5. Conclusions: How Capacity Affects Demand

5.1 Introduction

The literature search, the additional case studies, and the home interview survey all point to the following effects of increased highway capacity on travel behavior:

- Increased trip frequency
- Increases in trip length (in terms of distance, not time)
- Changes in trip scheduling to avoid peak periods
- Increases in auto driving mode split
- Changes in route choice to less congested routes
- Changes in residential location to locations farther from work

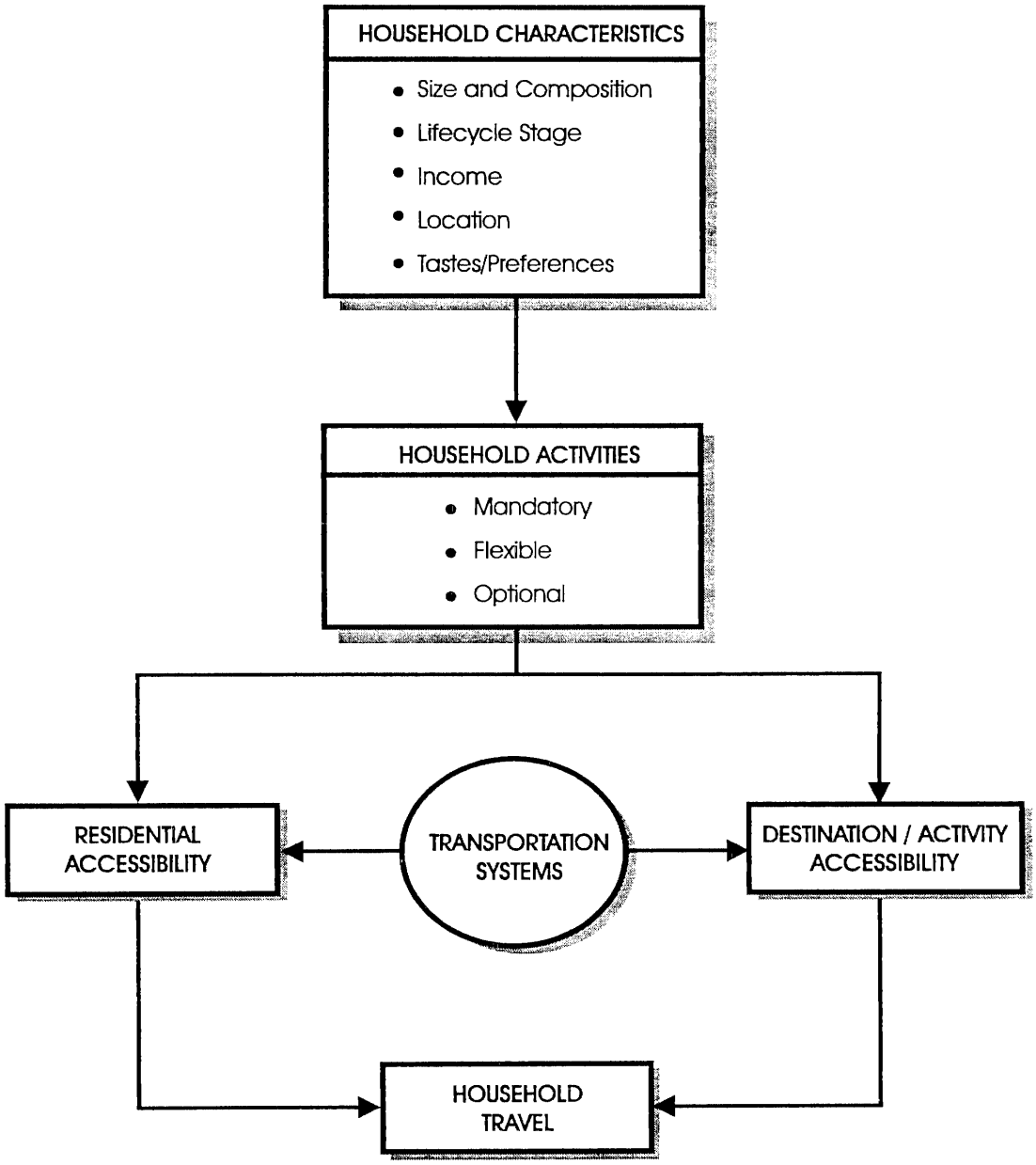
Highway capacity increases can also indirectly affect travel behavior by affecting land development patterns. The remainder of this chapter explains these effects in more detail.

5.2 Why People Travel

Travel is a "derived demand". Travel is just one of many daily activities engaged in by a rational individual. This individual must allocate his or her limited time and monetary resources among these activities. Travel is just one of the many activities a person may (or may not) undertake **[20]**. Figure 5-1 shows a simple diagram of the interplay of various factors that determine travel **[21]**. The types and amounts of each kind of activity will vary according to travel needs (which are affected by household size and composition), the stage of life (old, young, parent, single), income (the ability to purchase travel services and activities), location, and individual tastes.

Each person has a fixed daily time budget of 24 hours and a more flexible daily dollar budget to spend on daily activities (see Figure 5-2). While there are always 24 hours in a day, a person can elect to spend more money on one day than on another.

Figure 5-1
A Generalized Framework for Consideration of Household Travel



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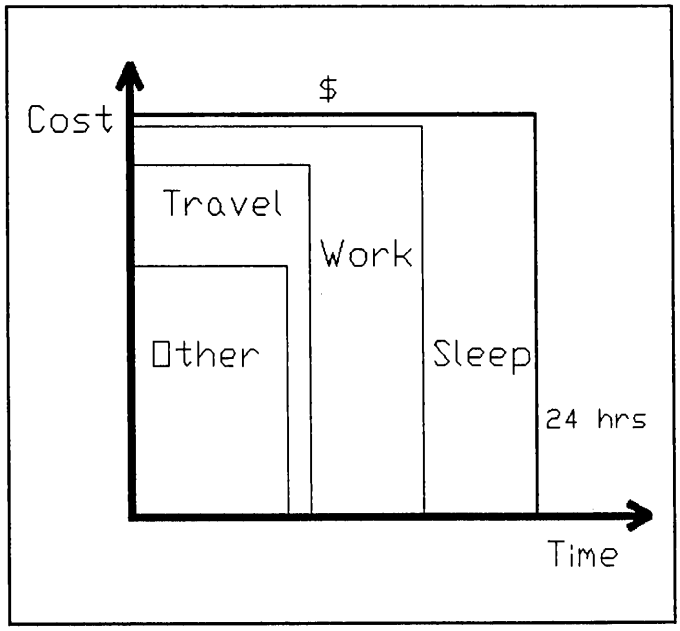
Each 24 hours is allocated among competing activities, such as sleeping, working, eating, and travel. A recent survey performed for the California Air Resources Board of 1,762 Californians over 12 years old by Wiley **[22]** found that individuals on the average spend the following time on these activities:

Sleeping	8.4 hours
Working	3.2 hours
Watching TV/Radio	2.4 hours
Travelling	1.8 hours
Eating	1.5 hours
Other	6.7 hours
Total:	24.0 hours

Figure 5-2
Allocation of Daily Time and Cost Budget Among Activities



While the total 24 hours available each day is fixed, the allocation of time to each activity is. The time and money allocated to travel is further subdivided among mandatory activities like going to work, school, etc., and discretionary activities such as going to a movie. These various daily activities can be thought of as "goods" in the economic sense which people "purchase" by spending "time" and money on the activity.

5.3 The Cost of Travel

The cost of travel determines how much travel a person will consume. It includes both monetary costs to the user and travel time costs. Monetary costs include fixed and variable vehicle operating costs that vary by road condition, speed, and vehicle type. Time costs include the time spent in the vehicle as well as the time spent "accessing" or getting to and from the vehicle.

The monetary and temporal costs of travel can be combined into a single "generalized" cost for travel if we have a "value of time" ($/hour) estimate for each traveller. The value of time will vary by the amount of time saved, the individual income level, and the trip purpose. AASHTO estimates that the value of time can range from zero up to $6.00 per hour per person (1975 dollars) depending on the purpose of the trip and the amount of time involved in the trip **[23]**.

The generalized cost of travel can then be expressed as follows:

$$\textit{Generalized Cost} = (\textit{Monetary Cost}) + (\textit{Value of Time}) * (\textit{Travel Time}) \quad (1)$$

The generalized cost of travel defined above is converted into a unit cost or price by dividing by distance and noting that distance divided by time is speed. The generalized unit cost or price of travel is then:

$$\textit{Price} = \frac{\textit{Monetary Cost}}{\textit{Distance}} + \frac{\textit{Value of Time}}{\textit{Speed}} \quad (2)$$

5.4 The Impacts of Travel Cost on Trip Making

Micro-economic theory provides several useful principles for understanding how and under what conditions people choose among various "goods".

The first principle we can apply is the "Principle of Diminishing Marginal Utility" **[24]** which simply stated means that "the more you have of something, the less you are willing to pay for one more unit of that item". Figure 5-3 illustrates a typical travel demand schedule for an individual based upon this principle (the axes have been rotated from their traditional economic orientation to show the product on the vertical scale and the price on the horizontal scale).

The rectangular area defined by a point on the demand curve defines the total person-hours of travel that will be made at that price of travel. The maximum person-hours of travel (PHT) will occur where the elasticity is equal to 1.00. Elasticity is defined as the percentage change in quantity purchased divided by the percentage change in price at a given point on the demand schedule.

Figure 5-3 An Individual's Travel Demand Schedule

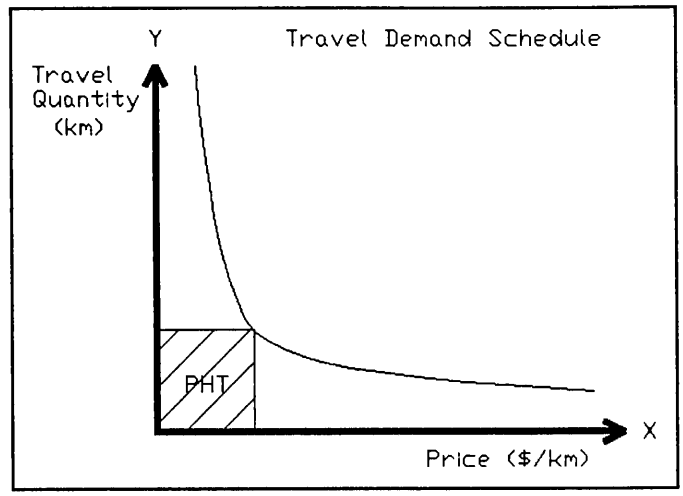
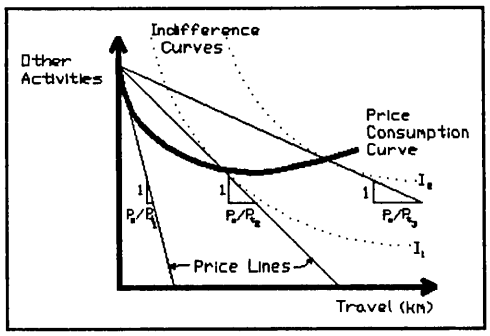


Figure 5-4 The Price Consumption Curve for Travel



One author (Zahavi **[25]**) has noted that regional travel time expenditures per person (PHT/person) are relatively constant over time and over different communities. Golob **[26]** however, investigating the travel behavior of individuals, noted that an individual's travel budget is not fixed.

Micro-economic theory of demand suggests that while people's daily time budgets may be fixed at 24 hours a day, their travel expenditures will vary according to the price of travel relative to the price of other available activities.

Figure 5-4 shows the construction of a "price consumption curve" for travel assuming that the price of all other activities (P_0) remains fixed. The price consumption curve is the locus of points defined by the intersection of price lines[14] with an individual's "indifference curves"[15].

Note that when the price of travel (P_t) is infinite (for example when one is snowed in and cannot travel) then all of the individual's time is spent on non-travel activities. As P_t decreases a person will actually allocate more time to travel until travel is no longer a "scarce" good. This is the point where the price elasticity (e_p) of travel

[14] A "Price Line" shows the different quantities of goods "A" and "B" that can be bought for a given budget. As the price of good "A" (travel) decreases, the slope of the price line flattens.

[15] The "Indifference Curve" shows the combinations of goods "A" and "B" that yield the same utility or value to the individual.

demand equals 1.00 and the individual's expenditures for travel (PHT and dollars expended) are at their maximum.

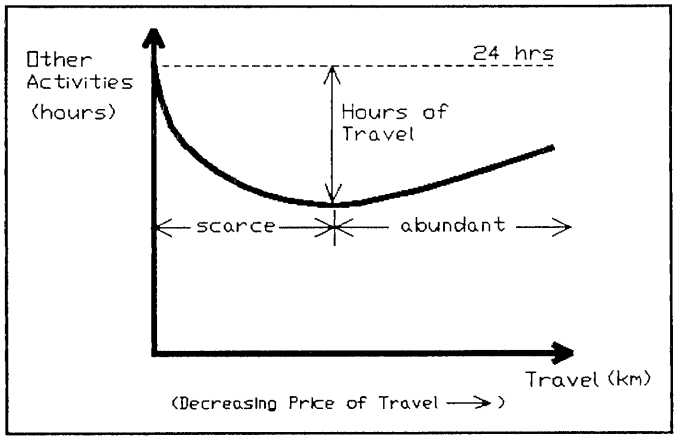
Figure 5-5 shows the same "price consumption curve" for travel with the vertical axis re-labeled in terms of hours devoted to non-travel activities. One can see that travel price reductions due to capacity improvements will initially cause people to invest more time (PHT) in travelling but then a point of "satiation" is reached where people will start diverting some of the time savings to non-travel activities.

Note that in all cases lower travel prices always result in more kilometers (or miles) travelled (PKT), since each reduction in travel price pushes us farther to the right on the price consumption curve.

5.5 The Impacts of Increased Highway Capacity on Travel Time and Cost

Traffic congestion occurs when traffic volumes approach the capacity of a highway. Increased highway capacity reduces this congestion which reduces travel time and travel cost for users of the highway facility. Travel time and cost can also be reduced when an entirely new facility, such as a freeway, is constructed.

Figure 5-5 The Effect of Price on Person-Hours Traveled and Person-Kilometers (miles) Traveled



Travel Time Effects: The BPR (Bureau of Public Roads[16]) curve **[27]** is used in most regional transportation planning models to predict the impacts of congestion on travel speeds, given the initial free flow speed and the volume/capacity ratio.

[16] This is an old (1950's) but still frequently used formula for relating the speed on a highway to the volume-to-capacity ratio on the roadway.

$$S_2 = \frac{S_1}{1+0.15*(V/C)^4}$$

where:

s_1 = Free flow speed
s_2 = Congested speed
v/c = Volume/capacity ratio

This curve is reasonably accurate for freeways at v/c ratios under 1.00. Its accuracy can be improved greatly by using an exponent for "v/c" of 8 or 10 in lieu of 4, which more accurately represents the speed degradation due to traffic congestion.

This same curve is often used for signalized arterials; however, recent speed flow research for the update of the motor vehicle pollutant model, DTIM2 **[28]**, has shown that the BPR curve uniformly over-estimates vehicle speeds and is not sufficiently sensitive to increases in traffic congestion. The 1985 *Highway Capacity Manual* **[29]** provides a more elaborate procedure that better estimates congested speeds on signalized arterials.

Cost Effects: Increased highway capacity, if it results in higher average operating speeds, reduces vehicle operating costs. The cost of fuel consumption increases with speeds above 25 mph, however; this is counteracted by the reduced need to change speeds at low volume/capacity (v/c) ratios. The American Association of State Highway and Transportation Officials (AASHTO) estimates that passenger car operating costs vary from $70.00 per 1,000 vehicle-miles at 25 mph to $78.49 per 1000 vehicle-miles at 60 mph **[30]** when the vehicles are operating at these constant uniform speeds.

The v/c ratio affects the number of speed changes per mile which adds to the above average operating costs. The added costs of speed changes ranges from zero dollars per 1000 vehicle-miles at v/c equal to zero, up to $6.00 per 1000 vehicle-miles at v/c ratios approaching 1.00. The speed change costs can increase to $16.00 per 1000 vehicle-miles if the facility is operating at level of service "F" (a queuing condition where the demand exceeds capacity) **[31]**.

Highway capacity increases for an existing facility therefore affect travel behavior only when they reduce the total generalized cost of travel. Capacity increases to an existing facility will not affect travel behavior if there is no congestion.

5.6 Traveler Responses to Increased Highway Capacity

Increased highway capacity affects travel behavior when it reduces traffic congestion which in turn reduces travel time and cost. The British Rochester Way Study (Pell), the Dutch M10 Motorway study (Loos), and the Stated Preference Home Interview Survey conducted for the current study indicate that individuals have definite

preferences regarding how they react to changes in travel time.

The Dutch study found that 25% of its survey group switched routes, and 30% changed departure times in response to the new motorway. The British study found that 80% of the drivers using the new road had switched routes. Five percent had switched modes, five percent were diverted from other destinations and 10% made more frequent trips.

The stated preference survey did not ask about changes in routes but did find that a five minute time savings on an individual trip would make no difference to 47% of the respondents. About 47% would reschedule their trip times. One half of one percent would change modes, one percent would change their trip destination, and three percent would make an extra stop (see Table 4).

Changes in route and trip schedule are the first choice of the vast majority of individuals, followed by changes in trip destination, mode choice and trip frequency. The behavioral effects of increased highway capacity consequently can be ranked as follows:

1. Route choice
2. Trip scheduling
3. Trip destination
4. Mode of travel
5. Trip frequency

Residential location is a long term indirect effect not directly comparable to the other behavior effects described here. The evidence of long term impacts is conflicting. If people have travel time budgets that are relatively fixed, then higher travel speeds (say, due to capacity increases or new freeways) should cause people to move further away from work and other activities. Conversely, increasing congestion in urban areas should cause people to move *closer* to work and other activities. Actual

California experience has not demonstrated the latter effect, although clearly work and shopping opportunities *have* been move closer to residences in the suburbs. Furthermore, other available evidence suggests that personal income may place a much stronger role in residential location than does accessibility **[32]**, with increasing incomes encouraging more decentralization. This is an area that will deserve continuing study.

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6. Assessment of Current Travel Modeling Approaches

This chapter reviews current transportation demand modeling and land use forecasting practices in California and evaluates the ability of these procedures to forecast the effects of increased highway capacity on travel behavior. The current demand modeling practices are summarized for the four major metropolitan areas in California, San Francisco, Los Angeles, Sacramento, and San Diego. These modeling practices are assessed for their ability to model the effects of new highway capacity on travel demand behavior. The following discussion is divided between travel demand models and land use models.

6.1 Existing Travel Behavior Models Used in California

Virtually all of the travel demand models used by metropolitan planning organizations (MPO's) in California estimate travel demand using a four step process. First, trip generation is estimated based upon socio-economic information (population, employed residents, income, employment, etc.). Second, trip distribution is estimated based upon assumed average travel speeds for the highway facilities in the region. Third, the trips are split by mode of travel again based upon assumed average travel times. Finally the trips are assigned by mode to their respective facilities based upon speed/flow relationships (see Figure 5-5). Commercial trips (by trucks, taxis, etc.) are typically included as in the non-home based purpose and are typically based on employment or other measures of activity present at a land use. A few

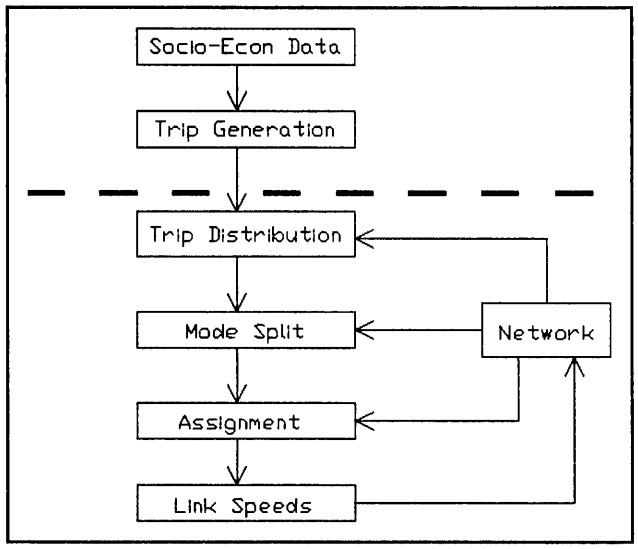

Figure 6-1 Traditional 4-Step Model With Feedback Loops

areas may estimate commercial trips as a separate purpose, but this tends to be the exception.

A single pass four-step model may produce inaccurate volume and speed forecasts, since the assumed speeds used in trip distribution and mode split may not reflect actual demand levels if there is significant congestion. The degree of inaccuracy will depend on the quality of the initial guesses of speed used in trip distribution and mode split.

Consequently some researchers (Levinson **[33]** for example) have proposed that feedback loops be included in models to better reconcile the speeds used to determine trip distribution and mode split, and the speeds estimated in the assignment (route choice) step. These feedback loops have generally stopped short at trip distribution (the dashed line barrier in Figure 5-6). Boyce **[34]** has demonstrated and tested various techniques for achieving equilibrium with feedback loops.

Most major MPO's in California now include in their models either a manual or semi-automated feedback procedure for reconciling the speeds input at the trip distribution and mode split stage with those speeds output at the traffic assignment stage. No models incorporate auto accessibility measures (travel time) in the estimation of trip generation. The following subsections describe each MPO model in more detail.

6.1.1 San Francisco Metropolitan Transportation Commission Model **[35]**

The San Francisco Metropolitan Transportation Commission (MTC) maintains the most technically sophisticated transportation demand modelling procedures in the State of California.

Basic Model Structure: The MTC model first stratifies households into worker and non-worker households. The workers in the worker households are then further stratified in primary and secondary workers. There is one primary worker per working household. All other workers are considered secondary. The MTC model then follows separate procedures for work trips and for non-work trips.

Non-work trips are forecasted using the traditional four-step process of trip generation, trip distribution, mode choice, and trip assignment. Work trips are

forecasted using a procedure unique to the MTC model. The model starts at trip generation, estimating the number of work trips generated by each zone. The model then switches from the traditional "top-down" approach (generation, distribution, mode split) to a "bottom-up" process (mode split, distribution). The accessibility of each origin zone by mode is computed in the mode split module. This accessibility is used to estimate worker household auto ownership which is then used to estimate work trip distribution. Once this "bottom-up" process is completed, the model then returns to the traditional "top-down" process of trip distribution, mode split, and assignment. The structures and linkages in the auto ownership, distribution, and mode choice models are early examples of "nested choice" models.

Feedback Loops: Travel times and costs for all modes of travel are fed back from assignment to trip distribution and mode split. As stated in MTC's model documentation: "A major component of MTC's travel forecasting system is an "equilibration" process where congested highway times (from the highway assignment) and transit times (made consistent with highway times) are "recycled" back into the work mode choice process. In other words, initial attempts are made at estimating future congested levels-of-service (times and costs). Network level-of-service information is input into the mode choice process; trip tables by mode are converted into daily and peak vehicle trips; vehicle trips are assigned or "loaded" using standard capacity restraint highway assignment techniques; the cycle begins anew as new levels-of-service files are prepared based on the loaded network; these new levels-of-service files are used as input into the mode choice process; and new assignments are prepared. This process is reiterated until an equilibrium is reached and the input speeds and times for highway and transit networks are reasonably consistent with the output speeds and times."

Trip Generation: The MTC model forecasts four trip purposes: 1) home-work; 2)home-shop; 3) home-other; 4) non-home based. The home-work purpose is further disaggregated from the trip generation through the mode-choice step into primary worker and secondary worker trips to work.

Home-work (HBW) trip generation is estimated based upon household size, income, and the employment density of the zone. Non-work trips are estimated based on auto ownership, income, household size, and employment. Travel time (i.e., accessibility) is used indirectly in the trip generation modules: auto ownership is in turn partly a function of accessibility. Therefore, the MTC modeling process indirectly accounts

for new highway capacity; capacity increases auto ownership, which in turn increases trip generation.

Trip Distribution: The distribution process for home-work (HBW) trips is based on a logit distribution model that takes into account the relative accessibility of destination zones via all modes of travel. Auto ownership affects the relative auto accessibility of each zone which affects the trip distribution. Non-work trips are distributed on the basis of a traditional gravity model using user specified friction factors. MTC models feedback the congested travel times from traffic assignment back into the work-trip distribution step.

Mode Choice: The mode choice model treats the four purposes differently. Home-Work modal share is projected from a multinomial logit model based on AM peak hour travel impedances and produces direct estimates of Drive Alone, Shared Ride 2, Shared Ride 3+ and Transit Person Trips. For the three non-work purposes, the formulation is a binary logit model with the impedance based on off-peak travel impedance; the model projects only auto and transit person trips. Auto person trips for the non-work purposes are converted to vehicle trips on the basis of average occupancies from the 1981 MTC Travel Survey, but specific HOV shares are not predicted for the non-work purposes. The result is a systematic under-estimation of HOV vehicle trips for the non-work purposes, at least as reflected in HOV lane assignment.

Variables in the multinomial modal choice logit model include: employment density at end zone, autos/workers, persons per household, household income and in- and out-of-vehicle travel time/travel cost by mode. For the auto modes, in-vehicle travel time includes network travel time, centroid-to-network access terminal times and time to find parking. For shared-ride two and three-plus occupancy auto modes, fixed pickup penalties of five and seven minutes are used. Shared-ride three-plus trips across the Bay Bridge get a 10-minute time savings. Out-of-vehicle travel times include walk to and from auto at the production and attraction end. Travel cost includes toll, parking fee, and auto-operating cost.

Traffic Assignment Process: MTC uses a three-stage capacity restrained equilibrium assignment algorithm for the assignment of vehicles to the highway network. Single occupant vehicles are loaded first, followed by 2-person carpools and then 3+ person carpools. MTC is experimenting with a simultaneous assignment of all three modes to the highway network.

6.1.2 The Southern California Association of Governments Model [36]

The Southern California Association of Governments (SCAG) Model covers all of Los Angeles, Orange, and Ventura counties, and the urbanized portions of western Riverside and San Bernardino counties. The area is divided into 1,527 transportation analysis zones and has 28 external cordon stations. The SCAG model uses the TRANPLAN software to model the following three analysis years: 1990, 2000, and 2010. Supplemental information on the SCAG model has been provided by SCAG and LARTS/Caltrans District 7 personnel.

Basic Model Structure: The inputs to the model include socioeconomic data and the highway and transit network data. The model follows the traditional four-step process of trip generation, trip distribution, mode choice, and trip assignment to arrive at the travel demand.

Feedback Loops: The SCAG model uses congested travel times from the initial peak period highway assignment for trip distribution and mode choice.

Trip Generation: The trip generation module uses the following socio-economic data: occupied single family dwelling units (OSDU); occupied multiple family dwelling units (OMDU); total dwelling units; total population; retail employment; non-retail employment; total employment; median household income.

Households are cross-classified into six categories based upon dwelling unit type (single family dwelling unit or multiple family dwelling unit) and number of vehicles (0, 1, or 2+). Using household survey data and a regression analysis, each of the six categories were estimated for each zone. The number of vehicles per housing unit is determined as a function of the single housing units, the total housing units, the population, and the average income. These functions vary by county based on the household survey data. Person trips rates for five trip types - home-to-work, home-to-shop, home-to-other, other-to-work, and other-to-other - are applied to each

category to calculate the productions. Attractions are a function of the population of the zone and the retail and total employment of the zone.

Trip Distribution: Trip distribution estimates the number of trips that travel from one zone to any other zone. Trips are distributed between the zones using the gravity model. The modellers include the effects of traffic congestion by feeding back the congested speeds and times to trip distribution.
Mode Choice Model: Trip tables for the five trip purposes are aggregated to three purposes (home-to-work, other-to-work, and non-work) for mode choice purposes. The mode choice model determines which of four options the commuter will choose for the home-to-work trip only. The model allocates person trips of the various modes using a three step process that combines three sub-models. The first step is the allocation of person trips to auto or transit using a binary choice model. The second step is to allocate auto trips to drive alone and shared ride vehicle modes. The third step further allocates the shared ride vehicle trips by auto occupancy.

The mode choice is a function of travel costs, time by each mode, and zonal characteristics. Costs are included in the mode choice model through the use of auto operating costs and transit fares.

For the other trip types, the transit trips are a factor of the home-to-work transit trips. Other-to-work transit trips are estimated to be nine percent of the home-to-work transit trips; Non-work transit trips are estimated to be 110% of the home-to-work transit trips. These are based on percentages from the 1967 home interview survey.

HOV Trip Estimation: The SCAG model uses a binary logit model to estimate auto and transit trips; a coupled multinomial logit model is used to divide auto trips for Home-work trips into drive-alone, 2 person carpool and 3+ person carpools. Other-work trip HOV usage is factored from the production/attraction person trip table. Other-work and non-work purposes are stratified into drive alone and 2+ carpools. The estimates are made for the AM, PM and mid-day periods.

Variables included in the estimation model include cost, income, in-vehicle travel time, out-of-vehicle travel time, transit fare, parking cost, distance, auto availability, disposable income, drivers per household, carpool pickup time, carpool cost-sharing factor, number of workers and employment density.

Trip Assignment: The SCAG model uses an iterative equilibrium method and a stochastic method for its assignment process. The process is repeated until equilibrium is achieved. The process uses Bureau of Public Road (BPR) speed-flow curves as the basis of the speed/flow adjustment. Trips are assigned for the morning and evening peak periods and midday and night off-peak periods.

The process involves assignment of drive-alone trip tables to the drive-alone network; HOV trips are then assigned to the congested network. The process allows congested times and/or speeds to be recycled into the mode split process.

Land Use Model: SCAG feeds back congested travel times to DRAM/EMPAL to obtain revised socio-economic data for forecasts

6.1.3 The Sacramento Council of Governments (SACOG) Model

The SACOG model was originally developed for the Sacramento Regional Transit District. This model is in the process of being upgraded, enhanced, and re-validated. The discussion below focuses on the existing model with a description of planned improvements as described in various working papers for the current model upgrade project.

Basic Model Structure: The existing model follows the standard four-step modeling process. The basic structure for the updated model supplements this process with an initial auto ownership submodel. The auto ownership submodel feeds into the trip generation submodel to estimate the number of trips end by zone. The trip distribution submodel utilizes zone-to-zone impedances for the AM, PM, and off-peak periods to distribute trips. The mode choice submodel estimates the proportions of total person trips using transit, rideshare, and drive-alone modes between each pair of zones and produces a transit trip table and a vehicle trip table. These trips are assigned to the appropriate networks for each of the time periods modeled.

*Feedback Loop*s: The existing model uses a two-pass process to include congestion as a factor in modal share estimation. An initial pass is made using pre-set modal share estimates at a regional level. These estimates are used to derive an initial assignment and an initial set of congested speeds. These congested speeds are then used for the modal share process. In the updated model, an additional feedback loop to trip distribution is included.

Auto Ownership Submodel: The SACOG model update includes the addition of an auto ownership submodel that estimates the number of automobiles owned by a household using a multinomial logit model. The auto ownership submodel has been adapted from Portland, Oregon's travel model using the data from the region-wide travel survey conducted by SACOG.

The submodel requires that households be stratified by household size, workers in household, and household income. Then auto ownership is predicted based on retail employment within one mile of the zone, the total employment within 30 minutes by transit from the zone, and an index of the pedestrian environment of the zone **[37]**.

Trip Generation Submodel: The trip generation submodel generates person trip ends by purpose for each zone based on the socio-economic and land use data. Travel time does not directly enter into this stage of the trip generation calculation although transit travel time does influence the estimate of auto ownership which influences trip generation. The SACOG model estimates trips for the following six purposes: 1) Home-based-work, 2) Home-based-shop, 3) Home-based-other, 4) Home-based-school, 5) Work-other and 6) Other-other. The input variables for estimating trip generation include workers per household, persons per household, auto ownership, and (for certain trip purposes) employment.

Trip Distribution Submodel: The trip distribution submodel estimates the number of trips that travel from one zone to any other zone. Trips are distributed from impedances for each time period. The current friction factors are adapted from those used in Seattle; the update provides the opportunity to develop a trip distribution based on local data. The updated model includes the effects of traffic congestion by feeding back the congested speeds and times to the trip distribution submodel.

Mode Choice Submodel: The mode choice submodel estimates the proportion of person trips by travel mode, including drive-alone, rideshare, transit, bicycle, and pedestrian travel modes. Mode choice is based on household characteristics, land use characteristics as well as measures of travel time and cost of all available models of travel **[38]**. The mode choice model collapses these purposes into two: home-based-work and non-work.

The home-based-work mode choice module includes a logit model that computes modal share for three classes of user: 0 car households, 1 car households and 2+ car

households. The land use data file further desegregates the three categories into single and multiple family residences, meaning that six economic groups are considered in the process. Home-work trips from the trip distribution process, which had been aggregated from the six household types in the trip generation process, are divided in proportion to the number of households in each category. The module computes modal attractiveness measures for each of the items included in the list of variables below and includes them in the n-logit formulation. The non-work purposes use some of the same variables, but the non-work modal share is based on a look-up table and subsequent factoring of the home-work modal share.

Traffic Assignment Process: The SACOG model contains two daily and one AM peak hour assignment modules. One of the daily modules uses a pre-set modal share estimate, while the second uses the modal share computed by the mode choice module. The AM Peak hour assignment is based on the pre-set modal share estimate.

All three modules follow a similar format. A five-iteration equilibrium process is used with capacity-per-lane values included in the module for each facility type. The model uses user-specified speed flow curves based on the 1985 *Highway Capacity Manual* for each of 47 capacity classifications; however, a total of only three actual curves are used.

6.1.4 The San Diego Association of Governments (SANDAG) Model

The San Diego Association of Governments (SANDAG) has recently completed a process to merge the SANDAG regional model with the numerous sub-area models in the county. The model is run using TRANPLAN forecasting software on two SUN workstations. ARC/INFO is used to maintain, manipulate, and display the data. Information on the SANDAG model has been provided by SANDAG personnel in response to our MPO survey and from SANDAG's Draft Transportation Model Documentation (May 1994) which describes the revised SANDAG model.

Basic Model Structure: The model follows the standard four-step modeling process. The trip generation step estimates the number of trip ends by zone. The trip distribution step utilizes zone-to-zone impedances for the AM, PM, and off-peak periods to distribute trips. The mode choice step estimates the proportions of total person trips using transit, rideshare, and drive-alone modes between each pair of

zones and produces a transit trip table and a vehicle trip table. These trips are assigned to the appropriate networks for each of the time periods modeled. These steps are described in more detail below.

Feedback Loops: The model allows for a two-pass process to include congestion as a factor in modal share estimation. For most applications, the model stops processing after the first pass. To meet the federal air quality requirements, the model allows for a second pass.

Trip Generation: Trip generation estimates person trip ends by trip type by zone for daily, peak, and off-peak periods. The SANDAG model estimates trip ends for the following 10 trip types: 1) home-work, 2) home-college, 3) home-school, 4) home-shop, 5) home-other, 6) work-other, 7) other-other, 8) serve passenger, 9) visitor, and 10) regional airport.

For residential trips, the trip rates are expressed as trips per occupied dwelling units and differ depending upon the type of structure, i.e. single family, multiple family, or mobile home. For non-residential land uses, the trip rates are expressed as both trips per acre and trips per employee for the 80 land use categories.

Time-of-day factors are applied to obtain separate peak and off-peak productions and attractions tables. These factors vary by trip type and land use. The daily productions and attractions table is the sum of the peak and off-peak tables.

Trip Distribution: Trip distribution estimates the number of trips that travel from one zone to any other zone. Trip distribution differs between the two iterations. The first iteration distributes person trips using off-peak highway travel times, daily trip ends, and daily friction factors.

The second iteration is a more refined approach. It distinguishes between peak and off-peak travel. The trips are distributed using peak and off-peak trip ends, peak and off-peak highway travel times, and peak and off--peak friction factors.

Vehicle Factoring Process: For the initial model run, the SANDAG model does not incorporate a formal mode choice model but elects to use a factoring process to estimate the proportion of person trips choosing auto and transit travel modes. Person trip tables are factored to vehicle trip tables for the highway assignment. These factors vary depending upon time period, location, distance, and trip type.

The factors are not based on transit network times. Peak and off-peak vehicle trip tables are obtained from applying time of day and directional factors.

Mode Choice: For the second iteration, a mode choice model is used to estimate the proportion of person trips by travel mode, including drive-alone, two-person auto, three-plus-person auto, transit-walk, transit-auto, and other which covers bicycle and pedestrian modes. The mode splits are determined for two time periods, three income levels, and eight trip types (visitor and airport trips are combined with other-other trips) based on survey data. A multi-modal logit model is used to estimate the mode choice.

First, the model computes network-related transit impedances as a function of trip type, initial wait time, transfer walk time, transfer wait time, in-vehicle time, and transit fare. The auto impedances are computed as a function of trip type, travel time, distance, auto cost, parking cost, and walk time. The transit-auto and transit-walk impedances are calculated from auto access times and walk times. Trips from trip distribution are apportioned to income level and production-attraction transit access areas combinations. The trips are split into individual modes in direct proportion to the mode's impedance relative to the sum of impedances for all modes. The last step of mode choice is to convert person trips to vehicle trips based on the mode choice results. Directional factors are also applied for the peak and off-peak periods by trip type.

Traffic Assignment Process: Four iterations of equilibrium assignment procedures is used instead of a capacity restraint procedure that was previously used by the regional and sub-area models. The results of the peak and off-peak assignments are merged to obtain a daily assignment. Speed/flow curves are user-specified and based on the *Highway Capacity Manual*. Drive-alone and HOVs are assigned to the network simultaneously. Capacity restrained speeds are recycled into the trip distribution and mode split model in a feedback process.

6.1.5 Assessment of the Adequacy of Trip Distribution Feedback for Modelling the Demand Effects of New Highway Capacity

All of the major metropolitan planning organizations (MPO's) in California have some form of manual or semi-automated procedure for ensuring that trip distribution and mode split for some trip purposes are based on the congested travel speeds

coming out of the traffic assignment stage. These feedback procedures to trip distribution allow these MPO models to account for most but not all of the effects (route choice, mode choice, destination choice, etc.) of new highway capacity on travel demand that have been observed in the literature and in the household survey.

The following simple example illustrates this conclusion. The total person-hours of travel (PHT) spent in the region is the sum of the travel time between each pair of zones, multiplied by the number of trips between each pair of zones:

$$PHT = \sum_{ij} T_{ij} * h_{ij}$$

where:

PHT = daily person-hours travelled in region.
T_{ij} = daily trips between zones "i" and "j"
h_{ij} = travel time between "i" and "j", in hours

According to the traditional gravity model of trip distribution used by all major MPO's in California, the number of trips between "i" and "j" is a function of the total number of trips produced by "i" times the relative attractiveness of the destination zone "j". The relative attractiveness is determined according to the total number of trips attracted to zone "j" times a weight, F_{ij}, (or friction factor) based on the travel time from zone "i" to "j" as follows:

$$T_{ij} = \frac{T_j * F_{ij}}{\sum_k T_k * F_{ik}}$$

where:

T_j = Total trips attracted to "j".
F_{ij} = A weight (or friction factor) computed based on the travel time from "i" to "j" (or sometimes a computed "impedance")
k = All potential destination zones in the model

We now globally increase the speed on all highway links in the model region so that all friction factors (F_{ij}) are reduced by the same percent "P"[17]. Substituting "P*F_{ij}"

[17] For example, let F_{ij} be a negative exponential function of travel time "h_{ij}", that is:
F_{ij} = a * exp(-b*h_{ij})). Then a constant reduction in travel time "c" would result in:
F_{ij}' = a * exp[-b*(h_{ij}-c)] or F_{ij}' = F_{ij} * exp(b*c). The terms "b" and "c" are constant thus:
F_{ij}' = F_{ij} * Constant.

for "F_{ij}" in the trip distribution equation results in the "P's" canceling out. Thus the proportion of trips going to each destination is unchanged. If the distribution is unchanged then the total miles travelled (PMT) is also unchanged.

Thus the entire travel time savings is translated into less PHT. The gravity model assumes that all travel time savings are used by individuals for non-travel activities. The PMT remains constant because the trip distribution pattern (T_{ij}) remains unchanged. This is a weakness of current travel forecasting practice.

This conclusion can be extended to any set of "fixed" weights F_{ij}. The specifics of the example may need to be changed if a different form of F_{ij} is selected. However, any global reduction in travel time that results in a "uniform" global percentage reduction in F_{ij} will yield the same conclusion. Kilometers travelled is held constant by the gravity model while the hours travelled is reduced. One hundred percent of the travel time savings is assumed to be used for non-travel purposes.

Unfortunately, this conclusion cannot be so easily illustrated for non-uniform travel time savings or for the log-sum and auto ownership weights used in MTC's work trip distribution model. Further research may be able to extend this conclusion to these cases. At this time we cannot say whether or not the work trip distribution model used by MTC would hold PMT constant under certain travel time savings conditions that might result from capacity improvements. We also cannot make the general conclusion at this time that the more traditional gravity model with "fixed" weights (F_{ij}) holds PMT constant under all possible (uniform and non-uniform) travel time savings scenarios.

This research to date though does indicate that most traditional gravity model formulations (with fixed friction factors - F_{ij}) have the potential for under-estimating travel demand increases that may occur due to increased highway capacity under certain conditions (a global reduction in travel time due to global capacity improvements).

6.2 Existing Transportation/Land Use Interactions Models

Meyer and Miller (1984, chapter 6) provide an overview of some of the urban activity models available at that time. They note that most large-scale land use forecasting models have suffered from a number of problems relating to data

intensiveness and cost of operation. They note the general lack of development and improvement of these models in the 1970's and early 1980's due to the shift from long range, large-scale forecasting in favor of smaller scale, problem-specific models and analysis. The separation of the functions of land use forecasts and transportation planning into different agencies is institutionally cumbersome and can result in myopic definitions of problems and their possible solutions, they state. Urban activity systems analysis is complicated by three major factors: the dynamic nature of the urban area; the complexity of urban behavior; and the need for high quality, detailed data.

The four major metropolitan regions of the state: Los Angeles (SCAG), the Bay Area (MTC), San Diego (SANDAG), and Sacramento (SACOG)-- have or are developing models that include transportation/land use interactions. The first three have operational models of varying degrees of sophistication, while Sacramento is developing the DRAM/EMPAL model, and expects to have it in place by 1994. All of the growth forecasting models contain a consultative process with local governments. The following discussions summarize the quantitative portions of the modeling processes.

San Francisco Bay Area Metropolitan Transportation Commission

MTC uses projections from the Association of Bay Area Government's POLIS (Projective Optimization Land use Information System).[18] POLIS is probably the most advanced of all the models, in that it uses a sophisticated mathematical programming process that allocates land uses to zones based on cost minimization (i.e., microeconomic theory). The model includes a travel time matrix provided from the regional travel model. The objective function of the model is to develop a "solution" of job, household, and labor distribution that maximizes "locational surplus" associated with a specific location, subject to the policy and economic constraints associated with each time period.

Population, new housing units, employment (five sectors), number of work trips (by mode and zone pair), and shopping trips (by mode and zone pair) are distributed to

[18] Actually, POLIS is part of a three-tier modelling system. However, it is the only one that is directly sensitive to accessibility and congestion.

107 zones in the MTC region. The model was calibrated using Census Bureau household and business data between 1964-1980.

In 1991, ABAG undertook an analysis of the land use implications of the 1989 Transportation Improvement Program (TIP) in the Bay Area using the POLIS model. Two tests were performed: one using existing land use policies and ABAG's *Projections '90* land uses as the basis for the analysis of the travel time network on growth distribution. The second test looked at the impacts of the transportation network scenarios on growth distribution, relaxing the constraint of local development policies.

Various corridors where major transportation improvements were planned in the TIP were analyzed under "build" and "no build" conditions. The model results suggest that the effects of capacity increases may be highly location-specific. In most cases the relative magnitude of shifts was not great, but in certain less developed areas (e.g., Half Moon Bay), the unconstrained land use test and highway improvements led to substantial growth. However, in Marin County, highway improvements would tend to keep growth from spreading to the less congested northern part of the county (Novato) in order to escape congestion. A similar conclusion was reached in Sonoma County in the North Bay: "...the existing transportation network-- independent of the build-no build scenarios-- will probably facilitate already existing development pressure to further decentralize jobs into the northern [less developed] portion of the [101] corridor." [bracketed statements added to quote]. The central I-80 corridor (Vallejo-Vacaville-Fairfield) was the area found to be most sensitive to highway improvements. In the build scenario, this area has 50,000 jobs in the year 2010, while under the no-build it has 46,000 jobs. Still, this difference is only about ten percent. One limitation of the POLIS system is that it assumes that the county total land use forecast is given, and does not make re-allocations between counties due to congestion. This constraint may be removed in the future.

SCAG and the Sacramento Region

The SCAG region uses the DRAM/EMPAL models (the models that SACOG is currently implementing). The forecasting process starts by using EMPAL (EMPloyment Allocation modeL) to allocate basic employment. Locations are selected because of the availability of natural resources and transportation. Manual intervention in this process is often required because factors are sufficiently subjective

that they are difficult to represent effectively by a mathematical formulation (Shunk, 1992). The residence location of workers are then determined with reference to basic employment. The model locates population on residential land that is within acceptable travel times or distances from basic employment. DRAM (Disaggregate Residential Allocation Model) allocates households (by income quartile) to zones using a generalized accessibility index for each zone. The index is computed from a formula that weights travel impedance to both other households and employment opportunities. Service and retail employment are then located in areas to service these populations. Several empirically estimated parameters are used for this purpose. The models are essentially probabilistic allocation models, using logit type formulations (similar to mode choice models).

San Diego

San Diego uses a three-step growth forecasting process which, like EMPAL, begins with allocation of basic employment. Transportation effects primarily are entered at the second step in the PLUM (Projective Land Use Model). PLUM is designed to simulate spatial development patterns, and allocates regionwide demographic, economic, and land use activities to 161 zones. Like DRAM/EMPAL, the usual forecasting steps involve basic employment, then population, then population-serving employment. Zone-to-zone travel times (both highway and transit[19]) and proximity to basic employment are taken into account in this process. The third and final step is an allocation of the PLUM outputs to smaller zones using the Sophisticated Allocation Process.

Most of the travel modeling process occurs at the 4,545-zone level, however, much of the data is stored by Master Geographic Reference Areas (MGRA) which is divided into 25,929 subareas. The MGRA underlies the transportation zones and the data is used in transit access procedures and special applications.

Conclusions

- All of the land use models are extremely data-intensive, making the initial development and calibration of the models very costly. Oftentimes manual

[19] Mode choice information is also needed to weight the travel times, which introduces a circular logic to the model, since relative travel times influence modal choice.

intervention is required to achieve reasonable results, or account for policy constraints.

- All of the models are "top down" models: they allocate a fixed number of people or jobs in the region to spatial or geographic units (zones). Typically, there is no consideration of what effect the development of transportation facilities could have on the regional "control totals" that are provided as an exogenous input to the model.

- Some of the models are not well grounded in microeconomic theory. They are essentially descriptive models that do not attempt to replicate the underlying behavioral processes that actors may be using to make their decisions. Land price, for example, has a powerful effect on who can use a given parcel, and at what density the land will be developed.

- Definitional problems arise in many of the models. For example, "land available for residential development" is often required as a model input. The variable sounds simple to determine, but upon reflection, is rather complex. Should unsewered land be excluded, even if sewage service could be added in the future? Should land with slopes over 20% be excluded? Such property is costly to develop, but if land prices on surrounding flatter parcels were to rise sufficiently, could become economic for development (see comment above).

- Land use forecasts are often developed at a less detailed level of geographic analysis, requiring manual intervention to make the final allocation from the land use model zones to transportation analysis zones (TAZ).

- Basic employment and non-employed residents are often allocated using historical trends or capture rate types of models. These tend to reinforce past trends and understate growth pressures on emerging areas ripe for development.

6.3 Critique of MPO Models

The literature review, case studies, and the household interview surveys indicated that highway capacity increases can have the following effects on travel demand behavior:

- Changes in route choice
- Changes in trip start/end times
- Extra stops along the way
- Changes in mode of travel
- Changes in trip destination
- Changes in home location

The travel demand models used by the four major metropolitan planning organizations (MPO's) in California have well-tested procedures for modelling changes in route choice, mode choice, and trip destination. These major MPO's also have land use models for predicting the effect of travel time changes on housing location. The MPO models however do not contain procedures for predicting how new highway capacity affects travel start and end times, or extra stops.

Changes in trip start and end times within a single day are not critical for daily traffic forecasts but they are critical for peak hour and peak period forecasts. Approximately 48% of the respondents to the home interview survey indicated that travel time savings on the order of 5 to 20 minutes would result in changes in their departure and/or arrival times. Approximately 95% however indicated that these time savings would not change the total number of trips they made in a given day.

The household survey indicated that travel time savings of between 5 and 20 minutes, such as might result from a highway capacity increase, would cause people to make an extra stop for about three to five percent of their trips. The four major MPO models are not currently capable of modelling this trip generation effect.

A final dilemma is that since most travel forecasting models calibrate to no better than ten percent at the screenline level, a three to five percent change in travel demand will not significantly influence model forecasts under most conditions. This is especially true if the highway capacity improvements represent only a few highway links of the entire regional transportation system.

7. Conclusions and Recommendations

This research effort has reached the following conclusions based on available literature, case studies of highway capacity increases, and the stated preferences of travelers in telephone interview survey of California households.

7.1 Conclusions

- A considerable amount of literature is available on the effects of new highway capacity, but many of these studies have significant limitations or qualifications, and were not able to make conclusive and transferable statements about the impacts of new capacity. The literature is reasonably congruent on the principle that highway capacity changes influence travel behavior principally by affecting travel time and cost. Changes in travel time and cost influence peoples' decisions to travel (trip generation), their choice of destination, their choice of travel mode, the time of day when they make their trip (trip scheduling), and their choice of route.

- Available literature indicates that travellers have definite preferences as to how they will respond to changes in travel time and cost. Their preferences generally follow this order:

  1. Change Route (find a faster route if the current one is congested);
  2. Change Schedule (find another time of day when congestion is less);
  3. Consolidate Trips (reduce number of daily trips by accomplishing more activities with a given trip);
  4. Change Mode (switch to more convenient mode);
  5. Change destination (find another location with the similar services).

  The order of the last two options (change mode and change destination) may vary by trip purpose. For example, shopping trips might change destination before switching mode. The order of responses appears to be similar for travel time decreases as well as for travel time decreases.

- The travel behavior survey conducted as part of this study for ARB indicates that people perceive their travel time to the nearest five minutes. Travel time savings of under five minutes do not appear to be meaningful for most people. This is also corroborated by the observation that, in reporting their own travel time, nearly all survey respondents (in this and other surveys) round the time to the nearest five minutes.

  Respondents to the behavior survey indicated a high degree of resistance to change in their travel behavior patterns when offered travel time savings of between five and fifteen minutes.

  - Survey respondents indicated that 94% of the time they would make no change or only make schedule changes to their trips if offered a five minute time savings for each trip. Slightly under three percent of the time they would make an extra stop. All other behavioral effects (such as mode shift, destination change, etc.) together accounted for the remaining three percent of their responses.

  - The percentage of time that respondents would make no change or change their trip schedule decreased to 92% when they were offered a 15 minute time savings for each trip. The percentage of extra stops increased to five percent. All other behavioral effects (such as mode shift, destination change, etc.) accounted for the remaining three percent of their responses.

  - People responded similarly to increases in travel time, although they did appear to be more sensitive to (or at least better able to relate to) travel time increases rather than travel time decreases.

- Since most trips in metropolitan areas are under 15 minutes duration and realistic time savings on such short trips would rarely exceed five minutes, it appears unlikely that new highway capacity would significantly reduce travel times for the majority of trips. Work (commute) trips may be an important exception, since these are typically between 20-30 minutes in duration.

- Available evidence from case studies of new capacity in California confirms the theory and actual evidence from other studies that new capacity will shift the timing (scheduling) of trips. However, with the limited count data available, no further conclusions could be drawn from these studies. The authors recommend that historic travel count data be maintained for a longer period in order to assess the long term impacts of highway capacity expansion. Further, the case study approach would be more successful if a research design were developed and appropriate "before" data collected as part of project implementation. The *post hoc* techniques applied to analyze case projects in this (and other studies) leave data gaps and unanswered questions.

- Although taxation and development policies are different in Canada, there are enough demographic similarities to make for an interesting comparison of what would have happened in the U.S. if an extensive system of urban freeways had not been developed. The Canadian evidence lends credence to the theory that people have a relatively fixed travel time budget, which they are reluctant to expand (or contract) beyond certain limits.

- California MPO models do not directly model the trip generation and trip scheduling effects of highway capacity changes. Trip scheduling (or peaking) is the single greatest effect of new highway capacity on travel behavior. Peaking is of minor importance if the travel model is being used only to estimate total daily traffic, but it is of much more importance in air quality analysis and peak period analyses.

  New trip generation caused by new highway capacity appears to be a relatively small effect (on the order of three to five percent) unlikely to significantly affect the validity of traffic forecasts produced by the current MPO travel models. However, this effect should be considered as one factor in project proposals, analyses, and decisions. Induced demand is likely to be proportional to the changes in travel times and accessibility created by the new capacity: capacity-increasing projects that make very little change in travel time are likely to have little trip generating potential; those that make very great changes in travel time are likely to make much greater potential for inducing new trips. The state of the art could be improved with a modest

amount of additional research on trip generation estimation techniques that take into account the effect of accessibility on tripmaking rates.

7.2 Recommendations for Future Research

It is recommended that the following steps be taken to improve the understanding of the effects of increased highway capacity on travel behavior and to improve the ability to forecast these effects at the regional level.

- Repeat the behavioral survey in other metropolitan, and possibly rural, areas to determine if the above survey results can be reliably extrapolated to all travellers. Adding survey observations from the Los Angeles metro area would be helpful to see if they are any different from those in the Bay Area and San Diego. A larger survey sample would also yield more information on the affect of new highway capacity on various trip types and purposes.

  As funds are available, two other research approaches appear to have merit. One is activity gaming and simulation, which allows researchers to better understand the intra-household allocation of travel and other activities. This study did not consider how travel time changes for one member of the household might affect the travel and activity patterns of other members of the household.

  Another approach is to collect detailed information on the before and after affects of those living in a corridor where travel times are improved. Recently developed automatic vehicle location technology, using cellular phones, would allow detailed travel diaries to be analyzed with the tedium and error associated with the traditional manually kept diaries.

- A longitudinal (time series) panel survey that could track the changes of the same individuals over a period of time in which congestion for some worsened, and for others increased, would provide extremely useful evidence of the effects of new highway capacity.

- Additional study would need to be done to examine whether a travel time savings is treated equally by motorists, regardless of the congestion condition it occurs under. Since some studies by psychologists indicate that commuting

in stop-and-go traffic is a stressful experience, traffic relief schemes that reduce congestion could have an impact beyond just the travel time savings. However, since there is no easy way to measure stress and present it to survey respondents, this issue could not be addressed as part of the current research effort.

- Fit a choice model to the survey results that predicts the change in trip scheduling (peaking) as a function of travel time savings. Such a model might then be used to enhance travel demand models currently in use by California MPO's. A robust peaking model would be a very valuable addition to the current state of the art.

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APPENDIX A

COMPUTER-ASSISTED TELEPHONE INTERVIEW (CATI) TRAVEL SURVEY

CATI SURVEY - EFFECTS OF ADDED CAPACITY ON TRAVEL BEHAVIOR

INTRO-1 Good evening. [*If a child answers, say:* May I speak to an adult in your home?]

My name is **(name)** of **(name of survey firm)**. We are conducting a survey for the State of California to look at how traffic congestion affects what people do.

INTRO-2 May I please speak to **(identify person in household from selection chart; If first person is not available, continue through selection chart until you can reach the indicated person)**?

Primary Selection	**Secondary Selection** If primary selection not present, ask for ...	**Tertiary selection** If secondary selection not present, ask for ...
Oldest male	Second oldest male 18 or older	Person with whom you are speaking
Second oldest male	Youngest male 18 or over	
Youngest male 18 or older	Oldest male	
Oldest female	Second oldest female 18 or older	
	Oldest male	
Second oldest female 18 or older	Youngest female 18 or older	
	Second youngest male 18 or older	
Youngest female 18 or older	Oldest female	
	Oldest male	

If person who answered the phone is the one selected from the chart, continue. Otherwise, reread INTRO-1. Continue with INTRO-3.

INTRO-3 The information you provide will be used to help plan for improvements in transportation and the environment. All information will be kept strictly confidential. We would like you to help us by answering a few questions about you and your household.

If person says he/she is busy, say: When would it be convenient for you to have us call back? *If the person gives a callback time, schedule the callback as shown in the interviewer manual.*

If person refuses to cooperate, or a response can not be obtained (language barrier, etc.), note the reason for noncompletion in your log and handle according to instructions in the interviewer manual.

SECTION A. HOUSEHOLD & PERSON DEMOGRAPHICS

I am first going to ask you about your household.

A-1. Which of the following categories best describes your household?
1. Single Person
2. Single Parent
3. Couple with no children **at home**
4. Couple with children **at home**
5. A group of **related** adults
6. A group of **unrelated** adults such as roommates
7. Other *(specify)*

A-2. What type of housing unit do you live in?
1. Single family detached unit
2. Duplex
3. Condominium/Co-op
4. Apartment
5. Mobile Home
6. Other *(specify)*

A-3. Do you rent or own your residence?
1. Own
2. Rent

A-4. How many people live in this household, including yourself? *(number)*

A-5. How many cars, vans, and pickup trucks in working condition does your household have available? *(number)*

A-6. How many motorcycles or mopeds are available for use by your household? *(number)*

A-7. How many persons in your household use bicycles? *(number)*

A-8. What is your ZIP code? *(If person does not know, ask:* In what city is your household located?

A-9. How long have you been at this address? *(years/months)*

A-9.5 How many phone lines are there in your home?

Now, I am going to ask you questions about each person in your household.
Let's start with you. *(Phrases within [ ] should be used for subsequent persons.* ***These questions should be asked for all persons in the household, regardless of age.)***

A-10. *(If not obvious)* Are you [Is this person] male or female?
1. Male
2. Female

A-11. How old are you? [How old is he/she?] *(years)*

A-12. Are you [Is he/she] ... *(record up to 2 categories)*
1. Employed full-time
2. Employed part-time
3. Student
4. Homemaker
5. Retired
6. Unemployed
7. Other *(specify)*

A-13. Do you [Does he/she] drive?
1. Yes
2. No

A-14. What is your [his/her] highest level of education? *(Do not ask for persons 16 and under.)*
1. Graduate degree(s)
2. College degree
3. Some college/Vocational school or training
4. High school graduate
5. Some school

Let's go on to the next person. *(Go to A-10)*

SECTION B. ATTITUDES TOWARDS/PERCEPTIONS OF TRAFFIC CONDITIONS

I am now going to read you a few statements. For each, please tell me how you feel about these. In other words, do you :
1. Strongly Agree; 2. Agree; 3. No Opinion; 4. Disagree; 5. Strongly Disagree.

For first few questions, if respondent says "Agree", ask: Do you strongly agree or just agree? *Likewise, if respondent says "Disagree", ask:* Do you strongly disagree or just disagree?

B-1. Traffic congestion is a major problem in my area.

If person answers "strongly disagree", "disagree", or "no opinion", continue with B-2. Otherwise, skip to Section C.

B-2. Traffic congestion will become a major problem within the next five years.

B-3. Traffic congestion causes me to take fewer trips.

B-4. Traffic congestion causes me to take shorter trips than I would otherwise.

B-5. Traffic congestion affects where I choose to live or work.

B-6. I do not mind driving or riding in congested traffic conditions.

B-7. Adding more lanes to roads and freeways will get rid of congestion.

B-8. Do you think something should be done now about traffic congestion?
1. Yes. What do you think should be done? *(specify)*
2. No

SECTION C. YESTERDAY'S TRAVEL/ACTIVITY PATTERNS

Now, I would like to ask you about what you did yesterday, such as shopping, work, things at home, and so on, starting from when you got up on **(travel day)** and when you ended your day. We need to know this to understand how people decide when and where to travel.

(Useful prompts to help jog the memory of the respondent are given in [ ] *)*

C-1. Did you leave home yesterday?
1. Yes *(Go to C-3)*
2. No *(Go to C-2)*

C-2. Why not?

1. Work (job-related) at home
2. Vacation/holiday
3. Illness
4. Other *(specify only if person indicates a reason)*

Go to G-1.

C-3. What did you do first yesterday? [What did you do next?] *(If person answers* nothing more, *go to C-9.)*

Occasional prompt to respondent on repeats of this question:

... and did you do anything else in between?

1. In-home Activities:
   1. Work (job-related)
   2. Other
2. Job
3. School
4. Social/recreation
5. Shopping
6. Personal business/medical/dental
7. Eat meal
8. Serve a passenger (pick up or drop off child, other household member, friend, etc.)
9. Other *(specify)*

If response to C-3 is non-home activity, ***or if C-3 is in-home activity and previous activity was non-home activity,*** *continue with C-5. Otherwise, repeat C-3. When person indicates he/she is finished, go to C-14.*

If response to C-3 is "work in home" and C-4 has not yet been asked, go to C-4; otherwise, go to C-5.

C-4. Do you usually work at home?
1. Yes
2. No

Go to C-3.

C-5. When did you leave to get there?

C-6. How did you get there?
1. Drive alone
2. Drive or ride with other household members
3. Drive or ride with others
4. Public transportation (includes walking, driving, or riding to/from bus stop, rail station, etc.)
5. Walk **only**
6. Bicycle **only**
7. Other *(specify)*

C-7. How long did it take you to get there? *(hours, minutes)*

C-8. How many miles did you travel to get there? *(miles)*

C-9. When did you finish this activity?

If response to C-3 was "job" (not in-home), go to C-10 ***only if it has not yet been asked in this interview*** *. Otherwise, go to C-13.*

C-10. How many days a week do you usually go to [work/school]?

C-11. What is your usual scheduled starting time at [work/school]?
1. Starting time: (record starting time)
2. Variable

C-12. Do you have to be at [work/school] by this starting time?
1. Yes *(Go to C-14)*
2. No *(Go to C-13)*

C-13. How much earlier or later than the scheduled start time can you arrive? *(hours/minutes earlier or later)*

If activity sequence from home to work (or work to home) includes serving a passenger, ask C-12 ***only if it has not yet been asked in this interview.*** *Otherwise, go to C-3.*

C-14. Do you usually pick up or drop off a child at day care or school on your way to or from your [work/school]?

1. Yes, usually
2. Sometimes
2. Never

Repeat C-3 for subsequent activities.

C-14. And did you do anything else yesterday or before 4:00 this morning?
1. Yes (Go to C-3)
2. No

If no trips greater than 5 minutes, skip to section "F".
If no trips greater than or equal to 10 minutes. skip to section "E".

SECTION D. TRAVEL BEHAVIOR EFFECTS OF ADDED CAPACITY

We are trying to find out how traffic congestion affects what people do. I am going to describe what might happen if traffic congestion got better or worse, and ask you how you might change your activities or travel as a result. Please take some time to think carefully about what you might do. Are you ready?

Proceed through each of yesterday's trips. If trip is 9 minutes long or less, skip to next trip.

Consider what you told me about what you did yesterday. For each trip I am going to ask you what you would have done if it had taken less time to make the trip. [*Statements in brackets refer to trips after the first.*]

D-1. Consider your first trip yesterday. [Consider your next trip.] You started at **(time from C-5)** and went to **(destination from C-3)** by **(mode C-6)**. This trip took **(trip time from C-7)**. Now suppose that this trip took **(randomized time[20])** less time to make. Please select one or more of these statements that best describe what you would have done.
1. Done nothing differently. *(Repeat D-1 for next trip)*
2. Started at the same time and arrived earlier *(Repeat D-1 for next trip)*
3. Started the trip later and arrived at the same time *(Repeat D-1 for next trip)*
4. Changed to another means of travel (*Go to D-2*)
5. Visited a different location (*Go to D-3*)
6. Made a stop on the way (*Go to D-3*)
7. Other *(specify)*

D-2. Which means of travel would you have switched to?
1. Drive alone
2. Drive or ride with other household members
3. Drive or ride with others
4. Public transportation (includes walking, driving, or riding to/from bus stop, rail station, etc.)

[20] For trips between 10 and 15 minutes long, inclusive; ask about a 5 minute reduction. For longer trips select a random percent of the trip time between 1% and 50%. If survey number is even, the minimum time savings asked is 10 minutes. If survey number is odd, the minimum time savings asked is 5 minutes.

5. Walk **only**
6. Bicycle **only**
7. Other *(specify)*

Repeat D-1 for next trip.

D-3. Where would you have stopped [*or* gone to]?
1. Home
2. Work/school
3. Shop
4. Bank/post office
5. Restaurant/cafe
6. Doctor/dentist
7. Child's day care/school
8. Fitness/sports center
9. Theater/movies/opera
10. Other *(specify)*

D-4. How long would you have stayed there? *(hours/minutes)*

D-5. What would have been the purpose of this trip?
1. In-home Activities:
   1. Work (job-related)
   2. Other
2. Job
3. School
4. Social/recreation
5. Shopping
6. Personal business/medical/dental
7. Eat meal
8. Serve a passenger (pick up or drop off child, other household member, friend, etc.)
9. Other *(specify)*

D-6. Is this trip currently made by another household member?
1. Yes
2. No

Repeat D-1 for subsequent trips. After finishing the last trip ...

D-7. Would you have left home again before the end of your day if you had **(randomized time)** extra time?
1. Yes *(Go to D-3)*
2. No *(Go to D-8)*

Now, consider what else you might eventually do if you spent less time traveling. This means that instead of spending a total of **(total hours, minutes from activity/trip log in Section D)** traveling yesterday, you would have spent only

(travel time from randomized design)[21] traveling. You would have had **(extra time from randomized design)** extra time to do as you please. I am going to read you a few statements. For each, please tell me how you feel about these. In other words, do you :
1. Strongly Agree; 2. Agree; 3. No Opinion; 4. Disagree; 5. Strongly Disagree.

For first few questions, if respondent says "Agree", ask: Do you strongly agree or just agree? *Likewise, if respondent says "Disagree", ask:* Do you strongly disagree or just disagree?

If respondent notes that his/her schedule does not permit changes, note that response here.

D-8. I would move closer to where I work.

D-9 I would move farther away from work.

D-10. I would work at a different place.

D-11. I would get an additional car or cars.

D-12 I would get rid of one or more cars I already own.

D-13. Are there any other changes you might make? *(Record responses)*

SECTION E. TRAVEL BEHAVIOR EFFECTS OF INCREASED CONGESTION

Now I am going to ask you about how you might have changed your travel if you had to spend **more** time to make the trips you did yesterday.

Proceed through each of yesterday's trips. If trip is 4 minutes long or less, skip to next trip.

Now consider again what you told me about what you did yesterday. For each trip I am going to ask you what you would have done if it had taken **more** time to make the trip. [*Statements in brackets refer to trips after the first.*]

E-1. Consider your first trip yesterday. [Consider your next trip.] You started at **(time from C-5)** and went to **(destination from C-3)** by **(mode C-6)**. This trip took **(trip time from C-7)**. Now suppose that this trip took

[21] Multiply total trip time yesterday by random percent between 10% and 50% with minimum time savings of 5 minutes.

(randomized time[22]) more time to make. Please select one or more of these statements that best describe what you would have done.

1. Done nothing differently. *(Repeat E-1 for next trip)*
2. Started at the same time and arrived later *(Repeat E-1 for next trip)*
3. Started the trip later and arrived at the same time *(Repeat E-1 for next trip)*
4. Changed to another means of travel (*Go to E-2*)
5. Visited a different location (*Go to E-3*)
6. Made a stop on the way (*Go to E-3*)
7. Other *(specify)*

E-2. Which means of travel would you have switched to?
1. Drive alone
2. Drive or ride with other household members
3. Drive or ride with others
4. Public transportation (includes walking, driving, or riding to/from bus stop, rail station, etc.)
5. Walk **only**
6. Bicycle **only**
7. Other *(specify)*

Repeat E-1 for next trip.

E-3. Where would you have stopped [*or* gone to]?
1. Home
2. Work/School
3. Shop
4. Bank/Post Office
5. Restaurant/Cafe
6. Doctor/Dentist
7. Child's Day Care/School
8. Fitness/Sports Center
9. Theater/Movies/Opera
10. Other

E-4. How long would you have stayed there? *(hours/minutes)*

E-5. What would have been the purpose of this trip?
1. In-home Activities:

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[22] For trips of 5 minutes to 9 minutes, ask 5 minute time saving.

For trips of 10 to 14 minutes, ask 5 minute time savings if survey number is divisible by 4 (25% of the survey), ask 10 minutes otherwise (75% of sample).

For longer trips select random percent between 1% and 50% of trip time. If survey number is even, the minimum time increase asked is 10 minutes. If the survey number is odd, the minimum time increase asked is 5 minutes.

1. Work (job-related)
2. Other

2. Job
3. School
4. Social/recreation
5. Shopping
6. Personal business/medical/dental
7. Eat meal
8. Serve a passenger (pick up or drop off child, other household member, friend, etc.)
9. Other *(specify)*

E-6. Is this trip currently made by another household member?
1. Yes
2. No

Repeat E-1 for subsequent trips. After finishing the last trip ...

E-7. Would you have left home again before the end of your day?
1. Yes *(Go to E-1)*
2. No *(Go to E-8)*

Now, consider what else you might eventually do if you had to spend **more** time traveling yesterday. This means that instead of spending a total of **(total hours, minutes from activity/trip log in Section D)** traveling yesterday, you would have spent a total of **(travel time from randomized design)** traveling. You would have had **(increase in travel time from randomized design**[23]) *less* time to do as you please. I am going to read you a few statements. For each, please tell me how you feel about these. In other words, do you :
1. Strongly Agree; 2. Agree; 3. No Opinion; 4. Disagree; 5. Strongly Disagree.

For first few questions, if respondent says "Agree", ask: Do you strongly agree or just agree? *Likewise, if respondent says "Disagree", ask:* Do you strongly disagree or just disagree?

E-8. I would move closer to where I work.

E-9. I would consider getting an additional car or cars.

E-10 I would consider getting rid of one or more cars I already own.

E-11. I would consider joining a carpool.

E-12. I would consider using transit.

E-13. Are there any other changes you might consider? *(Record responses)*

---

[23] Multiply total trip time yesterday by random percent between 10% and 50% with minimum time increase of 5 minutes.

SECTION F. INCOME

F-1. And finally, what is the total annual income of your household? I will read you a list of ranges. Please stop me when I reach the correct one.

1. Under $7,500
2. Between $ 7,500 and $ 15,000
3. Between $ 15,000 and $ 30,000
4. Between $ 30,000 and $ 50,000
5. Between $ 50,000 and $ 75,000
6. Between $ 75,000 and $ 100,000
7. Between $ 100,000 and $ 150,000
8. More than $ 150,000

F-2. Would it be possible for us to call you again sometime in the future for a similar interview?

1. Yes
2. No

Thank you for your help.

END OF SURVEY

APPENDIX B

DESCRIPTION OF TRAVEL SURVEY METHODOLOGY

Survey Method and Response Rates

The survey was conducted between March 15 and May 15, 1994 on Tuesday through Friday evenings from 6:00 pm to 9:30 pm and on Saturdays between 10:00 am and 2:00 pm. Participants were selected at random from the San Francisco Bay and San Diego metropolitan areas. Commercially available lists of residential phone numbers were purchased. Un listed numbers were reached by taking the listed number and adding one. Due to the disruption caused by January's Northridge Earthquake, the Los Angeles area was not included in the study as originally planned.

A CATI approach was used to question respondents. A CATI computer program was written to display the questions on the screen, provide random numbers for the time savings questions, skip over non-relevant questions, and to record the responses. The program, called ARB.COM, is written in the "Z-BASIC" programming language for IBM-DOS compatible micro-computers.

Interviewers made a minimum of three attempts at varying times and on different days to contact each residential phone number. Answering machines, no answers, and busy signals were recorded as such after the third attempt. If the answering party hung up immediately, the call was recorded as a refusal. If the party hung up after consenting and beginning the survey, the call was recorded as a "Termination". Only calls which resulted in completed surveys were recorded as "Completions". Because of the length and complexity of the survey, considerable interviewer training was necessary. On average, interviewers required 4-6 hours of training and practice before they began work.

Response rates varied only slightly between the geographical areas. The survey contractor, Nelson\Nygaard, calculated a completion rate of 17% for both the San Francisco and San Diego areas. Refusal rates differed slightly; 26% for San Francisco, and 27% for San Diego. Interviewers commented that San Diegans were generally more abrasive in their refusals.

Metropolitan Area	San Diego	San Francisco
Completions	17%	17%
Refusals	27%	26%
Terminations, answer machines, business numbers	56%	55%

The length of the survey affected the participation rate. The average survey took between 20 and 25 minutes to complete. A number of respondents who initially consented, changed their minds after discovering that it would take 20 minutes or more. The length of the survey and the difficulty in persuading people to complete it, resulted in interviewers obtaining an average completion rate of only 3.9 surveys per four hour shift. The number of successful completions varied by night of the week. Tuesday and Wednesday were the best, Friday was the worst. Friday, April 15, the day income tax forms were due, was particularly unsuccessful.

Post-Mortem Critique of Survey and Suggestions for Next Survey

These comments and suggestions were provided by the people who actually administered the CATI survey after they had completed the survey effort. The pre-test of the survey indicated that the survey length needed to be cut about 50%. This reduction was made, but the length of the survey continued to be a significant problem for interviewers and the respondents. The demographic questions at the outset of the survey (Questions A1-A11) irritated some respondents and aroused their suspicions about its legitimacy.

The wording of the survey created some confusion between *trips* and *activities*, and the interviewers had to probe carefully to avoid irrelevant in-home activities, and to capture midday trips. The majority of the trips recorded were less than 20 minutes in duration and the opportunities for genuine travel time savings (greater than 10 minutes) were limited.

A common frustration was the lack of an adequate opportunity for respondents to voice their opinions about traffic congestion and the need for more public transit service. Many created their own opportunity by offering suggestions, although a CATI survey does not provide a good forum for open ended questions. As a follow up to this survey, and as a method for capturing these comments, CARB may want to consider organizing focus groups. Focus groups could illuminate the reasons behind travel behavior, in a way survey methods cannot. As an example, respondents who would not change their travel behavior with 15 minutes savings may do so because their commute is tied to another household member or due to other family responsibilities. It is recognized that many Californians have complex commutes, although this type of information is not captured in this survey.

Critique of Specific Sections and Questions

This information was provided by survey consultants Nelson\Nygaard after debriefing the five survey interviewers and their supervisor:

SECTION A: HOUSEHOLD & DEMOGRAPHICS

General Comments: This is where the majority of the people who had initially agreed to participate terminated. Quite often people became suspicious at being asked personal questions first, when they were under the impression that they were answering a travel survey. Many people were willing to give their own personal information, but refused to discuss other household members, particularly if those members were their dependant children.

In general, demographic questions are least often answered, (and the least relevant) and for this reason they are normally placed at the end of a survey. Nelson\Nygaard strongly recommends following this approach in future surveys.

Specific Questions:

Question A-2: Townhouse was cited frequently and should have a separate category, as their occupants are reluctant to categorize them as either a "Single Family Detached" or a "Condominium".

Question A-5: The phrase "in working condition" prompted laughter. This question should be phrased more explicitly as, "How many cars, vans, and pick-up trucks that run do you have access to". In many cases, there is one or more vehicles in the household, but the respondent can't use them.

Question A-12: "Add Employed for Pay At Home" as a separate choice (rather than implied under "Employed Full or Part-Time").

SECTION B: ATTITUDES TOWARDS/PERCEPTIONS OF TRAFFIC CONDITIONS

General Comments: This section should have been first. It directly relates to the stated purpose of the survey, without immediately asking for personal information. Questions B-3 through B-8 should have been posed to all respondents, since people who feel that congestion is already a problem most likely have some strong recommendations about what to do about it.

Specific Questions:

Question B-1: Define "area" more precisely. Respondents were weak on the concept. Granted this can be difficult, however a little more guidance, such as "Traffic is a major problem in the places where I travel each day", would help.

SECTION C: YESTERDAY'S TRAVEL/ACTIVITY PATTERNS

General Comments: The wording of the survey leaves some confusion between trips and activities. Many respondents were unclear as to whether "when did you finish this activity referred to the travel itself, or the activity for which the person was traveling, such as work. Where the person interprets it as finishing the activity, particularly in the case of work, all intervening activities during the day are lost. A perfect example of this is the person who goes to work, works until lunch, leaves the workplace for lunch, goes back, then leaves again for a meeting, then comes back, etc, until the end of the working day when (s)he goes home. In this case, four trips, contributing to midday congestion, might have been completely lost without constant probing by the interviewer. To prevent losing intermediate travel, interviewers were constantly reminded to probe respondents very carefully. To minimize this hassle and potential loss of valuable data, the questions should spell out explicitly in sequence 1) when did you start traveling, 2) how long, 3) how far, 4) what time did you go out again..., so there is a clear closure at the end of each activity, but one does not skip intervening action.

Specific Questions:

Question C-2: Add "retired" or "not need to leave home" as a specific choice. It was a fairly common response.

Question C-3: This question should have been " Where did you **go** first", Where did you **go** next? Its present wording, "What did you **do** first?", implies in-home activities which were eliminated during the pre-test. Question C-4, "Did you/do you work at home" should precede this.

Question C-4: Should precede C-3.

Question C-13: Allow the respondent to give a range of how much earlier **and** later they could arrive, and possibly whether that varies by day of the week. In general, we found big ranges on this one.

SECTION D: TRAVEL BEHAVIOR EFFECTS OF ADDED CAPACITY

General Comments: The average trip length was quite similar to that found in metropolitan transportation studies. Since many trips were of short duration, there was no way many of them could realistically be reduced by more than five to ten

minutes, and people had a hard time dealing with the concept of reduced travel time, let alone knowing what they would do with it.

Specific Questions:

Question D-1: Clarify whether a visit a different location means a different location for the same purpose (i.e. I can get farther in the same time, so therefore I will go to the cheaper Lucky's farther away) or to a different location for another or additional purpose.

Question D-6: Rephrase this as "Would this replace a trip/activity that another household member is already doing?"

Question D-7: The travel time increase/decrease was independent of the individual reported trips. Very often, the randomized time savings were far greater(or less) than the sum of the time reductions the respondent had previously been offered. Many respondents realized this and were confused. Additionally, a number of respondents stated that their responses were conditional on when during the day the time savings would occur (Would it be at 8:00 AM before work or would the additional time occur at 6:00 pm?).

SECTION E: TRAVEL BEHAVIOR EFFECTS OF INCREASED CONGESTION

General Comments:

In general, the same issues raised with Section D reappeared here, with the added fact that by the time they reached this section, respondents had invested fifteen minutes in the survey and were getting irritated.

Specific Questions:

Question E-1: "I would take another route." was a frequent response. This should be added as a choice, or it should be explicitly specified that ALL alternative paths will face the same amount of delay.

Question E-6: See Question D-6.

Question E-7: See Question D-7.

SECTION F:

General Comments:

As per usual with any survey, some people would not answer the income. Refusal rates of between 10 and 20% are common for telephone interview surveys, however, and this survey fell into that range.

APPENDIX C

TRAVEL SURVEY RESULTS

APPENDIX
CATI SURVEY RESULTS

A.1. Household Characteristics (Parts "A" & "F") - Entire Household C-124

A.2. Household Characteristics (Part "A") - Respondents Only C-134

B. Opinion Survey C-137

C. Travel Characteristics C-141

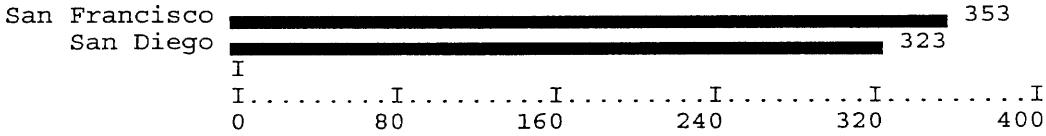
D. Effects of Increased Capacity C-155

E. Effects of Increased Congestion C-163

A.1. Household Characteristics (Parts "A" & "F") - Entire Household

AREA

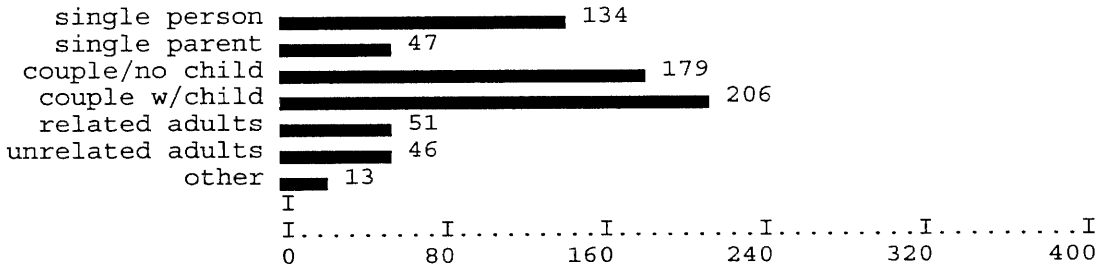
Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
San Francisco	1	353	52.2	52.2	52.2
San Diego	2	323	47.8	47.8	100.0
	TOTAL	676	100.0	100.0	



Mean	1.478	Median	1.000	Mode	1.000
Valid Cases	676	Missing Cases	0		

A1 household category

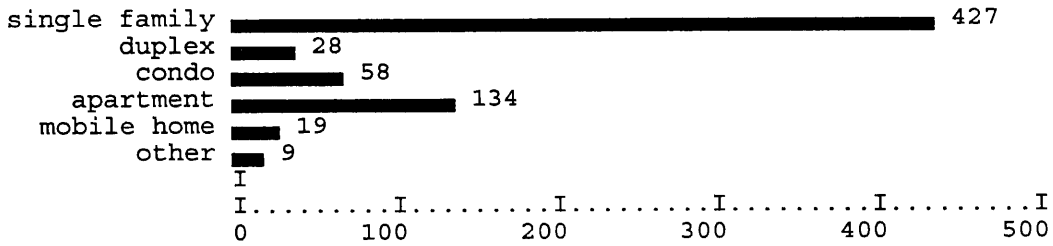
Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
single person	1	134	19.8	19.8	19.8
single parent	2	47	7.0	7.0	26.8
couple/no child	3	179	26.5	26.5	53.3
couple w/child	4	206	30.5	30.5	83.7
related adults	5	51	7.5	7.5	91.3
unrelated adults	6	46	6.8	6.8	98.1
other	7	13	1.9	1.9	100.0
	TOTAL	676	100.0	100.0	



Mean	3.271	Median	3.000	Mode	4.000
Valid Cases	676	Missing Cases	0		

A2 dwelling unit type

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
single family	1	427	63.2	63.3	63.3
duplex	2	28	4.1	4.1	67.4
condo	3	58	8.6	8.6	76.0
apartment	4	134	19.8	19.9	95.9
mobile home	5	19	2.8	2.8	98.7
other	6	9	1.3	1.3	100.0
	-1	1	.1	MISSING	
	TOTAL	676	100.0	100.0	



Mean	1.988	Median	1.000	Mode	1.000
Valid Cases	675	Missing Cases	1		

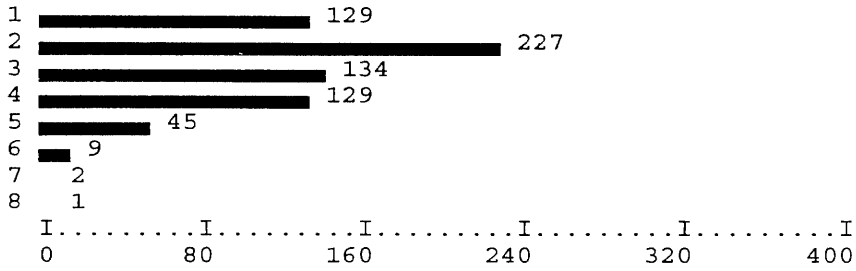
A3 own/rent

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
own	1	413	61.1	61.3	61.3
rent	2	261	38.6	38.7	100.0
missing data	-1	2	.3	MISSING	
	TOTAL	676	100.0	100.0	

Mean	1.387	Median	1.000	Mode	1.000
Valid Cases	674	Missing Cases	2		

A4 people/household

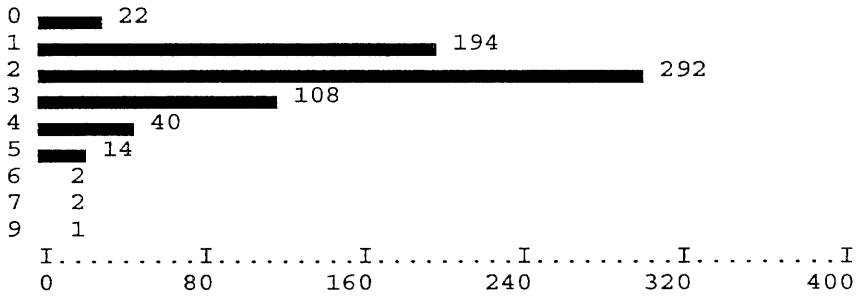
Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
	1	129	19.1	19.1	19.1
	2	227	33.6	33.6	52.7
	3	134	19.8	19.8	72.5
	4	129	19.1	19.1	91.6
	5	45	6.7	6.7	98.2
	6	9	1.3	1.3	99.6
	7	2	.3	.3	99.9
	8	1	.1	.1	100.0
	TOTAL	676	100.0	100.0	



Mean	2.666	Median	2.000	Mode	2.000
Valid Cases	676	Missing Cases	0		

A5 cars/household

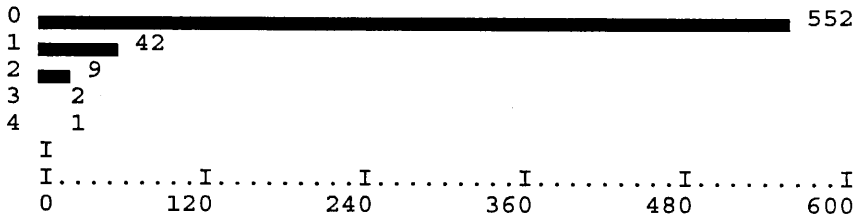
Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
	0	22	3.3	3.3	3.3
	1	194	28.7	28.7	32.0
	2	292	43.2	43.3	75.3
	3	108	16.0	16.0	91.3
	4	40	5.9	5.9	97.2
	5	14	2.1	2.1	99.3
	6	2	.3	.3	99.6
	7	2	.3	.3	99.9
	9	1	.1	.1	100.0
	-1	1	.1	MISSING	
	TOTAL	676	100.0	100.0	



Mean	2.025	Median	2.000	Mode	2.000
Valid Cases	675	Missing Cases	1		

A6 motorcycles/household

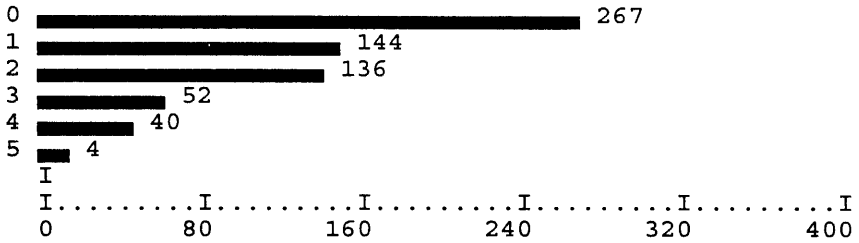
Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
	0	552	81.7	91.1	91.1
	1	42	6.2	6.9	98.0
	2	9	1.3	1.5	99.5
	3	2	.3	.3	99.8
	4	1	.1	.2	100.0
	-1	70	10.4	MISSING	
	TOTAL	676	100.0	100.0	



Mean	.116	Median	.000	Mode	.000
Valid Cases	606	Missing Cases	70		

A7 bicyclists/household

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
	0	267	39.5	41.5	41.5
	1	144	21.3	22.4	63.9
	2	136	20.1	21.2	85.1
	3	52	7.7	8.1	93.2
	4	40	5.9	6.2	99.4
	5	4	.6	.6	100.0
	-1	33	4.9	MISSING	
	TOTAL	676	100.0	100.0	

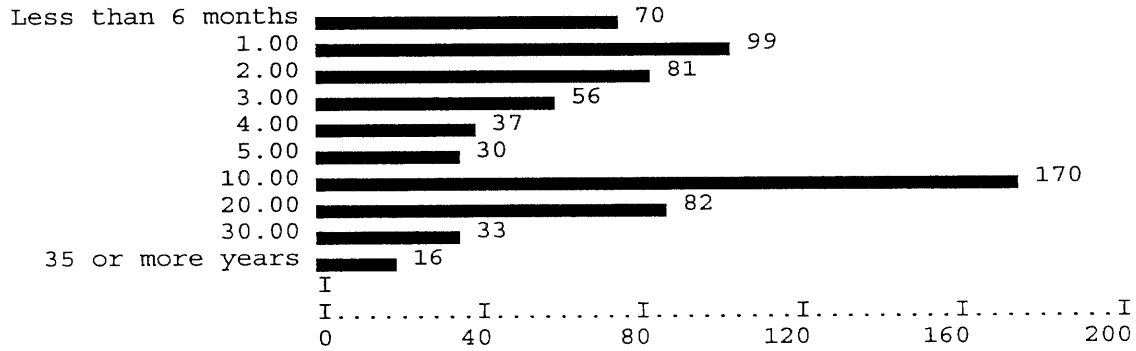


Mean	1.170	Median	1.000	Mode	.000
Valid Cases	643	Missing Cases	33		

A9 Time at Address (years)

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
Less than 6 months	.00	70	10.4	10.4	10.4
	1.00	99	14.6	14.7	25.1
	2.00	81	12.0	12.0	37.1
	3.00	56	8.3	8.3	45.4
	4.00	37	5.5	5.5	50.9
	5.00	30	4.4	4.5	55.3
	10.00	170	25.1	25.2	80.6
	20.00	82	12.1	12.2	92.7
	30.00	33	4.9	4.9	97.6
35 or more years	50.00	16	2.4	2.4	100.0
	-1	2	.3	MISSING	
	TOTAL	676	100.0	100.0	

A9 Time at Address (years)



Mean	8.690	Median	4.000	Mode	10.000
Valid Cases	674	Missing Cases	2		

A9.5 How many phone lines are there in your house?

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
	1	540	79.9	80.5	80.5
	2	104	15.4	15.5	96.0
	3	19	2.8	2.8	98.8
	4	6	.9	.9	99.7
	6	1	.1	.1	99.9
	12	1	.1	.1	100.0
	-1	5	.7	MISSING	
	TOTAL	676	100.0	100.0	

Mean	1.262	Median	1.000	Mode	1.000
Valid Cases	671	Missing Cases	5		

A10 sex

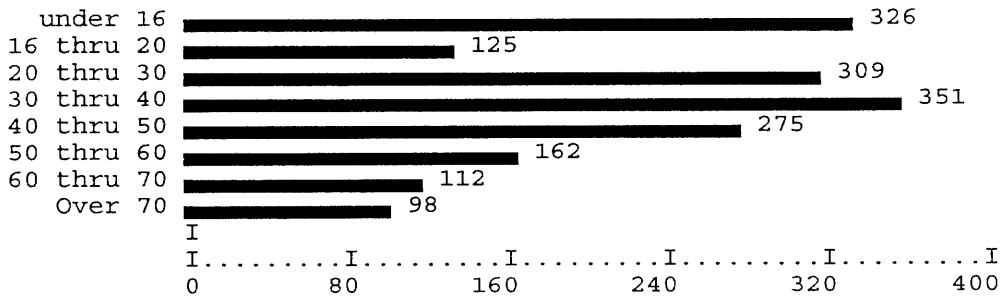
Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
male	1	876	48.6	49.5	49.5
female	2	894	49.6	50.5	100.0
	-1	32	1.8	MISSING	
		---	---	---	
	TOTAL	1802	100.0	100.0	

Mean	1.505	Median	2.000	Mode	2.000
Valid Cases	1770	Missing Cases	32		

A11 age

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
under 16	1	326	18.1	18.5	18.5
16 thru 20	2	125	6.9	7.1	25.7
20 thru 30	3	309	17.1	17.6	43.2
30 thru 40	4	351	19.5	20.0	63.2
40 thru 50	5	275	15.3	15.6	78.8
50 thru 60	6	162	9.0	9.2	88.1
60 thru 70	7	112	6.2	6.4	94.4
Over 70	8	98	5.4	5.6	100.0
	-1	44	2.4	MISSING	
	TOTAL	1802	100.0	100.0	

A11 age



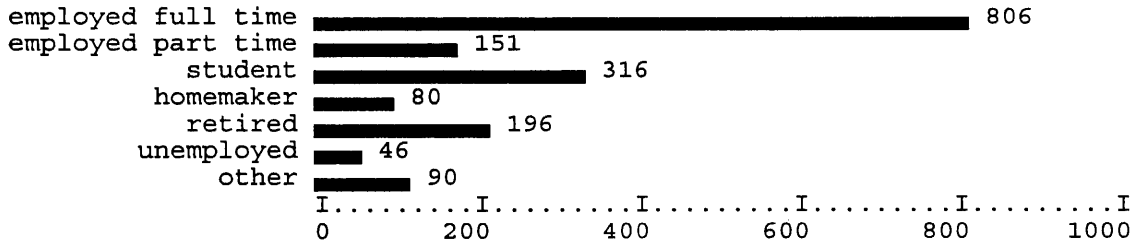
Mean 3.881 Median 4.000 Mode 4.000

Valid Cases 1758 Missing Cases 44

A12A primary occupation

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
employed full time	1	806	44.7	47.8	47.8
employed part time	2	151	8.4	9.0	56.8
student	3	316	17.5	18.8	75.5
homemaker	4	80	4.4	4.7	80.3
retired	5	196	10.9	11.6	91.9
unemployed	6	46	2.6	2.7	94.7
other	7	90	5.0	5.3	100.0
	-1	117	6.5	MISSING	
	TOTAL	1802	100.0	100.0	

A12A primary occupation

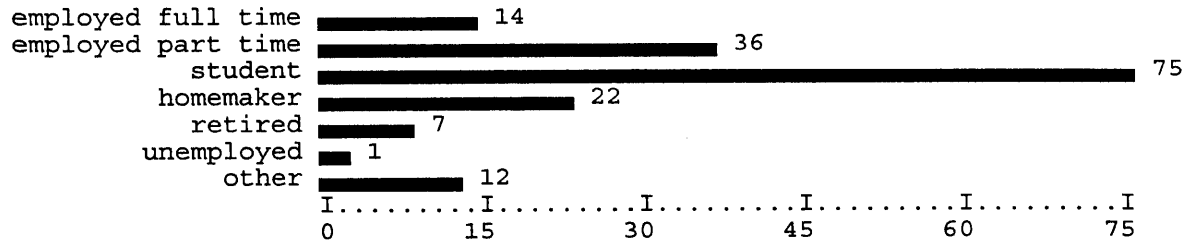


Mean	2.529	Median	2.000	Mode	1.000
Valid Cases	1685	Missing Cases	117		

A12B second occupation

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
employed full time	1	14	.8	8.4	8.4
employed part time	2	36	2.0	21.6	29.9
student	3	75	4.2	44.9	74.9
homemaker	4	22	1.2	13.2	88.0
retired	5	7	.4	4.2	92.2
unemployed	6	1	.1	.6	92.8
other	7	12	.7	7.2	100.0
	-1	1635	90.7	MISSING	
	TOTAL	1802	100.0	100.0	

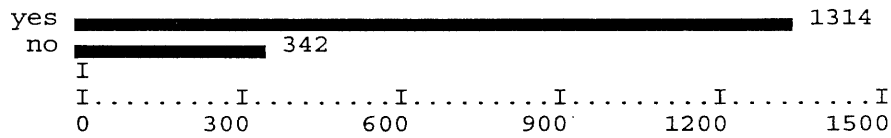
A12B second occupation



Mean	3.138	Median	3.000	Mode	3.000
Valid Cases	167	Missing Cases	1635		

A13 driver

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
yes	1	1314	72.9	79.3	79.3
no	2	342	19.0	20.7	100.0
	-1	146	8.1	MISSING	
	TOTAL	1802	100.0	100.0	

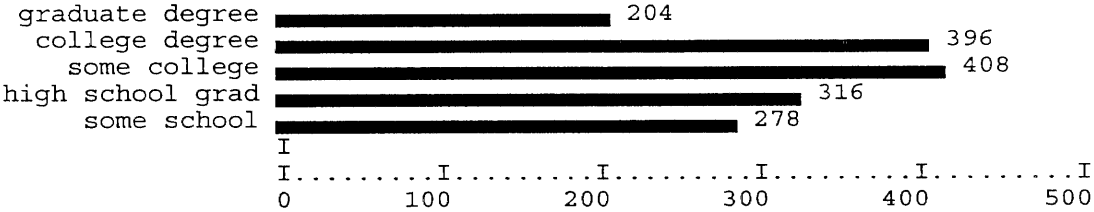


Mean	1.207	Median	1.000	Mode	1.000
Valid Cases	1656	Missing Cases	146		

A14 education

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
graduate degree	1	204	11.3	12.7	12.7
college degree	2	396	22.0	24.7	37.5
some college	3	408	22.6	25.5	62.9
high school grad	4	316	17.5	19.7	82.6
some school	5	278	15.4	17.4	100.0
	-1	200	11.1	MISSING	
	TOTAL	1802	100.0	100.0	

A14 education

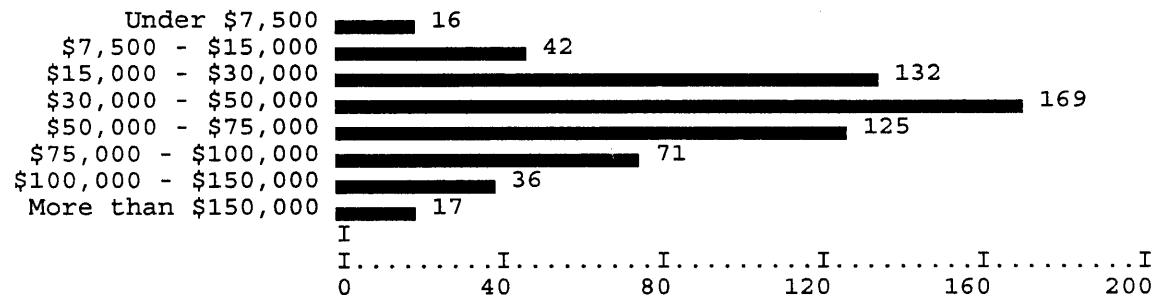


Mean	3.042	Median	3.000	Mode	3.000
Valid Cases	1602	Missing Cases	200		

F1 Annual income

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
Under $7,500	1	16	2.4	2.6	2.6
$7,500 - $15,000	2	42	6.2	6.9	9.5
$15,000 - $30,000	3	132	19.5	21.7	31.3
$30,000 - $50,000	4	169	25.0	27.8	59.0
$50,000 - $75,000	5	125	18.5	20.6	79.6
$75,000 - $100,000	6	71	10.5	11.7	91.3
$100,000 - $150,000	7	36	5.3	5.9	97.2
More than $150,000	8	17	2.5	2.8	100.0
	-1	68	10.1	MISSING	
	TOTAL	676	100.0	100.0	

F1 Annual income



Mean	4.294	Median	4.000	Mode	4.000
Valid Cases	608	Missing Cases	68		

F2 Would it be possible for us to call you in future?

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
Yes	1	569	84.2	86.3	86.3
No	2	90	13.3	13.7	100.0
	-1	17	2.5	MISSING	
	TOTAL	676	100.0	100.0	

Mean	1.137	Median	1.000	Mode	1.000
Valid Cases	659	Missing Cases	17		

A.2. Household Characteristics (Part "A") - Respondents Only

A10 Sex

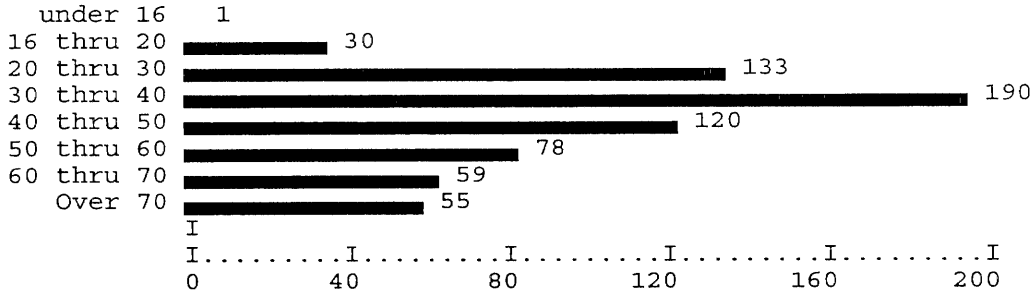
Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
male	1	302	44.7	44.8	44.8
female	2	372	55.0	55.2	100.0
	-1	2	.3	MISSING	
	TOTAL	676	100.0	100.0	

Mean	1.552	Median	2.000	Mode	2.000
Valid Cases	674	Missing Cases	2		

A11 age

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
under 16	1	1	.1	.2	.2
16 thru 20	2	30	4.4	4.5	4.7
20 thru 30	3	133	19.7	20.0	24.6
30 thru 40	4	190	28.1	28.5	53.2
40 thru 50	5	120	17.8	18.0	71.2
50 thru 60	6	78	11.5	11.7	82.9
60 thru 70	7	59	8.7	8.9	91.7
Over 70	8	55	8.1	8.3	100.0
	-1	10	1.5	MISSING	
	TOTAL	676	100.0	100.0	

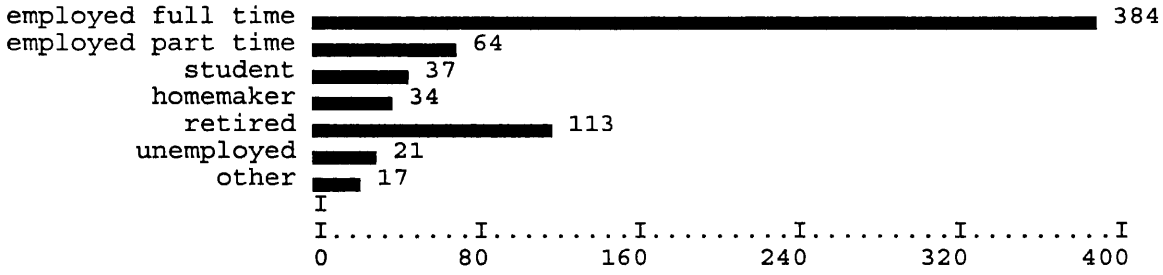
A11 age (years)



Mean	4.716	Median	4.000	Mode	4.000
Maximum	88.000	Valid Cases	666	Missing Cases	10

A12A Primary occupation

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
employed full time	1	384	56.8	57.3	57.3
employed part time	2	64	9.5	9.6	66.9
student	3	37	5.5	5.5	72.4
homemaker	4	34	5.0	5.1	77.5
retired	5	113	16.7	16.9	94.3
unemployed	6	21	3.1	3.1	97.5
other	7	17	2.5	2.5	100.0
	-1	6	.9	MISSING	
	TOTAL	676	100.0	100.0	

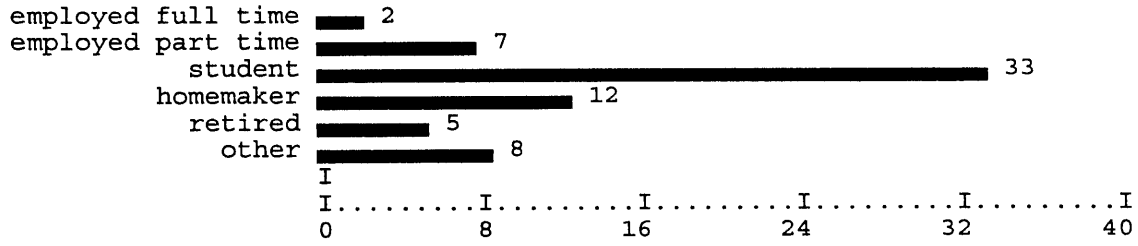


Mean	2.342	Median	1.000	Mode	1.000
Valid Cases	670	Missing Cases	6		

A12B second occupation

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
employed full time	1	2	.3	3.0	3.0
employed part time	2	7	1.0	10.4	13.4
student	3	33	4.9	49.3	62.7
homemaker	4	12	1.8	17.9	80.6
retired	5	5	.7	7.5	88.1
other	7	8	1.2	11.9	100.0
	-1	609	90.1	MISSING	
	TOTAL	676	100.0	100.0	

A12B second occupation



Mean	3.642	Median	3.000	Mode	3.000
Valid Cases	67	Missing Cases	609		

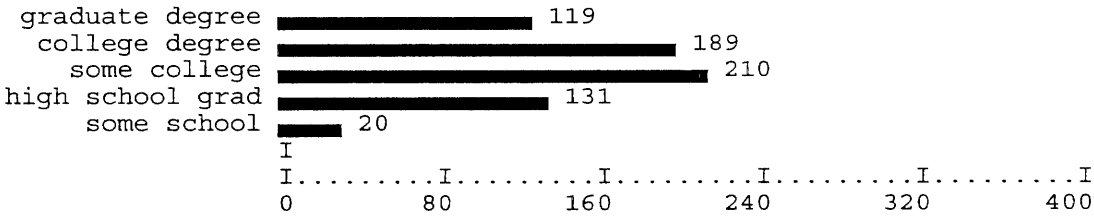
A13 Driver

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
yes	1	648	95.9	96.4	96.4
no	2	24	3.6	3.6	100.0
	-1	4	.6	MISSING	
	TOTAL	676	100.0	100.0	

Mean	1.036	Median	1.000	Mode	1.000
Valid Cases	672	Missing Cases	4		

A14 Education

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
graduate degree	1	119	17.6	17.8	17.8
college degree	2	189	28.0	28.3	46.0
some college	3	210	31.1	31.4	77.4
high school grad	4	131	19.4	19.6	97.0
some school	5	20	3.0	3.0	100.0
	-1	7	1.0	MISSING	
	TOTAL	676	100.0	100.0	



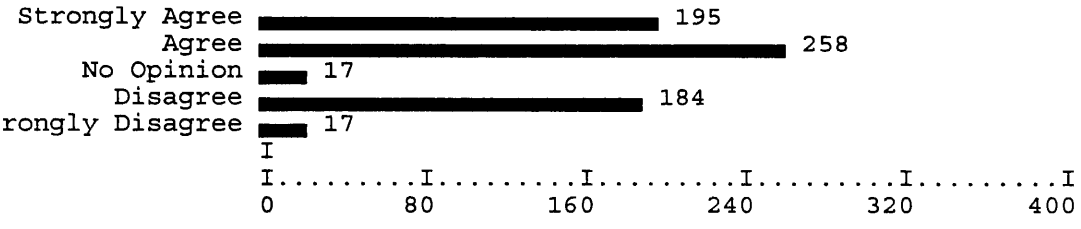
Mean	2.617	Median	3.000	Mode	3.000
Valid Cases	669	Missing Cases	7		

B. Opinion Survey

B1 Is Congestion a Problem?

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
Strongly Agree	1	195	28.8	29.1	29.1
Agree	2	258	38.2	38.5	67.5
No Opinion	3	17	2.5	2.5	70.0
Disagree	4	184	27.2	27.4	97.5
Strongly Disagree	5	17	2.5	2.5	100.0
No Response	-1	5	.7	MISSING	
	TOTAL	676	100.0	100.0	

B1 Congestion is Problem?



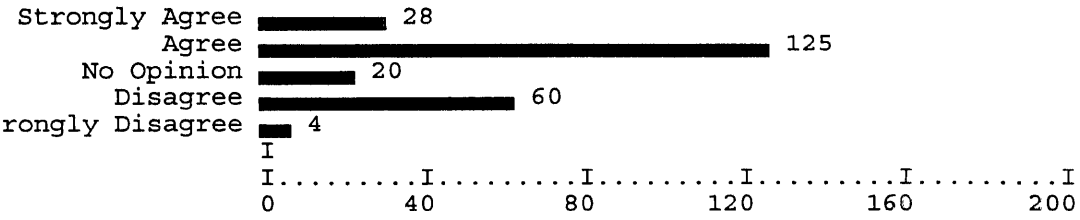
Mean	2.359	Median	2.000	Mode	2.000
Valid Cases	671	Missing Cases	5		

(Questions B2 thru B8 <u>not asked</u> of people who "agree" or "strongly agree" with Question B1)

B2 Congestion will be a problem in 5 years

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
Strongly Agree	1	28	4.1	11.8	11.8
Agree	2	125	18.5	52.7	64.6
No Opinion	3	20	3.0	8.4	73.0
Disagree	4	60	8.9	25.3	98.3
Strongly Disagree	5	4	.6	1.7	100.0
	-1	439	64.9	MISSING	
	TOTAL	676	100.0	100.0	

B2 Congestion will be a problem in 5 years

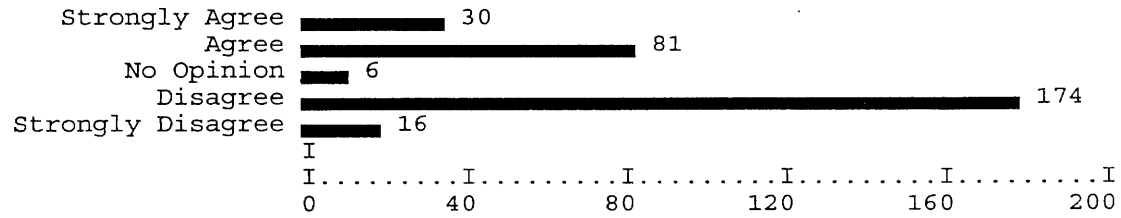


Mean	2.523	Median	2.000	Mode	2.000
Valid Cases	237	Missing Cases	439		

B3 Congestion makes me take fewer trips

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
Strongly Agree	1	30	4.4	9.8	9.8
Agree	2	81	12.0	26.4	36.2
No Opinion	3	6	.9	2.0	38.1
Disagree	4	174	25.7	56.7	94.8
Strongly Disagree	5	16	2.4	5.2	100.0
	-1	369	54.6	MISSING	
	TOTAL	676	100.0	100.0	

B3 Congestion makes me take fewer trips

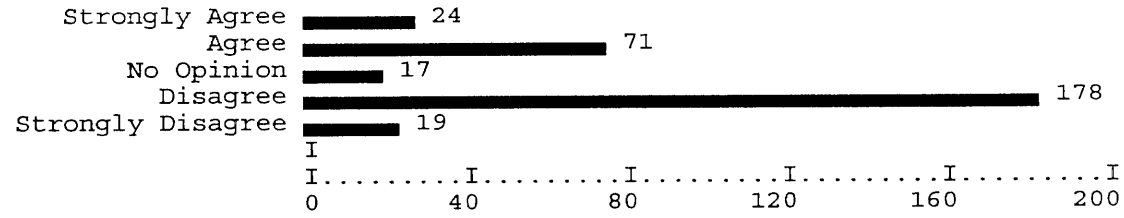


Mean	3.212	Median	4.000	Mode	4.000
Valid Cases	307	Missing Cases	369		

B4 Congestion makes me take shorter trips

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
Strongly Agree	1	24	3.6	7.8	7.8
Agree	2	71	10.5	23.0	30.7
No Opinion	3	17	2.5	5.5	36.2
Disagree	4	178	26.3	57.6	93.9
Strongly Disagree	5	19	2.8	6.1	100.0
	-1	367	54.3	MISSING	
	TOTAL	676	100.0	100.0	

B4 Congestion makes me take shorter trips

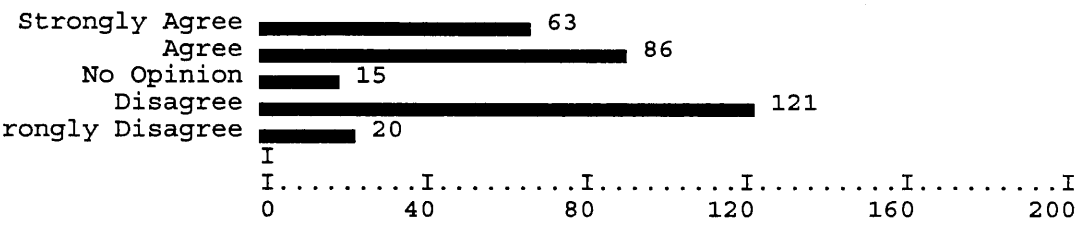


Mean	3.314	Median	4.000	Mode	4.000
Valid Cases	309	Missing Cases	367		

B5 Congestion affects where I live or work

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
Strongly Agree	1	63	9.3	20.7	20.7
Agree	2	86	12.7	28.2	48.9
No Opinion	3	15	2.2	4.9	53.8
Disagree	4	121	17.9	39.7	93.4
Strongly Disagree	5	20	3.0	6.6	100.0
	-1	371	54.9	MISSING	
	TOTAL	676	100.0	100.0	

B5 Congestion affects where I live or work

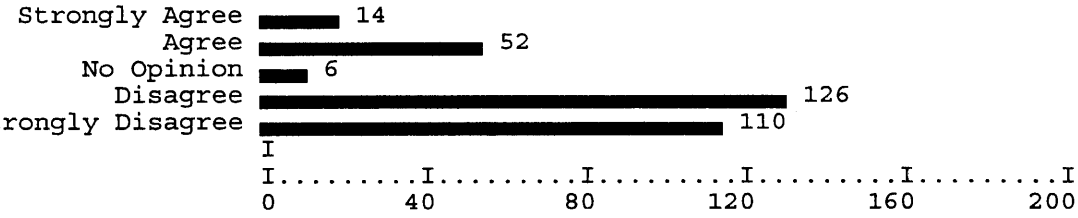


Mean	2.833	Median	3.000	Mode	4.000
Valid Cases	305	Missing Cases	371		

B6 I do not mind driving in congestion

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
Strongly Agree	1	14	2.1	4.5	4.5
Agree	2	52	7.7	16.9	21.4
No Opinion	3	6	.9	1.9	23.4
Disagree	4	126	18.6	40.9	64.3
Strongly Disagree	5	110	16.3	35.7	100.0
	-1	368	54.4	MISSING	
	TOTAL	676	100.0	100.0	

B6 I do not mind driving in congestion

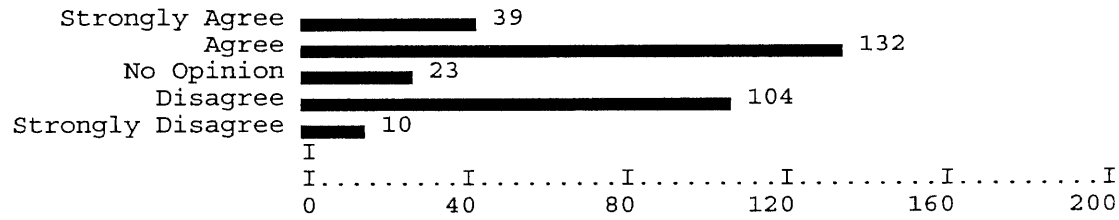


Mean	3.864	Median	4.000	Mode	4.000
Valid Cases	308	Missing Cases	368		

B7 Adding lanes will get rid of congestion

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
Strongly Agree	1	39	5.8	12.7	12.7
Agree	2	132	19.5	42.9	55.5
No Opinion	3	23	3.4	7.5	63.0
Disagree	4	104	15.4	33.8	96.8
Strongly Disagree	5	10	1.5	3.2	100.0
	-1	368	54.4	MISSING	
	TOTAL	676	100.0	100.0	

B7 Adding lanes will get rid of congestion

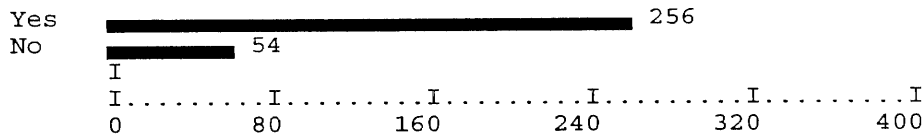


Mean	2.721	Median	2.000	Mode	2.000
Valid Cases	308	Missing Cases	368		

B8 Should more be done now about congestion

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
Yes	1	256	37.9	82.6	82.6
No	2	54	8.0	17.4	100.0
	-1	366	54.1	MISSING	
	TOTAL	676	100.0	100.0	

B8 Should more be done now about congestion



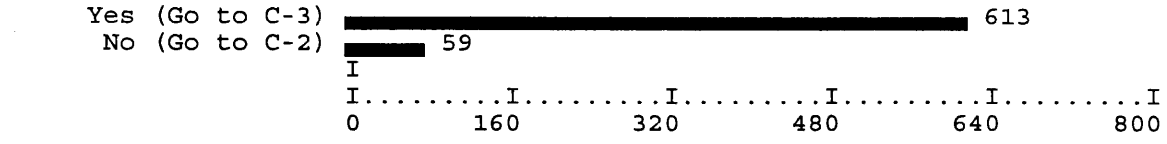
Mean	1.174	Median	1.000	Mode	1.000
Valid Cases	310	Missing Cases	366		

C. Travel Characteristics

C1 Did you leave home yesterday?

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
Yes (Go to C-3)	1	613	90.7	91.2	91.2
No (Go to C-2)	2	59	8.7	8.8	100.0
	-1	4	.6	MISSING	
	TOTAL	676	100.0	100.0	

C1 Did you leave home yesterday?



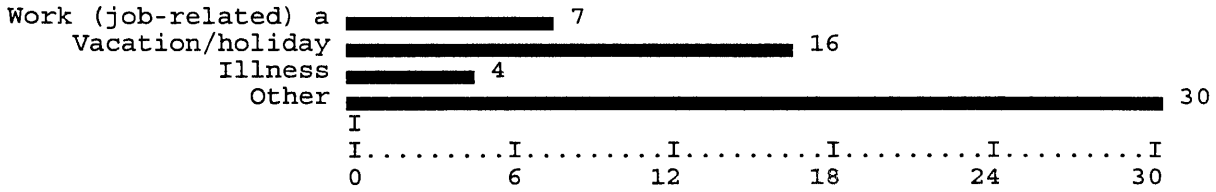
Mean 1.088 Median 1.000 Mode 1.000

Valid Cases 672 Missing Cases 4

C2 Why didn't you leave home?

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
Work at home	1	7	1.0	12.3	12.3
Vacation/holiday	2	16	2.4	28.1	40.4
Illness	3	4	.6	7.0	47.4
Other	4	30	4.4	52.6	100.0
	-1	619	91.6	MISSING	
	TOTAL	676	100.0	100.0	

C2 Why didn't you leave home?

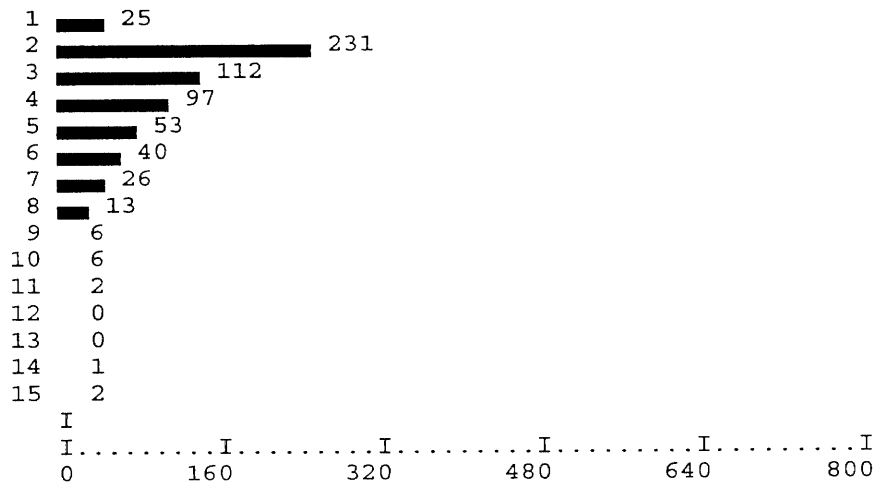


Mean 3.000 Median 4.000 Mode 4.000
Valid Cases 57 Missing Cases 619

TRIP Number of Trips Made Yesterday by Respondent

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
	0	62	9.2	9.2	9.2
	1	25	3.7	3.7	12.9
	2	231	34.2	34.2	47.1
	3	112	16.6	16.6	63.7
	4	97	14.3	14.3	78.0
	5	53	7.8	7.8	85.8
	6	40	5.9	5.9	91.7
	7	26	3.8	3.8	95.5
	8	13	1.9	1.9	97.4
	9	6	.9	.9	98.3
	10	6	.9	.9	99.2
	11	2	.3	.3	99.5
	12	0	.0	.0	99.5
	13	0	.0	.0	99.5
	14	1	.1	.1	99.6
	15	2	.3	.3	100.0
	TOTAL	676	100.0	100.0	

TRIP Number of Trips Made Yesterday by Respondent

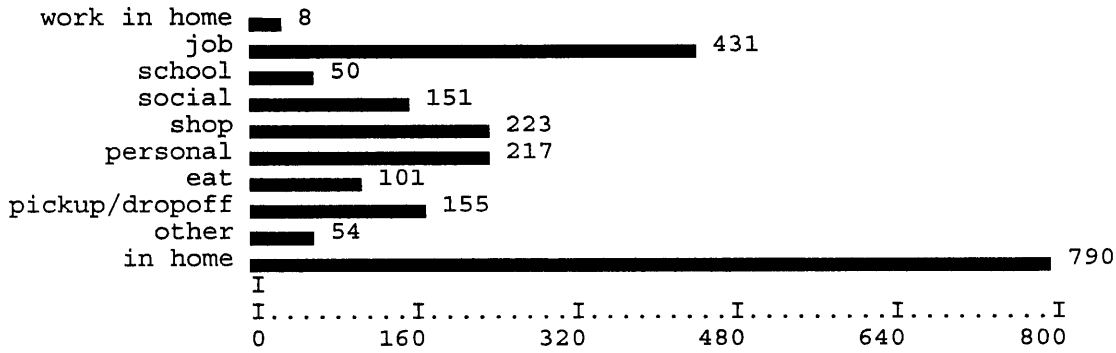


Mean	3.228	Median	2.000	Mode	2.000
Valid Cases	676	Missing Cases	0		

C3 Yesterday's Activities

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
work in home	1	8	.4	.4	.4
job	2	431	19.8	19.8	20.1
school	3	50	2.3	2.3	22.4
social	4	151	6.9	6.9	29.4
shop	5	223	10.2	10.2	39.6
personal	6	217	9.9	10.0	49.5
eat	7	101	4.6	4.6	54.2
pickup/dropoff	8	155	7.1	7.1	61.3
other	9	54	2.5	2.5	63.8
in home	12	790	36.2	36.2	100.0
	-1	2	.1	MISSING	
	TOTAL	2182	100.0	100.0	

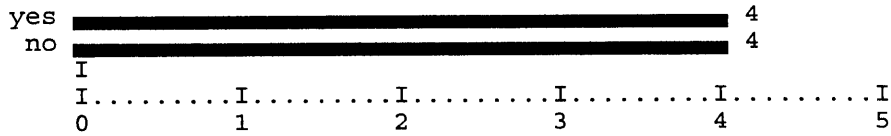
C3 Yesterday's Activities



Mean	7.318	Median	7.000	Mode	12.000
Std Dev	3.964				
Valid Cases	2180	Missing Cases	2		

C4 Of those who worked at home yesterday, do they usually work at home?

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
yes	1	4	.2	50.0	50.0
no	2	4	.2	50.0	100.0
	-1	2174	99.6	MISSING	
	TOTAL	2182	100.0	100.0	

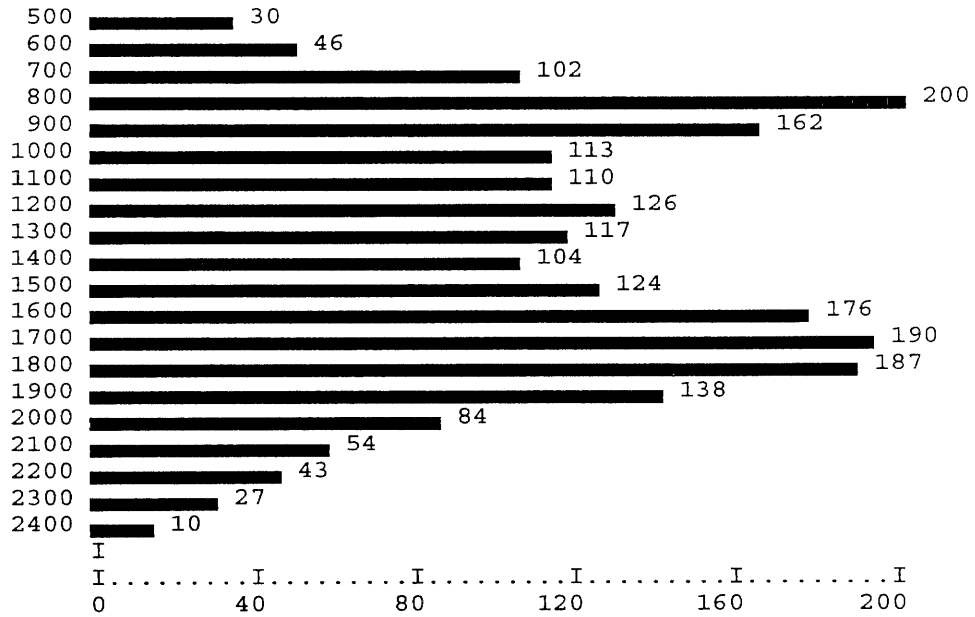


Mean	1.500	Median	1.500	Mode	1.000
Std Dev	.535	Maximum	2.000		
Valid Cases	8	Missing Cases	2174		

C5 departure time (hours:min)

Value Label	Hours	Frequency	Percent	Valid Percent	Cum Percent
Between Midnight and 5 AM	5:00	30	1.4	1.4	1.4
	6:00	46	2.1	2.1	3.5
	7:00	102	4.7	4.8	8.3
	8:00	200	9.2	9.3	17.6
	9:00	162	7.4	7.6	25.2
	10:00	113	5.2	5.3	30.5
	11:00	110	5.0	5.1	35.6
	12:00	126	5.8	5.9	41.5
	13:00	117	5.4	5.5	46.9
	14:00	104	4.8	4.9	51.8
	15:00	124	5.7	5.8	57.6
	16:00	176	8.1	8.2	65.8
	17:00	190	8.7	8.9	74.7
	18:00	187	8.6	8.7	83.4
	19:00	138	6.3	6.4	89.8
	20:00	84	3.8	3.9	93.7
	21:00	54	2.5	2.5	96.3
	22:00	43	2.0	2.0	98.3
	23:00	27	1.2	1.3	99.5
	24:00	10	.5	.5	100.0
	-1	39	1.8	MISSING	
	TOTAL	2182	100.0	100.0	

C5 departure time (hours:min)

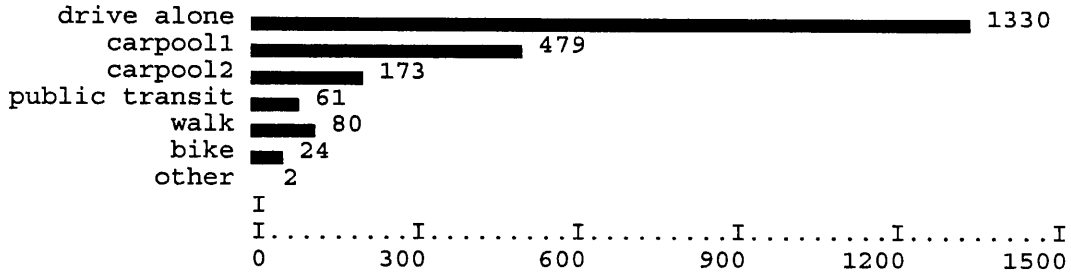


Mean	1378.535	Median	1400.000	Mode	800.000
Std Dev	461.047				
Valid Cases	2143	Missing Cases	39		

C6 mode of travel

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
drive alone	1	1330	61.0	61.9	61.9
carpool1	2	479	22.0	22.3	84.2
carpool2	3	173	7.9	8.1	92.2
public transit	4	61	2.8	2.8	95.1
walk	5	80	3.7	3.7	98.8
bike	6	24	1.1	1.1	99.9
other	7	2	.1	.1	100.0
	-1	33	1.5	MISSING	
	TOTAL	2182	100.0	100.0	

C6 mode of travel



Mean	1.679	Median	1.000	Mode	1.000
Std Dev	1.117				
Valid Cases	2149	Missing Cases	33		

C7 trip time (minutes)

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
	1	12	.5	.6	.6
	2	47	2.2	2.2	2.7
	3	39	1.8	1.8	4.6
	4	20	.9	.9	5.5
	5	298	13.7	13.9	19.4
	6	11	.5	.5	19.9
	7	39	1.8	1.8	21.7
	8	23	1.1	1.1	22.8
	9	1	.0	.0	22.8
	10	400	18.3	18.6	41.4
	12	19	.9	.9	42.3
	13	6	.3	.3	42.6
	14	2	.1	.1	42.7
	15	346	15.9	16.1	58.8
	16	3	.1	.1	58.9
	17	2	.1	.1	59.0
	18	5	.2	.2	59.2
	20	276	12.6	12.8	72.1
	22	2	.1	.1	72.2
	23	2	.1	.1	72.3
	25	99	4.5	4.6	76.9
	27	1	.0	.0	76.9
	30	219	10.0	10.2	87.1
	33	1	.0	.0	87.2
	35	37	1.7	1.7	88.9
	40	61	2.8	2.8	91.7
	45	68	3.1	3.2	94.9
	50	13	.6	.6	95.5
	60	38	1.7	1.8	97.3
	65	1	.0	.0	97.3
	74	1	.0	.0	97.3
	75	12	.5	.6	97.9
	80	2	.1	.1	98.0
	85	1	.0	.0	98.0
	90	23	1.1	1.1	99.1
	105	2	.1	.1	99.2
	120	9	.4	.4	99.6
	150	1	.0	.0	99.7
	180	2	.1	.1	99.8
	210	1	.0	.0	99.8
	240	2	.1	.1	99.9
	343	1	.0	.0	100.0
	360	1	.0	.0	100.0
	-1	33	1.5	MISSING	
	TOTAL	2182	100.0	100.0	

Mean	20.013	Median	15.000	Mode	10.000
Std Dev	21.883	Maximum	360.000		
Valid Cases	2149	Missing Cases	33		

Total Daily Time Spent Traveling = 43,008 minutes
Total Persons Responding = 672
Average daily time traveling per person = 64.0 minutes

C8 trip length (miles)

Value	Frequency	Percent	Valid Percent	Cum Percent
0	2	.1	.1	.1
1	263	12.1	12.4	12.5
2	229	10.5	10.8	23.4
3	205	9.4	9.7	33.1
4	107	4.9	5.1	38.1
5	235	10.8	11.1	49.3
6	64	2.9	3.0	52.3
7	89	4.1	4.2	56.5
8	70	3.2	3.3	59.8
9	15	.7	.7	60.5
10	172	7.9	8.1	68.7
11	14	.6	.7	69.3
12	57	2.6	2.7	72.0
13	21	1.0	1.0	73.0
14	20	.9	.9	74.0
15	142	6.5	6.7	80.7
16	12	.5	.6	81.3
17	6	.3	.3	81.5
18	16	.7	.8	82.3
20	105	4.8	5.0	87.3
22	5	.2	.2	87.5
23	3	.1	.1	87.6
24	4	.2	.2	87.8
25	77	3.5	3.6	91.5
26	2	.1	.1	91.6
27	6	.3	.3	91.9
28	8	.4	.4	92.2
30	45	2.1	2.1	94.4
31	1	.0	.0	94.4
32	5	.2	.2	94.7
33	2	.1	.1	94.7
35	17	.8	.8	95.6
37	4	.2	.2	95.7
38	4	.2	.2	95.9
39	2	.1	.1	96.0
40	15	.7	.7	96.7
45	14	.6	.7	97.4
47	2	.1	.1	97.5
49	2	.1	.1	97.6
50	14	.6	.7	98.2
54	2	.1	.1	98.3
55	1	.0	.0	98.4
57	2	.1	.1	98.5
60	7	.3	.3	98.8
61	1	.0	.0	98.9
63	1	.0	.0	98.9
65	2	.1	.1	99.0
70	3	.1	.1	99.1
80	2	.1	.1	99.2
85	1	.0	.0	99.3
90	1	.0	.0	99.3
97	1	.0	.0	99.4
100	2	.1	.1	99.5
110	1	.0	.0	99.5

C8 trip length (miles)

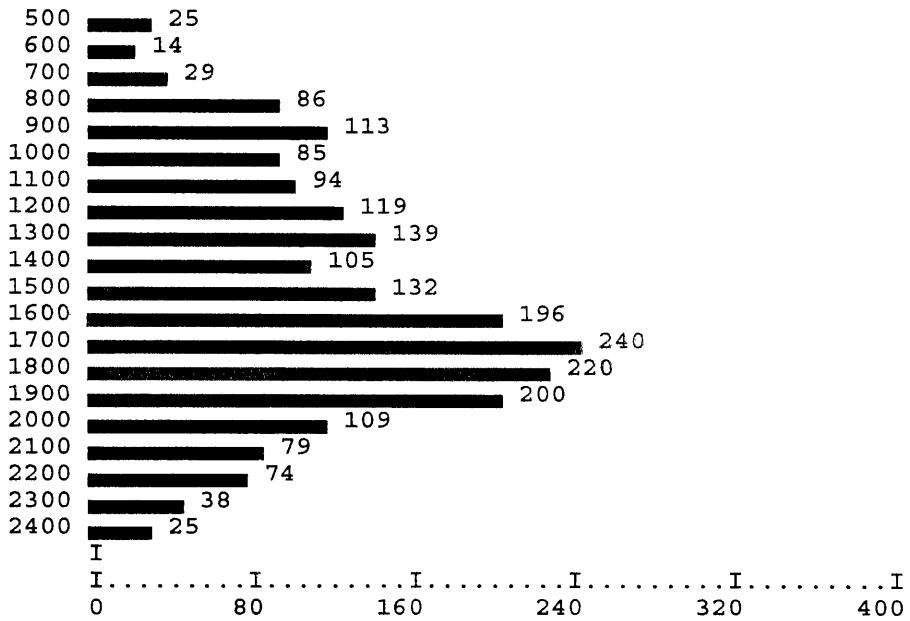
150	4	.2	.2	99.7
180	2	.1	.1	99.8
225	2	.1	.1	99.9
280	1	.0	.0	100.0
300	1	.0	.0	100.0
-1	69	3.2	MISSING	
	---	---	---	
TOTAL	2182	100.0	100.0	

Mean	11.262	Median	6.000	Mode	1.000
Std Dev	18.020				
Valid Cases	2113	Missing Cases	69		

C9 Finish time of activity (hr:min)

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
Between Midnight and 5 AM	5:00	25	1.1	1.2	1.2
	6:00	14	.6	.7	1.8
	7:00	29	1.3	1.4	3.2
	8:00	86	3.9	4.1	7.3
	9:00	113	5.2	5.3	12.6
	10:00	85	3.9	4.0	16.6
	11:00	94	4.3	4.4	21.0
	12:00	119	5.5	5.6	26.6
	13:00	139	6.4	6.6	33.2
	14:00	105	4.8	4.9	38.1
	15:00	132	6.0	6.2	44.3
	16:00	196	9.0	9.2	53.6
	17:00	240	11.0	11.3	64.9
	18:00	220	10.1	10.4	75.3
	19:00	200	9.2	9.4	84.7
	20:00	109	5.0	5.1	89.8
	21:00	79	3.6	3.7	93.5
	22:00	74	3.4	3.5	97.0
	23:00	38	1.7	1.8	98.8
	24:00	25	1.1	1.2	100.0
	-1	60	2.7	MISSING	
	TOTAL	2182	100.0	100.0	

C9 Finish time of activity

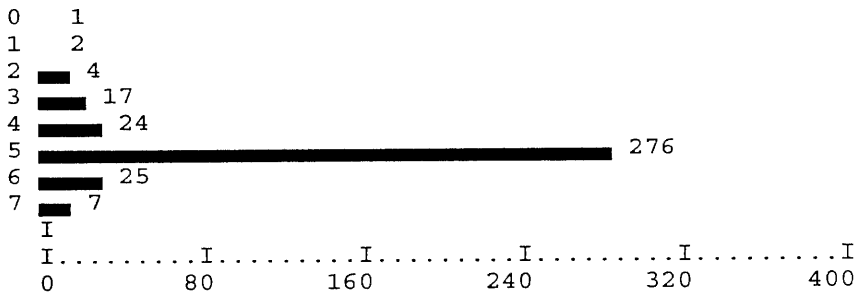


Mean	1536.428	Median	1600.000	Mode	1700.000
Std Dev	427.923				
Valid Cases	2122	Missing Cases	60		

C10 Usual work days/week

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
	0	1	.0	.3	.3
	1	2	.1	.6	.8
	2	4	.2	1.1	2.0
	3	17	.8	4.8	6.7
	4	24	1.1	6.7	13.5
	5	276	12.6	77.5	91.0
	6	25	1.1	7.0	98.0
	7	7	.3	2.0	100.0
	-1	1826	83.7	MISSING	
	TOTAL	2182	100.0	100.0	

C10 Usual work days/week

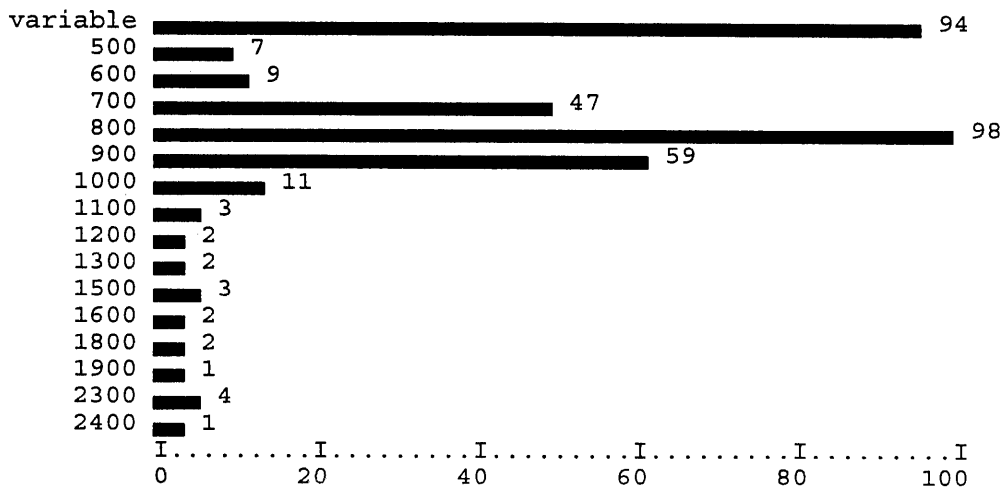


Mean	4.876	Median	5.000	Mode	5.000
Std Dev	.809				
Valid Cases	356	Missing Cases	1826		

C11 Usual work start time (hrs:min)

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
Start time is Variable:	0	94	4.3	27.2	27.2
Between Midnight and 5 AM	5:00	7	.3	2.0	29.3
	6:00	9	.4	2.6	31.9
	7:00	47	2.2	13.6	45.5
	8:00	98	4.5	28.4	73.9
	9:00	59	2.7	17.1	91.0
	10:00	11	.5	3.2	94.2
	11:00	3	.1	.9	95.1
	12:00	2	.1	.6	95.7
	13:00	2	.1	.6	96.2
	15:00	3	.1	.9	97.1
	16:00	2	.1	.6	97.7
	18:00	2	.1	.6	98.3
	19:00	1	.0	.3	98.6
	23:00	4	.2	1.2	99.7
	24:00	1	.0	.3	100.0
	-1	1837	84.2	MISSING	
	TOTAL	2182	100.0	100.0	

C11 Usual work start time (hrs:min)



Mean	630.145	Median	800.000	Mode	800.000
Std Dev	455.287				
Valid Cases	345	Missing Cases	1837		

C12 Do you have to be at work at start time?

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
yes	1	189	8.7	57.1	57.1
no	2	142	6.5	42.9	100.0
	-1	1851	84.8	MISSING	
	TOTAL	2182	100.0	100.0	

Mean	1.429	Median	1.000	Mode	1.000
Std Dev	.496				
Valid Cases	331	Missing Cases	1851		

C13 How much earlier/later can you arrive at work? (min)

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
	-240	1	.0	.9	.9
	-60	11	.5	9.4	10.3
	-30	2	.1	1.7	12.0
	0	2	.1	1.7	13.7
	1	2	.1	1.7	15.4
	2	2	.1	1.7	17.1
	10	2	.1	1.7	18.8
	15	3	.1	2.6	21.4
	20	1	.0	.9	22.2
	24	2	.1	1.7	23.9
	30	16	.7	13.7	37.6
	45	1	.0	.9	38.5
	60	32	1.5	27.4	65.8
	75	2	.1	1.7	67.5
	90	1	.0	.9	68.4
	120	15	.7	12.8	81.2
	150	2	.1	1.7	82.9
	180	5	.2	4.3	87.2
	240	6	.3	5.1	92.3
	300	1	.0	.9	93.2
	360	1	.0	.9	94.0
	480	2	.1	1.7	95.7
	720	1	.0	.9	96.6
	1200	4	.2	3.4	100.0
	-1	2065	94.6	MISSING	
	TOTAL	2182	100.0	100.0	

Valid Cases 117 Missing Cases 2065

C14 For those taking a passenger, do you usually pick up drop off child on way to work?

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
yes	1	56	2.6	64.4	64.4
sometimes	2	15	.7	17.2	81.6
never	3	16	.7	18.4	100.0
	-1	2095	96.0	MISSING	
	TOTAL	2182	100.0	100.0	

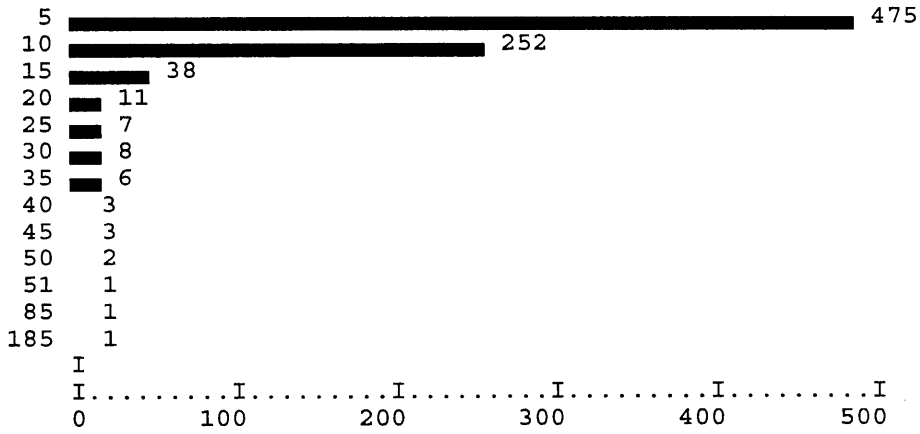
Mean	1.540	Median	1.000	Mode	1.000
Std Dev	.790				

D. Effects of Increased Capacity

TMCHG The amount of time savings (less time traveling) asked for questions D1-D6.

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
	5	475	21.8	58.8	58.8
	10	252	11.5	31.2	90.0
	15	38	1.7	4.7	94.7
	20	11	.5	1.4	96.0
	25	7	.3	.9	96.9
	30	8	.4	1.0	97.9
	35	6	.3	.7	98.6
	40	3	.1	.4	99.0
	45	3	.1	.4	99.4
	50	2	.1	.2	99.6
	51	1	.0	.1	99.8
	85	1	.0	.1	99.9
	185	1	.0	.1	100.0
Missing and Not Asked:	-1	1374	63.0	MISSING	
	TOTAL	2182	100.0	100.0	

TMCHG Time savings asked for questions d1-d6 (min)

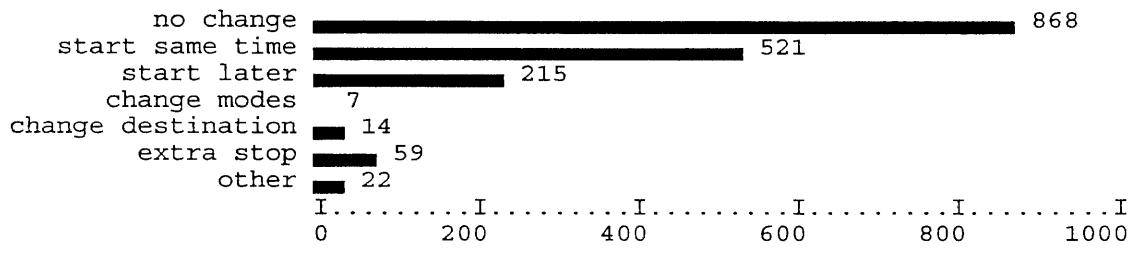


Mean	8.646	Median	5.000	Mode	5.000
Std Dev	9.211	Maximum	185.000		
Valid Cases	808	Missing Cases	1374		

D1 Reaction to time savings of 5 minutes or more.

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
no change	1	868	39.8	50.9	50.9
start same time	2	521	23.9	30.5	81.4
start later	3	215	9.9	12.6	94.0
change modes	4	7	.3	.4	94.4
change destination	5	14	.6	.8	95.3
extra stop	6	59	2.7	3.5	98.7
other	7	22	1.0	1.3	100.0
	-1	476	21.8	MISSING	
	TOTAL	2182	100.0	100.0	

D1 Reaction to 5 minute or more time saving

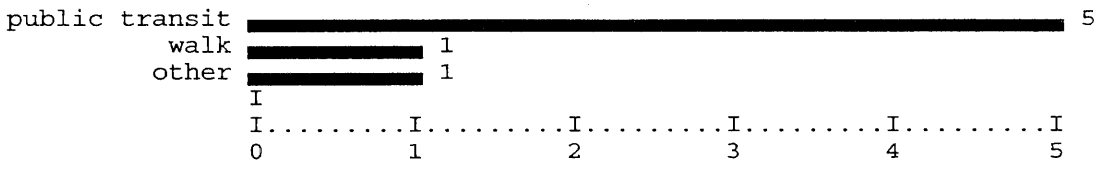


Mean	1.853	Median	1.000	Mode	1.000
Std Dev	1.257				
Valid Cases	1706	Missing Cases	476		

D2 If they would have switched modes, the mode they would switch to:

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
public transit	4	5	.2	71.4	71.4
walk	5	1	.0	14.3	85.7
other	7	1	.0	14.3	100.0
	-1	2175	99.7	MISSING	
	TOTAL	2182	100.0	100.0	

D2 If they would have switched modes, the mode they would switch to:

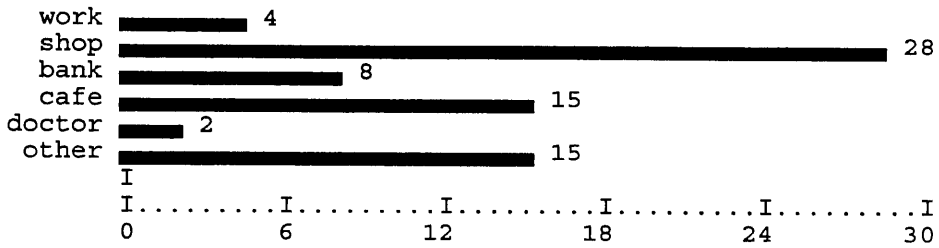


Mean	4.571	Median	4.000	Mode	4.000
Std Dev	1.134	Maximum	7.000		
Valid Cases	7	Missing Cases	2175		

D3 Where would you have stopped?

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
work	2	4	.2	5.6	5.6
shop	3	28	1.3	38.9	44.4
bank	4	8	.4	11.1	55.6
cafe	5	15	.7	20.8	76.4
doctor	6	2	.1	2.8	79.2
other	10	15	.7	20.8	100.0
	-1	2110	96.7	MISSING	
		---	---	---	
	TOTAL	2182	100.0	100.0	

D3 Where would you have stopped?



Mean	5.014	Median	4.000	Mode	3.000
Std Dev	2.740	Maximum	10.000		
Valid Cases	72	Missing Cases	2110		

D4 How long would you have stayed there? (minutes)

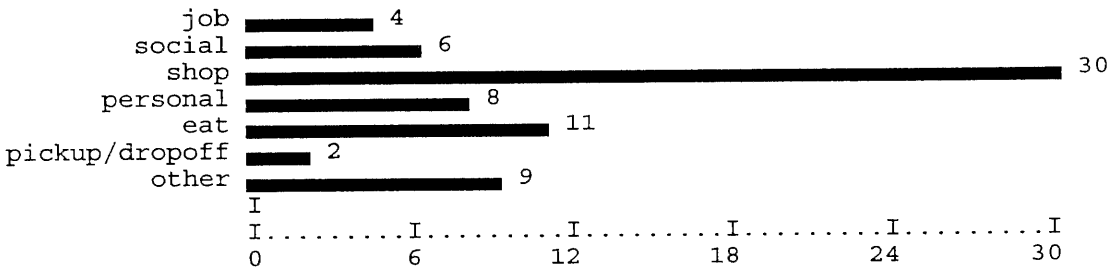
Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
	2	1	.0	1.4	1.4
	5	7	.3	10.1	11.6
	10	14	.6	20.3	31.9
	12	1	.0	1.4	33.3
	15	8	.4	11.6	44.9
	20	9	.4	13.0	58.0
	30	19	.9	27.5	85.5
	45	2	.1	2.9	88.4
	60	5	.2	7.2	95.7
	120	3	.1	4.3	100.0
	-1	2113	96.8	MISSING	
		---	---	---	
	TOTAL	2182	100.0	100.0	

Mean	26.217	Median	20.000	Mode	30.000
Std Dev	24.866	Maximum	120.000		
Valid Cases	69	Missing Cases	2113		

D5 What would have been the purpose of the extra stop?

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
job	2	4	.2	5.7	5.7
social	4	6	.3	8.6	14.3
shop	5	30	1.4	42.9	57.1
personal	6	8	.4	11.4	68.6
eat	7	11	.5	15.7	84.3
pickup/dropoff	8	2	.1	2.9	87.1
other	9	9	.4	12.9	100.0
	-1	2112	96.8	MISSING	
	TOTAL	2182	100.0	100.0	

D5 What would have been the purpose of the



Mean	5.771	Median	5.000	Mode	5.000
Std Dev	1.763	Maximum	9.000		
Valid Cases	70	Missing Cases	2112		

D6 Is this trip currently made by another household member?

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
yes	1	16	.7	22.2	22.2
no	2	56	2.6	77.8	100.0
	-1	2110	96.7	MISSING	
	TOTAL	2182	100.0	100.0	

Mean	1.778	Median	2.000	Mode	2.000
Std Dev	.419	Maximum	2.000		
Valid Cases	72	Missing Cases	2110		

Crosstabulation: D1 By LESS — Reaction to 5 minute or more time saving time savings (min) asked D1 thru D-6

Reaction: D1	Count / Col Pct	Time Savings Asked (min): 5	10	15	20+	Row Total
no change	1	212 46.5	123 49.6	13 35.1	16 38.1	364 46.5
start same time	2	159 34.9	84 33.9	15 40.5	13 31.0	271 34.6
start later	3	59 12.9	31 12.5	6 16.2	10 23.8	106 13.5
change modes	4	2 .4	1 .4	1 2.7	1 2.4	5 .6
change destinati	5	4 .9				4 .5
extra stop	6	13 2.9	7 2.8	2 5.4	2 4.8	24 3.1
other	7	7 1.5	2 .8			9 1.1
	Column Total	456 58.2	248 31.7	37 4.7	42 5.4	783 100.0

Number of Missing Observations = 1399

Crosstabulation: D1 By PLESS — Reaction to 5 minute or more time saving time savings (%) asked D1 thru D-6

Time Savings Asked as Percent of Trip Time:

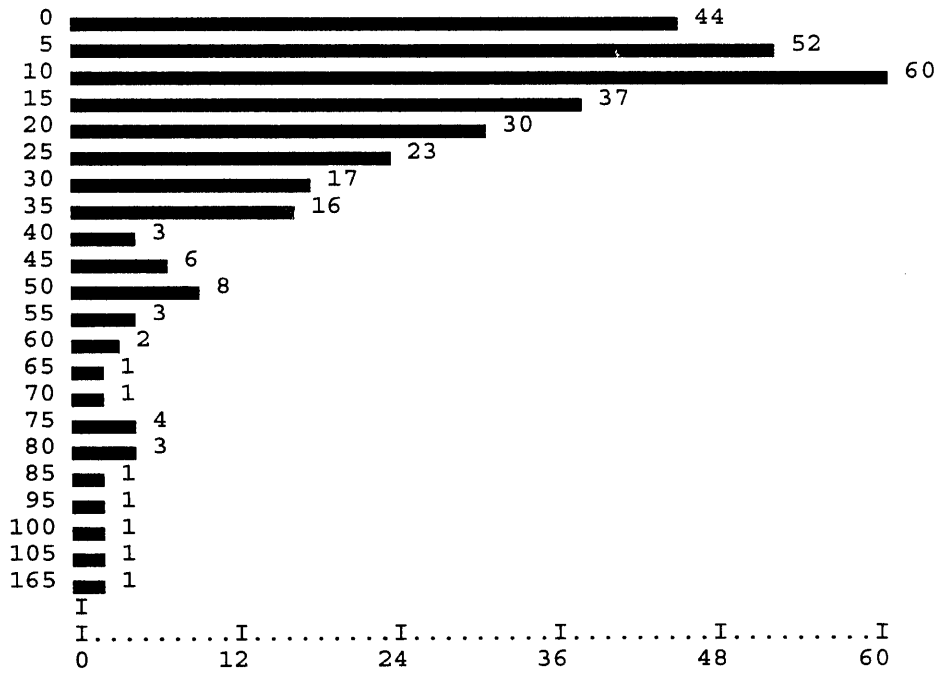
PLESS-->	Count / Col Pct	0 to 25%	25%to50%	50%to75%	75to100%	Row Total
D1 no change	1	70 46.7	277 45.7	10 58.8	7 70.0	364 46.5
start same time	2	52 34.7	213 35.1	5 29.4	1 10.0	271 34.6
start later	3	20 13.3	83 13.7	1 5.9	2 20.0	106 13.5
change modes	4	1 .7	4 .7			5 .6
change destinati	5	1 .7	3 .5			4 .5
extra stop	6	6 4.0	17 2.8	1 5.9		24 3.1
other	7		9 1.5			9 1.1
	Column Total	150 19.2	606 77.4	17 2.2	10 1.3	783 100.0

Number of Missing Observations = 1399

Less time spent traveling all day Yesterday (minutes) (asked for Questions D-8 to D-13).

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
	0	44	6.5	14.0	14.0
	5	52	7.7	16.5	30.5
	10	60	8.9	19.0	49.5
	15	37	5.5	11.7	61.3
	20	30	4.4	9.5	70.8
	25	23	3.4	7.3	78.1
	30	17	2.5	5.4	83.5
	35	16	2.4	5.1	88.6
	40	3	.4	1.0	89.5
	45	6	.9	1.9	91.4
	50	8	1.2	2.5	94.0
	55	3	.4	1.0	94.9
	60	2	.3	.6	95.6
	65	1	.1	.3	95.9
	70	1	.1	.3	96.2
	75	4	.6	1.3	97.5
	80	3	.4	1.0	98.4
	85	1	.1	.3	98.7
	95	1	.1	.3	99.0
	100	1	.1	.3	99.4
	105	1	.1	.3	99.7
	165	1	.1	.3	100.0
	-1	361	53.4	MISSING	
	TOTAL	676	100.0	100.0	

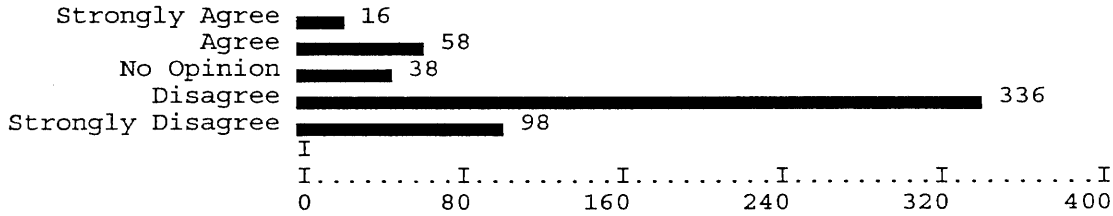
LESS Less time spent traveling in minute.



Mean	18.921	Median	15.000	Mode	10.000
Valid Cases	315	Missing Cases	361		

D8 I would move closer to where I work.

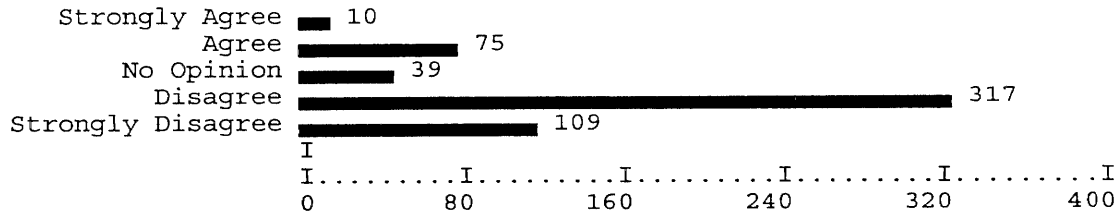
Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
Strongly Agree	1	16	2.4	2.9	2.9
Agree	2	58	8.6	10.6	13.6
No Opinion	3	38	5.6	7.0	20.5
Disagree	4	336	49.7	61.5	82.1
Strongly Disagree	5	98	14.5	17.9	100.0
No Response	-1	130	19.2	MISSING	
	TOTAL	676	100.0	100.0	



Mean	3.810	Median	4.000	Mode	4.000
Valid Cases	546	Missing Cases	130		

D9 I would move farther away from work.

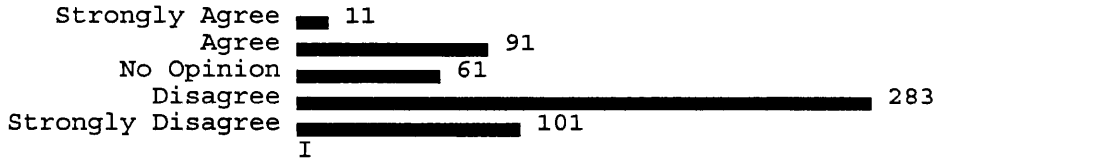
Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
Strongly Agree	1	10	1.5	1.8	1.8
Agree	2	75	11.1	13.6	15.5
No Opinion	3	39	5.8	7.1	22.5
Disagree	4	317	46.9	57.6	80.2
Strongly Disagree	5	109	16.1	19.8	100.0
No Response	-1	126	18.6	MISSING	
	TOTAL	676	100.0	100.0	



Mean	3.800	Median	4.000	Mode	4.000
Valid Cases	550	Missing Cases	126		

D10 I would work at a different place.

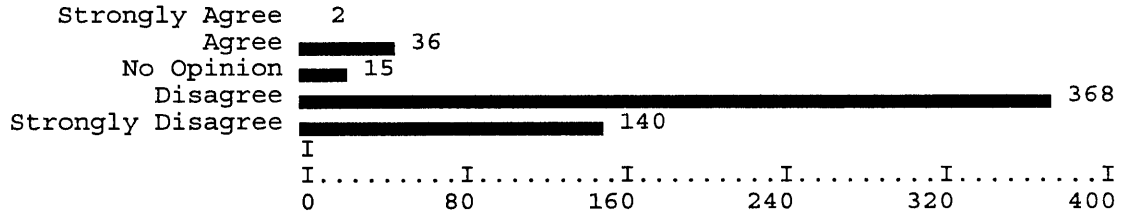
Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
Strongly Agree	1	11	1.6	2.0	2.0
Agree	2	91	13.5	16.6	18.6
No Opinion	3	61	9.0	11.2	29.8
Disagree	4	283	41.9	51.7	81.5
Strongly Disagree	5	101	14.9	18.5	100.0
No Response	-1	129	19.1	MISSING	
	TOTAL	676	100.0	100.0	



Mean	3.680	Median	4.000	Mode	4.000
Valid Cases	547	Missing Cases	129		

D11 I would get an additional car or cars.

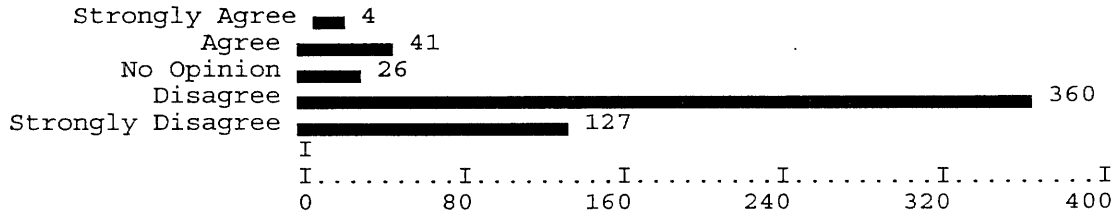
Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
Strongly Agree	1	2	.3	.4	.4
Agree	2	36	5.3	6.4	6.8
No Opinion	3	15	2.2	2.7	9.4
Disagree	4	368	54.4	65.6	75.0
Strongly Disagree	5	140	20.7	25.0	100.0
No Response	-1	115	17.0	MISSING	
	TOTAL	676	100.0	100.0	



Mean	4.084	Median	4.000	Mode	4.000
Valid Cases	561	Missing Cases	115		

D12 I would get rid of one or more cars I already own.

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
Strongly Agree	1	4	.6	.7	.7
Agree	2	41	6.1	7.3	8.1
No Opinion	3	26	3.8	4.7	12.7
Disagree	4	360	53.3	64.5	77.2
Strongly Disagree	5	127	18.8	22.8	100.0
No Response	-1	118	17.5	MISSING	
	TOTAL	676	100.0	100.0	



Mean	4.013	Median	4.000	Mode	4.000
Valid Cases	558	Missing Cases	118		

D13 Are there any other changes you might make?

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
Yes	1	158	23.4	28.6	28.6
No	2	394	58.3	71.4	100.0
	-1	124	18.3	MISSING	
	TOTAL	676	100.0	100.0	

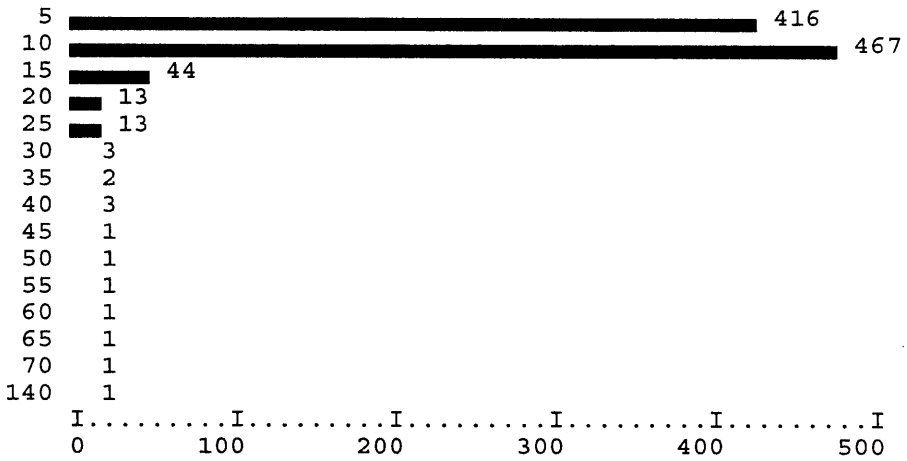
Mean	1.714	Median	2.000	Mode	2.000
Valid Cases	552	Missing Cases	124		

E. Effects of Increased Congestion

TMCHG The amount of time loss (extra time traveling) asked for questions E1-E6.

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
	5	416	19.1	43.0	43.0
	10	467	21.4	48.2	91.2
	15	44	2.0	4.5	95.8
	20	13	.6	1.3	97.1
	25	13	.6	1.3	98.5
	30	3	.1	.3	98.8
	35	2	.1	.2	99.0
	40	3	.1	.3	99.3
	45	1	.0	.1	99.4
	50	1	.0	.1	99.5
	55	1	.0	.1	99.6
	60	1	.0	.1	99.7
	65	1	.0	.1	99.8
	70	1	.0	.1	99.9
	140	1	.0	.1	100.0
	-1	1214	55.6	MISSING	
		---	---	---	
	TOTAL	2182	100.0	100.0	

TMCHG Longer Trip Time asked for questions e1-e6

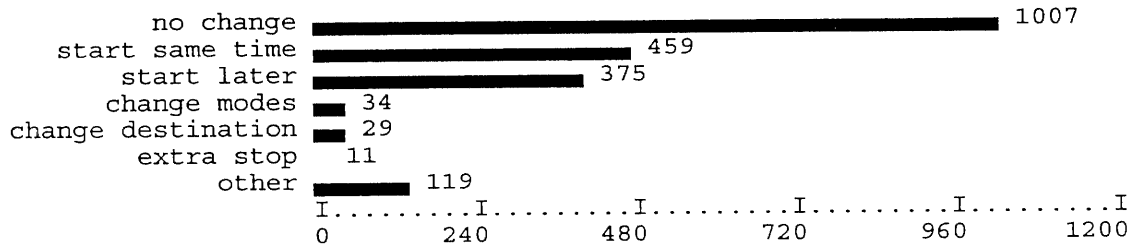


Mean	9.050	Median	10.000	Mode	10.000
Std Dev	7.253	Maximum	140.000		
Valid Cases	968	Missing Cases	1214		

E1 Reaction to 5 minute or more time loss (increased congestion)

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
no change	1	1007	46.2	49.5	49.5
start same time	2	459	21.0	22.6	72.1
start later	3	375	17.2	18.4	90.5
change modes	4	34	1.6	1.7	92.2
change destination	5	29	1.3	1.4	93.6
extra stop	6	11	.5	.5	94.1
other	7	119	5.5	5.9	100.0
	-1	148	6.8	MISSING	
	TOTAL	2182	100.0	100.0	

E1 Reaction to 5 minute or more time loss

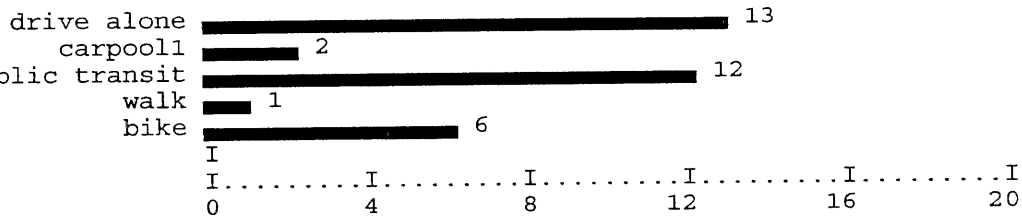


Mean	2.080	Median	2.000	Mode	1.000
Std Dev	1.555	Valid Cases	2034	Missing Cases	148

E2 Would have switched mode of travel to:

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
drive alone	1	13	.6	38.2	38.2
carpool w/household member	2	2	.1	5.9	44.1
public transit	4	12	.5	35.3	79.4
walk	5	1	.0	2.9	82.4
bike	6	6	.3	17.6	100.0
	-1	2148	98.4	MISSING	
	TOTAL	2182	100.0	100.0	

E2 Would have switched mode of travel to:

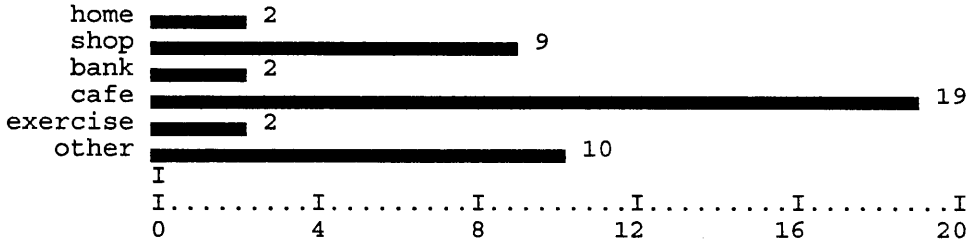


Mean	3.118	Median	4.000	Mode	1.000
Std Dev	1.935	Maximum	6.000		
Valid Cases	34	Missing Cases	2148		

E3 Where would you have stopped?

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
home	1	2	.1	4.5	4.5
shop	3	9	.4	20.5	25.0
bank	4	2	.1	4.5	29.5
cafe	5	19	.9	43.2	72.7
exercise	8	2	.1	4.5	77.3
other	10	10	.5	22.7	100.0
	-1	2138	98.0	MISSING	
		---	---	---	
	TOTAL	2182	100.0	100.0	

E3 Where would you have stopped?

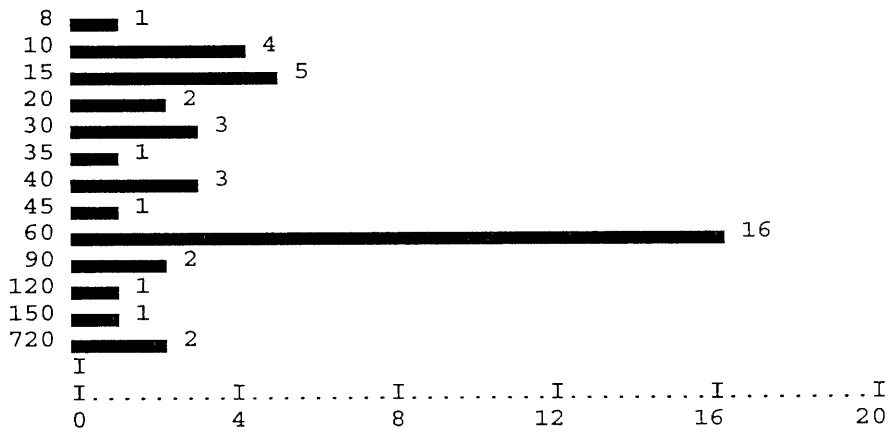


Mean	5.636	Median	5.000	Mode	5.000
Std Dev	2.729	Maximum	10.000		
Valid Cases	44	Missing Cases	2138		

E4 How long would you have stayed there? (minutes)

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
	8	1	.0	2.4	2.4
	10	4	.2	9.5	11.9
	15	5	.2	11.9	23.8
	20	2	.1	4.8	28.6
	30	3	.1	7.1	35.7
	35	1	.0	2.4	38.1
	40	3	.1	7.1	45.2
	45	1	.0	2.4	47.6
	60	16	.7	38.1	85.7
	90	2	.1	4.8	90.5
	120	1	.0	2.4	92.9
	150	1	.0	2.4	95.2
	720	2	.1	4.8	100.0
	-1	2140	98.1	MISSING	
		---	---	---	
	TOTAL	2182	100.0	100.0	

E4 How long would you have stayed there? (m



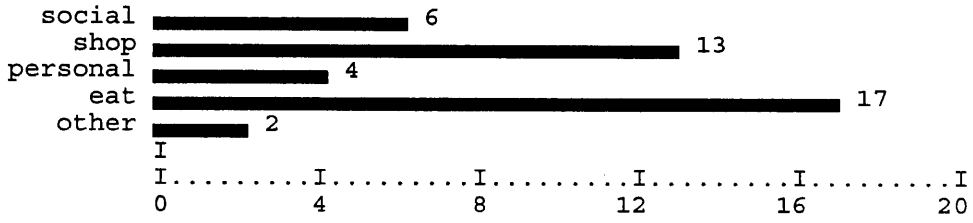
Mean	78.643	Median	60.000	Mode	60.000
Std Dev	148.232	Maximum	720.000		

Valid Cases 42 Missing Cases 2140

E5 What would have been the purpose of the new trip?

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
social	4	6	.3	14.3	14.3
shop	5	13	.6	31.0	45.2
personal	6	4	.2	9.5	54.8
eat	7	17	.8	40.5	95.2
other	9	2	.1	4.8	100.0
	-1	2140	98.1	MISSING	
	TOTAL	2182	100.0	100.0	

E5 What would have been the purpose of the new trip?



E5 What would have been the purpose of the

Mean	5.952	Median	6.000	Mode	7.000
Std Dev	1.324	Maximum	9.000		
Valid Cases	42	Missing Cases	2140		

E6 Is this trip currently made by another household member?

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
yes	1	6	.3	14.0	14.0
no	2	37	1.7	86.0	100.0
	-1	2139	98.0	MISSING	
	TOTAL	2182	100.0	100.0	

Mean	1.860	Median	2.000	Mode	2.000
Std Dev	.351	Maximum	2.000		
Valid Cases	43	Missing Cases	2139		

Crosstabulation: E1 By MORE — Reaction to 5 minute or more longer trip; Longer trip time (min) asked E1 thru E-6

MORE--> / E1	Count / Col Pct	Additional Minutes 5.00	10.00	15.00	20+	Row Total
no change	1	220 53.5	192 41.3	17 38.6	10 24.4	439 45.7
start same time	2	91 22.1	144 31.0	17 38.6	15 36.6	267 27.8
start later	3	71 17.3	82 17.6	4 9.1	10 24.4	167 17.4
change modes	4	5 1.2	7 1.5	2 4.5	1 2.4	15 1.6
change destinati	5	4 1.0	2 .4	1 2.3		7 .7
extra stop	6	1 .2	6 1.3			7 .7
other	7	19 4.6	32 6.9	3 6.8	5 12.2	59 6.1
	Column Total	411 42.8	465 48.4	44 4.6	41 4.3	961 100.0

Number of Missing Observations = 1221

More time spent traveling Yesterday (minutes) (asked for Questions E-8 and higher).

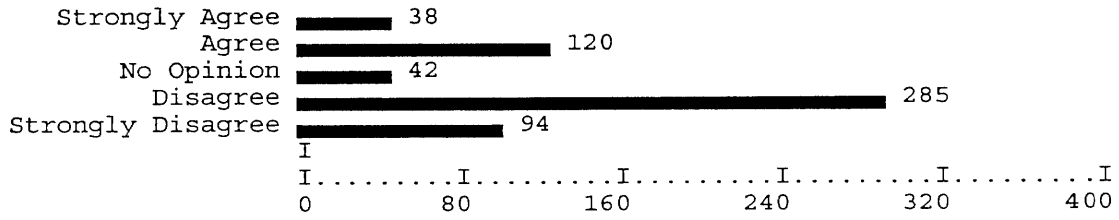
Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
	0	31	4.6	9.8	9.8
	5	25	3.7	7.9	17.8
	10	27	4.0	8.6	26.3
	15	31	4.6	9.8	36.2
	20	34	5.0	10.8	47.0
	25	27	4.0	8.6	55.6
	30	31	4.6	9.8	65.4
	35	22	3.3	7.0	72.4
	40	11	1.6	3.5	75.9
	45	9	1.3	2.9	78.7
	50	12	1.8	3.8	82.5
	55	5	.7	1.6	84.1
	60	7	1.0	2.2	86.3
	65	5	.7	1.6	87.9
	70	7	1.0	2.2	90.2
	75	3	.4	1.0	91.1
	80	1	.1	.3	91.4
	85	3	.4	1.0	92.4
	90	4	.6	1.3	93.7
	95	2	.3	.6	94.3
	100	2	.3	.6	94.9
	105	2	.3	.6	95.6
	110	2	.3	.6	96.2
	115	1	.1	.3	96.5
	120	1	.1	.3	96.8
	125	1	.1	.3	97.1
	135	2	.3	.6	97.8
	140	1	.1	.3	98.1
	160	2	.3	.6	98.7
	175	1	.1	.3	99.0
	205	1	.1	.3	99.4
	350	1	.1	.3	99.7
	375	1	.1	.3	100.0
	-1	361	53.4	MISSING	
	TOTAL	676	100.0	100.0	

Mean	34.302	Median	25.000	Mode	20.000
Valid Cases	315	Missing Cases	361		

E8 I would move closer to where I work.

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
	0	1	.1	.2	.2
Strongly Agree	1	38	5.6	6.6	6.7
Agree	2	120	17.8	20.7	27.4
No Opinion	3	42	6.2	7.2	34.7
Disagree	4	285	42.2	49.1	83.8
Strongly Disagree	5	94	13.9	16.2	100.0
No Response	-1	96	14.2	MISSING	
	TOTAL	676	100.0	100.0	

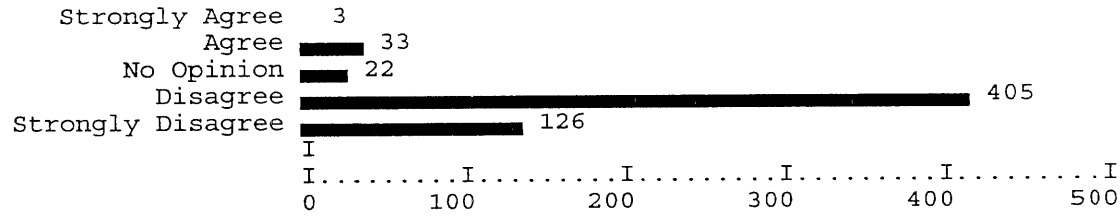
E8 I would move closer to where I work.



Mean	3.472	Median	4.000	Mode	4.000
Valid Cases	580	Missing Cases	96		

E9 I would get an additional car or cars.

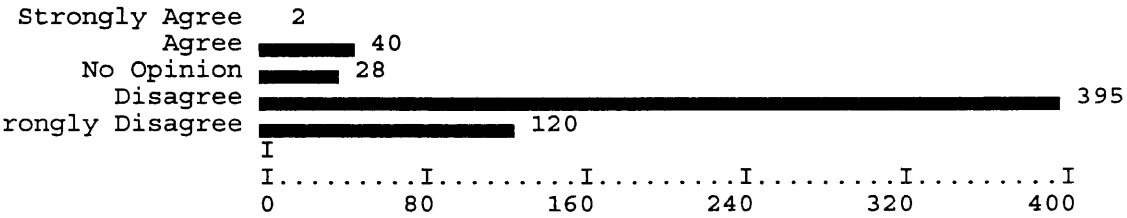
Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
Strongly Agree	1	3	.4	.5	.5
Agree	2	33	4.9	5.6	6.1
No Opinion	3	22	3.3	3.7	9.8
Disagree	4	405	59.9	68.8	78.6
Strongly Disagree	5	126	18.6	21.4	100.0
No Response	-1	87	12.9	MISSING	
	TOTAL	676	100.0	100.0	



Mean	4.049	Median	4.000	Mode	4.000
Valid Cases	589	Missing Cases	87		

E10 I would consider getting rid of a car

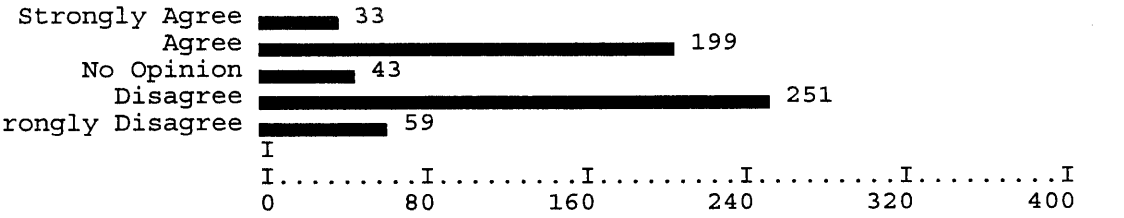
Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
Strongly Agree	1	2	.3	.3	.3
Agree	2	40	5.9	6.8	7.2
No Opinion	3	28	4.1	4.8	12.0
Disagree	4	395	58.4	67.5	79.5
Strongly Disagree	5	120	17.8	20.5	100.0
No Response	-1	91	13.5	MISSING	
	TOTAL	676	100.0	100.0	



Mean	4.010	Median	4.000	Mode	4.000
Valid Cases	585	Missing Cases	91		

E11 I would consider joining a carpool.

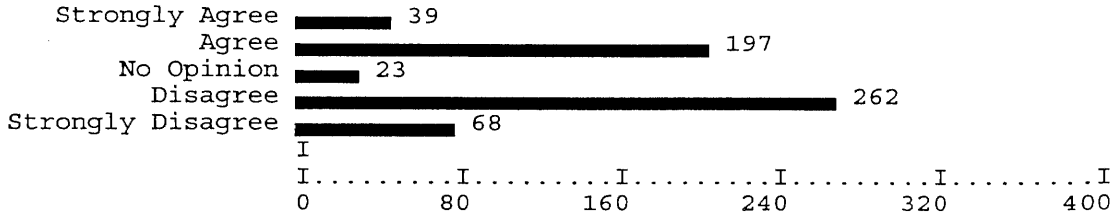
Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
Strongly Agree	1	33	4.9	5.6	5.6
Agree	2	199	29.4	34.0	39.7
No Opinion	3	43	6.4	7.4	47.0
Disagree	4	251	37.1	42.9	89.9
Strongly Disagree	5	59	8.7	10.1	100.0
No Response	-1	91	13.5	MISSING	
	TOTAL	676	100.0	100.0	



Mean	3.178	Median	4.000	Mode	4.000
Valid Cases	585	Missing Cases	91		

E12 I would consider using transit.

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
Strongly Agree	1	39	5.8	6.6	6.6
Agree	2	197	29.1	33.4	40.1
No Opinion	3	23	3.4	3.9	44.0
Disagree	4	262	38.8	44.5	88.5
Strongly Disagree	5	68	10.1	11.5	100.0
No Response	-1	87	12.9	MISSING	
	TOTAL	676	100.0	100.0	



Mean	3.209	Median	4.000	Mode	4.000
Valid Cases	589	Missing Cases	87		

E13 Are there any other changes you might make?

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
Yes	1	202	29.9	34.8	34.8
No	2	378	55.9	65.2	100.0
	-1	96	14.2	MISSING	
	TOTAL	676	100.0	100.0	

Mean	1.652	Median	2.000	Mode	2.000
Valid Cases	580	Missing Cases	96		

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