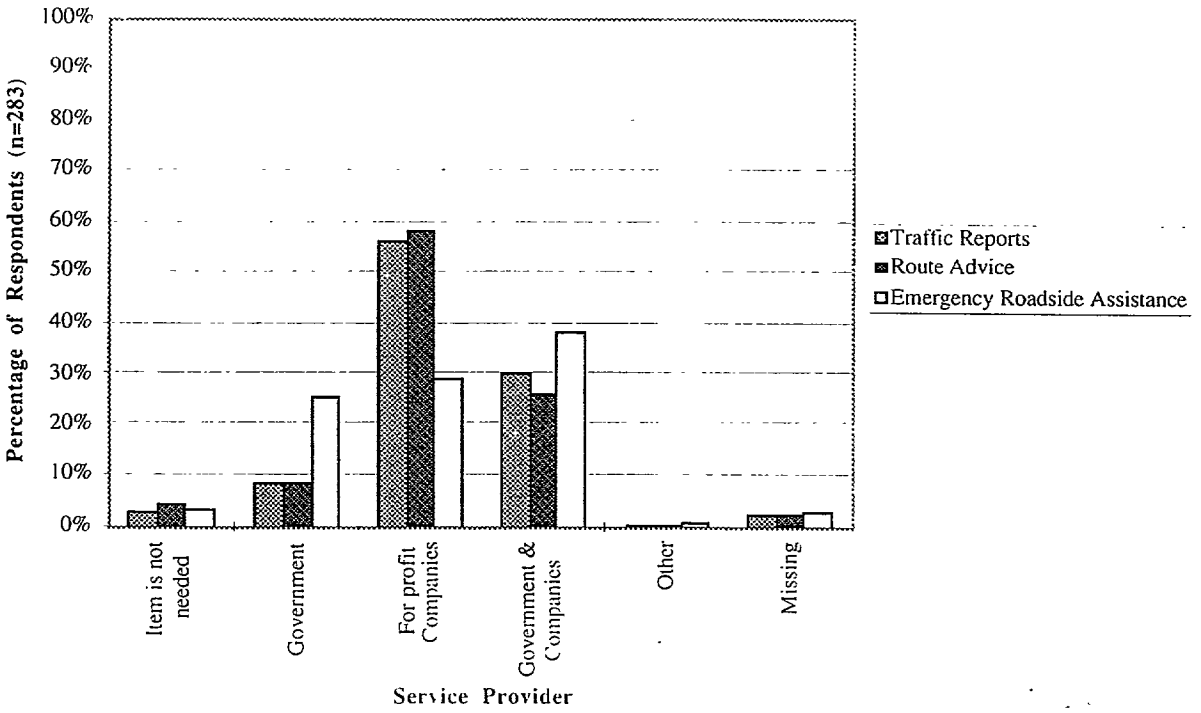


Figure B5b: Mean Response to Willingness to Accept Advertising Question (Question 4)

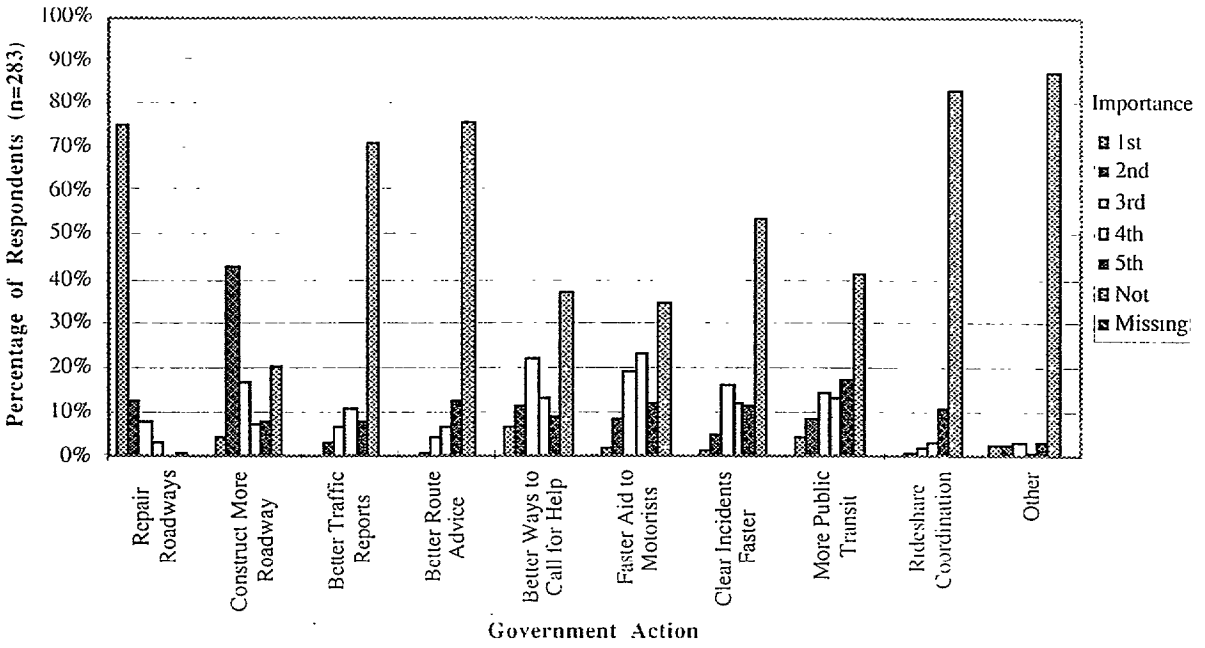
[Using the definitions provided in the questionnaire,] who should provide each of the following services?



[13 subjects listed "radio" for the party who should provide traffic reports: 3 subjects listed "radio" for provision of route advice. These responses were recoded as "for profit companies".]

Figure B6: Traveler Service Provider (Question 3)

What are the top five things that the government should do with transportation tax dollars?



(most important on the left for each government action)

Figure B7a: Government Use of Transportation Tax Dollars (Question 5)

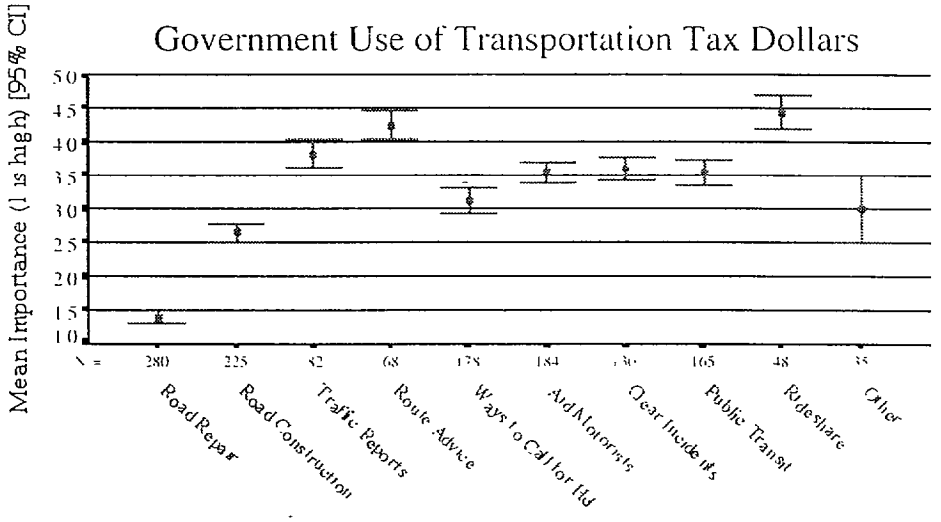


Figure B7b: Mean Response to Government Use of Transportation Tax Question (Question 5)

List Bl: Respondent Comments to the Open-Ended Question (Question 18)

The Opinion Questionnaire concluded with an open-ended questionnaire. The responses to the questionnaire are categorized below.

Cost

- Due to amount of income everything must be budgeted in our household. The aforementioned items must be weighed individually and/or collectively in its perceived value on whether to invest in one of these services due to the amount of driving we do.

- Fees for the most part are too high. One would be getting too little for too much.

- Wonderful Service. If I was purchasing a car I would carefully calculate Long Term costs and this might lead me to be less willing to pay monthly fee than I indicated here.

Emergency Assistance

- Emergency assistance seems somewhat unrelated to traffic reports and route guidance. Although emergency assistance is important it is very hard to weigh in terms of necessity and willingness to spend resources on it compared to the other two. If you have an emergency you want a ready way to get help ASAP. If you don't have an emergency the reports and route guidance are a constant luxury while driving during non-emergencies. Further the emergency assistance concerns may better be addressed by other technology i.e. availability of cell phones or a reverse page type system (designated cell phone?) which are perhaps unrelated to route guidance and reports.

- For safety and security I have a carphone at my expense. As for traffic it has in 1 instance altered my travel (this past year). I simply went a different route. Travel is important. So is slowing down and not stressing oneself out.

- Emergency messaging system is a must for the next level of vehicle technology. Today we are more concerned with health and safety.

- An emergency beacon would be a great idea!

- Car phone takes care of my roadside assistance.

Traffic Reports

- I use the radio traffic reports which are a service of the Radio Station (profit or non-profit). I also use the trip service offered by the car company I purchased my car from (Lincoln Town car). I use my car phone to call the emergency help number by my car company.
  All of the items you have list are only needed about 5% of my actual driving time. Therefore under my driving requirements today I would have little need for them. I drive up north a lot, when there is an accident where am I going to go to get out of traffic during Holiday traffic jams? So, preinformed really doesn't do me any good.

- I am a school bus driver in the Detroit area. I drive 500 miles a week. It is not unusual in my occupation to find traffic tied up for as long as 30 minutes, because of a "fender bender" up ahead. When a major artery is reduced from 4 lanes to 2 at 7:00 am, it is real problem. I feel that offering motorists. "Dynamic" traffic conditions, would be the most helpful to alleviate these situations.

- Two comments:
  1. My experience is that radio traffic reports are usually very good.
  2. In case of heavy traffic or delays, I have found that generally speaking, alternative routes are not much better, because: (1) that's why, for me they are alternate routes in the first place; and, (2) if my main route is heavy, the alternative will be heavy too--or even worse (i.e. if southbound I-75 is bad--so is southbound Woodward).

Route Advice

- I think I would find the Route System handy out of town. If you could rent one to go from here to Texas or something like that. I have driven the same way to work for 20 years. I already know where traffic is bad. So I take other routes already.

- Four comments:
  1. I have little desire to pay $250 for traffic navigation system. I might pay $250 for a system that includes: On demand and up-to-date traffic and route information; Maps display of above Turn-by-turn Systems have little value in my opinion except possible for rental vehicles (unfamiliar with area). ALI-Scout was neat, but I wouldn't pay anything for it.
  2. If anything the government (local) should emphasize traffic planning and infrastructure. Let the market provide devices and features.
  3. If I'm not mistaken Japan and Germany have never developed traffic planning, control and information systems. Can we learn anything from these countries?
  4. Why is Metro Detroit different than San Francisco, Chicago, Boston, New York, DC, etc. in that we don't have a decent mass transit system? To make it work here it would have to cover a large area (e.g. Detroit/Ann Arbor/Auburn Hills/Macomb area).

- If anybody can read a map and or will take time to do so, route guidance is not needed. People are lazy, the government should not charge me taxes because others are lazy. Let companies make money on lazy people, not tax me and give it to the lazy Bums in any form. Emergency Roadside assistance is flood, a cost should be involved for those that use it.

- The only real time the route advice etc. would be useful if one is driving to an unfamiliar area and did not have a AAA trip layout. re; turn by turn instructions: best for uptight people with no sense of direction- no reference is made in the section on whether route taken would be most direct or safest. Example ii-direct route is through a high crime area with confusing streets is it the best route?

Government Involvement

- Government should restrict its participation to providing the help and services needed by private companies, to make knowledgeable competitive bids on all services on questionnaire.

- The responsibilities of government should be kept to a bare minimum! No traffic reports, route guidance of any type are needed from anyone who isn't in the business to make a profit. "Government" takes 60% of my income now. Both my wife and I work to maintain a reasonable living standard. Please study how we can minimize government intervention. I may be agreeable to 30% of my income paying for defense, mail, roads and police. Everything else should be privately handled. There must be dozens of investigations in Washington of public officials, each one staffed to the teeth with $300/hour lawyers. Waste is rampant in government please don't add services I can't afford.
  No one invcstigutes privatization seriously. We should make every effort to reverse the trend of higher and higher- taxes. No one knows how to spend my money better than I. Does this mean I don't get the 5 bucks?

ALI-Scout™

- I really enjoyed using the Siemans ALI-Scout. I will really miss it when this "test" is over. Anytime you need someone to participate in other tests, please count me in.

- I would have really liked to purchase my ALI-Scout- I miss it.

- I was a beta-tester for the ALI-Scout System. The "dynamic" information was simply too imprecise to be of much help. Also, in it's current state, the system doesn't cover enough territory to be of much consistent use.

- I enjoyed being a part of this experiment and feel saddened that I will no longer hear the beeps and guy talking thru my unit. If you ever need additional testing, please contact me.

- The system you have tested in my car has proven very useless to me. The small range the computer has can not get me anywhere that is unfamiliar to me. Also, it stops giving directions too soon before the destination is reached. The beeping and talking is somewhat distracting, although the talking is better than averting your eyes from the road to the screen. I would like to see it easier to program also.

- I had the Auto Scout System in my car for a year. After a while it became boring.

- I had one of these computerized devices but was not very impressed by it. It was not very accurate after programming after a few months I had it removed.

- I used ALI-Scout for on year-it was totally worthless-Never Once did it give me an alternative and better route.

Design of Study

- It seems as though all good/services described in questions 1-32 are cross elastic with information available for free or for comparatively less cost. Specifically radio reports of traffic conditions or routing available from AAA.
  A more interesting dimension to this study might have been to: 1. Set the assumption/fact, that all (local) traffic reporting information comes from the Michigan State Highway Patrol, or some other "traffic service" who feeds information to broadcast results. 2. Convey that the source of route information for these proposed services specifically, dynamic is different than the source for radio reports. I may have a willingness to pay for product differentiation, but I do not have the willingness if I can nor discern value add over that which I can get free (on radio).
  Finally for fee based reports-extend the product so 1 can plan trips, look up routes, check local congestion immediately prior to my departure. Use the central information warehouse as a value add resource and allow me on-line access through an ISP or other access means.

- On part one. I thought there should have been a description that contained "No Fee" for the purchase price. In addition to a purchase price, there should have been an increase for a monthly fee ($30-$40). This would be similar to some of the Sat. TV offers and very similar to the cable TV offers. This could also lend itself to customize the system for each user

- Please confine your questions to the subject that is the object of this survey. [In response to questions regarding demographics] Keep the $5, the school needs it more than I do, tuitions are high enough. I also wish that you DO NOT WASTE money for this type of survey, leave it to the private sector, concentrate on teaching students something useful so they can earn not only a degree but some knowledge too. I am not impressed to see a Ph.D. doing research of this sort. I consider that a waste of money. I am sure that you would not spend a dime of your money for this type of project. You want to do research go to private sector and see what you can do.

General Topics

- We desperately need the roads improved - especially in heavily traveled areas. The traffic light system in Troy and area works great and I believe has reduced my travel time.

- My primary concerns with transportation deal with long-term issues, the environment and the cost for individual transportation (autos). I feel that we are a “spoiled” community when it involves using natural resources for individual transportation. Instead of concentrating on the short-term solutions such as traffic control for autos, perhaps we should investigate effective methods of public transportation that would not limit our individual freedom that we have become accustomed to (driving when we want to , where we want). I understand that there are very strong lobbys against such thinking but we must begin thinking long-term. Perhaps in the short-term, we can combine use of the electric vehicle with Maglev or TGV type transportation.

- Still feel the same; this is not for us. Maybe 40 years ago when we were travelers and workers and needed all the help we could get when going to unknown places. But now we don’t have parents to visit. our children have their lives and our grandchildren are all busy doing their thing. Volunteer work at Beaumont hospital and working with plants keeps me busy. Also caring for 3 dogs plus the house, looking after each other (not necessarily in that order) keeps us at home. We are not travelers do not enjoy it so all these new trends do not interest us; they are for the young!!!!