Investigation of Criteria Influencing Route Choice:
Initial Analysis Using Revealed and Stated Preference Data

by

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ABSTRACT

A third wave of route surveys was designed and conducted to gain an in-depth understanding of the factors that play important roles in the decision to choose a particular route; to investigate the potential impact of Advanced Traveler Information Systems (ATIS) on route choice; and, to estimate commuters' willingness to use this information. The survey was undertaken in October 1993 targeting a sub-sample of the respondents of the previous two surveys.

The analysis showed that minimizing travel time is the most important reason for choosing a commute route. However, it is not the sole reason for route choice. A large number of the respondents indicated the significance of other factors such as travel time variability, which illustrates the significance of the uncertainty measure in route choice, and introduces the significance of an information system that reduces the level of uncertainty and helps commuters select routes adaptively. Other important factors that influence route choice are minimizing travel distance and traffic safety on the chosen route.

A majority of the respondents (79.9%) indicated that they would accept ATIS advice, and 40.6% indicated they would prefer to receive information before leaving for work (pre-trip). A binary logit model was developed to estimate respondents' choice to accept or reject an ATIS advice. The model showed that income, age, gender, and the flexibility of the work starting time affect the likelihood of accepting ATIS advice.

Modeling route choice using stated preference observations, asserted the significance of travel time on route choice, and showed clearly that ATIS has a great potential in influencing commuters' route choice even when advising a route different from the usual one. Also several socio-economic factors such as age and gender were found to affect route choice.

1. INTRODUCTION

BACKGROUND

The problem of route choice for a traveler might be stated as follows: given the characteristics of the trip to be made -- purpose, time, origin, destination, etc. -- choose the best route through the transportation network based on some criteria. This best route most often is thought of as the one which minimizes travel disutility.

Fastest-path routing has been adopted over the years because of its simplicity and linkage with algorithms for generating equilibrium in static traffic assignment models. However, in real life, driver's routes are likely to deviate from optimal shortest paths in significant ways. Empirical research on route choice behavior shows that drivers use numerous criteria in formulating a route: travel time, number of intersections, traffic safety, traffic lights and other factors. Drivers' experiences, habits, cognitive limits and other behavioral considerations may also produce variations in route selection. Viewed in this light, one can see that assuming travel time as the sole criterion of route choice may be an unrealistic abstraction of individual driver behavior, and when aggregated at the network level may result in an inaccurate representation of traffic.

There have been several empirical studies of the factors affecting drivers' route choice. In the urban context the situation is not clear; some researchers have concluded that time minimization is the dominant criterion while others have noted the importance of aspects such as road type (Wachs, 1967; Ben-Akiva et al., 1984); avoidance of congestion (Wachs, 1967) and avoidance of stops and traffic signals (Huchingson et al., 1977).

ROUTE CHOICE STUDY

An ongoing effort for a Partners for Advanced Transit and Highways (PATH) at UC Davis, is to investigate the actual route choices of drivers, with the objective of developing refined route choice models that can include the effect of traveler information. This section presents a summary of the important findings so far accumulated from this study.

To probe into drivers' route choice behavior, a telephone survey of Los Angeles area morning commuters was conducted. The survey undertaken in May and June 1992, was designed to investigate how much information drivers have about their routes, their awareness of alternate routes, their awareness of traffic conditions which could affect their route choices, and their use of available traffic information (either en route, pre-trip or both). A detailed description of the survey design, descriptive statistics, and initial modeling results are included in a research report by the authors (Abdel-Aty et al., 1993). The results indicated that a large percentage of the commuters perceive little variation in traffic conditions from day to day, and that traffic conditions on their usual route are reasonable. Respondents who perceive variable and/or bad traffic conditions were more likely to listen to traffic reports. More females used pre-trip traffic information than males, while more males sought and used en route information. Only 15.5% of the sample reported that they do not follow the same route to work every day. Freeways were less often used as part of secondary routes. High income, high education level, departure time, and traffic variation on the usual route, were among the factors that contributed to commuters not following the same route to work every day.

Modeling commuters' information use and route choice (Abdel-Aty et al., 1994) showed significant effect of income, education, frequency of driving to work, and listening to traffic reports on commuters' route choice. While perceived variation in traffic conditions, gender, commute distance, and travel time uncertainty affect the likelihood of listening to traffic information.

Modeling commuters' frequency of "changing routes based on pre-trip traffic reports" showed significant effect of commuters' perceptions of the accuracy of traffic reports, variation in traffic conditions, travel time, and the level of education, on the frequency of route changes. Also, traffic conditions, perceptions of information accuracy and traffic variation, freeway use, commute distance and carpool, were among the variables influencing the frequency of route changes based on en route traffic information.

To probe more into drivers' route choice behavior, and to measure any changes within the last year, a second computer-aided telephone interview was designed and conducted in May 1993. The survey targeted the same sample interviewed in May/June 1992. A detailed description of the survey design, descriptive statistics, and initial modeling results are included in Abdel-Aty et al., 1994. General descriptive statistics showed several significant trends and characteristics in the sample. The main reasons for changing the commute routes since the first wave of the survey were changing home or work location, avoiding congestion, and discovering a faster route. A majority of the sample (71%) reported that they experience on some days delays up to 10 minutes over their normal travel time. A majority (32%) of the sample also indicated that such delays occur on 2-3 days per two weeks.

Commuters are very sensitive to delays they encounter during their commute. About 39% of the respondents indicated that they would decide to divert from their usual routes even if they encountered less than 5 minutes increase in their normal travel time.

Changing the commute route was found to be associated with changing departure time; 42% of the respondents who changed their primary route to work in the year May 1992-May 1993 also changed their departure time.

Females are generally more concerned than males regarding traffic safety, unsafe neighborhoods, and the existence of buses and trucks in traffic. The results also showed that females and younger respondents are more likely to carpool than males and older respondents. Carpoolers changed their routes less frequently than single vehicle drivers, and the carpool drivers are usually the ones who choose the commute route.

Factor analysis performed on some attitudinal variables produced three factors, which are named: shorter commute, safety and comfort, and perceptions of the ease of driving.

Multinomial logit models were used to estimate commuters' route choices when faced with a traffic related incident (respondents were asked if they can remember a specific event or traffic related problem on their route to work within the last month). The choice set included: stay on the same route, divert to another route, or divert only around the location of the problem. The results of the models illustrated that females are more likely to stay on the same route when encountering incident related congestion, carpoolers tend to divert from their initial route either to another route or around the location of the problem, individuals who receive traffic information are more likely to divert. Also, perceiving not driving through unsafe neighborhoods as extremely or very important increases the probability of the commuter staying on his route, and not risking diversion which might lead him to unfamiliar routes that could be unsafe. While commuters perceiving less congestion as extremely or very important are less likely to stay on the same route but try to avoid congestion by diverting.

Five stated preference choices are included in the survey. In each choice the respondent is asked to choose between two hypothetical routes. The choices are designed such that the travel time on the first route is longer and certain, while the second's route travel time is shorter but uncertain. Binary logit models used to predict the choices between the two hypothetical routes illustrated the significance of commuters' attitudes, travel time variation, gender, and traffic information, on the route choice.

A third mail survey, targeting a sub-sample of the previous two surveys, was undertaken in October 1993. This survey is divided into two main parts. The first is a revealed preference section, in which two routes are introduced to each respondent, his primary route, and an alternative route. The alternative route is the optimal route from home to work generated by a GIS system using the Navigation Technology databases. The second section is a stated preference section, in which several hypothetical choice sets are introduced to the respondent with the objective of investigating the effect of road type, travel time and advanced traffic information on route choice.

This report describes the third survey design, and introduces general descriptive statistics that show commuters' perceptions of their routes and the optimal route, the important criteria for route choice, and the possible impact of advanced information systems on route choice.

2. LITERATURE REVIEW

One of the main objectives of this study is to understand the factors that influence drivers' route choice. A previous report (Abdel-Aty et al., 1992) reviewed literature that investigated route choice behavior in conjunction with information systems (effect of these systems on route choice). One of the findings of the previous literature review was that there is a need to understand how drivers choose or change routes in the absence of information systems in order to gain an understanding of route choice behavior in the presence of information. the objective of this section is to identify the factors that influence route choice in the absence of information. The studies cited here are concerned mainly with route choice behavior.

Winsum (1989) referred to a study by Freeman et al. (1971) in which he compared actually driven routes with optimal routes on travel time, distance and costs. Travel times and distances were measured by driving different routes a number of times with a test car. The costs were determined as a linear function of travel time and distance. They concluded that cost appeared to be more important than distance and time. Car drivers chose suboptimal routes much more often than the researchers expected.

Ratcliffe (1972) compared actually driven routes with routes which were optimal according to the criteria travel time, distance, total costs, perceived costs and two congestion factors. Travel times and distances were determined by driving different routes once with a test car. Cost was estimated as a linear function of speed, and speed was estimated as a linear function of traffic density. All criteria, except for one congestion factor, appeared to be about equally important. When calculations were made according to the assumption that everyone chooses the optimal route 46 to 56% of the chosen routes were predicted correctly, depending on the criterion; minimization of perceived cost was the best predictor of route choice, and travel time and a congestion factor were the worst predictors. However, the criteria used by Ratcliffe are not independent. One can assume strong correlations between these criteria.

Duffel and Kalombaris (1988) compared the data of several case studies on travel time, distance and frequency of use of routes. Travel time seemed to be the most important determinant of route choice. In addition to travel time there appears to be relevant factor for route choice which relates to the desire of car drivers to maintain speed or keeping moving.

Winsum (1989) cite that Jansen & Den Adel (1986) remarked that the theory based on objective characteristics of routes (e.g. travel time, distance, and number of junctions) is not able to explain the route choice travellers sufficiently.

Huchingson et al. (1977) surveyed 202 drivers from the central business district of Dallas. The work-trip questionnaire was given to the commuters through the personal departments of their employers. The commuters were asked to describe the routes they regularly took to work and home, the alternative routes, and the reasons for their choice of route. The major reasons these commuters gave for taking their present routes to work and homeward are speed (fastest route), and directness (shortest, most direct). Convenience and accessibility, fewest stops, less traffic, and good traffic flow were mentioned less often. Sixty percent of the commuters indicated that they chose from a number of alternative routes, 74% of them had chosen a different route from the route they usually drove in the month preceding the investigation. These drivers were asked to detail two alternative routes and the reasons for their route choice. The principal reasons were lighter traffic (29%), change of scenery (15%), and the need to make specific stops (13%).

The main conclusions found by Huchingson et al. were:

[1] The commonalities in the reasons given for selecting routes suggest that a message system could satisfy the needs of a great majority by presenting traffic information and positive route guidance.

[2] At least 50% of those electing to continue through incident-related congestion would have diverted if they had additional information.

[3] Drivers are not committed to a single route. Typical route-choice decisions, as well as incident-related decisions, are dictated by driver expectations regarding comparative traffic conditions on the routes.

Wachs (1967) interviewed a sample (undefined) in Evanston, Illinois. The sample was biased toward males and included only 21% females. Approximately 43% of the respondents worked in the CBD of Chicago, and they had an average trip to work of 28 minutes and covered 9.7 miles.

Twenty one attitudinal questions, were given to the subjects, in which they scored the importance of a statement with regard to route choice on a five point scale, for 21 statements. Socioeconomic and demographic characteristics of the respondents were not clearly related to attitudes towards route choice criteria. Safety however, was seen as less important by the youngest group of subjects. Travel time, less congestion and absence of stops and interruptions were experienced as the most important criteria for all trip purposes (home to work, shopping, trip to friends). Safety, scenery and comfortable pavement were seen as more important in trips to friends than in home-work trips (Wachs has not reported quantitative data on this). For the trips from home to work a factor analysis was performed on the attitude scores. The most important factor appeared to be "preference for access controlled roads". Statements connected with this factor are about, fewer traffic lights, more lanes and fewer stops and interruptions.

In order to gather information about the characteristics of the work trip and the alternative routes perceived by the trip-maker, questions were included in the interview about the nature of the trip and the alternative routes. In addition, the respondent indicated by marking on a detailed street map of Chicago, exactly what his alternative routes were. Most of the respondents spoke of two alternative routes for their trip to work, although some cited as many as six or seven. The travel time used for each route was the respondent's estimated travel time. Traffic volumes on the routes were obtained from the Chicago Bureau of Street Traffic. Average daily volumes were multiplied by an hourly proportion to estimate volumes during the hour in which the respondent made the trip. The ratios of volume to capacity would have been more meaningful than volumes alone, but design capacities were not available and therefore could not be used. The number of intersecting arterials along each route was counted and included as a surrogate for delay and interrupted driving. Twenty one work-trip were used in the analysis. Canonical correlations were used to test the hypothesis that the stated attitudes could be related to the characteristics of the respondents and their trip and route characteristics. Therefore, the correlations were performed between work-trip attitude variables and socioeconomic and trip characteristics, and between work-trip factors and socioeconomic and trip characteristics variables. Also grouping technique was employed to examine the same interrelationships.

The analysis indicated that reasonably strong relationships do exist between the attitudes of the respondents toward the type of route which they seek when they make a trip, and the characteristics of the respondents, their trips, and the routes to which they have been exposed. People's preferences for various route characteristics do vary, and the variations can be related to the characteristics of the people, their trips, and the routes. Drivers seem to be able to satisfy their preferences for many route characteristics, i.e. drivers who express preferences for many route characteristics actually tend to travel on routes which possess them.

Duffell and Kalombaris (1988) conducted an empirical route choice study in Hertfordshire, England. They performed field studies, and questionnaire surveys on the routes taken by car drivers in the morning peak period.

Detailed questionnaires were distributed to two major commercial firms as well as to local authority staff. The sample comprised 255 (about 70% response rate) completed questionnaires. A very high proportion (90.9%) of the people indicated that they use a preferred route which is the quickest; further, 89.3% indicated that their route is also the shortest. On average respondents indicated awareness of three significant routes used at some stage. When respondents were asked to indicate the single most important reason for their route choice, 54.2% indicated it to be minimum journey time, and the next most important reason was less traffic (13.3%). In an attempt to investigate the way in which drivers balance the two factors of time and distance, they were asked to choose among 6 alternative routes that have different degrees of distance and time variation. About 90.5% of the respondents chose three alternatives that embraced increases in travel distance, but significant time-saving, which meant that minimum journey time is the most important factor in drivers' route choices.

In the field studies, routes between an origin and a destination in several areas were monitored. For each origin/destination there was a main route and one or two alternative routes passing through residential areas (rat-run). From the results of the observations, and supported by a regression model estimating the percentage of drivers using the rat-run, Duffell and Kalombaris concluded that travel time is the single most important criterion affecting driver route choice in networks where there is a viable alternative to the main route. The field observations also demonstrated that drivers are willing to incur some extra travel distance to find the quickest route, provided the alternative is not tortuous. Conversely, there does appear to be the situation whereby, provided traffic is moving, drivers may forego a perceived and possible time saving given the predictability and familiarity of the main route time. In short, the observations have confirmed the findings of the questionnaire survey, that travel time is the overriding route choice criterion.

Jou and Mahmassani (1994) analyzed commuter behavior revealed from a trip diary survey conducted in Dallas, Texas, alongside results from an earlier survey conducted in Austin, Texas. Mathematical models were used, relating the frequency of departure time and of route switching along the commutes to the characteristics of the commuters, the work environment, and the urban network. The analysis focused on the commuter's departure time and route choice, and the variation that they exhibited from day to day. It applied both a "day-to-day" and a "deviation from normal" approach to switching behavior. In general commuters were found to have a tendency to change departure times, routes, or both more frequently in the morning than evening, possibly a reflection of a constrained arrival time at the work place compared to a flexible arrival time at home. Also route and departure time decisions were shown to be interdependent. Overall, commuters exhibit a greater rate of switching in Dallas than in Austin in the morning and almost the same rate of switching in the evening for departure time, route, and joint switching. Probable reasons include a city size effect and stringency of work start time constraints. The characteristics of the commuter, work place, and the traffic system, along with the commuter's trip-chaining patterns were all important determinants of the departure time and route switching behavior.

For route switching, the socioeconomic, work place condition, and routine stop variables all exert a similar effect in both cities, for both AM and PM commutes. The trip chaining factor has a different influence on route switching in the AM in Austin than in Dallas.

Jou and Mahmassani showed that route and departure time switching are already taking place on a wide scale in actual systems, implying that users may be willing to shift commuting patterns in response to information. Also, the higher frequency of departure time switching relative to route switching suggests that real-time information systems are likely to have significant impacts not only on path selection but also (and perhaps more so) on trip timing.

Mannering et al. (1994) used the ordered-response logit models and the Weibul duration models to investigate the frequency with which commuters undertake route changes, and the amount of traffic delay needed to induce a change in route respectively. The results indicated the importance of both traffic network and commuter socioeconomic characteristics on the frequency of route changes. Also significant differences were found between the factors that determine morning and afternoon route change frequencies. For the amount of traffic delay needed to induce a change in route, the authors found that although significantly more delay was required to induce a shift to an unfamiliar route relative to a familiar one, the factors determining this delay were quite similar.

Minimizing travel time is considered the most important criterion affecting drivers' route choice as found by Duffell and Kalombaris (1988), Huchingson (1977), and Wachs (1967). Also, directness (Huchingson, 1977) and less congestion (Wachs, 1967) were among the important reasons. Wachs (1967) concluded that socioeconomic and demographic characteristics does not clearly relate to attitudes toward route choice criteria, while Jou and Mahmassani (1994) and Mannering (1994) found that socioeconomic characteristics together with the traffic network were important determinants of route changing behavior. The results from the third survey will support some of the previous results, and clarify some of the discrepancies found.

3. ROUTE CHOICE SURVEY: PHASE III

A route choice survey was developed targeting a sub-sample of the respondents interviewed in the previous two CATI surveys, which consisted of the Los Angeles area morning commuters.

The Survey Objectives

The survey was designed to obtain the following information:

- Which attributes of routes are considered important by the individual in the decision process that leads to the choice of a route.
- Commuters' willingness to use ATIS.
- The effect of advanced traffic information on route choice.

Response Rate

The number of targeted respondents was restricted by the availability of their addresses and the success in geocoding their commute origins (home) and destinations (work) using the GIS system. Origins and destinations were successfully geocoded and addresses were available for 263 respondents (agreed to provide the address during the second CATI survey). The 263 questionnaires were customized according to each respondent's origin, destination, primary route, and travel time. The questionnaires were sent to the respondents along with a postage paid return envelope and an incentive of two dollars. A total of 143 respondents completed and returned the questionnaires (54.4% response rate), which represents very good response rate for a mail-back survey.

The Survey Design

As mentioned above, the questionnaires were customized for each respondent. A customized questionnaire is attached as an example in the Appendix. Each questionnaire consisted of two main parts. The first is a revealed preference section, while the second is stated preference.

Revealed Preference Section

The main objective of this section is to understand why commuters choose a particular route (in this case their primary route); why they do not necessarily use the optimal route; how they perceive both primary and optimal routes; how familiar they are with the streets/highways network; and how willing they are to use and accept ATIS's advice.

The primary route for each respondent is identified from the previous CATI surveys. If the respondent stated in the second CATI that he didn't change his primary route then this route is captured from the first CATI, if he stated that he did change his primary route, then this route is captured from the second CATI. Each segment of the primary route is presented to the respondent in a table (please see page 1 in the questionnaire in the Appendix), then the respondent is asked to rate a series of subjectively measured route attributes related to his primary route.

Given each respondent's origin (home) and destination (work), and using GIS capabilities, the Navigation Technology's databases are used to generate minimum path routes. Navigation Technology's databases are detailed databases that include all the highways/streets network in the study area. Several friction factors enter into the algorithm calculating the minimum path (e.g., stops, U turns, one way streets, speed limits, etc.), together with the experience of a large number of drivers that are acquainted with the area, and according to their chosen routes each route is assigned with a weight that also enter in calculating the optimal (fastest) route. Figures 1 and 2 give two computer screens from the GIS process. Figure 1 shows the map that includes the respondent's origin, destination and his generated fastest route highlighted. Figure 2 shows a printout of the fastest route by segment, which is presented in the questionnaire (e.g., page 3 in the Appendix), followed by several questions that measure the respondent's familiarity with this route, reasons for not using this route, willingness to use an ATIS system, and rating of a series of route attributes related to the fastest route.

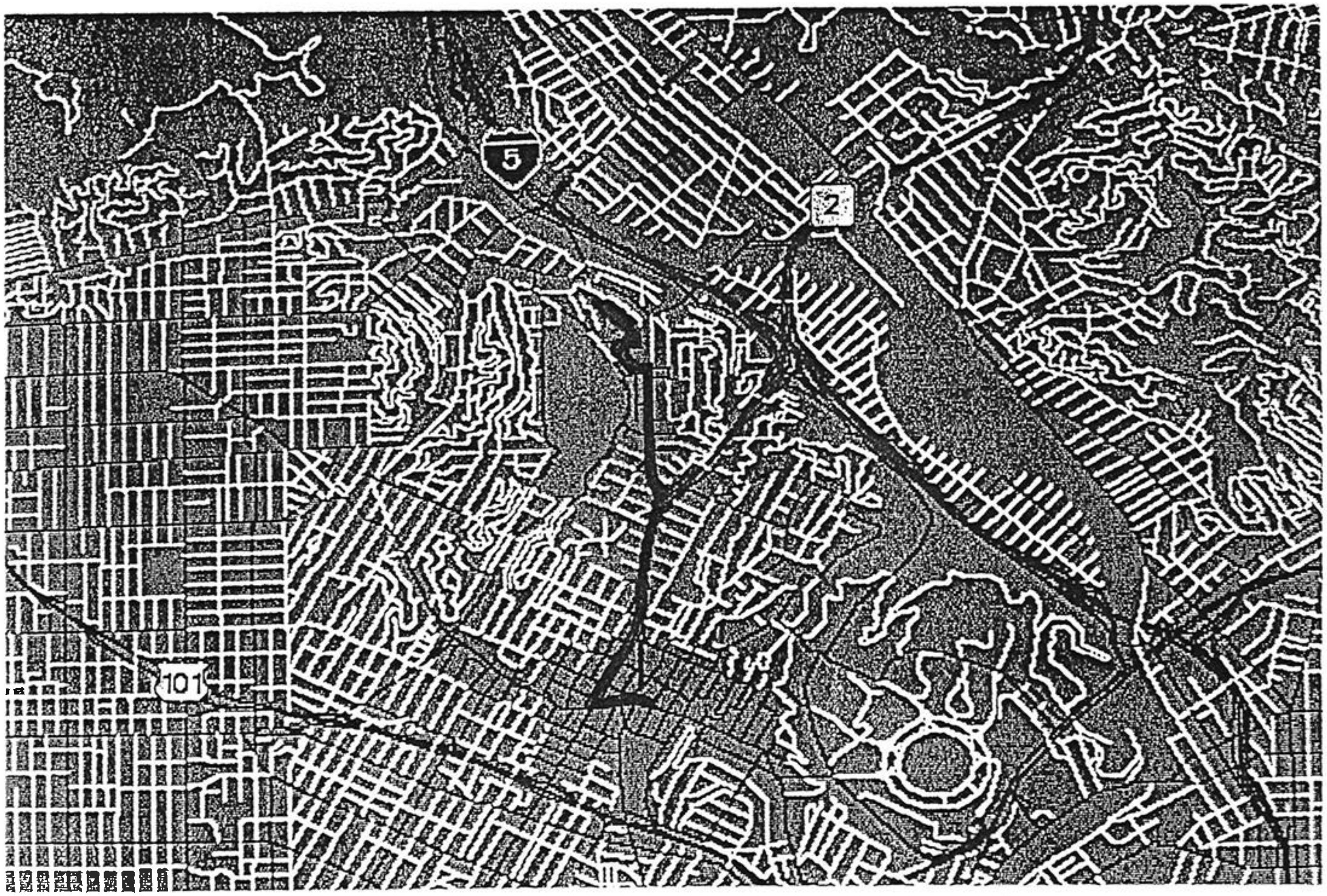

Figure 1: A computer screen showing the optimal route

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DriverGuide Version 5.45 - Copyright (c) 1993 - Navigation Technologies
                              route.$$$

From:           112 S LUCIA AVE
                REDONDO BEACH

To:             4405 W EL SEGUNDO BLVD and HAWTHORNE BLVD
                HAWTHORNE

                About 6.2 miles, 10 minutes.

        Total
        Miles   Directions

   1)     0.0   Start out going North on S LUCIA AVE towards EMERALD
                ST.
                Drive a short distance.

   2)     0.0   Turn RIGHT onto EMERALD ST.
                Drive 0.1 miles.

   3)     0.1   Turn LEFT onto N PROSPECT AVE.
                Drive 0.7 miles.

   4)     0.8   Turn RIGHT onto FLAGLER LN.
                Drive 0.1 miles.

   5)     0.8   Turn LEFT onto DIAMOND ST.
                Drive 0.1 miles.

   6)     0.9   DIAMOND ST will become FLAGLER LN.
                Drive 0.3 miles.

   7)     1.3   Turn RIGHT onto RIPLEY AVE.
                Drive 1.2 miles.

   8)     2.5   Turn LEFT onto INGLEWOOD AVE.
                Drive 3.3 miles.

   9)     5.8   Turn RIGHT onto W EL SEGUNDO BLVD.
                Drive 0.5 miles to the intersection of 4405 W EL
                SEGUNDO BLVD and HAWTHORNE BLVD in HAWTHORNE.

                Thank you for using DriverGuide!

Copyright 1992 Navigation Technologies Corp.
              Keys: ↑↓→ PgUp PgDn Home End  P:PRINT  Esc:Exit
```

Figure 2: A printout of the optimal route

Stated-Preference Section

The main objective of this section is to investigate the effect of ATIS together with road type, travel time and familiarity with a particular route, on the route choice. Stated preference (SP) methods become an attractive option in transportation research when revealed preference methods cannot be used in a direct way to evaluate the effect or demand for non existing services (e.g., ATIS). SP methods are easier to control, more flexible, and cheaper to apply (as each respondent provides multiple observations for variations in the explanatory variables).

In this survey, three scenarios are provided. The respondent must choose between two routes and indicate his departure time (as an example see pages 6 and 7 of the questionnaire in the Appendix). The choices are binary; route 1 is customized for each respondent so that the SP design would be as realistic as possible, while route 2 is hypothetical. For route 1 it is stated: **"Your primary route using ..."** and then a segment of the respondent's actual route is written. The travel time of route 1 is the respondent's actual commute time as stated in the CATI surveys, and the road type is the actual route type of the primary route (mainly freeway, mainly surface streets or freeway/surface streets). The objective here is to use the route that the respondent is familiar with, and make the SP design realistic.

Road type of route 2 is either: mainly freeway, mainly surface streets, or freeway/surface Streets.

Normal travel time on route 2 is either:

0.9 * (normal travel time on route 1),

1.0 * (normal travel time on route 1), or

1.1 * (normal travel time on route 1).

Traffic information is available on either route 1 or route 2, but not both. If traffic information is available then it gives estimation of the travel time on that day which is either:

0.9 * (normal travel time on the same route),

1.0 * (normal travel time on the same route),

1.1 * (normal travel time on the same route),

1.2 * (normal travel time on the same route), or

1.4 * (normal travel time on the same route).

In case the information system estimates travel time above the normal, then the cause of the delay is given to the respondent. The cause of the delay is either: accident, maintenance, stalled vehicle, or regular congestion.

All possible combinations of the previous cases are considered, after excluding the obvious choices (e.g., if route 1 is faster and has information that predict no delays). In all 68 different combinations were used, 3 for each respondent randomly.

4. DESCRIPTION OF THE SAMPLE

As indicated before, the respondents are a sub-sample of the second CATI sample, but limited to respondents from Los Angeles and Orange counties because the Navigation Technology's databases were available only for these two counties. Table 1 shows the distribution of the mail survey's sample (3rd wave) by county.

Table 1: Distribution of the Sample by County

County	Number of Respondents Wave 1 (1992)	Number of Resp. Wave 2 (1993)	Number of Resp. Wave 3 (1993)
Los Angeles	691 (75.9%)	387 (68.8%)	101 (70.6%)
Orange	171 (18.8%)	128 (22.7%)	41 (28.8%)
San Bernardino	30 (3.3%)	30 (5.3%)	--
Riverside	18 (2.0%)	14 (2.5%)	--
Other	--	4 (0.7%)	1 (0.6%)
Total	910* (100%)	563 (100%)	143 (100%)

* Excludes 34 respondents who didn't know their home zip code.

The sample is consisted of 72 females and 71 males. The distributions of age, income and education level are depicted in Figures 3, 4 and 5 respectively, and follow to a large extent the trend in the previous surveys. The sample contained 16.8% carpoolers, 75.6% respondents driving alone to work, and the rest either used transit or walked.

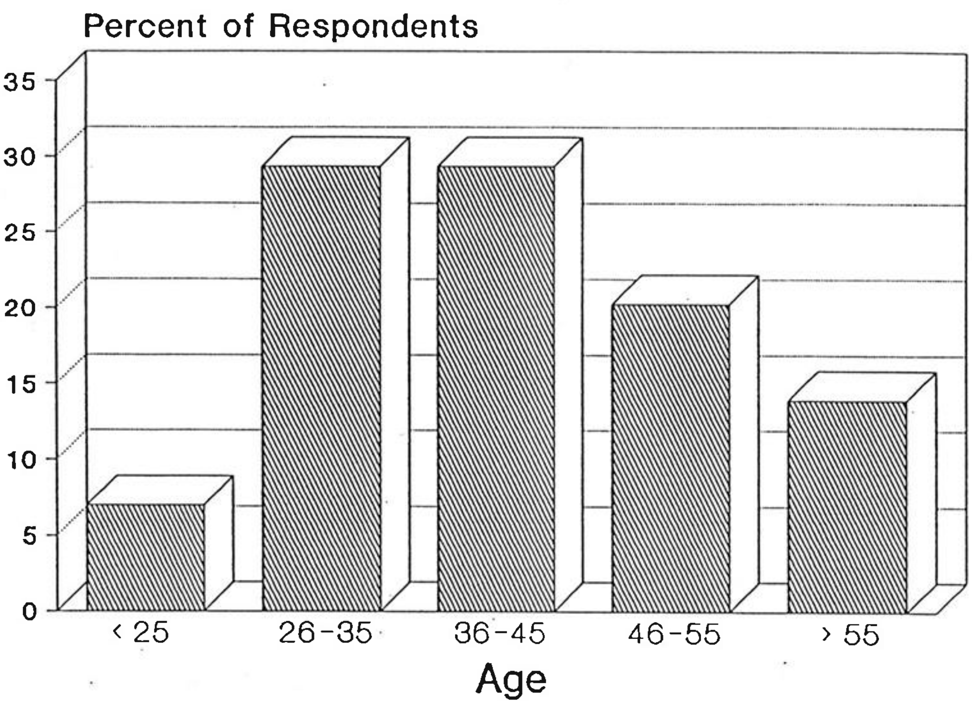

Figure 3: Age distribution

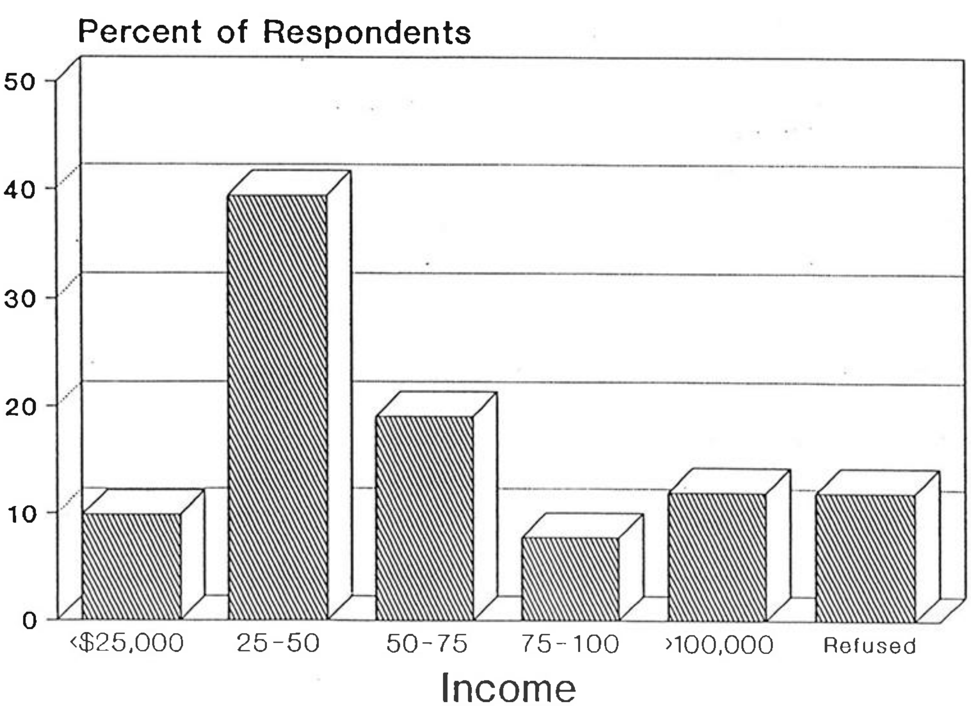

Figure 4: Income distribution

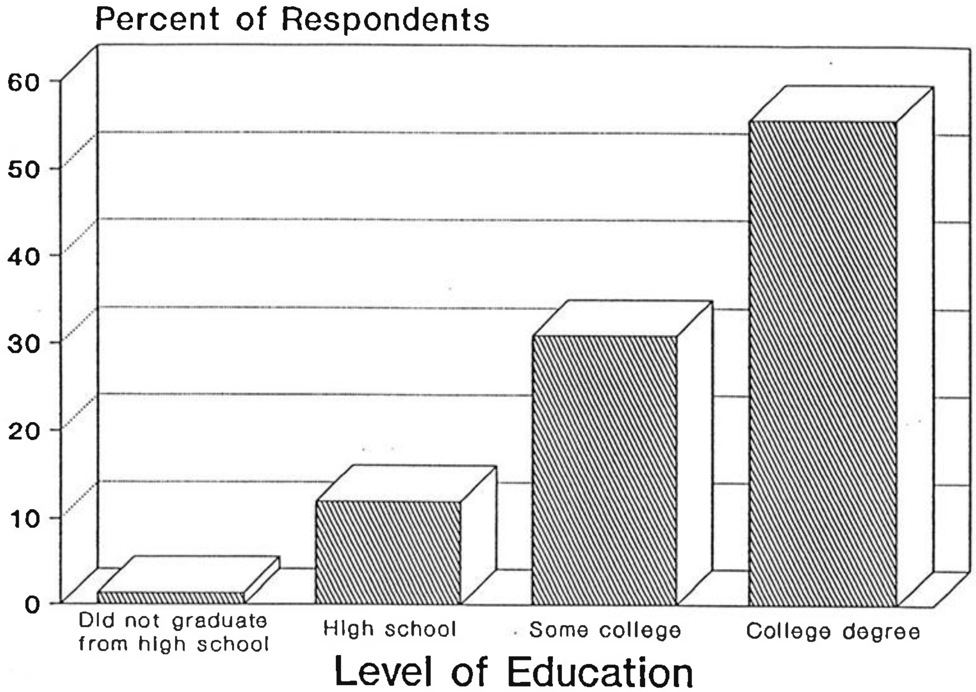

Figure 5: Distribution of the level of education

5. FACTORS AFFECTING ROUTE CHOICE

As mentioned above, one of the main objectives of this survey is to determine which route attributes are considered important by the individual in the decision process that leads to the choice of a route.

Respondents were asked to rank several factors that made them choose their primary route. The factors and the respondents ranking is depicted in Table 2. Shorter travel time is the most important factor (1st reason) for choosing the primary route followed by both shorter distance and travel time reliability. About 40%, 32% and 31% of the respondents indicated shorter travel time, travel time reliability, and shorter distance, respectively, as the most important reason for choosing their primary route. About 62%, 54% and 47% indicated that shorter travel time, travel time reliability, and shorter distance, respectively, as either the most or second important reason for choosing their primary route. Other reasons included fewer traffic signals, greater traffic safety and no unsafe neighborhoods, which 10%, 6% and 3% of the respondents, respectively, considered the most important reason for route choice.

Table 2: Reasons for choosing the primary route

Reason for route choice	1st reason	2nd reason	3rd reason	4th reason	5th reason
Shorter distance	45 (31.5%)	23 (16.1%)	17 (11.9%)	11 (7.7%)	4 (2.8%)
Shorter travel time	58 (40.6%)	31 (21.7%)	11 (7.7%)	8 (5.6%)	4 (2.8%)
Travel time is reliable	46 (32.2%)	31 (21.7%)	21 (14.7%)	14 (9.8%)	8 (5.6%)
Fewer traffic signals	15 (10.5%)	15 (10.5%)	24 (16.8%)	24 (16.8%)	11 (7.7%)
Greater traffic safety	8 (5.6%)	15 (10.5%)	14 (9.8%)	17 (11.9%)	31 (21.7%)
No unsafe neighborhoods	5 (3.5%)	7 (4.9%)	9 (6.3%)	11 (7.7%)	19 (13.3%)
Drive more on carpool lanes	1 (0.7%)	3 (2.1%)	0	0	0

Note: Summing each column might exceed 100%, that is because some people chose two factors as 1st or 2nd reason, e.g., they consider shorter travel time and travel time reliability as the most important reason for route choice.

The above result shows clearly that minimizing travel time is the primary reason for route choice which conforms with many previous studies (see for example Duffell and Kalombaris 1988, Huchingson 1977 and Wachs 1967). This result illustrates that minimizing travel time is not the sole factor, but there exist other very important reasons for route choice. One of these reasons are travel time reliability, which add the measure of uncertainty to the route choice. It also introduces the significance of an information system that may help reduce travel time by selecting routes adaptively. In a report by the authors (Abdel-Aty et al., 1994), the degree of travel time variation on the route was found to be significant for route choice. Also, this result points that shortest path criteria (either time or distance) solely is indeed an unrealistic abstraction of individual driver behavior, and when aggregated at the network level may result in an inaccurate representation of traffic. It might be more realistic to include all the previous factors in determining drivers' route choice behavior, and giving each factor a weight that represents its significance in the route choice.

Table 3 depicts the factors that make respondents choose their primary route over the suggested minimum path route (which was generated using a GIS system). Again, the results here support the previous result that travel time minimization is the most significant factor. About 62.9% of the respondents indicated that they don't use the suggested optimal route because their primary

Table 3: Reasons for not using the GIS generated optimal route

Reason	No. of respondents (percent)
Not completely familiar with this route	5 (3.5%)
Primary route is shorter	54 (37.8%)
Primary route is faster	90 (62.9%)
Primary route is safer	41 (28.7%)
Have to make stop on the way along the primary route	11 (7.7%)
Had a bad experience in the past with the suggested route	5 (3.5%)
Travel time is unpredictable	53 (37.1%)
Many short roadway segments	16 (11.2%)
Primary route involves more freeway segments	14 (9.8%)
Primary route does not include insecure neighborhoods	9 (6.3%)

Note: Multiple answers are allowed (respondents can choose more than one factor) route is faster. However, there exist other factors that enter in the decision to choose a particular route. Shorter distance, travel time reliability and traffic safety, were among the factors indicated by 37.8%, 37.1% and 28.7%, respectively.

However, others factors enter in some individuals decision to use a particular route. Number of roadway segments, freeway use, trip chaining, neighborhood security, and familiarity were among the factors less frequently stated. In general, 10.5% of the respondents indicated that they are already using the same suggested minimum path route as their primary route.

Figure 6 depicts respondents' perception of their familiarity with the GIS generated route (this measure might indicate the respondents overall familiarity with their streets/highways network). The figure shows that a large majority of the respondents (73%) consider themselves "extremely familiar" with the suggested route, and 21.6% considered themselves "very familiar" with this route. The rest, about 5% considered themselves "somewhat familiar" with the route. Only one respondent considered himself "not at all familiar". Also, about 54.3% of the respondents indicated that they did use the GIS generated route before, 28.6% used part of the route, while only 17% did not use this route.

The previous results indicate that the majority of the respondents are familiar to a large extent with their networks, which suggests that the commuters' unfamiliarity with alternative routes are not one of the main reasons that they choose a particular route, but their perceptions of the attributes of a particular route, as discussed earlier (travel time, travel time reliability, distance, safety, etc.) lead to a certain choice.

6. ROUTE ATTRIBUTES

As discussed above, several factors contribute to the driver's decision in choosing a route. Drivers use numerous criteria in formulating a route: travel time, traffic safety, traffic lights and other factors. Drivers' experiences, habits, cognitive limits and other behavioral considerations may also produce variations in route selection. In this section we look at commuters' perceptions regarding several route attributes. It is important to understand commuters' perceptions as they eventually lead to their behavior.

Figures 7 through 13 compares, for both the respondents' primary route and their GIS generated optimal route, the distributions of commuters' perceptions of the traffic lights and stop signs, variation in traffic conditions, traffic conditions, traffic safety, neighborhood security, scenery, and travel time reliability, respectively.

The majority of the respondents (40.5%) perceived that their primary route has "some" traffic lights and stop signs, while the majority (40.3%) perceived that the generated route has "many" traffic lights and stop signs (Figure 7). About 61% of the respondents perceived that traffic conditions on their primary route to be "about the same everyday" versus 43% for the GIS generated route, while only 3.5% of the respondents indicated "substantial differences in traffic from day to day" versus 23% for

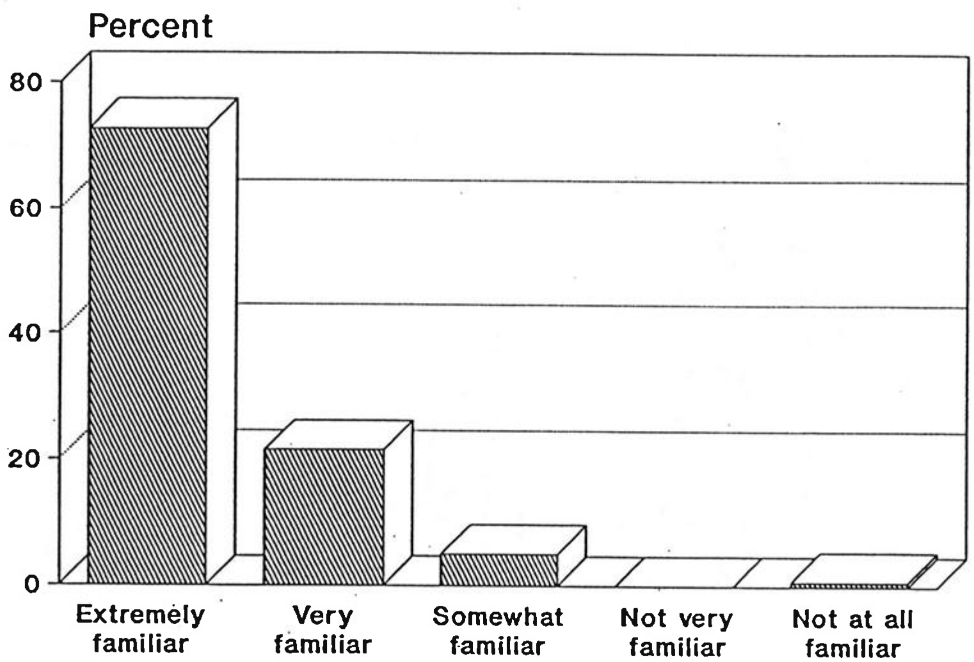

Figure 6: Respondents' familiarity with the GIS generated route

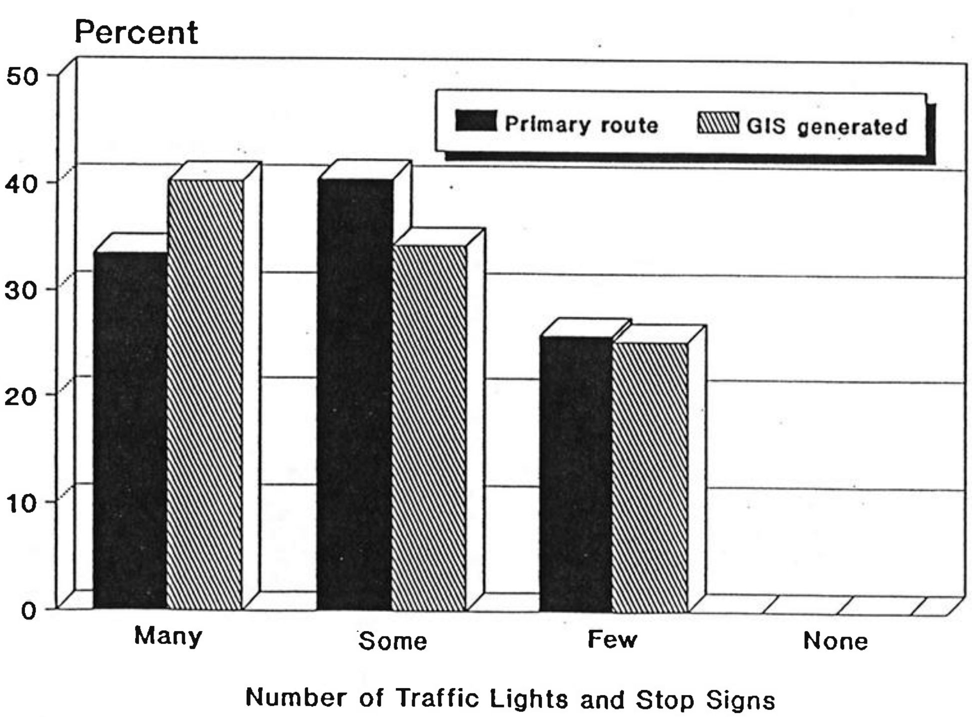

Figure 7: Respondents' perception of the number of traffic lights and stop signs along their primary and GIS generated routes

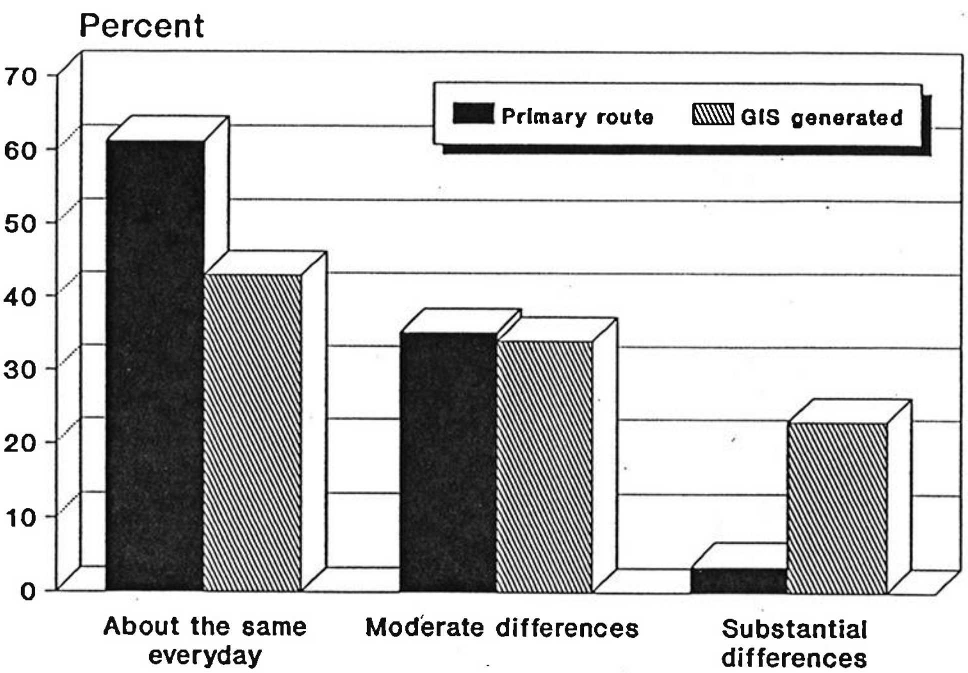

Figure 8: Respondents' perception of the variation in traffic conditions for their primary and GIS generated routes

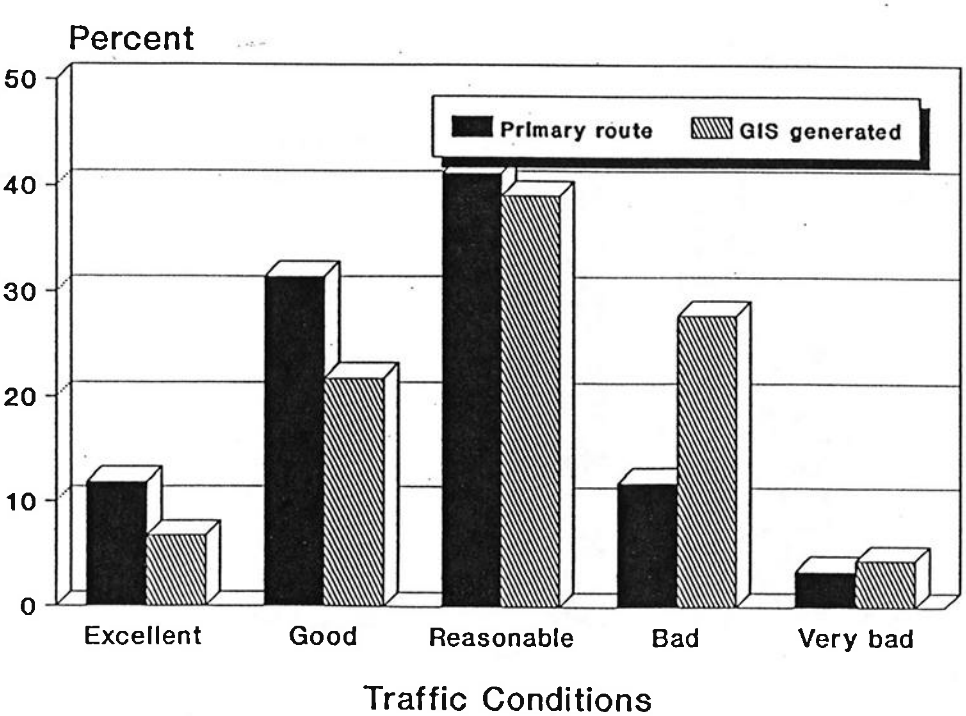

Figure 9: Respondents' perception of traffic conditions on their primary and GIS generated routes

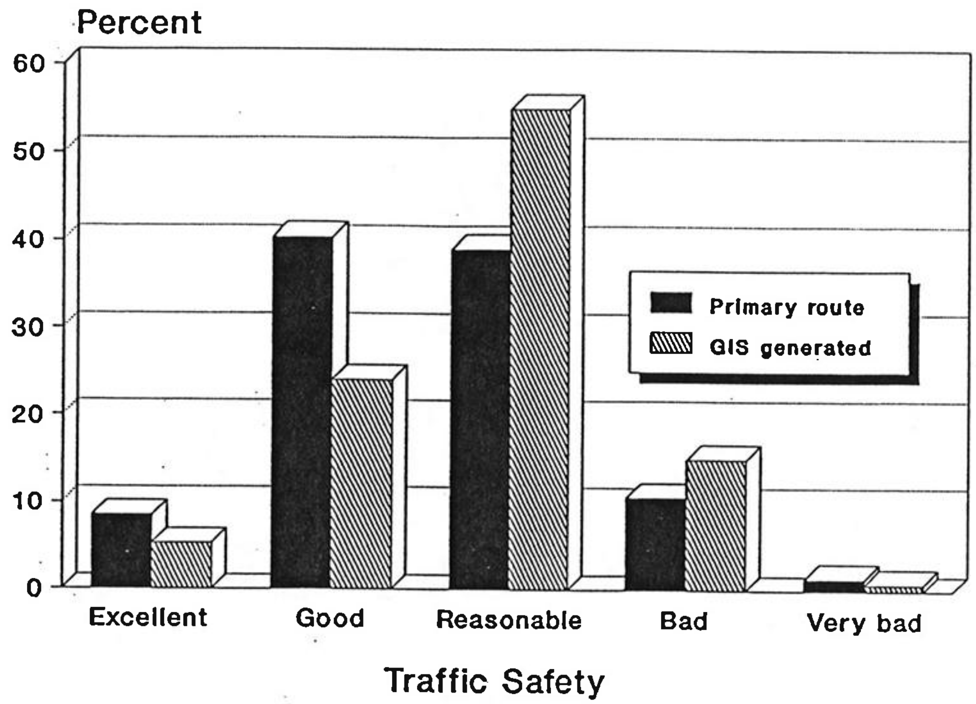

Figure 10: Respondents' perception of traffic safety on their primary and GIS generated routes

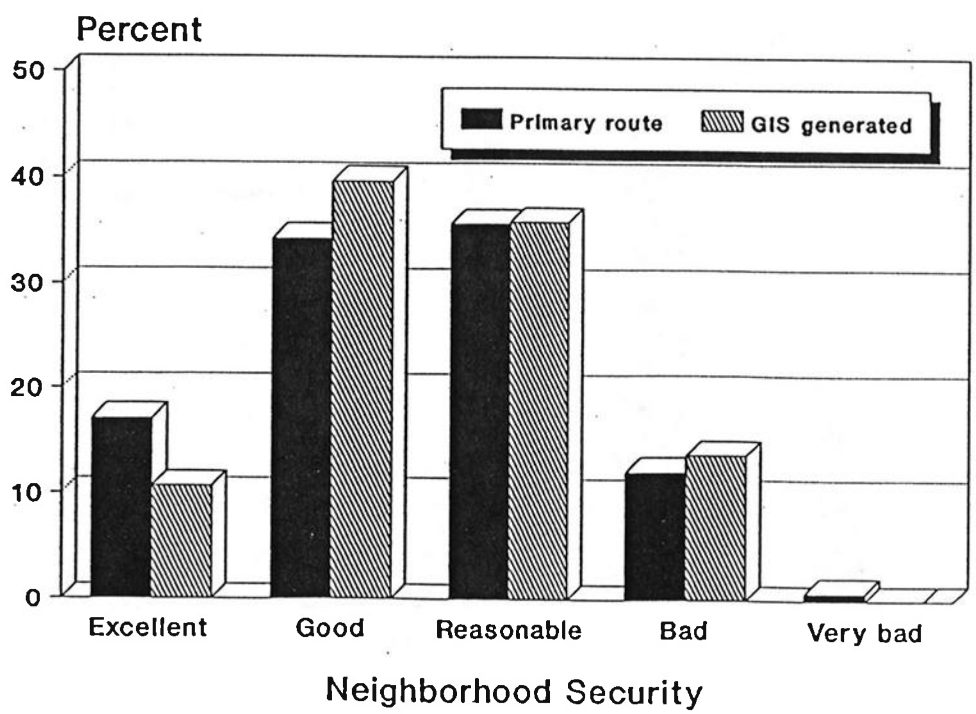

Figure 11: Respondents' perception of neighborhood security on their primary and GIS generated routes

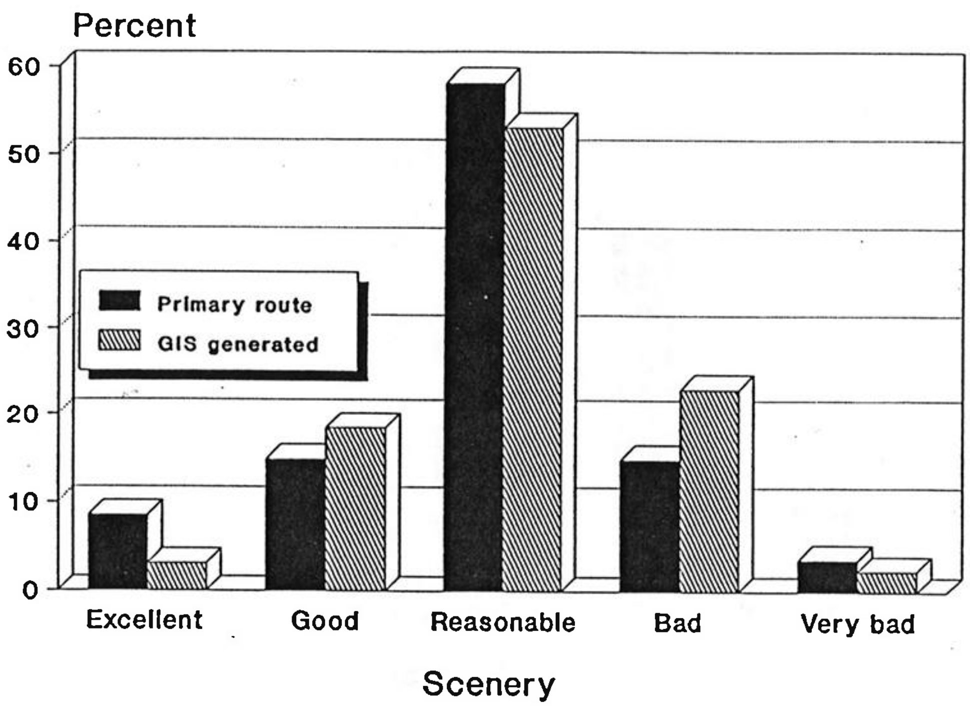

Figure 12: Respondents' perception of scenery on their primary and GIS generated routes

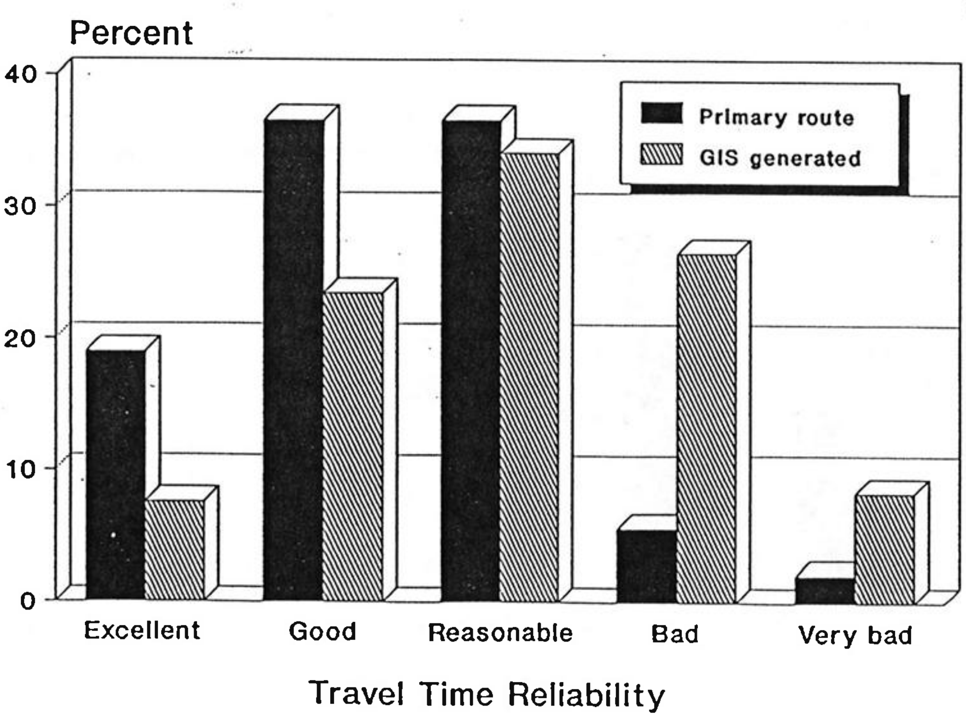

Figure 13: Respondents' perception of travel time reliability on their primary and GIS generated routes

the generated route (Figure 8).

About 43% of the respondents reported that traffic conditions on their primary routes are "excellent" or "good" versus 28% for the generated optimal route, while only 15% indicated "bad" or "very bad" traffic conditions for their primary route versus 32% for the optimal route (Figure 9). the same trend holds for traffic safety and travel time reliability (Figures 10 & 13), more respondents perceive these attributes to be "excellent" or "good" on primary route and "bad" or "very bad" on the optimal route. Neighborhood security and scenery were to a large extent similarly perceived by the respondents for both routes.

The distributions shown above indicate a significant bias of the respondents toward their used routes, and against the optimal route. It also indicates the significance of some attributes over the others, e.g. number of traffic lights, traffic variation and safety. An information system which would provide commuters with attributes of alternative routes might alter their perceptions and hence their route choice.

7. COMMUTERS' WILLINGNESS TO ACCEPT ATIS ADVICE

Advanced traffic information systems (ATIS) were defined to the respondents in the survey as: a system that can offer you personalized information about your trip, and advise you with other routes to take while considering current traffic conditions. Respondents were asked if they were willing to accept such system's advice to use the generated optimal route. Despite their bias against that route (as discussed before), 79.7% of the respondents indicated that they would accept the system's advice, indicating that ATIS would likely have an impact on commuters' perceptions and route choice.

Also, older age groups indicated willingness to accept advice more than younger groups. The fraction of individuals that are willing to accept advice increases from 77% among those with ages under 25 to 89.5% among those with ages over 55.

The majority of the respondents (40.6%) indicated that they would prefer to receive ATIS information "at home, before leaving for work" (pre-trip information), which supports a previous finding by the authors (Abdel-Aty et al., 1994) that commuters prefer pre-trip information to en route traffic information. About 39% indicated they would prefer to receive ATIS information "both at home and while driving, and only 7.2% prefer to receive it "while driving to work".

Table 4 shows association between gender and where to receive ATIS information, 48.6% of the females versus 32.3% of the males prefer pre-trip information, while 11.8% of the males versus 2.8% of the females prefer en route information (this result was found before by Abdel-Aty et al., 1994).

Table 4: Association between gender and preference for ATIS information

	Male	Female	Tot
At home, before leaving for work	22 (32.3%)	34 (48.6%)	56
While driving to work	8 (11.8%)	2 (2.8%)	10
Either at home or while driving	9 (13.2%)	9 (12.8%)	18
Both at home and while driving	29 (42.7%)	25 (35.8%)	54
Total	68 (100%)	70 (100%)	138

Minimum estimated expected value = 4.93
Pearson chi-square = 6.44
D.F. = 3
Probability = 0.0921

MODELING COMMUTERS' WILLINGNESS TO ACCEPT ATIS ADVICE

A binary logit model was used to estimate whether a respondent will choose to accept or reject the ATIS advice to follow the suggested optimal route. Estimation results for the model are given in Table 5.

Table 5: A binary logit model estimating the respondent's choice to accept or reject an ATIS advice.

	Coefficient	t-stat.
Accept advice constant	-0.398	-0.771
X_1 Income dummy variable (1 if income < $50,000, 0 otherwise)	0.925	1.825
X_2 Age dummy variable (1 if age > 45, 0 otherwise)	0.989	1.751
X_3 Male dummy variable	1.287	2.347
X_4 Rigidity of work starting time dummy (1 if starting time absolutely fixed, 0 otherwise)	1.189	2.088

<u>Summary Statistics</u>

Log Likelihood at zero = -83.178

Log Likelihood at market share = -60.048

Log Likelihood at convergence = -52.618

Likelihood ratio index = 0.37

Number of observations = 120

Note: Variables' coefficients are defined for accepting ATIS advice.

Examining specific coefficient estimates, we find that commuters with incomes less than $50,000 are more likely to accept advice from an ATIS system. Probably lower income individuals have fixed work schedules and need to arrive at work on time, and therefore are more willing to use information, while higher income people have more flexibility in arriving at work. Also, previous results (Abdel-Aty et al., 1994) showed that high income individuals use more than one route to work, so they think they are already familiar with alternative routes and they are choosing the best route.

Older respondents (age more than 45 years), males, and individuals with absolutely fixed work starting time are found to be more likely to accept ATIS advice.

8. ESTIMATING ROUTE CHOICE MODELS USING STATED PREFERENCE CUSTOMIZED RESPONSES

As mentioned above, each respondent was presented with three scenarios, in each he had to choose between two routes. The first route is customized to represent his actual primary route which in some cases has ATIS information available on it. The second route is a hypothetical route, but based on route 1, and also has ATIS information in some cases (information is available on either route 1 or 2 but not both). The objective of this SP choices is to investigate the effect of ATIS, travel time, road type, and respondents' familiarity with a particular route on route choice.

Table 6 depicts the three stated preference choice sets and the observed frequency of choices for each case. The table shows that greater number of people choose route 1 in the three cases, this is a result of customizing route 1 to be the respondents' actual primary routes, which indicates that commuters tend to choose a route which they are familiar with. Also, it was realized that respondents with ages more than 55, tend to choose route 1, which indicates that older drivers are usually not willing to take risk and choose a different route than their familiar one.

Table 6: Stated Preference Choices

Case	Route	Observed Choices
1	1	84
	2	57
2	1	73
	2	64
3	1	84
	2	55

Route Choice Model

A binary probit model is developed to estimate the commuters' choice between route 1 (customized according to the commuter's primary route) and route 2 (hypothetical). The overall observations are used to estimate the model, this gives a total of 429 observations (i.e., 143 respondents each making 3 choices). The estimation of a single overall model with repeated observations for each respondent gives rise to a correlation of disturbances because the unobserved influences affecting a specific individual's choice are likely to be correlated from one of his selections to the next. As a result, the t-statistics of the model coefficients might be overstated. However, this modeling effort is an initial attempt to investigate the significant factors that enter into the individual's route choice. More rigorous modeling effort is underway, and will account for the correlation of the unobserved influences in order to adjust the t-statistics.

The model is illustrated in Table 7. Route 2 specific constant is negative indicating that other things being equal, commuters are less likely to choose this route, and more likely to choose route 1 which they are familiar with. The model shows that older commuters (respondents with ages over 55 years old) are less likely to choose an unfamiliar route, so they prefer to use their primary route over the other route. An advanced information system that provides an estimate of travel time on an alternative route, are likely to be used by commuters. The model shows that as the travel time on route 2 estimated by the information system divided by the normal travel time on route 1 increases the less likely route 2 will be chosen. Also, if information is available on route 2, then college graduates (respondents with high level of education) are more likely to choose this route.

Table 7: Binary probit route choice model

	Coeff.	t-stat.
Constant	-0.604	-2.611
X_1 Age dummy variable (1 if age > 55 years, 0 otherwise)	-0.361	-1.872
X_2 Predicted travel time on route 2/normal travel time on route 1	-0.552	-3.994
X_3 Dummy variable representing travel time (1 if normal travel time on route 2 < normal travel time on route 1 and respondent perceive shorter travel time as very or extremely important, 0 otherwise)	0.671	3.362
X_4 Dummy variable of information availability and high level of education (1 if information is available on route 2 and respondent is a college graduate, 0 otherwise)	0.233	1.230
Summary Statistics		
Log Likelihood at zero = -297.36		
Log Likelihood at market share = -290.41		
Log Likelihood at convergence = -270.51		
Likelihood ratio index = 0.09		
Number of observations = 429		

Note: Variables' coefficients are defined for route 2.

Individuals who perceive shorter travel time to be very or extremely important are more likely to seek a faster route. These respondents are more likely to choose route 2 if the normal travel time on it is less than that on route 1. Roadway type and type of incident supplied by the information system did not appear to have a significant effect on the commuters' route choice decisions.

The model was repeated but by formulating the variables in different ways in order to illustrate the effect of some variables associated with information use. The model is illustrated in Table 8. The results show that males are more likely to choose an unfamiliar route, which conform with what was presented in Table 5, that males are likely to accept an information system advice to use an alternative route, also in a previous work (Abdel-Aty et al., 1994) males were found likely to use another route when faced with an incident.

Minimizing travel time was found again to be a significant factor in route choice. The likelihood of choosing route 2 decreases as the percent of "travel time on route 2 divided travel time on route 1" increases. Again, respondents were found to use information in their choices. Respondents were found more likely to choose route 2 if the information system predicted a travel time less than the normal travel time, while they were less likely to choose route 2 if the information system predicted a travel time more than the normal travel time.

Table 8: Binary probit route choice model

	Coeff.	t-stat.
Constant	-0.426	-3.887
X_1 Male dummy variable	0.152	1.219
X_2 Travel time on route 2/travel time on route 1	-1.101	-1.952
X_3 Dummy variable representing information availability (1 if predicted travel time on route 2 < normal travel time on route 2, 0 otherwise)	1.492	2.579
X_4 Dummy variable representing information availability (1 if predicted travel time on route 2 > normal travel time on route 2, 0 otherwise)	-0.388	-3.092
X_5 Age dummy variable (1 if age > 55 years, 0 otherwise)	-0.368	-1.932
Summary Statistics		
Log Likelihood at zero = -297.36		
Log Likelihood at market share = -290.41		
Log Likelihood at convergence = -279.79		
Likelihood ratio index = 0.06		
Number of observations = 429		

Note: Variables' coefficients are defined for route 2.

9. SUMMARY AND CONCLUSIONS

This report is based on a third wave of route choice surveys. The survey was undertaken in October 1993, targeting a sub-sample of the sample interviewed using CATI techniques in May 1992 and May 1993. The survey utilized innovative methods in studying route choice behavior by customizing mail-out/mail-back questionnaires. A geographic information system was used to generate optimal routes to understand drivers' familiarity with the highways/streets network, and to study commuters perceptions of this route in a way that help identify the factors that influence route choice behavior. The survey included also a customized stated preference section that enables the investigation of the possible impact of ATIS on route choice. The survey was conducted to gain in-depth understanding of the factors that play an important role in the decision to choose a particular route. The potential impact of ATIS on route choice and commuters' willingness to use this information are also investigated in the survey.

The analysis showed clearly that minimizing travel time is the most important reason for choosing a commute route. About 40% of the respondents indicated that shorter travel time is their principal reason for choosing their primary route, and 63% indicated that they choose their primary route over the suggested generated optimal route because their primary route is faster.

However, minimizing travel time is not the sole reason for route choice, a large number of the respondents indicated the significance of other factors such as travel time reliability, which illustrates the significance of the uncertainty measure in route choice (travel time variation and uncertainty is addressed thoroughly in a previous work by the authors, Abdel-Aty et al., 1994), and introduces the significance of an information system that reduces the level of uncertainty and helps commuters select routes adaptively. Other important factors that influence route choice are minimizing travel distance and traffic safety on the chosen route.

Also there exist other factors that appeared to enter in the route choice process, such as the number of traffic signals and stop signs, and the neighborhood security. These results suggests that route choice selection is a function of several factors, in which travel time would be assigned a heavy weight, and the other factors would contribute to the function according to the degree in which they influence the route choice.

A majority of the respondents (79.9%) indicated that they would accept an ATIS advice, and 40.6% indicated they would prefer to receive information before leaving for work (pre-trip). A binary logit model was developed to estimate respondents' choice to accept or reject an ATIS advice. The model showed that income, age, gender, and the flexibility of the work starting time affect the likelihood of accepting ATIS advice.

Modeling route choice using the stated preference observations, asserted the significance of travel time on route choice, and showed clearly that ATIS has a great potential in influencing commuters route choice even when advising a route different from the usual one. Also several socio-economic factors such as age and gender were found to affect route choice.

This report illustrated clearly several significant factors influencing route choice, including advanced traffic information that provides commuters with travel time estimates. However, more work should be done to study the effect of factors that were not included in this study, along with drivers' experiences, habits, cognitive limits and other behavioral considerations. An important factor which was raised in this report and needs more investigation is the effect of travel time variation and uncertainty on route choice, work on route choice over different degrees of travel-time reliability is underway by the project team.

Acknowledgement

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APPENDIX

PART I

In this part of the survey, we are presenting your primary commute route (as you gave us during the telephone interview), and also an alternative route generated by the computer. Each route is followed by questions about the route.

1. The following is your primary route to work as you indicated in the telephone survey. Please write in the usual travel time for each roadway segment. If the information is incorrect or incomplete, please make changes or add roadway names as needed.

YOUR PRIMARY ROUTE		
Seg. #	Road segment	Estimated Time (min.)
1	WESTGATE ST	
2	OHIO ST	
3	SANTA MONICA BLVD	
4	AVENUE OF THE STARS	

2. Would you say that traffic lights and stop signs on your primary route are:

☐ 1 Many ☐ 2 Some ☐ 3 Few ☐ 4 None

3. Would you say that traffic conditions on your primary route are:

☐ 1 About the same everyday.

☐ 2 There are moderate differences in traffic from day to day.

☐ 3 There are substantial differences in traffic from day to day.

Please rate the following factors for your route

	Excellent	Good	Reasonable	Bad	Very Bad
4. Traffic conditions	☐	☐	☐	☐	☐
5. Traffic Safety	☐	☐	☐	☐	☐
6. Neighborhood Security	☐	☐	☐	☐	☐
7. Scenery	☐	☐	☐	☐	☐
8. Travel time reliability	☐	☐	☐	☐	☐

9. Please indicate up to five most important reasons that made you choose your primary route. Write "1" in the box for the most important reason, "2" in the second most important reason, and so on.

I choose my primary route over other alternatives because:

☐ 1 Shorter distance
☐ 2 Shorter travel time
☐ 3 Travel time is reliable
☐ 4 Fewer traffic signals
☐ 5 Greater traffic safety
☐ 6 No unsafe neighborhoods
☐ 7 I drive more on carpool lanes
☐ 8 Other; Please describe ______________________________

The following route was generated by the computer as an alternative route from your home to work. The questions below are about this alternate route.

POSSIBLE ALTERNATE ROUTE		
Seg #	Road Segment	Distance (miles)
1	S WESTGATE AVE	0.1
2	WILSHIRE BLVD	0.8
3	I-405 SAN DIEGO FWY S	0.7
4	SANTA MONICA BLVD/CA-2 HWY	2.0
5	AVENUE OF THE STARS	0.4

10. Assuming that you use this route from your home to your work in typical traffic conditions, what would be your estimation of the travel time? _______ (minutes)

11. To what extent do you consider yourself familiar with this route?

- ☐ 1 Extremely familiar
- ☐ 2 Very familiar
- ☐ 3 Somewhat familiar
- ☐ 4 Not very familiar
- ☐ 5 Not at all familiar

12. Have you ever used this alternate route shown on page 3?

- ☐ 1 Yes
- ☐ 3 No
- ☐ 2 Used a part (or parts) of the route

13. Why don't you use the alternate route as your primary route to commute? (check all that apply)

- ☐ 1 Not completely familiar with this route.
- ☐ 2 My primary route is shorter.
- ☐ 3 My primary route is faster.
- ☐ 4 My primary route is safer.
- ☐ 5 Have to make a stop on the way along my primary route.
- ☐ 6 Had a bad experience in the past on this route.
- ☐ 7 The travel time is unpredictable on this route.
- ☐ 8 Many short roadway segments that inconvenience me on this route.
- ☐ 9 My primary route involves more freeway segments.
- ☐ 10 My primary route doesn't include unsecure neighborhoods.
- ☐ 11 Other; please describe ______________________________

14. If you used the alternate route, what time would you leave home to go to work? _______ AM/PM

15. Would you say that traffic lights and stop signs on this route are:

☐ 1 Many ☐ 2 Some ☐ 3 Few ☐ 4 None

16. Would you say that traffic conditions on the alternate route are:

- ☐ 1 About the same everyday.
- ☐ 2 There are moderate differences in traffic from day to day.
- ☐ 3 There are substantial differences in traffic from day to day.

Please rate the following factors for the alternate route shown on page 3, as best as you can

	Excellent	Good	Reasonable	Bad	Very Bad
17. Traffic conditions	☐	☐	☐	☐	☐
18. Traffic Safety	☐	☐	☐	☐	☐
19. Neighborhood Security	☐	☐	☐	☐	☐
20. Scenery	☐	☐	☐	☐	☐
21. Travel time reliability	☐	☐	☐	☐	☐

22. Suppose you were advised to use the alternate route by an advanced traffic information system. Would you be willing to accept the advice and follow the route? You can think of the advanced traffic information system as one that can offer you personalized information about your trip, and advise you with other routes to take while considering current traffic conditions.

☐ 1 No
☐ 2 Yes

23. Where would you prefer to receive information from an advanced traffic information system?

☐ 1 At home, before leaving for work
☐ 2 While driving to work
☐ 3 Either at home or while driving
☐ 4 Both at home and while driving

PART II

On the following 2 pages, we are asking you to choose from among two routes, the first is similar to your primary route, while the second is a hypothetical route.

Suppose one day you are choosing between
the following two routes from your home to work

	Route 1 Your primary route using OHIO ST	**Route 2**
1. Road type	Surface streets	Mainly Freeway
2. Normal Travel Time	15 minutes	13 minutes
3. Traffic Information		
• Estimated travel time on this day	Not available	13 minutes
• Information on the cause of the delay	-----	-----

24. Given these choices, which route would you choose on this particular day?

☐ 1 Route 1 ☐ 2 Route 2

25. When would you leave home on that day? __________ AM

Suppose one day you are choosing between
the following two routes from your home to work

	Route 1 Your primary route using OHIO ST	Route 2
1. Road type	Surface streets	FWY/Surface st.
2. Normal Travel Time	15 minutes	17 minutes
3. Traffic Information		
• Estimated travel time on this day	17 minutes	Not available
• Information on the cause of the delay	Accident	----

26. Given these choices, which route would you choose on this particular day?

☐ 1 Route 1 ☐ 2 Route 2

27. When would you leave home on that day? __________ AM

	Route 1 Your primary route using OHIO ST.	Route 2
1. Road type	Surface streets	Mainly Freeway
2. Normal Travel Time	15 minutes	15 minutes
3. Traffic Information		
• Estimated travel time on this day	Not available	18 minutes
• Information on the cause of the delay	----	Lane closed for maintenance

28. Given these choices, which route would you choose on this particular day?

☐ 1 Route 1 ☐ 2 Route 2

29. When would you leave home on that day? __________ AM

Thank You