MODELING INDIVIDUALS' RELATIVE DESIRED TRAVEL AMOUNTS

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EXECUTIVE SUMMARY

This report is one of a series of research documents produced by an ongoing study of individuals' mobility and attitudes toward travel. The data are obtained from 1,357 residents of three San Francisco Bay Area neighborhoods, who work either part- or full-time and commute.

The key premise of this research is as follows: although the demand for travel is, for the most part, derived from the demand to engage in spatially-separated activities (as conventional wisdom holds), travel itself has an intrinsically positive utility that contributes to the demand for it. That affinity for travel itself (partially operationalized in this study through the Travel Liking variables) varies by person, mode, and purpose of travel. The goals of this research are to better understand causes and effects of that affinity for travel. The key variables used in the study can be grouped into 11 categories: Objective Mobility, Subjective Mobility, Relative Desired Mobility, Travel Liking, Attitudes, Personality, Lifestyle, Excess Travel, Mobility Constraints, Travel Modifiers and Demographics.

Ultimately, structural equations models will be developed to properly account for the multiple interrelationships among these variables. As initial building blocks toward that ultimate goal, however, single-equation models are being developed for the major types of endogenous variables in the system. This report focuses on modeling Relative Desired Mobility; companion reports focus on Objective Mobility and Subjective Mobility.

Censored ordered probit single-equation models were developed for nine dependent Relative Desired Mobility variables, representing the amount people want to travel in various categories, compared to what they are doing now, measured on a five-point ordinal scale ranging from "much less" to "much more". For short-distance travel the categories modeled include Relative Desired Mobility for travel overall, for work/school-related reasons, for entertainment/recreation/social reasons, and by personal vehicle. For long-distance travel, we modeled the Relative Desired Mobility for travel overall, for work/school-related reasons, for entertainment/recreation/social purposes, by personal vehicle and by airplane. A similar model for the commute to work/school was previously developed using the same data (Redmond and Mokhtarian, 2001 a).

Relative Desired Mobility measures the dissonance between individuals' actual mobility and their preferred amounts of mobility. Therefore, it constitutes an indicator of the instability of individuals' current levels of actual mobility. Since this dissonance is due to both internal and external constraints acting upon the individual, if one or more of those constraints are relaxed, the individual will likely react by modifying her level of mobility so as to adjust it to her preferences. Understanding the factors affecting Relative Desired Mobility is then expected to provide insight into individuals' *latent* (unconstrained) travel demand, which in turn may provide useful input to transportation policy making. This study is aimed at improving this understanding.

Table ES-1 (Table 13 in the text) presents a qualitative summary indicating the direction of impact of each significant variable in each model. The R^2_{MZ} s for the models range from 0.237 for the short-distance entertainment/recreation/social model, to 0.454 for the short-distance personal

vehicle model. The table shows that, in addition to the actual amount of travel, Demographic, Objective Mobility, Subjective Mobility, and Travel Liking variables, as well as Attitudes, Lifestyles, and, to a lower extent, Personalities are also important to explaining individuals' Relative Desired Mobility in each category. To our knowledge, this is the first study involving the modeling of Relative Desired Mobility incorporating all these types of individuals' characteristics.

Our two major hypotheses were that Subjective Mobility would be negatively related to Relative Desired Mobility (the higher the assessment people make of their actual amount of travel, the less they will want to increase their travel), and that Travel Liking would be positively related (the higher people's liking for travel, the more they will want to increase their travel). These hypotheses were, for the most part, strongly supported by the results. The influence of Travel Liking was powerful and universal: in every Relative Desired Mobility model, the corresponding Travel Liking measure (always with a positive coefficient) was by far the most significant variable in the model. In six of the nine models, both the short- and long-distance measures of Travel Liking for the dependent variable category of travel were (positively) significant.

The fact that the Travel Liking variables are highly significant in the models provides a direct indication that there is an intrinsic affinity for travel for its own sake (varying by individual, purpose, mode and circumstance), prompting a desire to travel more. Such an effect of Travel Liking can potentially add travel at the margin that is unnecessary or excess from the perspective of simply meeting the demand for spatially separated activities (it is not excess from the standpoint of maximizing the individual's utility).

The results for Subjective Mobility are somewhat more complex, but overall provide strong support for the hypothesis. The one exception is interesting, however: in the model for long-distance entertainment/social/recreation travel, no Subjective or Objective Mobility variables whatsoever were significant. This means that, at least within the range of travel experienced by our respondents, their desires to change their amount of this kind of travel (whether up or down or neither) are independent of how much they are currently doing. Since most people reported wanting more of this kind of travel, we interpret this result as a kind of "insatiability effect". It is natural that this effect would appear for what is arguably the most fun and exciting category of travel studied here, long-distance entertainment.

Another hypothesis generally supported by the results is that Subjective Mobility variables are more important to explaining the corresponding Relative Desired Mobility than are the corresponding Objective Mobility variables, with three models having no significant Objective Mobility variables at all. While this might not be too surprising, the finding that the perceived rather than the actual amount of travel one does better predicts one's desire to modify that amount, is an important contribution of this study.

Three Lifestyle factors repeatedly enter the models: the frustrated person, the status seeker, and the family/community oriented person. The first of these was frequently encountered in the Objective Mobility models, with negative coefficients, as opposed to the positive coefficients it holds in the present models. The systematic positive association between status seekers and their Relative Desired Mobility is consistent with the inclination of these people to show off. The

family/community-oriented factor shows a saturation with short-distance and non-discretionary travel and a (likely ensuing) deficit of long-distance discretionary travel, as indicated by its positive effect on corresponding Relative Desired Mobility variables.

In view of their pervasiveness in the models for Objective and Subjective Mobility, the scant impacts of the adventure seeker Personality factor and the Excess Travel indicator on Relative Desired Mobility are noteworthy. We believe that the effects of these two variables are generally accounted for through the other variables (Objective Mobility, Subjective Mobility, and especially Travel Liking) that do appear in the models. The presence of the adventure seeker variable in the model for long-distance travel by airplane, and the Excess Travel indicator in the model for long-distance travel by personal vehicle, suggests that at least for these types of travel, there are important aspects to being an adventure seeker or an excess traveler that are not fully captured by the Travel Liking and other variables alone.

Given that adventure seekers and excess travelers have high Objective and Subjective Mobilities as well as high Travel Likings for the categories in question, *but* that Objective Mobility, Subjective Mobility, and Travel Liking are already largely accounted for in those models, the *additional* positive impact of the adventure seeker and excess traveler variables on Relative Desired Mobility points to an insatiability of those types of people for those categories of travel.

Some of the most commonly used Demographic variables, particularly measures of household composition, neighborhood type, and age, entered the models repeatedly. There is virtually no effect of the characteristics of the personal vehicle on Relative Desired Mobility, indicating that the desire for more or less travel is generally independent of the type of vehicle one drives. Interestingly, the only exceptions were for short-distance work/school-related travel: driving either a mid-sized or a sports car was associated with wanting to increase one's work/school-related travel, as was driving a recent-vintage vehicle of any type.

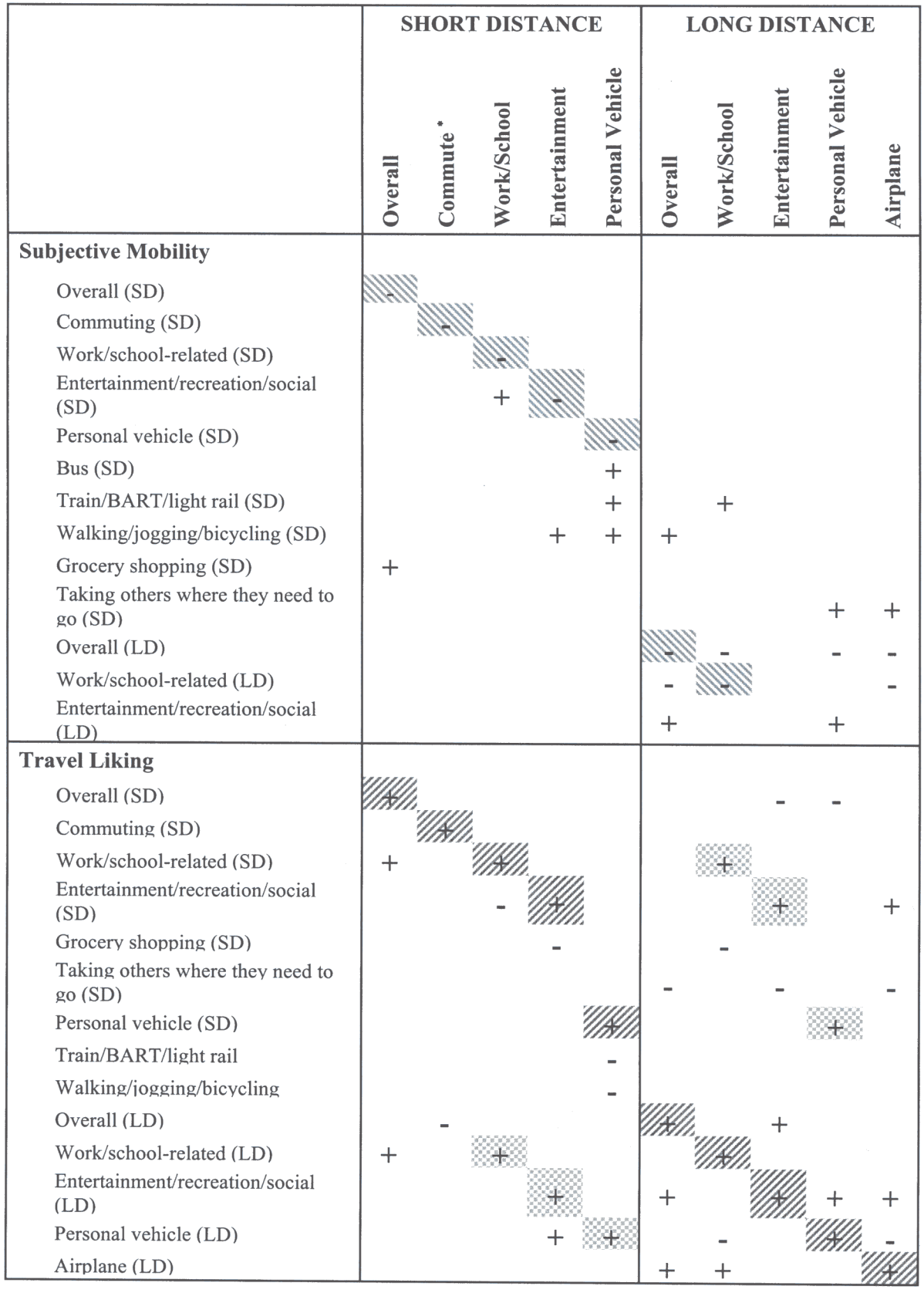
It is also intriguing that income is relatively insignificant as a predictor of Relative Desired Mobility, entering (negatively) only in the model for air travel. Similarly to the situation for the adventure seeker and excess traveler variables, our hypothesis is that the effect of income is generally accounted for through its impact on the included Objective Mobility and Subjective Mobility variables.

A number of recurrent effects on Relative Desired Mobility were identified in this study: complementarity, competing preferences, substitution, saturation, relative mobility deprivation, insatiability, and family-related travel. Table ES-2 (Table 14 in the text) summarizes these effects. The models presented here are successful in confirming our expectations that Subjective Mobility is a critical determinant of Relative Desired Mobility. They also provide valuable insight into how unobserved characteristics of the individuals can affect latent travel demands. Among these characteristics, Travel Liking (affective attitude toward travel) is the most prominent.

Table ES-1: Summary of Effects on Relative Desired Mobility

	SHORT DISTANCE					LONG DISTANCE				
	Overall	**Commute** *	**Work/School**	**Entertainment**	**Personal Vehicle**	**Overall**	**Work/School**	**Entertainment**	**Personal Vehicle**	**Airplane**
N	1283	1155	1208	1348	1268	1338	1336	1345	1336	1305
R^2_{MZ}	0.366	N.A.	0.334	0.237	0.454	0.342	0.444	0.400	0.348	0.433
VARIABLE										
Objective Mobility										
Frequency of commute (SD)	-				-					
Frequency of work/school-related travel (SD)	-									
Frequency of travel going to eat a meal (SD)	+				-		+			+
Frequency of travel taking others where they need to go (SD)									-	-
Weekly miles in BART (SD)									+	
Total weekly miles (SD)		+								
Weekly miles commuting (SD)	-	-					-			
Weekly miles work/school-related (SD)		-								
Weekly miles to eat a meal (SD)							+			
Commute time		-								
Distance to work					-				-	
Excess commute	-				-					
Sum of logs of miles for each trip (LD)						-	-			
Miles for work/school/entertainment by personal vehicle (LD)					+					
Miles for work/school/entertainment by airplane (LD)										-

* This model is summarized from Redmond and Mokhtarian (2001a) for completeness, and not separately discussed here.


SHORT DISTANCE
LONG DISTANCE
Overall
Commute *
Work/School
Entertainment
Personal Vehicle
Overall
Work/School
Entertainment
Personal Vehicle
Airplane
Subjective Mobility
Overall (SD)
Commuting (SD)
Work/school-related (SD)
Entertainment/recreation/social (SD)
Personal vehicle (SD)
Bus (SD)
Train/BART/light rail (SD)
Walking/jogging/bicycling (SD)
Grocery shopping (SD)
Taking others where they need to go (SD)
Overall (LD)
Work/school-related (LD)
Entertainment/recreation/social (LD)
Travel Liking
Overall (SD)
Commuting (SD)
Work/school-related (SD)
Entertainment/recreation/social (SD)
Grocery shopping (SD)
Taking others where they need to go (SD)
Personal vehicle (SD)
Train/BART/light rail
Walking/jogging/bicycling
Overall (LD)
Work/school-related (LD)
Entertainment/recreation/social (LD)
Personal vehicle (LD)
Airplane (LD)

	SHORT DISTANCE					LONG DISTANCE				
	Overall	Commute *	Work/School	Entertainment	Personal Vehicle	Overall	Work/School	Entertainment	Personal Vehicle	Airplane
Attitudes										
Pro-environmental solutions factor					-					
Commute benefit factor	+	+	+		+			-		
Travel dislike factor						-		-		
Pro-high density factor							+			
Lifestyle										
Frustrated factor score			+	+	+	+				
Status seeker factor score	+	+		+	+				+	+
Family & community-oriented factor score	-						-	+		+
Workaholic factor score		+								
Personality										
Adventure seeker factor score										+
Organizer factor score						-		-		-
Excess Travel										
Excess travel indicator									+	
Frequency of travel by a longer route to experience more of the surroundings		-								
Mobility Constraints										
Percent of time a vehicle is available	-				-				-	
Limitations on taking public transportation					+					

	SHORT DISTANCE					LONG DISTANCE				
	Overall	Commute*	Work/School	Entertainment	Personal Vehicle	Overall	Work/School	Entertainment	Personal Vehicle	Airplane
Demographics										
Female				+		+				
Age			-	+			-	-		
Number of people in the household				+				-		-
Number of workers in the household								+		+
Number of adults in the household		+								
Number of children in the household										+
Number of people under 6 years old in the household									-	
Number of people 6-15 years old in the household								+		
Number of people 75 years old and older			+							
Someone other than preschoolers needs special care			-							
Manager or professional (occupational)			+							
Sales (occupational)				-						
Personal income category										-
Urban	-			+	-	+		+		
Year of personal vehicle			+							
Vehicle type mid-size or sport			+							
Vehicle type is van/minivan		-								

Table ES-2: Summary of Recurring Effects on Relative Desired Mobility

Effect	Explanatory Variable (direction of effect)	Relative Desired Mobility Variable	Table	Page
Complementarity	Miles by personal vehicle (LD) (+)	Personal Vehicle (SD)	7	25
	Frequency of travel to eat a meal (SD) (+)	Overall (SD)	3	15
		Work/School-Related (LD)	9	31
		Airplane (LD)	12	39
	Weekly miles to eat a meal (SD) (+)	Work/School-Related (LD)	9	31
	Travel Liking overall (LD) (+)	Entertainment/Recreation/ Social (LD)	10	33
	Travel Liking work/ school-related (SD) (+)	Work/School-Related (LD)	9	31
	Travel Liking entertain-ment/recreation/social (SD) (+)	Entertainment/Recreation/ Social (LD)	10	33
		Airplane (LD)	12	39
	Travel Liking personal vehicle (SD) (+)	Personal Vehicle (LD)	11	36
	Travel Liking work/ school-related (LD) (+)	Work/School-Related (SD)	4	19
	Travel Liking entertain-ment/recreation/social (LD) (+)	Entertainment/ Recreation/Social (SD)	5	22
	Travel Liking personal vehicle (LD) (+)	Personal Vehicle (SD)	7	25
Competing Preferences	Travel Liking entertain-ment/recreation/social (SD) (-)	Work/School-Related (SD)	4	19
	Someone other than preschoolers needing special care (-)	Work/School-Related (SD)	4	19
	Family/community-oriented (-)	Work/School-Related (LD)	9	31
	Travel Liking chauffeur-ing (SD) (-)	Overall (LD)	8	28
		Entertainment/Recreation/ Social (LD)	10	33
		Airplane (LD)	12	39
	Weekly miles chauffeur-ing (SD) (-)	Personal Vehicle (LD)	11	36
	Frequency chauffeuring (SD) (-)	Airplane (LD)	12	39
	Travel Liking personal vehicle (LD) (-)	Work/School-Related (LD)	9	31

(Desired) Substitution	Subjective Mobility for bus (SD) (+)	Personal Vehicle (SD)	7	25
	Subjective Mobility for train/BART/light rail (SD) (+)	Personal Vehicle (SD)	7	25
	Subjective Mobility for walking/jogging/bicycling (SD) (+)	Personal Vehicle (SD)	7	25
	Travel Liking grocery shopping (SD) (-)	Entertainment/Recreation/ Social (SD)	5	22
	Travel Liking train/ BART/light rail (SD) (-)	Personal Vehicle (SD)	7	25
	Travel Liking walking (SD) (-)	Personal Vehicle (SD)	7	25
	Travel Liking overall (SD) (-)	Entertainment/Recreation/ Social (LD)	10	33
		Personal Vehicle (LD)	11	36
	Travel Liking personal vehicle (LD) (-)	Airplane (LD)	12	39
	Sales occupation (-)	Entertainment/Recreation/ Social (SD)	5	22
	Organizer (-)	Entertainment/Recreation/ Social (LD)	10	33
	Weekly miles commuting (SD) (-)	Work/School-Related (LD)	9	31
	Subjective Mobility overall (LD) (-)	Work/School-Related (LD)	9	31
	Commute distance (-)	Personal Vehicle (LD)	11	36

Saturation	Weekly miles commuting (SD) (-)	Commute (SD)	-	-
	Commute time (-)	Commute (SD)	-	-
	Commute distance (-)	Personal Vehicle (SD)	7	25
		Personal Vehicle (LD)	11	36
	Excess commute (-)	Personal Vehicle (SD)	7	25
	Frequency of commute (-)	Overall (SD)	3	15
		Personal Vehicle (SD)	7	25
	Sum of logs of miles for each trip (LD) (-)	Overall (LD)	8	28
	Miles for work/school/ entertainment by airplane (LD) (-)	Airplane (LD)	12	39
	Subjective Mobility overall (SD) (-)	Overall (SD)	3	15
	Subjective Mobility commuting (SD) (-)	Commute (SD)	-	-
	Subjective Mobility work/ school-related (SD) (-)	Work/School-Related (SD)	4	19
	Subjective Mobility entertainment/recreation/ social (SD) (-)	Entertainment/Recreation/ Social (SD)	5	22
	Subjective Mobility personal vehicle (SD) (-)	Personal Vehicle (SD)	7	25
	Subjective Mobility overall (LD) (-)	Overall (LD)	8	28
	Subjective Mobility work/ school-related (LD) (-)	Work/School-Related (LD)	9	31
	Organizer (-)	Overall (LD)	8	28
		Entertainment/Recreation/ Social (LD)	10	33
		Airplane (LD)	12	39
	Weekly miles chauffeur-ing (SD) (-)	Personal Vehicle (LD)	11	36
	Urban dummy variable (+)	Overall (LD)	8	28
	Family/community-oriented (-)	Overall (SD)	3	15
		Work/School-Related (LD)	9	31

Relative Mobility Deprivation	Household size (+)	Entertainment/Recreation/ Social (SD)	5	22
	Miles by personal vehicle (LD) (+)	Personal Vehicle (SD)	7	25
	Percentage of time a personal vehicle is available (-)	Personal Vehicle (SD)	7	25
		Personal Vehicle (LD)	11	36
	Physical/anxiety limitations on taking public transportation (+)	Personal Vehicle (SD)	7	25
	Weekly miles by train/ BART/light rail (SD) (+)	Personal Vehicle (LD)	11	36
	Weekly miles chauffeur-ing (SD) (-)	Personal Vehicle (LD)	11	36
	Subjective Mobility chauffeuring (SD) (+)	Personal Vehicle (LD)	11	36
		Airplane (LD)	12	39
	Frequency of chauffeuring (SD) (+)	Airplane (LD)	12	39
Insatiability	Travel Liking entertain-ment/recreation/social (LD) (+)	Entertainment/Recreation/ Social (LD)	10	33
	Excess Travel indicator (+)	Personal Vehicle (LD)	11	36
	Adventure seeker (+)	Airplane (LD)	12	39
	Urban dummy variable (+)	Overall (LD)	8	28
		Entertainment/Recreation/ Social (LD)	10	33
Family Related Travel	Family/community-oriented (+)	Entertainment/Recreation/ Social (LD)	10	33
		Airplane (LD)	12	39
	Number of workers in the household (+)	Entertainment/Recreation/ Social (LD)	10	33
		Airplane (LD)	12	39
	Number of household members between 6 and 15 years old (+)	Entertainment/Recreation/ Social (LD)	10	33
	Number of children in the household (+)	Airplane (LD)	12	39
	Number of people in household (-)	Entertainment/Recreation/ Social (LD)	10	33
		Airplane (LD)	12	39

1. INTRODUCTION

1.1 Background and Conceptual Model

This report is one of a series of research documents produced by an ongoing study of individuals' attitudes toward travel. The key premise of this research is as follows: although the demand for travel is, for the most part, derived from the demand to engage in spatially-separated activities (as conventional wisdom holds), travel itself has an intrinsically positive utility that contributes to the demand for it (Salomon and Mokhtarian, 1998; Mokhtarian and Salomon, 2001). That affinity for travel itself (partially operationalized in this study through the Travel Liking variables) varies by person, mode, and purpose of travel. The goals of this research are to better understand the factors explaining the observed variations in Travel Liking, and the impact of Travel Liking on other travel-related characteristics. With Travel Liking being both the effect of some relationships and the cause of others, we envision it as being embedded in a structural model representing multi-directional relationships. Figure 1 illustrates the current version of our conceptual model of an individual's affinity for travel; the model will continue to be refined as the study progresses.

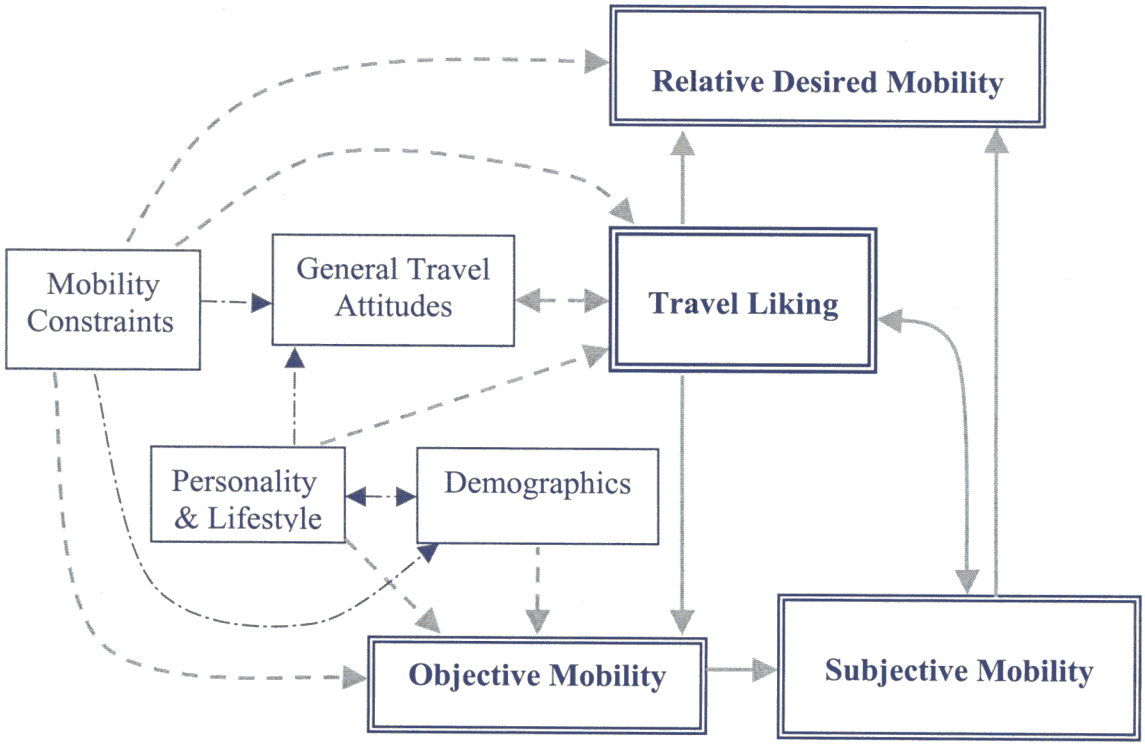
The key endogenous variable categories in this model are Travel Liking, Objective Mobility, Subjective Mobility, and Relative Desired Mobility (each of the variable types is described further in Section 2). We envision Travel Liking to be a function of Personality and Lifestyle characteristics, general travel-related Attitudes, Mobility Constraints, Demographic traits and the subjective amount one travels. In turn, we hypothesize that Travel Liking affects the amount one travels (both Subjective and actual, or Objective). Individuals' perception of their mobility is expected to be a function of their Objective Mobility, modified by their Liking for Travel. And one's Relative Desired Mobility (whether one wishes to decrease, hold constant or increase one's travel) is viewed as a function of current Subjective Mobility and Travel Liking, as well as Mobility Constraints. Specifically, and importantly for this report, we generally expect Relative Desired Mobility to be negatively related to Subjective Mobility (the more one perceives she travels, the less she wants to increase her travel) and positively related to Travel Liking (the more one likes traveling, the more he wants to increase his travel).

In some sense, Relative Desired Mobility is the apex of the model. As the conceptual model is currently portrayed, Relative Desired Mobility is directly dependent on Travel Liking, Subjective Mobility, and Mobility Constraints but is not explanatory of any other variables. In a dynamic context, Relative Desired Mobility at time *t-1* would be expected to affect Objective Mobility at time *t*.

As a reasonable simplification, Mobility Constraints are the only basically exogenous variables in the model. These variables include limitations on the ability to fly, walk, ride a bike, take public transit, drive, drive at night, or drive on the freeway. Such limitations are postulated to affect Attitudes, Travel Liking, Objective Mobility, and Relative Desired Mobility, but not to be influenced by the other variables in the model. Some Demographic variables (e.g. age, gender) are exogenous but others are endogenous (e.g. occupation is a function of education; vehicle ownership is a function of income; driver's license holding may be a function of Mobility Constraints and Travel Liking with respect to personal vehicles; residential location may be a

function of the pro-high-density Attitude; and so on). Personality and Lifestyle variables are somewhat exogenous but, at least as measured in this study, could be influenced by the stage in one's lifecycle as indicated by Demographic traits (e.g. older people with families may be less adventure-seeking, and are presumably more likely to be family-oriented, than are young singles).

Figure 1: Conceptual Model of the Individual's Affinity for Travel



This initial conceptual model attempts to identify the dominant causal relationships among our defined characteristics; many other relationships could be hypothesized. For instance, the argument could be made that Objective Mobility affects Travel Liking in that an individual who rarely travels by bus may view it as less burdensome than someone who travels by bus every day, and may therefore "like" it more. However, we are suggesting that the causal relationship from Objective Mobility to Travel Liking is mediated by Subjective Mobility. That is, regardless of the actual amount of travel, the perceived amount of travel is the direct indicator of how much an individual likes it. The person who travels every day by bus may not view that as a lot, and

hence like it more (representing a reciprocal relationship between Travel Liking and Subjective Mobility) than the person who rarely travels by bus but views that as too much as it is.

Two key bi-directional relationships exist in this model: between Travel Liking and Attitudes, and between Travel Liking and Subjective Mobility. For example, we could expect a negative impact of Travel Liking on Subjective Mobility (the more one likes traveling, the less burdensome it seems and a given amount may not be perceived as a lot), and also a negative impact of Subjective Mobility on Travel Liking (one reason a person may dislike the travel she is doing is because she has to do it too much). On the other hand, we would expect a positive impact of Travel Liking on Objective Mobility (the more one likes travel the more one tries to do it) and through that, an indirect positive impact on Subjective Mobility. These counteracting relationships can be difficult to sort out in single-equation models such as those presented in this report; a more complete accounting of them must await the multiple-equations models to be developed later in the study.

1.2 The Data

The data analyzed in this study come from a fourteen-page self-administered survey mailed in May 1998 to 8000 randomly-selected households in three neighborhoods of the San Francisco Bay Area. Half of the total surveys were sent to an urban neighborhood of North San Francisco and the other half were divided evenly between the suburban cities of Concord and Pleasant Hill. These areas were chosen to represent the diverse lifestyles, land use patterns, and mobility options in the Bay Area. Approximately 2000 surveys were completed by a randomly-selected adult member of the household and returned, for a 25% response rate. The subset of 1357 cases used in this analysis constitutes those respondents identified as workers (part-time or full-time) who commute (using the variable "workcom" = 1).

1.3 The Context of this Report

A number of research documents have been produced by this study to date:

- Salomon and Mokhtarian (1998) review the evidence for an affinity for travel itself, and introduce the key endogenous variables described in Section 1.1 (building on the unpublished dissertation research of Hebrew University PhD student Perl Ramon).
- Mokhtarian and Salomon (2001) extend the conceptual arguments for a positive utility of travel, and present some descriptive statistics from the survey data that support the existence of such a utility.
- Curry (2000) explores the relationships among Travel Liking, Perceived Mobility (now referred to as Subjective Mobility), and Relative Desired Mobility in several different ways.
- Redmond (2000) develops measures of Attitudes, Personality, and Lifestyle through factor analysis of multiple interrelated indicators of each concept measured by the survey, and identifies distinct clusters of individuals based on their Attitude profiles and their Personality/Lifestyle profiles.
- Redmond and Mokhtarian (2001a) model Ideal Commute Time and Relative Desired Commute amount as functions of the other appropriate variables in the conceptual model.

- Choo and Mokhtarian (2002) analyze variables related to the type of vehicle the respondents drive most often.
- Redmond and Mokhtarian (2001b) estimate single-equation models of Objective Mobility (distance traveled) in 11 categories.
- Mokhtarian *et al.* (2001) present key findings from earlier reports in the series, augmented by additional evidence from the literature for a positive utility of travel.

The empirical work to date can generally be characterized as focusing on one component of the conceptual model and studying it in more detail. Ultimately, the entire model will be operationalized through developing a multiple-equation structural model representing the relationships believed to be most important. In advance of the construction of that highly complex model, however, it is important to continue to analyze simpler components as building blocks for the final model.

Current work is focused on developing single-equation models for the key endogenous variables: Objective Mobility, Subjective Mobility, and Relative Desired Mobility. To facilitate the fullest possible exploration of the data, these single-equation models allow all relevant explanatory variables to enter the model, not just the ones hypothesized to *directly* influence the dependent variable as shown in Figure 1. For example, in the models of Subjective Mobility, Demographic, Personality/Lifestyle, and Attitude variables are allowed to enter directly, not just indirectly through Travel Liking as shown in Figure 1. This broader exploration is important when multiple equations are not yet being estimated simultaneously, and will assist in suggesting ways to refine the conceptual model. Nevertheless, it must be pointed out that the single-equation models are subject to simultaneity bias due to the inclusion of variables endogenous to the conceptual model as explanatory variables. Thus, the single-equation results can only be viewed as preliminary rather than definitive. However, we believe them to be quite informative, providing considerable insight into the influences on the endogenous variables of interest to this study.

This report focuses on the development of single-equation models for Relative Desired Mobility. Companion reports develop single-equation models for Objective Mobility (Redmond and Mokhtarian, 2001b) and Subjective Mobility (Collantes and Mokhtarian, 2002).

Relative Desired Mobility measures the dissonance between individuals' actual mobility and their preferred amounts of mobility. Therefore, it constitutes an indicator of the instability of individuals' current levels of actual mobility. Since this dissonance is due to both internal and external constraints acting upon the individual, if one or more of those constraints are relaxed, the individual will likely react by modifying her level of mobility so as to adjust it to her preferences. Understanding the factors affecting Relative Desired Mobility is then expected to provide insight into individuals' *latent* (unconstrained) travel demand, which in turn may provide useful input to transportation policy making. This study is aimed at improving this understanding.

The organization of this report is as follows. The next section introduces the key types of variables measured by the survey and used in this study. Section 3 discusses the models and the variables that are significant in the models in greater detail. The final section summarizes and comments on the results.

2. THE VARIABLES

The key variables used in the models can be grouped into 11 categories: Objective Mobility, Subjective Mobility, Relative Desired Mobility, Travel Liking, Attitudes, Personality, Lifestyle, Excess Travel, Mobility Constraints, Travel Modifiers (not shown in the conceptual model but discussed below), and Demographics. Each category is described in general terms below; the dependent variables and specific explanatory variables that are significant in the final models will be further explained in Section 3. Descriptive statistics for all variables appearing in any of the models are found in Tables A.1 to A.3 of the Appendix.

The three mobility categories and the Travel Liking category of variables had similar structures. In each case, measures were obtained both overall and separately by purpose and mode, for short-distance and long-distance travel. Short-distance trips were defined as those of 100 miles or less, one way. The short-distance purposes measured in the survey were: commute, work/school-related travel, grocery shopping, to eat a meal, for entertainment/recreation/social activities, and for the purpose of taking others where they need to go. The short-distance modes measured were: personal vehicle, bus, train/heavy rail/light rail and walking/jogging/bicycling. Long-distance measures were obtained for the work/school-related and entertainment/recreation/social purposes, and for the personal vehicle and airplane modes.

Objective Mobility:

These questions asked about distance and frequency of travel by mode and trip purpose, as well as travel time for the commute trip. For short-distance trips, respondents were asked how often they traveled for each purpose, with six categorical responses ranging from "never" to "5 or more times a week". Frequency of trips by mode was not obtained. Respondents were also asked to specify how many miles they traveled each week, in total and by mode and purpose.

The long-distance Objective Mobility variables come from a section of the survey in which respondents were asked how often they traveled to various parts of the globe "last year", by purpose (for entertainment and work/school-related activities) and mode (personal vehicle, airplane and other) combinations, with an "other" category to catch any remaining travel. Whereas the Objective Mobility questions for short-distance travel, and the Subjective Mobility, Travel Liking and Relative Desired Mobility questions for both short- and long-distance travel, were asked for purpose and mode separately in order to save space and reduce the burden on the respondent, in this section it was relatively convenient to ask for purpose-mode combinations. These responses indicated number of trips directly, and were also converted into approximate distances by measuring from a central position in the Bay Area to a central location within the destination region. The conversion factors used are shown in Table 1.

Trips were combined across world regions to obtain three different measures of distance:

1. Total miles, the simple sum of the estimated miles for each reported trip.
2. Log of miles, the natural logarithm of one plus the total number of miles. One mile was added to each total so that when zero miles were actually traveled in a given category, the log transformation would return the value zero (= ln(1)) rather than $-\infty$ (= ln(0)).

3. Sum of the log-miles, obtained by taking the natural logarithm of one plus the number of miles of each trip in the category *separately*, and summing across all trips in the category.

Discriminating each of these variables by travel mode (personal vehicle, airplane, and other means), plus retaining the original "total" variables, yielded a set of 12 measures of distance, which were eventually used in the models.

Table 1: Long-Distance Trip Frequency to Miles Traveled Conversion Factors

Region	Miles assigned to each trip
California or adjacent states (Oregon, Nevada, Arizona)	200
Other western states (Wash., Wyo., Idaho, Utah, Mont., Colorado, New Mexico)	700
Elsewhere in the US (except Alaska or Hawaii)	2000
Alaska, Canada, Mexico	3000
Central/South America, Caribbean	6000
Asia	7500
Australia, New Zealand, Pacific (including Hawaii)	5000
United Kingdom/Europe/Middle East	7300
Africa	9000

Log transformations of miles traveled are common in transportation demand modeling. They reduce the weight of longer trips, and represent a diminishing marginal impact of distance traveled (the marginal impact of 50 miles added to a 3,000-mile trip should be much smaller than the impact of 50 miles added to a 101-mile trip). As shown by the example in Section 4.1.1 of Curry (2000), the third distance measure described above (sum of log-miles) gives more weight to a larger number of trips traveling the same number of miles, compared to the second distance measure (log of total miles).

According to our conceptual model, Objective Mobility will be affected by the Mobility Constraints of the individual, Travel Liking, Demographic characteristics and Personality/Lifestyle traits, and will, in turn, affect Subjective Mobility.

Subjective Mobility:

We are interested not only in the Objective amount an individual travels, but also in how that amount of travel is perceived. One person may consider 100 miles a week to be a lot, while another considers it minimal. For each of the same overall, purpose, and mode categories for short- and long-distance, respondents were asked to rate the amount of their travel on a five-point semantic-differential scale anchored by "none" and "a lot".

We view Subjective Mobility as the result of a *post hoc* filtering process through which individuals assess their Objective Mobility. Thus, in the models we allow Objective Mobility to affect Subjective Mobility, but not vice versa. Further, as a simplification we hypothesize that Relative Desired Mobility is affected by Subjective Mobility but not vice versa, and that (as

indicated in Section 1.1) there is reciprocal causation between Travel Liking and Subjective Mobility.

Relative Desired Mobility:

An individual may consider that she travels "a lot", but want to do even more. Thus, Relative Desired Mobility refers to how much a person wants to travel compared to what she is doing now. The structure of this question mirrors the structure for Subjective Mobility, with respondents rating the amount of travel they want to do compared to the present, on a five-point scale from "much less" to "much more".

In our conceptual model Relative Desired Mobility is primarily affected by Travel Liking and Subjective Mobility, as well as by Mobility Constraints. It may be that the impact of Mobility Constraints is achieved mainly through an effect on Travel Liking, but we hypothesize a further deprivation effect directly on the desired amount of travel itself.

Travel Liking:

Whether a respondent who already travels a lot wants to reduce it or do even more is likely to depend on how much he enjoys traveling. Respondents were asked to rate each of the same categories as for Subjective Mobility, on a five-point scale from "strongly dislike" to "strongly like".

The Travel Liking variables are viewed as indicators of affective attitudes — specifically attitudes toward travel.

Travel Liking is central to our conceptual model and interacts with all of the other characteristics in the model: it is affected by Demographics, Mobility Constraints, and Personality and Lifestyle characteristics; has a reciprocal relationship with general Attitudes, and influences Objective Mobility and Relative Desired Mobility. Finally, we hypothesize that the Travel Liking variables have a reciprocal relationship with Subjective Mobility.

General Travel Attitudes:

The survey contained 32 attitudinal statements related to travel, land use, and the environment, to which individuals responded on the five-point Likert-type scale from "strongly disagree" to "strongly agree". These 32 variables were then distilled, through factor analysis (Redmond, 2000), into six underlying dimensions: travel dislike, pro-environmental solutions, commute benefit, travel freedom, travel stress, and pro-high density. Taken at face value, the travel freedom factor measures the respondent's cognitive evaluation of how free s/he is to travel, rather than an emotion toward travel *per se*. However, it is likely that many respondents endowed the word "freedom" (in the dominant statements comprising this factor) with an affective component, and answered in terms of the degree to which they value travel as an expression of freedom. These Attitude factors were then used as explanatory variables in the models. Attitudes are the main tool used by social psychologists in predicting behavior, as opposed to personality traits, which are the focus of interest of personality psychology. For a good general treatment of the concept of attitudes and personality traits, see Ajzen (1988).

Attitudes are directly affected by Personality and Lifestyle characteristics and Mobility Constraints, and have a reciprocal interaction with Travel Liking.

Personality:

Respondents were asked to indicate how well (on a five-point scale from "hardly at all" to "almost completely") each of 17 words and phrases described their personality. Each of these traits was hypothesized to relate in some way to one's orientation toward travel, or to reasons for wanting to travel for its own sake. These 17 attributes reduced to four Personality factors: adventure seeker, organizer, loner, and the placid personality.

Lifestyle:

The survey contained 18 Likert-type scale statements relating to work, family, money, status and the value of time. These 18 questions comprised four Lifestyle factors: status seeker, workaholic, family/community-oriented and a frustrated factor. These variables are expected to affect either Attitudes toward travel, Travel Liking, or the Travel Modifiers described below.

Excess Travel:

Thirteen statements asked how often (on a three-point scale: "never/seldom"=0, "sometimes"=1, "often"=2) the respondent engaged in various activities that would be considered unnecessary or excess travel. The Excess Travel indicator is the sum of the responses to these statements, ranging from 0 for the respondent who never/seldom did any of them to 26 for the respondent who often did all of them. This variable can be considered an indicator of Objective Mobility, but also has a psychological flavor indicating an enjoyment of travel beyond the purely utilitarian. The index may represent a strong desire for travel generally, or a preference for discretionary travel which may have a negative relationship with mandatory travel for such purposes as commuting and taking others where they need to go.

Mobility Constraints:

In our study, Mobility Constraints are physical or psychological limits on travel. These constraints may affect the amount an individual travels or her/his enjoyment of that travel. In our survey, these constraints are measured by questions concerning limitations on traveling by certain modes or at certain times of day (with ordinal response categories "no limitation", "limits how often or how long", and "absolutely prevents"), and the availability of an automobile when desired.

Travel Modifiers:

One section of the survey asked respondents if they had made, or were considering, certain choices to ease or change their travel. Previous analysis (Salomon and Mokhtarian, 1997; Mokhtarian, *et al.*, 1997; Raney, *et al.*, 2000) of a similar list provided in an earlier survey classified the options as *travel-maintaining* strategies (such as getting a mobile phone or buying a more comfortable car), *travel-reducing* strategies (such as compressed work week schedules or telecommuting), and *major lifestyle/location changes* (such as moving home and work closer together, changing to part-time work, or quitting work altogether). We expect that people who want to travel more or the same amount compared to what they are currently doing will be more likely to adopt travel-maintaining strategies, whereas those who want to travel less will be more receptive to the other two types of strategies. Hence, understanding people's Relative Desired Mobility will be important to forecasting the response to policies intended to reduce travel.

These variables are being extensively analyzed in a separate stage of the project. For the models developed in the present report no variables in this group were allowed in the model specification.

Demographics:

Finally, the survey included an extensive list of Demographic variables to allow for comparison to other surveys and to Census data. A number of relationships between these variables and the key endogenous variables can be hypothesized. The Demographic variables include neighborhood and car type dummies, age, years in the U.S., education and employment information, and household information such as number of people in the household, their age group, and personal and household income.

3. THE MODELS

3.1 General Specification Issues

The Relative Desired Mobility dependent variables are measured on a five-point ordinal scale anchored by "much less" and "much more", rather than on a continuous scale. In a previous study of Relative Desired Mobility for commuting based on the same dataset, it was noted that, for a number of reasons, an ordered probit model is preferred to ordinary least squares (OLS) regression models on these variables (Redmond and Mokhtarian, 2001a). First, OLS regression treats the distance between, e.g., "much more" and "more", and the distance between "more" and "about the same", as equal, although this may not be the case universally. Second, in some cases it is desirable to obtain results in the form of probabilities for an individual to choose a specific answer from the set of discrete alternatives, and OLS cannot yield predictions in such a form. Third, the assumption of constant variance of the error term is violated for ordinal dependent variables. Fourth, the OLS predicted values of Relative Desired Mobility are not constrained to the range (in our case, zero to four) of the observed discrete dependent variable. Finally, although the above considerations indicate the theoretical superiority of ordered probit in this context, OLS could be viewed as a reasonable practical choice if it gave similar results. In fact, however, experiments both by McKelvey and Zavoina (1975) and by the present authors found that OLS failed to identify some of the variables that were significant in the final ordered probit models.

Presenting the respondents with a *discrete* set of ordinal options from which to rate their Relative Desired Mobility is a typical and appropriate survey design choice to simplify the task of responding. However, doing so constrained the respondents into being able to give only an approximation to their true answer. We hypothesize that the true amount more or less that a respondent wants to travel lies on a continuous scale (unbounded at each end), and that her reported response represents a mapping from her true answer to the category that best represented that answer. "Ordered response" models, of which ordered probit and ordered logit are the most widely used, are designed for exactly such circumstances.

The assumption of normally distributed random terms leads to the formulation of the ordered probit model, which postulates that the dependent variable (here the true Relative Desired Mobility) for person *i* satisfies:

$$y_i^* = \boldsymbol{\beta}' \mathbf{x}_i + \epsilon_i .$$

In the above expression, y_i^* is the continuous *unobserved* (latent) variable representing the respondent's "true" underlying Relative Desired Mobility, $\mathbf{x}_i$ is a vector of explanatory variables, $\boldsymbol{\beta}$ is a vector of unknown coefficients to be estimated, and ϵ_i is the normally distributed random term, with mean equal to zero and variance equal to one. The *observed* Relative Desired Mobility variable y_i is specified as

$$y_i = 0 \text{ (much less)}, \text{if } -\infty = \mu_{-1} < y_i^* \le \mu_0,$$
$$y_i = 1 \text{ (less)}, \text{if } \mu_0 < y_i^* \le \mu_1,$$
$$y_i = 2 \text{ (about the same)}, \text{if } \mu_1 < y_i^* \le \mu_2,$$
$$y_i = 3 \text{ (more)}, \text{if } \mu_2 < y_i^* \le \mu_3,$$
$$y_i = 4 \text{ (much more)}, \text{if } \mu_3 < y_i^* < \mu_4 = +\infty.$$

The μs are threshold parameters to be estimated together with β, under the condition that $\mu_0 < \mu_1 < \mu_2 < \mu_3 < \mu_4 = +\infty$, so that the probabilities will be positive. The probability that y_i takes on a particular value k ($k = 0, 1, 2, 3,$ or 4) is

$$\begin{aligned}\Pr[y_i = k] &= \Pr[\mu_{k-1} < y_i^* \le \mu_k] \\ &= \Pr[y_i^* \le \mu_k] - \Pr[y_i^* \le \mu_{k-1}] \\ &= \Pr[\epsilon_i \le \mu_k - \beta' x_i] - \Pr[\epsilon_i \le \mu_{k-1} - \beta' x_i] \\ &= \Phi[\mu_k - \beta' x_i] - \Phi[\mu_{k-1} - \beta' x_i].\end{aligned}$$

Generally, the μ parameters and β can be estimated using the maximum likelihood method, setting $\mu_0 = 0$ without loss of generality (identical results for all the β parameter estimates except the constant term would be obtained by shifting all μs by the same constant).

A special boundary case arises with these data. Specifically, when a respondent's Subjective Mobility is "none" and she does not wish to travel in that category, the only logical answer to the corresponding Relative Desired Mobility question is "about the same", which would logically result in her Subjective Mobility being still "none" (all else equal). Recognizing that this might be a difficult case for respondents to handle, we put specific instructions to that effect in the survey. Nevertheless, and unsurprisingly, not all respondents read or heeded these instructions, and in some cases a Subjective Mobility response of "none" was matched with a Relative Desired Mobility of "less" or "much less". It is plausible that some "none" Subjective Mobility responses constituted the respondent's view of the best way to represent "very little", and hence that at least a "less" Relative Desired Mobility response (although probably not "much less") would be logically consistent. However, we believe that these responses most likely represent either a strong emotional (rather than rational) reaction against the type of travel in question ("I dislike it so much I want to do it even *less* than none"), or a careless response approach that simply took the lowest of the desired amount categories without reading them carefully ("I'm not doing it at all and I don't want to do it, so my relative desired amount must be the lowest category"). The patterns found across all categories of travel in the survey provide evidence that strengthens the first of these explanations (Curry, 2000), with the least popular categories of travel (such as for work purposes and by bus) having the largest number of problematic responses. However, that does not preclude the second explanation from also applying in many cases.

Although investigating the extent to which any of these explanations holds would be an interesting study in survey design and analysis, the current data do not permit such an investigation. To maintain logical consistency, we recoded "much less" and "less" Relative Desired Mobility responses to "about the same" when Subjective Mobility was "none". To respect the information offered by these cases, though, we treated these observations as censored. That is, when Subjective Mobility was "none" we treated any Relative Desired Mobility response of "about the same", "less", or "much less" as representing $y_i^* \leq \mu_2$, without specifying its position relative to μ_0 and μ_1. We treated as censored even Subjective Mobility = "none" cases whose original Relative Desired Mobility response was "about the same", on the assumption that some of them would have exhibited a response mechanism similar to the others if they had not read the instructions. In other words, when Subjective Mobility was "none" and the observed indicator of Relative Desired Mobility was "about the same" or less, we argue that the unobserved latent measure of the respondent's desires, y_i^*, cannot be located with confidence in a particular bounded interval of the real line, and that the most we can say is that it falls somewhere below μ_2. Table 2 tabulates the number of censored cases in each model, distinguished according to their original Relative Desired Mobility responses. It is readily seen that by far the largest numbers of cases requiring censoring fell into the mandatory work/school-related categories.

Table 2: Number of Censored Cases in Each Model (N = 1357)

Relative Desired Mobility	Subjective Mobility = "none"								
	Short Distance				Long Distance				
	Overall	Work/School	Entertainment	Personal Vehicle	Overall	Work/School	Entertainment	Personal Vehicle	Airplane
"Much less"	2	42	1	2	5	102	11	22	28
"Less"	3	23	8	8	3	64	10	8	7
"About the same"	8	177	32	21	36	390	66	96	57

Censored ordered probit models were thus developed for nine Relative Desired Mobility variables. For short-distance travel these include the Relative Desired Mobility for travel overall, for work/school-related reasons, for entertainment/recreation/social purposes, and by personal vehicle. For long-distance travel, we modeled the Relative Desired Mobility for travel overall, for work/school-related reasons, for entertainment/recreation/social purposes, by personal vehicle and by airplane. A model for commute Relative Desired Mobility can be found in Redmond and Mokhtarian (2001a). The sample used in this model was defined as respondents who were either full- or part-time employed and, additionally, completed the questions regarding

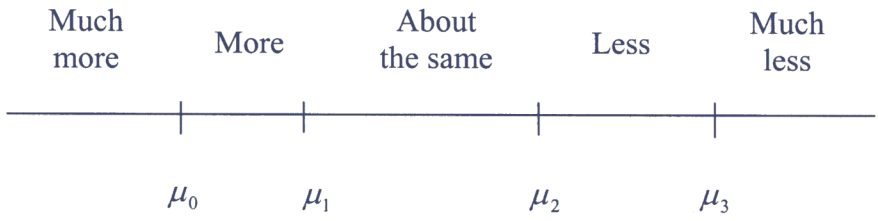
ideal commute time and actual commute time (giving an initial sample size of 1300 and eventually resulting in a sample size of 1155 for the model). Although it is not discussed separately here, it is included in the summary table presented in Section 4, for completeness.

The LIMDEP econometrics package (Greene, 1995) was used to estimate the models. The initial model specifications contained 114 variables measuring travel Attitudes, Personality, Lifestyle, Objective and Subjective Mobility, Travel Liking, Mobility Constraints, and Demographic traits. Each of these variables had a conceptual justification for inclusion. The significance of the variables in the initial model specifications was inspected, and statistically insignificant variables were eliminated. Variations on the remaining specification were further tested to obtain a final model having all (and only) significant explanatory variables. Through this procedure the final models were obtained, all of whose explanatory variables were not only statistically significant, but also conceptually interpretable.

In the following sections, we present and discuss the models. Two comments about interpretation are in order. First, in discussing the impact of the beta coefficient, it is important to distinguish between its impact on y_i, the observed discrete Relative Desired Mobility, versus y_i^*, the latent, continuous Relative Desired Mobility. With respect to y_i^*, the β coefficient is interpreted in the usual way: if β_j is positive, it is correct to say that a one-unit increase in the corresponding x_{ij} would result in an expected increase of β_j units in the respondent's true unobserved Relative Desired Mobility. With respect to y_i, however, the interpretation is not so straightforward (Greene, 2000). Here, it is logical to discuss the impact of β_j on the predicted probability that a respondent selects one of the five discrete answer categories. But, perhaps contrary to intuition, a unit increase in x_{ij} will not necessarily increase the probability that higher categories of y_i are chosen (to be precise, it *will* increase the probability that the highest category is chosen, and decrease the probability that the lowest category is chosen, but the effect on all the other categories will depend on where $\boldsymbol{\beta}'\mathbf{x}_i$ for that particular individual falls relative to the μ thresholds). To avoid this ambiguity, we will always interpret the β coefficients in terms of their impacts on the latent Relative Desired Mobility, y_i^*.

The second comment about interpretation concerns the way in which LIMDEP treats censored models. This econometric package handles only right censoring, while our models involve *left* censoring. We therefore recoded the Relative Desired Mobility answers, reversing their order. The resulting β coefficients had, as a consequence, reversed signs. The tables present the coefficients with the correct signs, that is, opposite to the ones given by LIMDEP's output. The threshold parameters μ, however, are presented as given by the output — meaning that higher μ s are then associated with lower response categories. Figure 2 illustrates the correspondence of the five categories on the observed Relative Desired Mobility scale to regions of the underlying continuous scale demarcated by the μ parameters.

Figure 2: The Threshold Parameters on the Underlying Continuous Scale



In the tables that follow, coefficients are reported to the third significant digit.

3.2 Short-Distance Overall

The "overall" categories are special in the sense that they comprise trips of all sorts, making the pertinent questions more diffuse, and consequently the answers more dependent on how the respondent interprets "overall" in her mind. Some people's mobility may be clearly dominated by their commutes, which they may perceive as excessive; these people's overall Relative Desired Mobility may be, to a large extent, dictated by their wish to reduce their commute travel. Similarly, other people's overall Relative Desired Mobility may be dominated by their craving for more, say, recreational types of travel. Yet for other people, no particular type of travel dominates their perception of the concept "overall travel". The questions pertaining to overall Relative Desired Mobility were placed at the beginning of their respective sections (short- and long-distance group of questions), in order to obtain instinctive responses, uncontaminated by rationalizations originating in answers to the questions on specific modes and purposes of travel.

The resulting model for short distance, presented in Table 3, includes fifteen explanatory variables plus the constant term. The log-likelihood for the final model is -1111.74, compared to a restricted log-likelihood (for the market share model containing only a constant term) of -1346.41. The χ^2 value of 469.4 shows that the final model explains substantially more information than the market share model ($\alpha << 0.005$). Although there are no universally-accepted measures of goodness of fit for the ordered probit model (censored or not), Veall and Zimmermann (1992) report that, in their ordered probit simulations involving one explanatory variable and up to four categories, the following modified McKelvey/Zavoina (1975) statistic most nearly replicated the "true" R^2 obtained by conducting OLS on the underlying continuous variable:

$$R^2_{MZ} = \frac{\sum_{i=1}^{N} (\hat{y}_i^* - \bar{\hat{y}}_i^*)^2}{\sum_{i=1}^{N} (\hat{y}_i^* - \bar{\hat{y}}_i^*)^2 + N},$$

where $\hat{y}_i^* = \hat{\beta}' x_i$ (the predicted value of the latent variable y_i^* based on the estimated parameters $\hat{\beta}$) and $\bar{\hat{y}}_i^* = \sum_{i=1}^{N} \hat{y}_i^* / N$ (the average value of $\hat{y}_i^*$). The numerator of the fraction can be viewed as a measure of explained variance (analogous to the regression sum of squares for regular

regression models), and N (= $N\sigma^2$, since σ is taken to be one without loss of generality, $= \sum_{i=1}^{N} \sigma^2 = \sum_{i=1}^{N} \text{var}(\varepsilon_i)$) is a measure of unexplained variance; hence R^2_{MZ} has the familiar interpretation of proportion of total variance explained by the model. This measure is 0.37 for the present model.

Table 3: Short-Distance Overall Relative Desired Mobility Model (N = 1283)

Variable	Coefficient	t
Constant	-2.780	-6.213
Objective Mobility		
Frequency of commuting to work/school (SD) [1, 2, ..., 6]	-0.140	-2.152
Frequency of travel for work/school related reasons (SD) [1, 2, ..., 6]	-0.0545	-2.371
Frequency of travel to eat a meal (SD) [1, 2, ..., 6]	0.0738	2.116
Miles per week commuting to work/school (SD) [≥0]	-0.00132	-4.141
Excess commute time [-35, ..., 115]	-0.00841	-3.559
Subjective Mobility [1, 2, ..., 5]		
Overall (SD)	-0.239	-7.023
Grocery shopping (SD)	0.0974	2.516
Travel Liking [1, 2, ..., 5]		
Overall (SD)	0.345	7.329
Work/school-related activities (SD)	0.129	3.082
Work/school-related activities (LD)	0.0989	2.817
Attitudes		
Commute benefit factor score [-2.9, ..., 2.6]	0.190	4.281
Lifestyle		
Status seeker factor score [-1.7, ..., 2.7]	0.105	2.499
Family/community oriented factor score [-3.9, ..., 2.1]	-0.0893	-1.949
Mobility constraints		
Percentage of time a personal vehicle is available [0, 20, ..., 100]	-0.00369	-3.080
Demographics		
Urban [0, 1]	-0.214	-2.920
Threshold Parameters		
μ_1^+	1.159	7.620
μ_2^+	3.377	21.601
μ_3^+	5.016	30.025

SD = Short Distance LD = Long Distance [ ] = range of possible or observed responses

$L(\hat{\beta})$ = -1111.737 $L(MS)$ = -1346.414 χ^2 = 469.354 d.f. = 15 R^2_{MZ} = 0.366

+ Care must be taken in the interpretation of the threshold parameters because LIMDEP allows only for right censoring, whereas our original model involved left censoring. To estimate the model, we reversed the RDM variable by subtracting each observed value from 4. For ease of interpretation, we reversed the resulting signs on the β coefficients in the table above, so that a positive coefficient indicates a higher value of RDM as in our original specification. We did not alter the LIMDEP-generated estimates of μ, however, so that the ranges (-∞, 0), (0, μ_1), (μ_1, μ_2), (μ_2, μ_3), and (μ_3, +∞) refer to "much more", "more", "about the same", "less", and "much less", respectively.

Turning to the explanatory variables in the final model, four of the five Objective Mobility variables (frequency of commute trips, frequency of work/school-related trips, commute miles

traveled per week, and excess commute time) have negative coefficients. It is natural that the more a person travels for work, the less overall short-distance travel he wants to do, because work trips constitute a substantial proportion of the overall short-distance travel (in our sample of commuters, commute or work-related person-miles traveled comprised about 65% of the total short-distance weekly person-miles traveled). The excess commute time variable was calculated by subtracting individuals' ideal commute time in minutes from their actual commute time. It therefore represents a clear indication of an amount of travel beyond what is actually wanted, and its negative sign is thus logical. Interestingly, the frequency of traveling to eat a meal is positively related to the Relative Desired Mobility for overall short-distance travel. This frequency variable may be an indicator of a lifestyle "on the go" including many interests outside of the normal routines of work and home. It is possible that for some individuals, eating out is a "second best" choice, a marker for the desire to undertake more recreational/social travel than their current constraints permit.

As expected, the Subjective Mobility for overall short-distance travel is strongly negatively related to the Relative Desired Mobility in the same category ($t = -7.02$): the more someone thinks he does a certain kind of travel, the more he will generally want to reduce the same type of travel. The Subjective Mobility for grocery shopping has a positive sign. This variable may indicate that individuals with an overload of domestic responsibilities, as suggested by a high perception of their grocery shopping travel, are less able to engage in all the *other* types of travel they desire to do.

It was noted in Section 2 that Travel Liking connotes an affective attitude toward traveling. Appropriately specific affective attitudes can be good predictors of an individual's intention (conative attitude) to behave in a certain way. The desire of an individual to increase or decrease her amount of travel can be viewed as a preference measure, that is a precursor of an *intention* to modify her current level of travel[1]. In light of this, we expect the liking for a specific type of travel to be a good predictor of the relative desire to increase or decrease the same type of travel. In support of this expectation, three Travel Liking variables (for short-distance overall and short- and long-distance work/school-related travel) have positive coefficients; the more I like overall short-distance and work/school-related travel, the more I want to increase my overall short-distance travel over what I currently do. Particularly, the Travel Liking variable for short-distance overall has the highest significance ($t = 7.33$) of all the variables in this model.

The commute benefit Attitudinal factor has a positive sign, consistent with expectations founded on the considerations laid out in the preceding paragraph, regarding the relation between attitudes and desires or precursors of intentions. This factor is an indicator of the positive utility that the respondent gives to her commute, with heavily-loadings statements including "[M]y commute is a real hassle" (negative loading), "[M]y commute trip is a useful transition between home and work", and "I use my commute time productively". While the argument that people with high scores on this factor would like to increase their commutes would be tenable, the

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[1] It is not an intention directly, since one can desire to do something she has no intention of actually doing, due to recognized constraints. For example, a study of 791 English car drivers found that 33% reported wanting to reduce auto travel over the next year, but only 7% reported being likely to do so (Stradling, *et al.*, 2000).

significance of this variable is probably mostly due to the desire of people with low scores to *reduce* their commutes.

Two Lifestyle factors enter the model, with opposite but natural signs. Those who are status seekers want to increase short-distance travel, because it is by traveling (as opposed to spending more time in habitual places like home or work) that they find opportunities to demonstrate their status. Probably they enjoy, say, displaying a nice car (statements heavily loading on this factor are "to me, the car is a status symbol" and "a lot of the fun of having something nice is showing it off"). It does not seem surprising that those who are family/community-oriented want to decrease short-distance travel, as reflected by the negative coefficient of the corresponding factor, given that they give high priority to their family (statements heavily loading on this factor are "I'd like to spend more time with my family and friends" and "I'd like to spend more time on social, environmental, or religious causes"). The implication is that for the most part, short-distance traveling represents time away from the family, or a less desirable form of time with family members.

Both the Demographic and Mobility Constraints variables have negative signs. All else equal, North San Francisco residents want to reduce their travel more than residents of the suburban neighborhoods of Concord and Pleasant Hill. This might be an indication that they located in a dense mixed-use neighborhood following a desire to minimize short-distance travel. In addition, the heavier traffic conditions found in denser urban areas probably inhibit people's desire for short-distance travel. We suggest that dense urban places give people a sense of proximity, closeness, and accessibility, which is not experienced in suburban places. This may create a feeling of travel deficit in dwellers of suburban areas, which would increase their perceived demand for additional mobility in order to achieve that proximity or accessibility. As for the Mobility Constraints variable, it is perhaps human nature to react to deprivation by wanting even more the thing of which one is deprived. Thus, the less a personal vehicle is available, the more an individual wants to travel. This variable may be also expressing a deficit in mobility: for two individuals with the same overall short-distance Objective Mobility, the one with higher accessibility to a personal vehicle is more likely to have his mobility needs[2] satisfied by the amount of travel he already does.

The threshold parameters, μ, define the response categories on a continuous scale. In other words, they indicate the range on the continuous unobserved scale to which each of the observed response categories apply (see Figure 2 in Section 3.1). Thus, it is interesting to examine the spacing of the estimated μ s to see how individuals differently interpret the five Relative Desired Mobility response categories. LIMDEP normalizes μ_0 to zero and thus the values obtained for the other three threshold parameters imply that the widths of the "less", "about the same", and "more" categories on the continuous latent scale are 1.59, 2.22, and 1.16, respectively. Those widths are neither identical nor symmetric around the middle category, confirming that the observed ordinal scale does not have interval properties. These values show that the "about the

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[2] A "need", in the context of Relative Desired Mobility, refers to a psychological requirement for the well-being of the person (definition adapted from Merriam-Webster's Collegiate Dictionary). Thus, it does not necessarily refer only to the minimum required mandatory and maintenance travel. A certain amount of travel beyond the minimum may be needed for well-being.

same" response category embraces a wider range of respondents' true feelings than do the "less" or "more" categories. It can also be seen that a wider (on the continuous latent scale) range of true feelings leads the respondent to answer "less", compared to the range that leads him to answer "more". As expected, the t-statistics for the μ s get successively larger with each one, indicating that the μ s are successively more significantly different from zero, the farther from zero they are.

3.3 Short-Distance Work/School-Related

The Relative Desired Mobility for commuting travel was analyzed in a previous study based on the same data (Redmond and Mokhtarian, 2001a), and will not be separately discussed within this report (however the results are summarized in Table 13 together with those of the models presented here). In this subsection, we introduce a model for work/school-related short-distance Relative Desired Mobility, the results of which are shown in Table 4.

A remarkable feature of this model is the absence of significant Objective Mobility explanatory variables. This result, however striking, is in accordance with the conceptual model shown in Figure 1, that is, Relative Desired Mobility is affected by Objective Mobility through the *subjective assessment* of that actual amount of travel (Subjective Mobility). Of course, this is a general conceptualization and the extent to which the results corroborate it will depend on the model in question. We have already seen, for example, that Objective Mobility does explicitly affect Relative Desired Mobility in the overall short distance model. However, as will be seen after studying all the models presented in this report, there is an overall preeminence of Subjective Mobility over Objective Mobility in determining Relative Desired Mobility. It is appropriate to remember that we are dealing with unidirectional linear models, and that the nature of the relationships between the key endogenous variables will be more precisely captured in a simultaneous equations framework.

Subjective Mobility for work/school-related travel has a logical negative sign. The positive sign of Subjective Mobility for long-distance entertainment travel is also natural: the less someone thinks she travels in this category, the more she desires to reduce her work-related travel, in order to be able to travel more for entertainment.

The Travel Liking variables include basically the same types of travel as the Subjective Mobility group (here, the *short-distance* version of the liking for entertainment travel enters the model), with the addition of *long-distance* work/school related. These Travel Liking variables have, as expected, the opposite signs to their Subjective Mobility counterparts. The interpretation is that the more one likes work/school-related travel, the more one will want to increase one's short-distance mobility in that category. The appearance of the long-distance Travel Liking variable is interesting; it suggests that in assessing their desires with respect to work-related travel, respondents think mainly about the purpose of the travel, and less about the distance range. Intuitively one may believe that a long-distance work-related trip may have a stronger "recreational" meaning than a similar short-distance trip. While this might still be true, it is noteworthy that the model captures the liking for the *primary* purpose of the long-distance travel as a significant predictor of its short-distance Relative Desired Mobility counterpart. The negative sign of the liking for short-distance entertainment/recreational/social travel is an expression of

competing preferences: someone who prefers this type of travel over work/school-related travel would wish to reduce his amount of the latter kind of travel.

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Table 4: Short-Distance Work/School-Related Relative Desired Mobility Model (N = 1208)

Variable	Coefficient	t
Constant	-5.851	-7.535
Subjective Mobility [1, 2, …, 5]		
Work/school-related activities (SD)	-0.238	-7.056
Entertainment/recreation/social (LD)	0.112	2.285
Travel Liking [1, 2, …, 5]		
Work/school-related activities (SD)	0.580	12.036
Entertainment/recreation/social (SD)	-0.160	-2.816
Work/school-related activities (LD)	0.254	6.040
Attitudes		
Commute benefit factor score [-2.9, …, 2.6]	0.152	3.082
Lifestyle		
Frustration factor score [-2.0, …, 2.7]	0.168	3.308
Demographics		
Year of personal vehicle […, 1997, 1998]	0.0162	2.121
Age category [1, 2, …, 5]	-0.164	-2.416
Number of persons 75 years old and older [0, 1, …]	0.602	2.373
Someone (other than preschoolers) needs special care [0, 1]	-0.540	-2.831
Personal vehicle type is mid-sized or sport [0, 1]	0.336	3.639
Manager or professional (occupational dummy variable) [0, 1]	0.306	3.466
Threshold Parameters		
μ_1^+	0.577	4.659
μ_2^+	3.606	23.861
μ_3^+	4.893	30.215

SD = Short Distance LD = Long Distance [ ] = range of possible or observed responses

$L(\hat{\beta})$ = -757.086 $L(MS)$ = -975.574 χ^2 = 436.976 d.f. = 13 R^2_{MZ} = 0.334

+ Care must be taken in the interpretation of the threshold parameters because LIMDEP allows only for right censoring, whereas our original model involved left censoring. To estimate the model, we reversed the RDM variable by subtracting each observed value from 4. For ease of interpretation, we reversed the resulting signs on the β coefficients in the table above, so that a positive coefficient indicates a higher value of RDM as in our original specification. We did not alter the LIMDEP-generated estimates of μ, however, so that the ranges $(-\infty, 0)$, $(0, \mu_1)$, (μ_1, μ_2), (μ_2, μ_3), and $(\mu_3, +\infty)$ refer to "much more", "more", "about the same", "less", and "much less", respectively.

A remarkable feature of this model is the absence of significant Objective Mobility explanatory variables. This result, however striking, is in accordance with the conceptual model shown in Figure 1, that is, Relative Desired Mobility is affected by Objective Mobility through the *subjective assessment* of that actual amount of travel (Subjective Mobility). Of course, this is a general conceptualization and the extent to which the results corroborate it will depend on the model in question. We have already seen, for example, that Objective Mobility does explicitly affect Relative Desired Mobility in the overall short distance model. However, as will be seen after studying all the models presented in this report, there is an overall preeminence of Subjective Mobility over Objective Mobility in determining Relative Desired Mobility. It is appropriate to remember that we are dealing with unidirectional linear models, and that the nature of the relationships between the key endogenous variables will be more precisely captured in a simultaneous equations framework.

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The commute benefit Attitudinal factor has a positive sign as it did in the model for overall short-distance Relative Desired Mobility, and its interpretation is similar. The two models have comparable magnitude and significance of the coefficients, which may be an indication that one's attitude toward commute travel affects the evaluation of Relative Desired Mobility in these categories similarly.

The frustrated Lifestyle factor has heavy loadings on statements like "I often feel like I don't have much control over my life" and "I am generally satisfied with my life" (negative loading). Its positive coefficient may indicate a tendency for these individuals to seek a solution to their dissatisfaction in a higher involvement with work.
Among the Demographic variables we find another work-related variable with positive sign: a dummy indicator of either managerial or professional occupation (this was originally two separate dummy variables that were combined when their coefficients were similar). These individuals' desire for more work-related short-distance travel may be attributed to a higher career-related ambition. People with other kinds of occupations may also have, on average, a lesser degree of occupational fulfillment, which may inhibit their motivation to increase their work-related travel.

Characteristics of the personal vehicle affect the Relative Desired Mobility in this category through two variables. The year of the personal vehicle has a positive sign, indicating that older vehicles probably make travel conditions less comfortable than newer ones, thereby inducing a desire to reduce the amount of travel. Conversely, a new vehicle may induce the desire for more travel, to enjoy or show off the new vehicle. A similar relationship may be at work with respect to the positive impact of driving a sports car on the Relative Desired amount of work-related travel. The positive relationship of driving a mid-sized car to Relative Desired Mobility is

probably a manifestation of the association of that vehicle type with the "Assistant VPs" Personality/Lifestyle cluster (Choo and Mokhtarian, 2002).

The negative coefficient of the respondent's age category has the intuitive interpretation that levels of ambition related to work/school may tend to decay with age. Ironically, the advanced age of *other* members of one's household seemingly tends to motivate one to want to travel more. This effect may be related to a wish to spend less time in a home that one shares with, say, one's parents. There might also be a rationalization effect here. Expressing a desire for more recreational travel to "escape" from the responsibility may be disloyal in the respondent's mind, whereas expressing a desire for more *work-related* travel may feel more legitimate and hence less likely to create a conflict. On the other hand, the role of this variable may be partly counteracted by the related dummy variable indicating the presence of someone other than preschoolers needing special care. The negative coefficient of this variable presumably indicates a concern that excessive work-related travel is interfering with the ability to care for a dependent. Both variables together seem to capture precisely the conflict between responsibility (as well as devotion) and a need for respite or escape felt by many in the position of providing dependent care to, or even just living with, an older household member.

Finally, looking at the value of the threshold parameters, we see that the "about the same" response translates into a much wider range (3.03) of the latent continuous dependent variable than do the "less" (1.29) and the "more" (0.58) responses. As with the overall model, the range corresponding to the observed response of "less" is wider than the range corresponding to "more", with the difference even more pronounced here.

3.4 Short-Distance Entertainment/Recreation/Social

The model presented in this subsection is concerned with a kind of travel whose nature is very different from the work-related type just analyzed. It is interesting then to see if, and how, this difference materializes in the results. The first look at the resulting model, presented in Table 5, reveals an important similarity: the absence of Objective Mobility variables, the effect of which seems, as in the model for work/school-related travel, to find expression through the mediation of Subjective Mobility variables. Among the latter, we find, with a negative coefficient, the Subjective Mobility for short-distance entertainment/recreation/social travel — the type of travel to which the dependent variable relates. The interpretation of this coefficient is again straightforward: the higher the subjective assessment of one's mobility in a certain category of travel, the less one will want to increase one's mobility in that category. The second Subjective Mobility variable, for walking/jogging/bicycling, has a positive coefficient, which may be representing individuals without sufficient access to motorized transportation modes.

Table 5: Short-Distance Entertainment/Recreation/Social Relative Desired Mobility Model (N = 1348)

Variable	Coefficient	t
Constant	-5.207	-17.411
Subjective Mobility [1, 2, …, 5]		
Entertainment/recreation/social (SD)	-0.136	-3.807
Walking/jogging/bicycling (SD)	0.0730	2.297
Travel Liking [1, 2, …, 5]		
Entertainment/recreation/social (SD)	0.544	12.407
Grocery shopping (SD)	-0.0975	-2.347
Entertainment/recreation/social (LD)	0.129	3.452
Personal vehicle (LD)	0.157	4.537
Lifestyle		
Status seeker factor score [-1.7, …, 2.7]	0.100	2.350
Frustration factor score [-2.0, …, 2.7]	0.146	3.747
Demographics		
Female [0, 1]	0.138	2.064
Age category [1, 2, …, 5]	0.115	2.331
Number of people in the household [1, 2, …]	0.0630	2.472
Urban [0, 1]	0.199	2.856
Sales (occupational dummy variable) [0, 1]	-0.296	-2.289
Threshold Parameters		
μ_1^+	1.335	18.484
μ_2^+	3.487	39.415
μ_3^+	5.033	30.183

SD = Short Distance LD = Long Distance [ ] = range of possible or observed responses

$L(\hat{\beta})$ = -1182.593 $L(MS)$ = -1329.171 χ^2 = 293.155 d.f. = 13 R^2_{MZ} = 0.237

+ Care must be taken in the interpretation of the threshold parameters because LIMDEP allows only for right censoring, whereas our original model involved left censoring. To estimate the model, we reversed the RDM variable by subtracting each observed value from 4. For ease of interpretation, we reversed the resulting signs on the β coefficients in the table above, so that a positive coefficient indicates a higher value of RDM as in our original specification. We did not alter the LIMDEP-generated estimates of μ, however, so that the ranges $(-\infty, 0)$, $(0, \mu_1)$, (μ_1, μ_2), (μ_2, μ_3), and $(\mu_3, +\infty)$ refer to "much more", "more", "about the same", "less", and "much less", respectively.

Four Travel Liking variables enter the model, the one for short-distance entertainment/recreation/social travel being dominant, with the expected positive coefficient. Just as in the model for work/school-related, the Travel Liking variable for the *long-distance* type of travel whose Relative Desired Mobility is modeled also enters the results with a positive coefficient. The interpretation is then analogous to the one outlined in the analogous situation found in Table 4. The negative coefficient of the Travel Liking for grocery shopping may be indicative of a certain lifestyle — some people more greatly enjoy activities related to their homes, feeling a lower need for entertainment/recreation/social activities *external* to the home. The fourth Travel Liking variable concerns long-distance travel by personal vehicle, and has a positive sign. This variable may also have a "going-out" lifestyle connotation: the more a person likes long-distance travel by personal vehicle, the more interested she is likely to be in engaging in various kinds of activities outside the home. It may further be capturing some effects that would normally be

expressed through the liking for *short-distance* travel by personal vehicle (these two Travel Liking variables have a correlation of 0.45). Presumably most of the short-distance travel for entertainment is done, or is more suitably done, by personal vehicle. Thus, for two people with the same Subjective Mobility for this type of travel, it seems reasonable to expect that the one with higher liking for personal-vehicle travel will more readily want additional recreational travel.

The positive coefficient of the status seeker Lifestyle factor may be given the same interpretation as in the model for overall short-distance: an indication of a tendency or desire to engage in travel that gives the opportunity to flaunt, possibly showing off a nice car. The frustration factor enters again (it entered the model for work/school-related travel) with a positive coefficient. A similar interpretation can be argued: frustrated people may feel that an increase in their recreational travel can palliate their personal dissatisfaction. Further, if frustrated individuals have an *overall* attitude that is more negative then average (more likely to express discontentment about any issue), it is plausible that they would tend to judge their amount of travel (at least for "fun" purposes) as insufficient, thus rating positively their Relative Desired Mobility.

Turning to the Demographic variables, we find that women, in our sample, have a greater desire to increase their mobility for social purposes than men. Evidence suggests that women spend more time than men on household-related activities, and this may result in them either having fewer opportunities to engage in recreational travel or needing more recreational travel to alleviate the burden of household responsibilities. In our sample, men objectively travel more for social purposes than women do (although the difference is only significant at a 0.16 level). However, the significant corresponding Subjective Mobility variable should largely be capturing the effects of differences in perceived amounts of recreational travel. The gender variable may be capturing some residual effects of differences in travel amounts, or may be representing an gender effect in addition to that.

The positive coefficient of the age category may initially seem a little perplexing since, intuitively, one expects younger people to have greater needs for entertainment activities/travel. However, the Relative Desired Mobility variable is not measuring an absolute need, but a relative, unmet need. Consider two individuals with the same levels of Subjective Mobility and Travel Liking for entertainment travel. It is plausible that a person in his 40s would be, on average, more restricted by family- and work-related responsibilities than a person in her 20s, and therefore less able to satisfy his needs for recreational travel.

The positive coefficient of the number of people in the household indicates that the deficit in recreational travel increases with household size. Additional household members, children or elders, bring about more responsibilities, which generally leave less disposable time to engage in short-distance social types of travel. Even if one is able to maintain one's recreational Objective Mobility with a bigger household, some psychological mechanisms may trigger a higher desire for this sort of travel. Increased household-related duties may generate a perception of insufficient recreational activities (perhaps compared to the sort of recreational activities one was able to do when, say, children were not present), which could prompt a desire to do more travel for such purposes.

The positive coefficient of the urban dummy variable indicates that urbanites have a greater desire to increase their short-distance recreational travel. This result contrasts — but does not necessarily conflict — with the negative coefficient of the same variable in Table 3 (short-distance overall). The coefficient of this dummy in the present case indicates that given two individuals with identical Subjective Mobility, one urbanite and one suburbanite, the former is likely to desire a greater recreational short-distance mobility. This result is probably based on differences between urban and suburban lifestyles, both related to, and perhaps independent of, demographic differences such as in age, income, and family status. Also, it is important to realize that, as shown in Table 6, a given level of Subjective Mobility corresponds, on average, to a lower Objective Mobility (in terms of distance traveled) for urbanites in our sample, compared to suburbanites. This may be due to differences in psychological predisposition, in land use density and mixture, in traffic conditions, and in other factors. In any case, the presence of this variable is suggesting that, when only Subjective Mobility (and Travel Liking) is controlled for, North San Francisco residents are more likely to have a deficit in their recreational short-distance mobility, compared to residents of Pleasant Hill and Concord.[3]

Table 6: Relationship of Objective Mobility to Subjective Mobility by Neighborhood Type

Social SD SM	Neighborhood Type	
	Suburban (N = 687)	Urban (N = 670)
	Mean Social SD Miles/Week (N = 1357)	
None	4 (32)	7 (24)
2	17 (265)	14 (243)
3	26 (259)	20 (259)
4	49 (101)	30 (108)
A lot	71 (30)	57 (36)

The negative coefficient of the sales occupational dummy variable may point to a lifestyle that often mingles social and work activities indistinguishably (the business lunch, the cocktail party for clients, attending sports events with clients, and so on). The extensive interaction with people that a sales occupation entails — with or without the explicit entertainment aspect — may amply fulfill the need for social activities, and dampen the enthusiasm for engaging in them in a non-work context.

Again, the "about the same" response category embraces a wider range of respondents' true feelings than the "less" or "more" categories. This is seen from the values of the threshold parameters, which render the widths for the "less", "about the same", and "more" categories, on the continuous latent scale as 1.55, 2.13, and 1.36 respectively. In this case, however, the widths of the "less" and "more" categories are more nearly equal than for the previous models.

[3] In terms of trip frequency, however, urbanites have higher means than the suburban residents.

3.5 Short-Distance Personal Vehicle

This subsection concerns the only mode-specific model for short-distance we present in this report: the Relative Desired Mobility by personal vehicle. The results, displayed in Table 7, show five Objective Mobility variables — an intriguing result, in view of the absence of Objective Mobility variables in the purpose-specific models analyzed in the two preceding subsections. The general presence of Objective Mobility-type variables (and the similarity of the actual variables) in both models constitutes, however, a commonality of this and the overall short-distance models. Resemblances between these two models are natural, given the fact that the personal vehicle is the prevalent transportation mode in short distance travel. In particular, three of these variables relate to commuting travel: frequency of commuting trips, commute distance, and commute-time excess. Their negative coefficients seem to be a consequence of the personal vehicle being the dominant commute mode—the more someone commutes, the more intensive her use of a personal vehicle for short distance travel, which will likely result in a desire to decrease that use. This sequence is strengthened to the extent that her actual commute time exceeds her ideal commute time. Along analogous lines one may interpret the negative coefficient of the frequency of trips to eat a meal.

The variable measuring the long-distance mileage traveled by personal vehicle for work, school, or entertainment purposes presumably represents most of the long-distance mileage by this mode (trips for purposes other than these were not captured on a mode-specific basis). Its positive coefficient indicates that the longer the total distance a person travels on long-distance trips, the higher his desire to increase his personal-vehicle mobility on the short-distance range. There could be two different bases for this result. On the one hand, it could represent a general positive orientation toward personal-vehicle travel, whether for long distance or short distance trips (the positive coefficients of both short-distance and long-distance personal-vehicle Travel Liking support this interpretation). On the other hand, it could also represent a perceived imbalance in one's travel distribution: because one travels so much for long distance, one feels relatively deprived when it comes to short distance. These two interpretations are not mutually exclusive.

Interestingly, while all the Objective Mobility variables are purpose-specific, all four Subjective Mobility variables entering the model are *mode*-specific. The coefficients of these variables have the logical direction, indicating that a higher personal-vehicle Subjective Mobility will likely inhibit the personal-vehicle Relative Desired Mobility, while higher bus, light rail/heavy rail, or walking/jogging/bicycling Subjective Mobility will likely have the opposite effect. While the latter results are logical, they are also important. They point to an innate dissatisfaction with non-personal-vehicle travel modes, and suggest a general desire to switch to the personal vehicle when possible.

Paralleling their Subjective Mobility counterparts, all four Travel Liking variables entering the model are mode-specific. The two variables related to modes other than personal vehicle — liking for light rail/heavy rail, and liking for walking/jogging/bicycling — have the intuitively logical negative sign. As another interesting result, we find the Travel Liking for the personal vehicle — both for short and long distance — in this model of short-distance personal vehicle Relative Desired Mobility. This pattern has been consistent for all three (purpose- and mode-) specific short-distance models. While both variables have a positive coefficient, suggesting that a

higher liking for long-distance personal-vehicle travel also triggers a desire to increase one's short-distance personal-vehicle travel, the coefficient and t-statistic for the short-distance Travel Liking variable are much higher.

Two Attitudinal factors enter the model: the pro-environmental solutions and the commute benefit. The former includes high loadings on statements like "I limit my auto travel to help improve congestion and air quality" and "[w]e can find cost-effective technological solutions to the problem of air pollution". Its negative coefficient is thus natural, since high scores on this factor are associated with individuals who, with ecological motives, are keen to minimize their personal-vehicle travel. The commute benefit factor was also found in the models for short-distance overall and work/school-related Relative Desired Mobility. There, as here, it has a positive coefficient indicative of a greater inclination to engage in travel due to its higher perceived utility. This variable is, like the Objective Mobility group, indicative of the strong association between commuting travel and the personal-vehicle mode.

Both the status-seeker and frustrated Lifestyle factors have been found in previous models, and their interpretations in the present context are similar to the ones outlined then.

This model contains two variables in the Mobility Constraints category. The percentage of the time a personal vehicle is available has a negative coefficient that seems logical: the lower an individual's vehicle availability, the more unlikely it is that his personal-vehicle travel needs will be satisfied. Even when Objective and Subjective Mobility are controlled for, these variables do not account for the degree of satisfaction of mobility demand. The variable indicating some inability to take public transportation has a somewhat similar interpretation. People who cannot take, or are limited in taking, public transportation, can be considered, to a large extent, mode captives of the personal vehicle. With their mode choices reduced, they are more vulnerable to deficits of personal-vehicle availability, which can leave them unable to satisfy their short-distance travel needs.

Resembling the result for the overall short-distance model, the urban dummy variable has a negative coefficient. Consistent with previous arguments, the lower personal-vehicle Relative Desired Mobility displayed by urbanites may be related to the very spirit that led them to choose to live in a high-density area. It can also be argued that heavy traffic conditions in urban areas can discourage people from wanting to use their personal vehicle.

The "about the same" response category, as in all the previous models, includes a wider range (2.41) of respondents' true feelings on the continuous latent scale than the "less" (1.49) or "more" (0.98) categories. Also in keeping with the general tendency of the previous models, the "less" category is wider than the "more" category in terms of their ranges on the true scale.

Table 7: Short-Distance Personal Vehicle Relative Desired Mobility Model (N = 1268)

Variable	Coefficient	t
Constant	-2.727	-5.361
Objective Mobility		
Frequency of commuting to work/school (SD) [1, 2, ..., 6]	-0.144	-2.389
Frequency of travel to eat a meal (SD) [1, 2, …, 6]	-0.0821	-2.290
Commute distance [≥0]	-0.0101	-2.920
Excess commute time [-35, …, 115]	-0.00727	-2.649
Total miles for work/school/entertainment purposes by personal vehicle (LD)	0.0000237	2.323
Subjective Mobility [1, 2, …, 5]		
Personal vehicle (SD)	-0.115	-3.295
Bus (SD)	0.151	4.020
Train/BART/light rail (SD)	0.133	3.736
Walking/jogging/bicycling (SD)	0.114	2.949
Travel Liking [1, 2, …, 5]		
Personal vehicle (SD)	0.561	12.820
Train/BART/light rail (SD)	-0.129	-3.375
Walking/jogging/bicycling (SD)	-0.113	-2.614
Personal vehicle (LD)	0.112	2.966
Attitudes		
Pro-environmental factor score [-2.3, …, 2.4]	-0.180	-3.491
Commute benefit factor score [-2.9, …, 2.6]	0.171	3.735
Lifestyle		
Status seeker factor score [-1.7, …, 2.7]	0.114	2.522
Frustration factor score [-2.0, …, 2.7]	0.106	2.403
Mobility constraints		
Physical condition/anxiety limiting taking public transportation [1, 2, 3]	0.338	2.649
Percentage of time a vehicle is available [0, 20, …, 100]	-0.00834	-5.188
Demographics		
Urban [0, 1]	-0.238	-2.769
Threshold Parameters		
μ_1^+	0.975	10.824
μ_2^+	3.387	31.931
μ_3^+	4.872	37.591

SD = Short Distance LD = Long Distance [ ] = range of possible or observed responses

$L(\hat{\beta})$ = -1064.150 $L(MS)$ = -1370.505 χ^2 = 612.711 d.f. = 20 R^2_{MZ} = 0.454

+ Care must be taken in the interpretation of the threshold parameters because LIMDEP allows only for right censoring, whereas our original model involved left censoring. To estimate the model, we reversed the RDM variable by subtracting each observed value from 4. For ease of interpretation, we reversed the resulting signs on the β coefficients in the table above, so that a positive coefficient indicates a higher value of RDM as in our original specification. We did not alter the LIMDEP-generated estimates of μ, however, so that the ranges $(-\infty, 0)$, $(0, \mu_1)$, (μ_1, μ_2), (μ_2, μ_3), and $(\mu_3, +\infty)$ refer to "much more", "more", "about the same", "less", and "much less", respectively.

3.6 Overall Long-Distance

Here we present the first of the five long-distance models included in this report: for overall long-distance Relative Desired Mobility. The model, shown in Table 8, includes 14 explanatory variables (plus the constant term) that were statistically significant and conceptually interpretable.

Table 8: Long-Distance Overall Relative Desired Mobility Model (N = 1338)

Variable	Coefficient	t
Constant	-3.720	-17.590
Objective Mobility		
Sum of the natural logarithms of (miles for each work/school-related trip + 1) (LD)	-0.00111	-3.163
Subjective Mobility [1, 2, …, 5]		
Walking/jogging/bicycling (SD)	0.0900	3.017
Overall (LD)	-0.193	-4.419
Work/school-related activities (LD)	-0.0807	-2.776
Entertainment/recreation/social (LD)	0.105	3.074
Travel Liking [1, 2, …, 5]		
Taking others where they need to go (SD)	-0.0741	2.096
Overall (LD)	0.362	7.151
Entertainment/recreation/social (LD)	0.243	5.605
Airplane (LD)	0.0995	2.927
Attitudes		
Travel dislike factor score [-1.8, …, 3.7]	-0.107	-2.560
Lifestyle		
Frustration factor score [-2.0, …, 2.7]	0.121	3.026
Personality		
Organizer factor score [-2.9, …, 2.6]	-0.0849	-2.129
Demographics		
Urban [0, 1]	0.214	3.193
Female [0, 1]	0.140	2.191
Threshold Parameters		
μ_1+	1.506	30.814
μ_2+	3.069	41.149
μ_3+	3.960	34.112

SD = Short Distance LD = Long Distance [ ] = range of possible or observed responses

$L(\hat{\beta})$ = -1415.577 $L(MS)$ = -1662.252 χ^2 = 493.351 d.f. = 14 R^2_{MZ} = 0.342

+ Care must be taken in the interpretation of the threshold parameters because LIMDEP allows only for right censoring, whereas our original model involved left censoring. To estimate the model, we reversed the RDM variable by subtracting each observed value from 4. For ease of interpretation, we reversed the resulting signs on the β coefficients in the table above, so that a positive coefficient indicates a higher value of RDM as in our original specification. We did not alter the LIMDEP-generated estimates of μ, however, so that the ranges $(-\infty, 0)$, $(0, \mu_1)$, (μ_1, μ_2), (μ_2, μ_3), and $(\mu_3, +\infty)$ refer to "much more", "more", "about the same", "less", and "much less", respectively.

Only one Objective Mobility variable, the sum of the log-miles for long-distance work/school-related travel, turned out significant, with a negative sign. As in the short-distance model, it is

natural that the more a person travels for work-related purposes, the less she wants to travel. It is interesting that this mileage enters transformed logarithmically, implying that additional miles have a lesser negative impact on Relative Desired Mobility as the total work/school-related mileage increases. This diminishing marginal impact is consistent with models of human perception/reaction in many areas (Stevens, 1957). Trips for these purposes can be considered partly discretionary. That is, someone may *have* to do a certain amount of work-related long-distance travel, and he may also *seek* additional travel because of his own motives. The latter constitutes the volitional or discretionary part of the total amount of long-distance work-related travel. Under this representation, one may argue that individuals who do more of this kind of travel often do so because they actively *seek* engaging in it. It may then be logical that the negative marginal effects of distance on Relative Desired Mobility decrease with distance, that is for people with higher motivations for this type of travel.

The Subjective Mobility variables have a stronger presence than the Objective Mobility ones, in variance with what we found for the short-distance overall model. The overall long-distance Subjective Mobility has a negative coefficient, which fits the pattern encountered among the previous models. The coefficients of Subjective Mobility for long-distance work/school-related (negative) and for long-distance entertainment/recreation/social (positive) can be better interpreted if they are analyzed in conjunction with the negative (and higher-absolute-value) coefficient of the overall long-distance Subjective Mobility. The latter includes the two former, therefore making it unlikely that a respondent had a higher purpose-specific Subjective Mobility than his *overall* Subjective Mobility. The positive coefficient of the entertainment/recreation/social variable thus tempers the effect of the negative coefficient of the overall variable, while the combined effect remains negative. Conversely, the negative coefficient of the work/school-related variable amplifies the negative effect of the overall variable. In other words, while it always applies that a higher long-distance Subjective Mobility has a net negative impact on the long-distance Relative Desired Mobility, the more the overall Subjective Mobility is influenced by a subjective assessment of the entertainment/recreation/social long-distance mobility, the less negative the combined effect of the Subjective Mobility variables will be. It is quite logical that a higher long-distance Subjective Mobility for entertainment purposes would not generate the same desire for reducing mobility that a high work-related long-distance Subjective Mobility would.

In our sample, those who perceive themselves to travel a lot by non-vehicular modes have a slight tendency to be lower income households with lower availability of personal vehicles. It is natural that a person with such a mobility constraint would desire more long-distance travel, thus explaining the positive coefficient of the Subjective Mobility variable for walking/jogging/cycling short-distance travel.

The three long-distance Travel Liking variables entering the model — for overall, airplane, and entertainment/recreational/social travel — have the expected positive signs. Similar to the short-distance overall model, the Travel Liking variable for the type of travel to which the dependent variable pertains, long-distance overall in the present case, has the highest significance ($t = 7.15$). The only short-distance Travel Liking variable — for taking others where they need to go — is negatively related to the dependent variable. Those with higher values of this variable might have a more family-oriented lifestyle. These people may find a greater satisfaction in

short-distance, local, family-related kinds of travel, and not feel the need for the more adventurous type of travel represented by long-distance trips. Their lower desire for long-distance travel may also be due to the realization that long-distance work-related travel reduces the time available for family, or may represent the perceived burden of making long-distance trips with dependents.

Logically, the travel dislike Attitudinal factor (with heavily loading statements of "traveling is boring", "travel time is generally wasted time", and "the only good thing about traveling is arriving at your destination") has a negative coefficient. The frustrated Lifestyle factor, on the other hand, has a positive sign. In our sample, the more dissatisfied individuals feel with their lives, the less long-distance travel they do, showing a small but significant negative relationship to travel in general. Admittedly, this variable might represent a cause, an effect, or a third-party correlation: the frustration may be due in part to restricted mobility, or another factor may be generating both the frustration and the limited travel. We have retained this variable, because it has entered in at least one short-distance model where such negative correlations with actual travel are not significant, which may support the interpretation that a desire to increase travel is a response to frustration generated for other reasons. Travel may represent an escape to such individuals, for example.

A previous study on the same data (Redmond, 2000) found that the organizer Personality factor is associated with managerial occupations, and this group would naturally be expected to travel for work more than average. Thus, as reflected by the negative coefficient, organizers may want to decrease long-distance travel because they engage in such travel a lot. Their time value is probably high as well, which may add some psychological burden to the time consumed by long-distance trips.

Two Demographic traits, the binary variables for female and residence in North San Francisco, have positive signs. The result for females is especially interesting since the Objective Mobility models (Redmond and Mokhtarian, 2001b) found that (all else equal) women traveled *more* than men in the long-distance entertainment and airplane categories (although less for work-related purposes). Here, with Objective Mobility basically controlled for, men are more desirous of reducing their overall long-distance mobility perhaps because the long-distance travel they engage in is more heavily "burdened" by work trips than women's. As for the coefficient of the North San Francisco dummy variable, Redmond and Mokhtarian (2001b) found that residents of North San Francisco already *actually* travel more in the long-distance range than do the residents of the suburban neighborhoods of Concord and Pleasant Hill — yet they want to travel even more in this category. Thus the positive coefficient of the urban dummy variable seems to point to an insatiability effect. The reasons for such apparent insatiability may be diverse. Perhaps urbanites see long-distance travel as a welcome escape from the relatively confined, high-density nature of their daily surroundings. The residents of the two suburban areas have a noticeably higher mean weekly mileage traveled in the short-distance range, which may cause some feeling of travel saturation, which in turn could induce in them a lower willingness to add long-distance travel. There is also a positive correlation in our data between this dummy variable and level of education, which may in turn be associated with a higher desire to *know* more, in this case new places.

Turning to the threshold parameters, the widths of the "less", "about the same", and "more" categories are 0.89, 1.56, and 1.51, respectively. Unlike the overall short-distance model, the widths of the "about the same" and "more" categories are nearly equal. Also in contrast to the overall short-distance model, the width of "more" is greater than the width of "less". Both results mean that larger intervals of the underlying unobserved variable correspond to the "more" and "about the same" observed responses than to the "less" response.

3.7 Long Distance Work/School-Related

A salient characteristic of the purpose-specific short-distance models was the absence of significant Objective Mobility explanatory variables. As the results in Table 9 show, the long-distance models will not observe such a pattern — four Objective Mobility variables enter the purpose-specific model presented in this subsection. The logical negative coefficient of the sum of the log-miles of long-distance trips can be directly interpreted. It is also unsurprising that the weekly miles commuting to work/school is negatively related to the dependent variable — both variables are concerned with work/school obligations, and it seems natural that an increase in one's travel in the short-distance range will result in a decrease of the desire to engage in additional similar travel in the long-distance. A somewhat more unexpected result is the appearance of variables related to trips to eat a meal — the frequency and the weekly miles of such trips. These variables, both with positive coefficients, most likely have an "out-of-home" lifestyle interpretation, with people "on the go" more eagerly embracing travel of various kinds, including the long-distance work-related category modeled here.

In accordance with the pattern exhibited by the foregoing models, the Subjective Mobility for the same category of travel of the dependent variable enters with a negative coefficient. While the interpretation of this variable is straightforward, its coefficient is the least significant of the three Subjective Mobility variables in this model ($t = -1.94$). The Subjective Mobility for overall long-distance travel, also with a negative coefficient, indicates that additional long-distance travel of *other* types will also contribute to reduce the desire for more work-related travel. The positive coefficient of Subjective Mobility on light/heavy rail has a less clear interpretation. Individuals with a high Subjective Mobility on rail may be more likely to be work-oriented suburbanites whose career aspirations motivate them to want more long-distance business travel. There is modest support for this interpretation in the slight but significant negative correlation (-0.073) between Subjective Mobility on rail and the urban dummy, and the slight but significant positive correlation (0.057) between Subjective Mobility on rail and the professional dummy.

There is an abundance of Travel Liking variables in this model: two for short-distance and three for long-distance travel. The presence, with positive coefficients, of both the short- and long-distance variables for the same type of travel as the dependent variable, is in conformity with similar structures obtained in all the preceding purpose/mode-specific models. The long-distance work/school-related Travel Liking is particularly significant ($t = 17.6$). The negative coefficient of the Travel Liking for grocery shopping may, as we suggested for Table 5, be a lifestyle indicator for people who enjoy more activities related to their homes. Interestingly, the coefficients of the Travel Liking variables for long-distance travel by personal vehicle and by airplane have virtually identical magnitudes, the former being negative and the latter positive. Thus, those who like traveling by airplane desire more long-distance work-related travel (presumably on the

assumption that such trips are likely to involve air travel), whereas those who like long-distance car trips want less work-related travel (perhaps because even long-distance work trips involving a car are constrained in time, destination, and possibly route, whereas long-distance work trips by air reduce the time and personal energy available for the desired long-distance travel by car).

Table 9: Long-Distance Work/School-Related Relative Desired Mobility Model (N = 1336)

Variable	Coefficient	t
Constant	-4.610	-12.622
Objective Mobility		
Sum of the natural logarithms of (miles for each work/school-related trip + 1) (LD)	-0.000906	-1.895
Frequency of travel to eat a meal (SD) [1, 2, ..., 6]	0.0989	2.515
Miles per week commuting to work/school (SD) [≥0]	-0.000861	-3.060
Miles per week to eat a meal (SD) [≥0]	0.00638	2.316
Subjective Mobility [1, 2, …, 5]		
Train/BART/light rail (SD)	0.0872	2.231
Overall (LD)	-0.130	-2.834
Work/school-related activities (LD)	-0.0789	-1.940
Travel Liking [1, 2, …, 5]		
Work/school-related activities (SD)	0.234	4.672
Grocery shopping (SD)	-0.176	-3.442
Work/school-related activities (LD)	0.725	17.616
Personal vehicle (LD)	-0.143	-3.441
Airplane (LD)	0.143	3.491
Attitudes		
Pro-high density factor score [-2.5, …, 2.6]	0.134	2.605
Lifestyle		
Family/community oriented factor score [-3.9, …, 2.1]	-0.136	-2.777
Demographics		
Age category [1, 2, …, 5]	-0.164	-2.564
Threshold Parameters		
μ_1^+	1.323	17.654
μ_2^+	3.506	33.319
μ_3^+	4.768	34.762

SD = Short Distance LD = Long Distance [ ] = range of possible or observed responses

$L(\hat{\beta})$ = -859.428 $L(MS)$ = -1254.706 χ^2 = 790.556 d.f. = 15 R^2_{MZ} = 0.444

+ Care must be taken in the interpretation of the threshold parameters because LIMDEP allows only for right censoring, whereas our original model involved left censoring. To estimate the model, we reversed the RDM variable by subtracting each observed value from 4. For ease of interpretation, we reversed the resulting signs on the β coefficients in the table above, so that a positive coefficient indicates a higher value of RDM as in our original specification. We did not alter the LIMDEP-generated estimates of μ, however, so that the ranges (-∞, 0), (0, μ_1), (μ_1, μ_2), (μ_2, μ_3), and (μ_3, +∞) refer to "much more", "more", "about the same", "less", and "much less", respectively.

This is the first model where we find the pro-high-density Attitudinal factor. This factor includes high loadings on statements like "[H]aving shops and services within walking distance of my home is important to me" and "[L]iving in a multiple family unit (apartment, condo, etc.) would not give me enough privacy" (negative loading). Its positive coefficient can therefore be given a

similar interpretation as for the urban dummy variable encountered in Table 8. Since, in our sample, the residents of North San Francisco have a lower mean age, it could additionally be argued that this coefficient is a indicator of more career-ambitious, adventurous individuals for whom long-distance work-related trips could be more attractive.

In the Lifestyle category, we find the family/community oriented factor, with a negative coefficient that can be interpreted as a desire, in individuals with high scores on this factor, to avoid long-distance work-related trips that take them away from their families.

The negative coefficient of the age category suggests that, as a person progresses in her career, she becomes more settled and less ambitious, while at the same time having greater responsibilities (both at work as well as at home). She may also actually *be* traveling more for work; all these factors would likely negatively impact on her desire to engage in long-distance work-related travel.

Given the values of the threshold parameters, the widths of the "less", "about the same", and "more" response categories for the continuous latent dependent variable are 1.26, 2.18, and 1.32, respectively.

3.8 Long-Distance Entertainment/Recreation/Social

We turn now to, arguably, the most discretionary of the types of travel being studied here: long-distance for entertainment/recreational/social purposes. This sort of travel is different in nature, contrasted with long distance travel for work-related reasons, and it would be reasonable to expect that difference to appear in the results. In fact, Table 10 reveals a remarkable result: neither Objective nor Subjective Mobility variables enter the model. Thus, Travel Liking is the only key endogenous variable that significantly explains the Relative Desired Mobility for long-distance recreation. This is a rather striking result because Objective and Subjective Mobility are the natural dampers of Relative Desired Mobility. Without them, an individual who likes a certain kind of travel would always be inclined to increase his amount of such travel, regardless of how much he actually does it. In view of this, it is very important to try to understand why this model includes no such dampers (only Travel Liking key endogenous variables enter the model). One immediate answer is that Objective and Subjective Mobility may be to some extent accounted for through other variables. In fact, it is certainly plausible that the Travel Liking variables are conveying some information regarding actual and perceived mobility, since previous work (Redmond and Mokhtarian, 2001b; Collantes and Mokhtarian, 2002) has found Travel Liking to be strongly positively associated with these variables. These considerations reinforce our belief that a simultaneous-equations approach will provide more insightful results for these models. On the other hand, there may well be something of an insatiability effect here — that at least within the range of most people's experience, "more is always better" when it comes to long distance travel for fun.

Table 10: Long-Distance Entertainment/Recreation/Social Relative Desired Mobility Model (N = 1345)

Variable	Coefficient	t
Constant	-4.050	-14.572
Travel Liking [1, 2, …, 5]		
Overall (SD)	-0.0885	-1.893
Entertainment/recreation/social (SD)	0.282	6.283
Taking others where they need to go (SD)	-0.104	-2.773
Overall (LD)	0.199	4.194
Entertainment/recreation/social (LD)	0.522	11.817
Attitudes		
Commute benefit factor score [-2.9, …, 2.6]	-0.106	-2.631
Travel dislike factor score [-1.8, …, 3.7]	-0.112	-2.487
Lifestyle		
Family/community oriented factor score [-3.9, …, 2.1]	0.119	2.646
Personality		
Organizer factor score [-2.9, …, 2.6]	-0.124	-3.152
Demographics		
Urban [0, 1]	0.263	3.864
Age category [1, 2, …, 5]	-0.155	-3.071
Number of workers [0, 1, …]	0.121	2.241
Number of people in the household [1, 2, …]	-0.131	-3.103
Number of people between 6 and 15 years old [0, 1, …]	0.244	3.328
Threshold Parameters		
μ_1^+	1.569	32.534
μ_2^+	3.096	39.843
μ_3^+	3.924	36.347

SD = Short Distance LD = Long Distance [ ] = range of possible or observed responses

$L(\hat{\beta})$ = -1341.785 $L(MS)$ = -1640.365 χ^2 = 597.160 d.f. = 14 R^2_{MZ} = 0.400

+ Care must be taken in the interpretation of the threshold parameters because LIMDEP allows only for right censoring, whereas our original model involved left censoring. To estimate the model, we reversed the RDM variable by subtracting each observed value from 4. For ease of interpretation, we reversed the resulting signs on the β coefficients in the table above, so that a positive coefficient indicates a higher value of RDM as in our original specification. We did not alter the LIMDEP-generated estimates of μ, however, so that the ranges $(-\infty, 0)$, $(0, \mu_1)$, (μ_1, μ_2), (μ_2, μ_3), and $(\mu_3, +\infty)$ refer to "much more", "more", "about the same", "less", and "much less", respectively.

As in all the previous specific models, the short- and long-distance Travel Liking variables for the same kind of travel as the dependent variable enter the model with a positive coefficient. The long distance overall Travel Liking variable, with a positive coefficient, indicates that a higher liking for long-distance travel in general (including for other purposes) will also contribute to generating a stronger desire to travel for recreational purposes. The more someone likes overall *short-distance* travel, on the other hand, the less she desires an increase in her long-distance recreational travel. This variable tempers the positive effect of the short-distance entertainment Travel Liking. In fact, it was discussed above that overall variables are often somewhat dominated by commuting travel. This variable then is likely to represent a type of travel (short distance and non-discretionary) diametrically opposite to that of the dependent variable, which explains its negative coefficient. We find again the variable indicating a liking for taking others

where they need to go, showing a negative relationship to the dependent variable. This variable was analyzed in Table 8, and we can assign it here a similar lifestyle interpretation.

While the negative coefficient of the travel dislike Attitudinal factor has a straightforward interpretation, the negative coefficient of the commute benefit factor seems less obvious. An individual with a high score on this factor is less affected by stresses normally associated with the commute, and this conclusion probably extends to other types of short-distance travel. This factor may be a general indicator of the adaptability of people to everyday life/travel (indeed, the positive utility that they find in it), being able to entertain themselves more easily within the context of their routines. These speculations may explain why these people have a lesser desire for additional long-distance recreational travel.

While the family/community-oriented Lifestyle factor had a negative impact on the long-distance work-related Relative Desired Mobility, here it appears with a *positive*, and logical, coefficient. Given that plans to engage in long-distance recreational travel are often prompted by a desire to do something fun with the family (or group of friends), it seems natural that individuals with high scores on this factor are shown as wanting more of this kind of travel.

We have encountered the organizer Personality factor in Table 8 with a negative coefficient; the same is true here. A study of Objective Mobility based on the same data employed in this report (Redmond and Mokhtarian, 2001b) shows that people with high scores on this factor do more long-distance work-related travel. Thus, the negative impact on Relative Desired Mobility for long distance entertainment travel may be reflecting saturation with long distance travel in general, or may also be an indication that their work-related long-distance travel fulfills some of their recreational needs. In fact, work-related long-distance travel often provides opportunities for leisure time.

A t-test shows that residents of North San Francisco have a higher mean total long-distance mileage traveled for non-work-related reasons than do the suburban residents. They also have a higher mean total long-distance mileage for work-related trips, although the difference in this case is smaller. The positive coefficient of the urban dummy variable thus seems to point to an insatiability effect. It is worth remembering, however, that a relatively high Objective Mobility does not mean that travel desires are satisfied. While North San Francisco residents do more long-distance travel, their difference in travel desires compared to residents of suburban areas may be larger than their difference in actual long-distance mileage.

As in the model for long-distance work-related travel, the age of the respondent also impacts negatively on her Relative Desired Mobility for long-distance recreational types of travel. Older individuals may have already seen more of the world, and may be more susceptible to the physical demands of long-distance travel, both of which could logically dampen their desire for discretionary long distance travel.

The last three Demographic variables — number of workers in the household, number of people in the household, and number of household members between six and 15 years old — should be interpreted together. The more workers in the household, the higher the disposable income to spend on recreational long-distance travel, and perhaps the greater the collective need for a break

from work. These factors would make long-distance recreational travel more attractive, which explains the positive coefficient of this variable. The presence of not-too-young children can act as a motivator for parents to seek this kind of travel as a family, as the positive coefficient of this variable indicates. The positive impact of the preceding two variables is moderated by the negative coefficient of the number of people in the household. As hinted above, the presence of very young children may actually deter parents from planning long-distance trips, due to the extra care they generally need. The presence of senior members in the household may have a similar effect. Further, the more household members there are, the more financially burdensome a long-distance trip will be.

The widths of the "less", "about the same", and "more" response categories on the continuous latent dependent variable, as determined by the values of the threshold parameters, are 0.83, 1.53, and 1.57, respectively.

3.9 Long-Distance Personal Vehicle

We present in this subsection the first mode-specific long-distance model. While in the short-distance range the personal vehicle is the dominant mode of transportation, in the long-distance range it has a strong competitor in the airplane. An important difference is, however, that the personal vehicle and the airplane are not always alternatives to each other in the same sense as the personal vehicle and, say, the bus for short-distance travel. In many situations, either the personal vehicle or the airplane is the only reasonable—or even possible—mode choice (these are the only two modes for which endogenous long-distance variables were collected). In view of these considerations, it will be interesting to compare this model with its short-distance counterpart and with the model for long-distance airplane. The results for this model are presented in Table 11.

This time we do obtain Objective Mobility variables in the model. However, none of the three variables that were significant accounts directly for long-distance mobility. Active users of light and heavy rail in the short distance are often people that have limited access to a personal vehicle. These people may have then a deficit of personal vehicle usage extrapolated to the long-distance range, which would increase their desire to travel by personal vehicle for long-distance trips. This argument could explain the positive coefficient of the short-distance weekly miles by light rail/heavy rail. For the same people there might be also a confounding of short-distance trips with long-distance ones — people with a high weekly mileage by this means are likely to engage in a number of relatively long short-distance trips, which they may perceive as approximately long-distance ones and prefer to do them by auto.

The negative coefficient of commute distance can be interpreted as a saturation of personal-vehicle travel, under the reasonable assumption that most commutes are done by this mode.

Table 11: Long-Distance Personal Vehicle Relative Desired Mobility Model (N = 1336)

Variable	Coefficient	t
Constant	-4.0213	-15.925
Objective Mobility		
Miles per week by train/BART/light rail (SD) [≥0]	0.00118	2.043
Miles per week taking others where they need to go (SD) [≥0]	-0.00414	-1.901
Commute distance [≥0]	-0.00767	-3.589
Subjective Mobility [1, 2, …, 5]		
Taking others where they need to go (SD)	0.0911	2.391
Overall (LD)	-0.208	-5.405
Entertainment/recreation/social (LD)	0.0883	2.538
Travel Liking [1, 2, …, 5]		
Overall (SD)	-0.0895	-1.977
Personal vehicle (SD)	0.131	3.495
Entertainment/recreation/social (LD)	0.0883	3.476
Personal vehicle (LD)	0.549	14.509
Lifestyle		
Status seeker factor score [-1.7, …, 2.7]	0.164	3.998
Excess Travel		
Excess Travel indicator [0, 1, …, 26]	0.0169	2.172
Mobility constraints		
Percentage of time a vehicle is available [0, 20, …, 100]	-0.00573	-4.125
Demographics		
Number of persons under six years old [0, 1, …]	-0.158	-2.261
Threshold Parameters		
μ_1^+	1.351	19.804
μ_2^+	3.376	38.789
μ_3^+	4.475	38.014

SD = Short Distance LD = Long Distance [ ] = range of possible or observed responses

$L(\hat{\beta})$ = -1228.184 $L(MS)$ = -1478.077 χ^2 = 499.786 d.f. = 14 R^2_{MZ} = 0.348

+ Care must be taken in the interpretation of the threshold parameters because LIMDEP allows only for right censoring, whereas our original model involved left censoring. To estimate the model, we reversed the RDM variable by subtracting each observed value from 4. For ease of interpretation, we reversed the resulting signs on the β coefficients in the table above, so that a positive coefficient indicates a higher value of RDM as in our original specification. We did not alter the LIMDEP-generated estimates of μ, however, so that the ranges $(-\infty, 0)$, $(0, \mu_1)$, (μ_1, μ_2), (μ_2, μ_3), and $(\mu_3, +\infty)$ refer to "much more", "more", "about the same", "less", and "much less", respectively.

The variable measuring short-distance chauffeuring weekly miles, with a negative coefficient, can be interpreted similarly to the Travel Liking version of this variable that appeared in Tables 8 and 10. This variable, however, should be viewed together with the Subjective Mobility for chauffeuring, which has a positive coefficient. While the actual mobility may serve as an indicator of lifestyle, the subjective assessment of that mobility may serve as an indicator of levels of saturation. That is, the more highly one assesses a given chauffeuring weekly mileage, the more likely for her to feel that activity as a burden, and probably the more she would like to engage in different types of trips. This may trigger a higher desire to take *long-distance* personal-vehicle trips.

In addition to Subjective Mobility for chauffeuring, two long-distance Subjective Mobility variables enter the model: for overall (negative coefficient) and entertainment/recreational/social (positive coefficient) travel. The variable corresponding to the same type of travel as the dependent variable (here, by personal vehicle), does not enter though, which constitutes a deviation from the pattern obtained in most of the preceding models. The effect of long-distance Subjective Mobility is mainly determined by the dominant coefficient of the "overall" variable, tempered by the positive coefficients of the aforementioned recreational variable and the variable for short-distance chauffeuring.

The positive impact of Travel Liking upon the personal-vehicle long-distance Relative Desired Mobility is mostly given by both the short- and long-distance variables corresponding to the personal-vehicle mode. This result is again similar to findings in the preceding models. The short-distance overall and long-distance recreational Travel Liking variables, with negative and positive coefficients respectively, present intuitively expected directions of impact. The magnitudes of the coefficients are virtually identical.

High scores on the status-seeker Lifestyle factor are associated with greater long-distance Relative Desired Mobility by personal vehicle, just as they were in the short-distance counterpart of this model. This is not a surprising result in view of the nature of the statements defining this factor (e.g. "I view my car … as having a personality", "To me, a car is a status symbol"). These people have a strong connection to their personal vehicles and are likely to particularly enjoy driving them.

Not only were excess travelers found to do more long-distance personal-vehicle travel (Redmond and Mokhtarian, 2001b), but they were further found to have a greater subjective assessment of that mobility (Collantes and Mokhtarian, 2002). The positive coefficient of the Excess Travel indicator in this model may be partly serving the role of those specific Objective Mobility and Subjective Mobility variables, which are otherwise conspicuously absent from this model as mentioned above. Beyond that role, however, specifically being an excess traveler (as distinguished from someone who travels the same amount, but out of necessity rather than choice) may also point to an insatiability effect. That is, excess travelers seem to have substantially higher-than-average personal vehicle long-distance travel desires, *despite* already having a greater-than-average mobility in that category, whereas non-excess travelers with the same above-average mobility will generally be inclined to reduce their travel.

We found (Table 7) that the percentage of the time a personal vehicle is available has a negative impact on the short-distance Relative Desired Mobility by personal vehicle. An identical result is obtained for the *long-distance* personal-vehicle model. Again, it can be argued that the less someone has access to a personal vehicle, the more unlikely it is that she will have her personal-vehicle travel needs satisfied.

The suggestion made for the preceding model that very young children can inhibit the desire of parents to engage in long-distance trips finds here some corroboration in the negative coefficient of the variable "number of persons under six years old in the household".

The widths of the "less", "about the same", and "more" response categories on the continuous latent dependent variable, obtained from the threshold parameters, are 1.10, 2.03, and 1.35, respectively.

3.10 Long Distance Airplane

This subsection presents the last model to be included in this report: for long-distance Relative Desired Mobility by airplane. In the previous subsection we commented on the different nature of long-distance trips by personal vehicle as compared to trips by airplane. The latter are associated with longer distances, usually longer absences from home, and higher expenses.

The results, presented in Table 12, show a very rich model in terms of the types of variables it includes. As in the preceding mode-specific model, all three key endogenous variables are present. In the Objective Mobility group we find the sum of the log-miles of the long-distance trips made by airplane (for either work or entertainment purposes), with a logical negative coefficient. The interpretation is direct: the more a person travels by airplane, the less she will wish to increase that kind of mobility. Two short-distance variables that have been encountered previously are included in this model. The frequency of trips to eat a meal has a positive coefficient, as it did in the model for long-distance work/school-related travel (Table 9), and we may assign it here a similar interpretation. An Objective Mobility variable with negative coefficient and the Subjective Mobility variable with positive coefficient, both for chauffeuring, enter this model, in an interesting similarity with the model for long-distance travel by personal vehicle presented in Table 11. Their (joint) interpretation can be considered similar.

The negative coefficient of long-distance overall Subjective Mobility is logical, while the negative coefficient of long-distance work-related Subjective Mobility indicates that this kind of travel enhances the negative impact of overall Subjective Mobility on the dependent variable. In other words, work-related trips are apparently more burdensome than trips for other purposes.

The impact of Travel Liking on the Relative Desired Mobility dependent variable is certainly dominated by the expected positive coefficient of the variable pertaining to airplane travel (t-statistic = 16). The negative coefficient for long-distance Travel Liking by personal vehicle indicates a mode-preference competition. A positive impact is shown by the variable related to entertainment/recreational/social travel, just as was found in the preceding model, for the personal-vehicle mode. This result could be anticipated, as the liking for a certain travel purpose could manifest itself in a desire for more travel by any mode that would accomplish that purpose. Less expected was the variable for *short-distance* entertainment/recreational/social travel. Its positive coefficient suggests a lifestyle/attitudinal interpretation. One might have hypothesized that, with all the other Travel Liking variables controlled for, the more a person likes short-distance recreational travel, the more she would be likely to be contented with such social activities and therefore desire less long-distance travel. However, we are modeling Relative Desired Mobility for a mode-specific type of travel, which may include *any* purpose. This mode — airplane — is often perceived as being associated with exciting travel, which may be particularly appealing to people with a natural predisposition for social types of travel. The last of the five Travel Liking variables — for chauffeuring — has been found already, also with a negative coefficient, in Table 10. Its interpretation here is similar.

Table 12: Long-Distance Airplane Relative Desired Mobility Model (N = 1305)

Variable	Coefficient	t
Constant	-3.932	-14.706
Objective Mobility		
Frequency of travel to eat a meal (SD) [1, 2, ..., 6]	0.0982	2.910
Frequency of travel taking others where they need to go (SD) [1, 2, ..., 6]	-0.0841	-2.541
Sum of the natural logarithms of (miles for work/school/entertainment by airplane + 1) (LD) [≥0]	-0.00238	-3.889
Subjective Mobility [1, 2, ..., 5]		
Travel taking others where they need to go (SD)	0.119	2.914
Overall (LD)	-0.0940	-2.338
Work/school-related activities (LD)	-0.0899	-2.939
Travel Liking [1, 2, ..., 5]		
Entertainment/recreation/social (SD)	0.151	3.187
Taking others where they need to go (SD)	-0.0985	-2.797
Entertainment/recreation/social (LD)	0.272	6.515
Personal vehicle (LD)	-0.125	-3.519
Airplane (LD)	0.577	16.021
Lifestyle		
Status seeker factor score [-1.7, ..., 2.7]	0.0825	2.066
Family/community oriented factor score [-3.9, ..., 2.1]	0.103	2.434
Personality		
Adventure seeker [-2.6, ..., 2.7]	0.127	3.155
Organizer factor score [-2.9, ..., 2.6]	-0.0930	-2.290
Demographics		
Number of workers [0, 1, ...]	0.113	2.064
Number of people in the household [1, 2, ...]	-0.179	-3.546
Number of children [0, 1, ...]	0.229	3.335
Personal income category [1, 2, ..., 6]	-0.0675	-2.602
Threshold Parameters		
μ_1^+	1.693	33.538
μ_2^+	3.152	40.917
μ_3^+	4.113	36.831

SD = Short Distance LD = Long Distance [ ] = range of possible or observed responses

$L(\hat{\beta})$ = -1296.054 $L(MS)$ = -1625.284 χ^2 = 658.460 d.f. = 19 R^2_{MZ} = 0.433

+ Care must be taken in the interpretation of the threshold parameters because LIMDEP allows only for right censoring, whereas our original model involved left censoring. To estimate the model, we reversed the RDM variable by subtracting each observed value from 4. For ease of interpretation, we reversed the resulting signs on the β coefficients in the table above, so that a positive coefficient indicates a higher value of RDM as in our original specification. We did not alter the LIMDEP-generated estimates of μ, however, so that the ranges $(-\infty, 0)$, $(0, \mu_1)$, (μ_1, μ_2), (μ_2, μ_3), and $(\mu_3, +\infty)$ refer to "much more", "more", "about the same", "less", and "much less", respectively.

The Lifestyle category includes two variables. The status-seeker factor, again coming in with a positive coefficient, has been encountered in the foregoing model (Table 11), and it can be interpreted along similar lines. Its presence in the model for airplane travel is interesting, however, in that (1) as indicated in the previous discussion, the factor is oriented toward personal vehicles, and (2) it was earlier found (Redmond and Mokhtarian, 2001b) to be *negatively*

associated with the objective amount of long-distance travel overall. The two results are not inconsistent, however, with the current finding suggesting an as yet unfulfilled aspiration for more airplane travel as a symbol of status.

The family/community-oriented factor impacted negatively on overall long-distance Relative Desired Mobility, and positively in the model for recreational long-distance travel. The fact that it appears with a positive coefficient in the present model may suggest that people with high scores on this factor more readily associate air travel with trips for recreational purposes, probably with their families.

For the third time the organizer Personality factor enters a long-distance model with a negative coefficient (see Tables 8 and 10). This seems to strengthen our previous considerations regarding the excess of long-distance travel, probably mainly for reasons related to their occupations, for people with high scores on this factor. The adventure-seeker Personality factor, on the other hand, appears for the first time and does so with a positive sign. This factor was repeatedly found in models for Objective Mobility (Redmond and Mokhtarian, 2001b) and Subjective Mobility (Collantes and Mokhtarian, 2002), providing evidence that people with high scores on this factor have higher mobility in general, including by air. Finding that these people still have a desire for more long-distance travel by airplane shows an insatiability effect, born in their adventurous nature — their air-travel needs exceed the amount of this travel that they are able to do.

Three of the four Demographic variables in this model relate to the household composition, and should be interpreted together. As the number of workers increases, so does the disposable income, making long-distance air travel a more feasible alternative, and attractive compared to other means. On the other hand, as the number of workers grows, disposable time may decrease, (especially the intersection of travel windows available to all workers simultaneously), possibly creating a deficit in this category of trips, which would help explain the positive coefficient. Looking at the (negative) coefficient of the number of people in the household together with the (positive and larger in magnitude) coefficient of the number of children in the household, we may conclude that the presence of children creates a deficit in airplane mobility. This is a logical result, particularly if we think of young children who may deter parents from engaging in this kind of travel altogether. At the same time, as the proportion of adults in the household increases, the deficit is reduced.

The remaining Demographic variable, personal income, has a logical negative coefficient. This variable is known to be a strong predictor of mobility, a result that was corroborated by Redmond and Mokhtarian (2001b). Consequently, people with lower incomes are likely to have a deficit of travel by airplane, which triggers in them a desire to increase such mobility.

The widths of the "less", "about the same", and "more" response categories on the continuous latent dependent variable, obtained from the threshold parameters, are 0.96, 1.46, and 1.69, respectively.

4. DISCUSSION AND CONCLUSIONS

In this study, we model Relative Desired Mobility – people's desire to reduce, maintain, or increase their current levels of travel, as indicated on a five-point ordinal scale – for nine different categories: short-distance overall, work/school-related, entertainment/recreation/social, and personal vehicle; and long-distance overall, work/school-related, entertainment/recreation/social, personal vehicle, and airplane. Commute travel was modeled in a previous paper (Redmond and Mokhtarian, 2001a), and those results are included in the summary Table 13 for completeness.

The equations were estimated under an ordinal probit formulation, that being the most appropriate class of models for our context of discrete ordinal observed dependent variables with censoring (see Section 3.1 for a more complete discussion). The ordinal probit formulation postulates the existence of an underlying latent (unobserved) continuous scale, with the observed discrete responses corresponding to contiguous intervals partitioning that scale. We used the modified McKelvey/Zavoina R^2 statistic, R^2_{MZ}, as our measure of goodness of fit. This statistic is interpreted, similarly to the R^2 for ordinary least squares regression, as the proportion of variance in the underlying latent continuous variable that is explained by the model. The R^2_{MZ} s for the models presented here fall into a range from 0.237 to 0.454, which is considered high goodness of fit for disaggregate models of travel behavior.

Our two major hypotheses were that Subjective Mobility would be negatively related to Relative Desired Mobility (the higher the assessment people make of their actual amount of travel, the less they will want to increase their travel), and that Travel Liking would be positively related (the higher people's liking for travel, the more they will want to increase their travel). These hypotheses were, for the most part, strongly supported by the results. The influence of Travel Liking was powerful and universal: in every Relative Desired Mobility model, the corresponding Travel Liking measure (always with a positive coefficient) was by far the most significant variable in the model. In six of the nine models, both the short- and long-distance measures of Travel Liking for the dependent variable category of travel were (positively) significant. Table 13 highlights this result through shading.

The fact that the Travel Liking variables (SD and LD) are highly significant in the models provides a direct indication that there is an intrinsic affinity for travel for its own sake (varying by individual, purpose, mode and circumstance), prompting a desire to travel more. Such an effect of Travel Liking can potentially add travel at the margin that is unnecessary or excess from the perspective of simply meeting the demand for spatially separated activities (it is not excess from the standpoint of maximizing the individual's utility).

Table 13: Summary of Effects on Relative Desired Mobility

	SHORT DISTANCE					LONG DISTANCE				
	Overall	Commute *	Work/School	Entertainment	Personal Vehicle	Overall	Work/School	Entertainment	Personal Vehicle	Airplane
N	1283	1155	1208	1348	1268	1338	1336	1345	1336	1305
R^2_{MZ}	0.366	N.A.	0.334	0.237	0.454	0.342	0.444	0.400	0.348	0.433
VARIABLE										
Objective Mobility										
Frequency of commute (SD)	-				-					
Frequency of work/school-related travel (SD)	-									
Frequency of travel going to eat a meal (SD)	+				-		+			+
Frequency of travel taking others where they need to go (SD)									-	-
Weekly miles in BART (SD)									+	
Total weekly miles (SD)		+								
Weekly miles commuting (SD)	-	-					-			
Weekly miles work/school-related (SD)		-								
Weekly miles to eat a meal (SD)							+			
Commute time		-								
Distance to work					-				-	
Excess commute	-				-					
Sum of logs of miles for each trip (LD)						-	-			
Miles for work/school/entertainment by personal vehicle (LD)					+					
Miles for work/school/entertainment by airplane (LD)										-

* This model is summarized from Redmond and Mokhtarian (2001a) for completeness, and not separately discussed here.

	SHORT DISTANCE					LONG DISTANCE				
	Overall	Commute *	Work/School	Entertainment	Personal Vehicle	Overall	Work/School	Entertainment	Personal Vehicle	Airplane
Subjective Mobility										
Overall (SD)	-									
Commuting (SD)		-								
Work/school-related (SD)			-							
Entertainment/recreation/social (SD)			+	-						
Personal vehicle (SD)					-					
Bus (SD)					+					
Train/BART/light rail (SD)					+		+			
Walking/jogging/bicycling (SD)				+	+	+				
Grocery shopping (SD)	+									
Taking others where they need to go (SD)									+	+
Overall (LD)						-	-		-	-
Work/school-related (LD)						-	-			-
Entertainment/recreation/social (LD)						+			+	
Travel Liking										
Overall (SD)	+							-	-	
Commuting (SD)		+								
Work/school-related (SD)	+		+				+			
Entertainment/recreation/social (SD)			-	+				+		+
Grocery shopping (SD)				-			-			
Taking others where they need to go (SD)						-		-		-
Personal vehicle (SD)					+				+	
Train/BART/light rail					-					
Walking/jogging/bicycling					-					
Overall (LD)		-				+		+		
Work/school-related (LD)	+		+				+			
Entertainment/recreation/social (LD)				+		+		+	+	+
Personal vehicle (LD)				+	+		-		+	-
Airplane (LD)						+	+			+

	SHORT DISTANCE					LONG DISTANCE				
	Overall	Commute *	Work/School	Entertainment	Personal Vehicle	Overall	Work/School	Entertainment	Personal Vehicle	Airplane
Attitudes										
Pro-environmental solutions factor					-					
Commute benefit factor	+	+	+		+			-		
Travel dislike factor						-		-		
Pro-high density factor							+			
Lifestyle										
Frustrated factor score			+	+	+	+				
Status seeker factor score	+	+		+	+				+	+
Family & community-oriented factor score	-						-	+		+
Workaholic factor score		+								
Personality										
Adventure seeker factor score										+
Organizer factor score						-		-		-
Excess Travel										
Excess travel indicator									+	
Frequency of travel by a longer route to experience more of the surroundings		-								
Mobility Constraints										
Percent of time a vehicle is available	-				-				-	
Limitations on taking public transportation					+					

	SHORT DISTANCE					LONG DISTANCE				
	Overall	Commute *	Work/School	Entertainment	Personal Vehicle	Overall	Work/School	Entertainment	Personal Vehicle	Airplane
Demographics										
Female				+		+				
Age			-	+			-	-		
Number of people in the household				+				-		-
Number of workers in the household								+		+
Number of adults in the household		+								
Number of children in the household										+
Number of people under 6 years old in the household									-	
Number of people 6-15 years old in the household								+		
Number of people 75 years old and older			+							
Someone other than preschoolers needs special care			-							
Manager or professional (occupational)			+							
Sales (occupational)				-						
Personal income category										-
Urban	-			+	-	+		+		
Year of personal vehicle			+							
Vehicle type mid-size or sport			+							
Vehicle type is van/minivan		-								

The results for Subjective Mobility are somewhat more complex. The hypothesis was unequivocally supported for the four short-distance models (plus the previous model for commuting) and two of the five long-distance models estimated in this study. In two of the three remaining models, related variables appear with expected signs, providing reasonable support for the hypothesis. For example, in the model for long-distance personal vehicle travel, overall long-distance Subjective Mobility enters with a negative sign. In the model for long-distance airplane travel, long-distance Subjective Mobility for overall and work-related trips both enter with negative signs, and so does a measure of Objective Mobility by airplane.

The remaining model, for long-distance entertainment travel, constitutes an interesting exception to the pattern. No Subjective or Objective Mobility variables whatsoever were significant in this model. This means that, at least within the range of travel experienced by our respondents, their desires to change their amount of this kind of travel (whether up or down or neither) are independent of how much they are currently doing. Since most people reported wanting more of this kind of travel, we interpret this result as a kind of "insatiability effect". It is natural that this effect would appear for what is arguably the most fun and exciting category of travel studied here, long-distance entertainment. It should be noted however that this model does contain Travel Liking variables that, in view of their positive relationships to Objective Mobility (Redmond and Mokhtarian, 2001b) and Subjective Mobility (Collantes and Mokhtarian, 2002), could capture some of the effect of these variables.

Another initial hypothesis, as expressed by our conceptual model in Figure 1, was that Objective Mobility would not be a direct predictor of Relative Desired Mobility, but that would rather be filtered through Subjective Mobility. The models presented here show that in fact Subjective Mobility variables are more important to explaining the corresponding Relative Desired Mobility than are the corresponding Objective Mobility variables, with three models (short-distance work/school-related and entertainment/recreation/social, and long-distance entertainment/recreation/social) having no significant Objective Mobility variables at all. While this might not be too surprising, the finding that one's perceived rather than actual amount of travel better predicts one's desire to modify that amount, is an important contribution of this study. On the other hand, Objective Mobility variables are not entirely absent, with several short-distance Objective Mobility measures appearing in short-distance Relative Desired Mobility models, and similarly for long-distance. And while long-distance Objective Mobility does not show any significant impact on short-distance Relative Desired Mobility, short-distance Objective Mobility does influence long-distance Relative Desired Mobility in a number of ways.

Three Lifestyle factors repeatedly enter the models: the frustrated person (in four models), the status seeker (in six models), and the family/community-oriented person (in four models). The first of these was frequently encountered in the Objective Mobility models, with negative coefficients, as opposed to the positive coefficients it holds in the present models. It is interesting, then, that, even in this sample of residents of a congested metropolitan area, frustration is consistently associated with *traveling less* than others, and *wanting to travel more* — not, for example, the other way around. The systematically positive association between status seekers and their Relative Desired Mobility is consistent with the inclination of these people to show off. This lifestyle trait may be prompted by some degree of dissatisfaction (frustration). In fact, the one Objective Mobility model for which this variable turned out to be significant showed that status seekers have lower long-distance overall actual mobility. The family/community-oriented factor shows a saturation with short-distance and non-discretionary travel and a (likely ensuing) deficit of long-distance discretionary travel. These results are compatible with the lower walking/jogging Objective Mobility of family-oriented people (Redmond and Mokhtarian, 2001b), and their higher personal-vehicle short-distance Subjective Mobility (Collantes and Mokhtarian, 2002).

In view of their pervasiveness in the models for Objective and Subjective Mobility, the scant impacts of the adventure seeker Personality factor and the Excess Travel indicator on Relative

Desired Mobility are noteworthy. We believe that the effects of these two variables are generally accounted for through the other variables (Objective Mobility, Subjective Mobility, and especially Travel Liking) that do appear in the models. The presence of the adventure seeker variable in the model for long-distance travel by airplane, and the Excess Travel indicator in the model for long-distance travel by personal vehicle, suggests that at least for these types of travel, there are important aspects to being an adventure seeker or an excess traveler that are not fully captured by the Travel Liking and other variables alone. These aspects may simply be a further extension of the Travel Liking dimension (for two people who both respond that they "strongly like" travel, the adventure seeker may strongly like it *more* than the other person), or they may represent a positive orientation toward travel that is more complex than can be captured by the single, simple, Travel Liking variable.

Given that adventure seekers and excess travelers have high Objective and Subjective Mobilities as well as high Travel Likings for the categories in question, *but* that Objective Mobility, Subjective Mobility, and Travel Liking are already largely accounted for in those models, the *additional* positive impact of the adventure seeker and excess traveler variables on Relative Desired Mobility points to an insatiability of those types of people for those categories of travel.

Among the Demographic variables, the age category and the urban neighborhood indicator are frequently appearing predictors of Relative Desired Mobility, both entering with mixed signs. Indicators of household composition abound in Table 13 — at least one of these indicators enters in six models, also with mixed signs. There is virtually no effect of the characteristics of the personal vehicle on Relative Desired Mobility, indicating that the desire for more or less travel is generally independent of the type of vehicle one drives. Interestingly, the only exceptions were for short-distance work/school-related travel: driving either a mid-sized or a sports car was associated with wanting to increase one's work/school-related travel, as was driving a recent-vintage vehicle of any type.

It is also interesting that income is relatively insignificant as a predictor of Relative Desired Mobility, entering (negatively) only in the model for air travel. We believe that the effect of income is accounted for indirectly: higher incomes are associated with higher Objective Mobility (Redmond and Mokhtarian, 2001), and higher Subjective Mobility (Collantes and Mokhtarian, 2002), and higher Subjective Mobility is associated with lower Relative Desired Mobility (the present study)[4]. The significance of income in the model for long-distance air travel may represent simply a "residual" effect of mobility not captured by the specific variables in the model, or there may be a more subtle psychological interpretation: for two people having the same Objective and Subjective Mobility amounts for air travel, the one with higher income may also have greater work-related stress, for example, and thus be more desirous of reducing travel.

The discussion of each model individually in Section 3, together with the overview of the models collectively in this section, leads to the identification of a number of recurrent effects on Relative Desired Mobility. We briefly describe each of them here, and summarize them in Table 14.

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[4] The same argument can apply to other variables (including, but not limited to, other demographic variables such as gender) not explicitly found in these models; the effects of such variables may indirectly be accounted for through their relationships with variables that *are* present here.

Complementarity

In many cases, a variable representing one category of travel appeared to induce a desire to increase the amount of travel in a different (usually related) category of travel. This suggests a complementary relationship between the two types, in which a positive orientation toward the first type accompanies a positive orientation toward the second.

Competing Preferences

The liking, desire or preference for a certain type of travel or activity may trigger a desire to reduce the amount of travel in some categories, so as to be able to increase the amount of time devoted to the preferred activity/travel.

Substitution

In a number of cases, the liking for, or engagement in, one type of travel was associated with a desire to *decrease* a related alternate type of travel, i.e. the desire to substitute one type of travel for another. In other cases, higher perceived mobility by one mode (specifically bus, rail, and walk) was associated with a desire to *increase* travel by a different mode (specifically, personal vehicle) — again, a desired substitution effect. In two cases, we suggested that occupation-related variables point to a substitutability between work-related functions and entertainment/re-creational/social functions.

Saturation

Logically, increasing amounts of real or perceived mobility of a certain type of travel result in a decreasing desire for the same or a related kind of travel. This helps explain the negative sign exhibited by numerous Objective and Subjective Mobility variables in models of related Relative Desired Mobility variables. Other variables, however, constituted indirect indicators of saturation and they are presented in Table 14.

Relative Mobility Deprivation

In a number of instances, increasing amounts of a given variable suggest increasing restrictions on some type of mobility, thereby inducing a positive Relative Desired Mobility for that category of travel.

Insatiability

In several cases we identified a desire to increase mobility in a certain category for a group of people whose Objective Mobility or Subjective Mobility in that category was already higher than average. We refer to this effect as insatiability, although such a term in this context can only be understood in a relative sense. That is, in an absolute sense insatiability often does not exist. The appetite in question is generally *capable* of being satisfied, it is just that within the range of

experience of the individual the appetite is *not* satisfied, sometimes despite considerable "feeding".

Family-related Travel

The mixed nature of the impacts of family-related variables on Relative Desired Mobility points to the complexity of the role that family plays in travel-related decisions. On the one hand, the positive impact of several variables related to household size and a family-oriented lifestyle on relative desired amounts of travel of a recreational nature suggests that the more central the role the family plays, the higher the desire to travel in those categories. On the other hand, the negative impact of other household size variables *in the same models*, no less, hints of the burdensome side of traveling with family. The negative effects seen here are distinguished from those of the family-related variables in the competing preferences category. Here, the negative effects are assumed to indicate a reduced desire to travel *with family*. In the case of competing preferences, the negative effects are assumed to indicate a reduced desire to travel for non-family trips (specifically work/school-related), due to a desire to be with family.

Overall, the results of this study provide a better understanding of the demand for travel, and the response to policies or trends affecting that demand. Especially, in transportation planning and policy, the relationships of Travel Liking and Subjective Mobility to Relative Desired Mobility in this study have important implications for the forecasts of revealed and latent travel demand based on current mobility patterns. However, there will be multiple interrelationships among the subjective and objective variables, which are not explained by our single equation models. In further analysis of this data set we will undertake the development of simultaneous equations models to represent such relationships.

Table 14: Summary of Recurring Effects on Relative Desired Mobility

Effect	Explanatory Variable (direction of effect)	Relative Desired Mobility Variable	Table	Page
Complementarity	Miles by personal vehicle (LD) (+)	Personal Vehicle (SD)	7	25
	Frequency of travel to eat a meal (SD) (+)	Overall (SD)	3	15
		Work/School-Related (LD)	9	31
		Airplane (LD)	12	39
	Weekly miles to eat a meal (SD) (+)	Work/School-Related (LD)	9	31
	Travel Liking overall (LD) (+)	Entertainment/Recreation/ Social (LD)	10	33
	Travel Liking work/ school-related (SD) (+)	Work/School-Related (LD)	9	31
	Travel Liking entertain-ment/recreation/social (SD) (+)	Entertainment/Recreation/ Social (LD)	10	33
		Airplane (LD)	12	39
	Travel Liking personal vehicle (SD) (+)	Personal Vehicle (LD)	11	36
	Travel Liking work/ school-related (LD) (+)	Work/School-Related (SD)	4	19
	Travel Liking entertain-ment/recreation/social (LD) (+)	Entertainment/ Recreation/Social (SD)	5	22
	Travel Liking personal vehicle (LD) (+)	Personal Vehicle (SD)	7	25
Competing Preferences	Travel Liking entertain-ment/recreation/social (SD) (-)	Work/School-Related (SD)	4	19
	Someone (other than preschoolers) needing special care (-)	Work/School-Related (SD)	4	19
	Family/community-oriented (-)	Work/School-Related (LD)	9	31
	Travel Liking chauffeur-ing (SD) (-)	Overall (LD)	8	28
		Entertainment/Recreation/ Social (LD)	10	33
		Airplane (LD)	12	39
	Weekly miles chauffeur-ing (SD) (-)	Personal Vehicle (LD)	11	36
	Frequency chauffeuring (SD) (-)	Airplane (LD)	12	39
	Travel Liking personal vehicle (LD) (-)	Work/School-Related (LD)	9	31

(Desired) Substitution	Subjective Mobility for bus (SD) (+)	Personal Vehicle (SD)	7	25
	Subjective Mobility for train/BART/light rail (SD) (+)	Personal Vehicle (SD)	7	25
	Subjective Mobility for walking/jogging/bicycling (SD) (+)	Personal Vehicle (SD)	7	25
	Travel Liking grocery shopping (SD) (-)	Entertainment/Recreation/ Social (SD)	5	22
	Travel Liking train/ BART/light rail (SD) (-)	Personal Vehicle (SD)	7	25
	Travel Liking walking (SD) (-)	Personal Vehicle (SD)	7	25
	Travel Liking overall (SD) (-)	Entertainment/Recreation/ Social (LD)	10	33
		Personal Vehicle (LD)	11	36
	Travel Liking personal vehicle (LD) (-)	Airplane (LD)	12	39
	Sales occupation (-)	Entertainment/Recreation/ Social (SD)	5	22
	Organizer (-)	Entertainment/Recreation/ Social (LD)	10	33
	Weekly miles commuting (SD) (-)	Work/School-Related (LD)	9	31
	Subjective Mobility overall (LD) (-)	Work/School-Related (LD)	9	31
	Commute distance (-)	Personal Vehicle (LD)	11	36

Saturation	Weekly miles commuting (SD) (-)	Commute (SD)	-	-
	Commute time (-)	Commute (SD)	-	-
	Commute distance (-)	Personal Vehicle (SD)	7	25
		Personal Vehicle (LD)	11	36
	Excess commute (-)	Personal Vehicle (SD)	7	25
	Frequency of commute (-)	Overall (SD)	3	15
		Personal Vehicle (SD)	7	25
	Sum of logs of miles for each trip (LD) (-)	Overall (LD)	8	28
	Miles for work/school/ entertainment by airplane (LD) (-)	Airplane (LD)	12	39
	Subjective Mobility overall (SD) (-)	Overall (SD)	3	15
	Subjective Mobility commuting (SD) (-)	Commute (SD)	-	-
	Subjective Mobility work/ school-related (SD) (-)	Work/School-Related (SD)	4	19
	Subjective Mobility entertainment/recreation/ social (SD) (-)	Entertainment/Recreation/ Social (SD)	5	22
	Subjective Mobility personal vehicle (SD) (-)	Personal Vehicle (SD)	7	25
	Subjective Mobility overall (LD) (-)	Overall (LD)	8	28
	Subjective Mobility work/ school-related (LD) (-)	Work/School-Related (LD)	9	31
	Organizer (-)	Overall (LD)	8	28
		Entertainment/Recreation/ Social (LD)	10	33
		Airplane (LD)	12	39
	Weekly miles chauffeur-ing (SD) (-)	Personal Vehicle (LD)	11	36
	Urban dummy variable (+)	Overall (LD)	8	28
	Family/community-oriented (-)	Overall (SD)	3	15
		Work/School-Related (LD)	9	31

Relative Mobility Deprivation	Household size (+)	Entertainment/Recreation/ Social (SD)	5	22
	Miles by personal vehicle (LD) (+)	Personal Vehicle (SD)	7	25
	Percentage of time a personal vehicle is available (-)	Personal Vehicle (SD)	7	25
		Personal Vehicle (LD)	11	36
	Physical/anxiety limitations on taking public transportation (+)	Personal Vehicle (SD)	7	25
	Weekly miles by train/ BART/light rail (SD) (+)	Personal Vehicle (LD)	11	36
	Weekly miles chauffeur-ing (SD) (-)	Personal Vehicle (LD)	11	36
	Subjective Mobility chauffeuring (SD) (+)	Personal Vehicle (LD)	11	36
		Airplane (LD)	12	39
	Frequency of chauffeuring (SD) (+)	Airplane (LD)	12	39
Insatiability	Travel Liking entertain-ment/recreation/social (LD) (+)	Entertainment/Recreation/ Social (LD)	10	33
	Excess Travel indicator (+)	Personal Vehicle (LD)	11	36
	Adventure seeker (+)	Airplane (LD)	12	39
	Urban dummy variable (+)	Overall (LD)	8	28
		Entertainment/Recreation/ Social (LD)	10	33
Family Related Travel	Family/community-oriented (+)	Entertainment/Recreation/ Social (LD)	10	33
		Airplane (LD)	12	39
	Number of workers in the household (+)	Entertainment/Recreation/ Social (LD)	10	33
		Airplane (LD)	12	39
	Number of household members between 6 and 15 years old (+)	Entertainment/Recreation/ Social (LD)	10	33
	Number of children in the household (+)	Airplane (LD)	12	39
	Number of people in household (-)	Entertainment/Recreation/ Social (LD)	10	33
		Airplane (LD)	12	39

REFERENCES

Ajzen, Icek (1988) *Attitudes, Personality, and Behavior.* Milton Keynes, U.K.: Open University Press.

Choo, Sangho and Patricia L. Mokhtarian (2002) *The Relationship of Vehicle Type Choice to Personality, Lifestyle, Attitudinal, and Demographic Variables.* Research Report UCD-ITS-RR-02-xx, Institute of Transportation Studies, University of California, Davis, August.

Collantes, Gustavo and Patricia L. Mokhtarian (2002) *Determinants of the Subjective Assessment of Individual Mobility*. Research Report UCD-ITS-RR-02-xx, Institute of Transportation Studies, University of California, Davis, August.

Curry, Richard (2000) *Attitudes toward Travel: The Relationships among Perceived Mobility, Travel Liking, and Relative Desired Mobility.* Master's Thesis, Department of Civil and Environmental Engineering, University of California, Davis, June.

Greene, William H. (1995) *LIMDEP Version 7.0 User's Manual*, Econometric Software, Inc., Bellport, New York.

Greene, William H. (2000) *Econometric Analysis*, 4th ed. Upper Saddle River, NJ: Prentice-Hall Inc.

McKelvey, Richard D. and William Zavoina (1975) A statistical model for the analysis of ordinal level dependent variables. *Journal of Mathematical Sociology* **4 (1):** 103-120.

Mokhtarian, Patricia L., Elizabeth A. Raney, and Ilan Salomon (1997) Behavioral response to congestion: Identifying patterns and socio-economic differences in adoption. *Transport Policy* **4 (3)**: 147-160.

Mokhtarian, Patricia L. and Ilan Salomon (2001) How derived is the demand for travel? Some conceptual and measurement considerations. *Transportation Research A* **35 (8)**: 695-719.

Mokhtarian, Patricia L., Ilan Salomon, and Lothlorien Redmond (2001) Understanding the demand for travel: it's not purely "derived". *Innovation: The European Journal of Social Science Research.*

Raney, Elizabeth A., Patricia L. Mokhtarian, and Ilan Salomon (2000) Modeling individuals' consideration of strategies to cope with congestion. *Transportation Research F* **3**: 141-165.

Redmond, Lothlorien (2000) *Identifying and Analyzing Travel-related Attitudinal, Personality, and Lifestyle Clusters in the San Francisco Bay Area.* Master's Thesis, Transportation Technology and Policy Graduate Group, Institute of Transportation Studies, University of California, Davis, September.

Redmond, Lothlorien and Patricia L. Mokhtarian (2001a) The positive utility of the commute: Modeling ideal commute time and relative desired commute amount. *Transportation* **28**: 179-205.

Redmond, Lothlorien and Patricia L. Mokhtarian (2001b) *Modeling Objective Mobility: The Impact of Travel-related Attitudes, Personality and Lifestyle on Distance Traveled*. Research Report UCD-ITS-RR-01-09, Institute of Transportation Studies, University of California, Davis, June.

Salomon, Ilan and Patricia L. Mokhtarian (1998) What happens when mobility-inclined market segments face accessibility-enhancing policies? *Transportation Research D* **3 (3)**: 129-140.

Salomon, Ilan and Patricia L. Mokhtarian (1997) Coping with congestion: Reconciling behavior and policy analysis. *Transportation Research D* **2 (2)**: 107-123.

Stevens, S. S. (1957) On the psychophysical law. *Psychological Review* **64**: 153-181.

Stradling, S. G., M. L. Meadows, and S. Beatty (2000) Helping drivers out of their cars: Integrating transport policy and social psychology for sustainable change. *Transport Policy* **7**: 207-215.

Veall, M. R. and K. F. Zimmermann (1992) Pseudo-R^2 in the ordinal probit model. *Journal of Mathematical Sociology* **16 (4)**: 333-342.

APPENDIX

DESCRIPTIVE STATISTICS

FOR THE VARIABLES IN THE MODELS

Table A. 1 Descriptive Statistics for Dependent Variables

Variable		Frequency	Valid Percent
Relative Desired Mobility			
Short distance overall N = 1357 Mean = 2.60	Much less	92	6.8
	Less	442	32.6
	About the same	746	55.0
	More	71	5.2
	Much More	6	0.4
Short distance commute N = 1357 Mean = 2.38	Much less	203	15.0
	Less	469	34.6
	About the same	664	48.9
	More	14	1.0
	Much More	7	0.5
Short distance work/school-related N = 1357 Mean = 2.65	Much less	112	8.3
	Less	301	22.2
	About the same	909	67.0
	More	25	1.8
	Much More	10	0.7
Short distance entertainment/ recreation/social N = 1357 Mean = 3.15	Much less	8	0.6
	Less	154	11.3
	About the same	867	63.9
	More	285	21.0
	Much More	43	3.2
Short distance personal vehicle N = 1357 Mean = 2.77	Much less	76	5.6
	Less	327	24.1
	About the same	818	60.3
	More	104	7.7
	Much More	32	2.4
Long distance overall N = 1357 Mean = 3.59	Much less	30	2.2
	Less	83	6.1
	About the same	483	35.6
	More	575	42.4
	Much More	186	13.7
Long distance work/school-related N = 1357 Mean = 2.73	Much less	159	11.7
	Less	235	17.3
	About the same	800	59.0
	More	143	10.5
	Much More	20	1.5

Long distance entertainment/ recreation/social N = 1357 Mean = 3.71	Much less	26	1.9
	Less	67	4.9
	About the same	422	31.1
	More	597	44.0
	Much More	245	18.1
Long distance personal vehicle N = 1357 Mean = 3.07	Much less	60	4.4
	Less	167	12.3
	About the same	797	58.7
	More	283	20.9
	Much More	50	3.7
Long distance airplane N = 1357 Mean = 3.58	Much less	54	4.0
	Less	89	6.6
	About the same	413	30.4
	More	612	45.1
	Much More	189	13.9

Table A. 2 Descriptive Statistics for Continuous Explanatory Variables

Variable	N	Mean	Standard Deviation
Short-distance Objective Mobility			
Frequency of commutes to work/school	1357	5.76	0.55
Frequency of work/school-related trips	1357	3.33	1.52
Frequency of trips to eat a meal	1357	3.82	1.00
Frequency of trips chauffeuring	1357	2.92	1.45
Miles/week by train/BART/light rail	1356	19.77	67.36
Miles/week total	1356	220.54	191.83
Miles/week commuting to work/school	1356	125.74	136.61
Miles/week work/school-related	1350	25.19	70.60
Miles/week to eat a meal	1350	9.87	13.91
Average commute time	1356	29.74	20.49
Commute distance	1356	14.33	16.68
Excess commute	1287	13.86	19.88
Long-distance Objective Mobility			
Sum of the logs of (miles for work/ school/entertainment by airplane + 1)	1344	36.52	60.28
Total miles for work/school/entertainment by personal vehicle	1344	1729.69	4358.87
Sum of the log of (miles for work/school + 1)	1344	31.64	84.56
Attitude			
Travel dislike factor score	1357	0.00136	0.857
Pro-environmental solutions factor score	1357	0.000222	0.859
Commute benefit factor score	1357	-0.00933	0.870
Pro-high density factor score	1357	0.00303	0.810

Lifestyle			
Frustration factor score	1357	0.0389	0.832
Family/community related factor score	1357	0.0719	0.749
Status seeker factor score	1357	0.00391	0.814
Workaholic factor score	1357	0.00909	0.758
Personality			
Adventure seeker factor score	1357	0.0567	0.902
Organizer factor score	1357	0.0185	0.809
Excess Travel			
Excess Travel indicator	1357	7.968	4.255
Demographics			
Personal vehicle ownership dummy variable times year of personal vehicle	1343	84.855	22.640
Number of workers in HH	1352	1.769	0.813
Number of people in HH	1357	2.387	1.228
Number of adults in HH	1350	1.938	0.826
Number of children in HH	1350	0.456	0.843
Number of people under 6years old in HH	1350	0.134	0.431
Number of people 6-15 years old in HH	1350	0.239	0.591
Number of people 75 years old and older in HH	1350	0.0393	0.219

Table A. 3 Descriptive Statistics for Discrete Explanatory Variables

Variable		**Frequency**	**Valid Percent**
Short-distance Travel Frequency			
Commute N = 1357 Mean = 5.756	1-3 times a month	10	0.7
	1-2 times a week	51	3.8
	3-4 times a week	199	14.7
	5 or more times a week	1097	80.8
Work/school-related N = 1357 Mean = 3.331	Never	160	11.8
	Less than once a month	281	20.7
	1-3 times a month	355	26.2
	1-2 times a week	243	17.9
	3-4 times a week	147	10.8
	5 or more times a week	171	12.6

To eat a meal N = 1357 Mean = 3.822	Never	16	1.2
	Less than once a month	97	7.1
	1-3 times a month	361	26.6
	1-2 times a week	598	44.1
	3-4 times a week	208	15.3
	5 or more times a week	77	5.7
Chauffeuring N = 1357 Mean = 2.924	Never	230	16.9
	Less than once a month	376	27.7
	1-3 times a month	326	24.0
	1-2 times a week	219	16.1
	3-4 times a week	104	7.7
	5 or more times a week	102	7.5
On a longer route to experience more of the surroundings N = 1357 Mean = 1.731	Never/seldom	472	34.8
	Sometimes	778	57.3
	Often	107	7.9
Short-distance Subjective Mobility			
Overall N = 1357 Mean = 3.573	None	14	1.0
	2	177	13.0
	3	502	37.0
	4	345	25.4
	A lot	319	23.5
Commute N = 1357 Mean = 3.566	None	30	2.2
	2	301	22.2
	3	328	24.2
	4	267	19.7
	A lot	431	31.8
Work/school-related N = 1357 Mean = 2.535	None	250	18.4
	2	541	39.9
	3	302	22.3
	4	118	8.7
	A lot	146	10.8
Entertainment/recreation/social N = 1357 Mean = 2.794	None	56	4.1
	2	508	37.4
	3	518	38.2
	4	209	15.4
	A lot	66	4.9

Grocery shopping N = 1357 Mean = 2.461	None	84	6.2
	2	746	55.0
	3	386	28.4
	4	100	7.4
	A lot	41	3.0
Chauffeuring N = 1357 Mean = 1.941	None	529	39.0
	2	537	39.6
	3	178	13.1
	4	68	5.0
	A lot	45	3.3
Personal vehicle N = 1357 Mean = 3.921	None	38	2.8
	2	190	14.0
	3	229	16.9
	4	284	20.9
	A lot	616	45.4
Bus N = 1357 Mean = 1.766	None	843	62.1
	2	252	18.6
	3	97	7.1
	4	67	4.9
	A lot	98	7.2
Train/BART/light rail N = 1357 Mean = 1.795	None	692	51.0
	2	438	32.3
	3	107	7.9
	4	53	3.9
	A lot	67	4.9
Walking/jogging/bicycling N = 1357 Mean = 2.538	None	217	16.0
	2	538	39.6
	3	351	25.9
	4	157	11.6
	A lot	94	6.9
Long-distance Subjective Mobility			
Overall N = 1357 Mean = 2.749	None	77	5.7
	2	537	39.6
	3	485	35.7
	4	166	12.2
	A lot	92	6.8
Work/school-related N = 1357 Mean = 2.027	None	603	44.4
	2	399	29.4
	3	170	12.5
	4	85	6.3
	A lot	100	7.4

Entertainment/recreation/social N = 1357 Mean = 2.737	None	135	9.9
	2	487	35.9
	3	430	31.7
	4	210	15.5
	A lot	95	7.0
Short-distance Travel Liking			
Overall N = 1355 Mean = 3.173	Strongly dislike	15	1.1
	Dislike	178	13.1
	Neutral	762	56.2
	Like	360	26.5
	Strongly like	42	3.1
Commute N = 1355 Mean = 2.749	Strongly dislike	123	9.1
	Dislike	423	31.2
	Neutral	520	38.3
	Like	254	18.7
	Strongly like	37	2.7
Work/school-related N = 1355 Mean = 3.049	Strongly dislike	64	4.7
	Dislike	291	21.4
	Neutral	749	55.2
	Like	227	16.7
	Strongly like	26	1.9
Entertainment/recreation/social N = 1355 Mean = 2.785	Strongly dislike	5	0.4
	Dislike	66	4.9
	Neutral	543	40.0
	Like	605	44.6
	Strongly like	138	10.2
Grocery shopping N = 1355 Mean = 3.546	Strongly dislike	36	2.7
	Dislike	219	16.1
	Neutral	773	57.0
	Like	299	22.0
	Strongly like	30	2.2
Chauffeuring N = 1355 Mean = 3.546	Strongly dislike	133	9.8
	Dislike	236	17.4
	Neutral	803	59.2
	Like	158	11.6
	Strongly like	27	2.0
Personal vehicle N = 1355 Mean = 3.546	Strongly dislike	33	2.4
	Dislike	125	9.2
	Neutral	410	30.2
	Like	647	47.7
	Strongly like	142	10.5

Train/BART/light rail N = 1355 Mean = 3.546	Strongly dislike	161	11.9
	Dislike	231	17.0
	Neutral	540	39.8
	Like	384	28.3
	Strongly like	41	3.0
Walking/jogging/bicycling N = 1355 Mean = 3.546	Strongly dislike	54	4.0
	Dislike	66	4.9
	Neutral	332	24.5
	Like	663	48.9
	Strongly like	242	17.8
Long-distance Travel Liking			
Overall N = 1355 Mean = 3.648	Strongly dislike	18	1.3
	Dislike	119	8.8
	Neutral	368	27.1
	Like	671	49.4
	Strongly like	181	13.3
Work/school-related N = 1355 Mean = 2.776	Strongly dislike	152	11.2
	Dislike	331	24.4
	Neutral	576	42.4
	Like	267	19.7
	Strongly like	31	2.3
Entertainment/recreation/social N = 1355 Mean = 3.840	Strongly dislike	22	1.6
	Dislike	83	6.1
	Neutral	320	23.6
	Like	597	44.0
	Strongly like	335	24.7
Personal vehicle N = 1355 Mean = 3.362	Strongly dislike	47	3.5
	Dislike	211	15.5
	Neutral	420	31.0
	Like	563	41.5
	Strongly like	116	8.5
Airplane N=1355 Mean = 3.691	Strongly dislike	53	3.9
	Dislike	130	9.6
	Neutral	272	20.0
	Like	632	46.6
	Strongly like	270	19.9
Mobility Constraints			
Percentage of time a personal vehicle is available N = 1352 Mean = 91.214	0	64	4.7
	20	34	2.5
	40	17	1.3
	60	10	0.7
	80	62	4.6
	100	1164	86.1

Limitations on taking public transportation N = 1355 Mean = 1.04	No limitation	1316	97.1
	Limits how often/long	30	2.2
	Absolutely prevents	9	0.7
Demographics			
Age category N = 1356 Mean = 2.547	23 or younger	44	3.2
	24-40	584	43.1
	41-64	685	50.5
	65-74	28	2.1
	75 or older	15	1.1
Personal income N = 1326 Mean = 3.408	Less than $15,000	96	7.2
	$15,00 - $34,999	282	21.3
	$35,000 - $54,999	405	30.5
	$55,000 - $74,999	241	18.2
	$75,000 - $94,999	132	10.0
	$95,000 or more	170	12.8
Female dummy N = 1357 Mean = 0.509	0	666	49.1
	1	691	50.9
Sales dummy N = 1357 Mean = 0.0892	0	1236	91.1
	1	121	8.9
Manager/professional dummy N = 1357 Mean = 0.694	0	415	30.6
	1	942	69.4
Urban dummy N = 1327 Mean = 0.494	0	687	50.6
	1	670	49.4
Mid-sized vehicle type N = 1306 Mean = 0.176	0	1076	82.4
	1	230	17.6
Van/minivan vehicle type N = 1306 Mean = 0.0505	0	1240	94.9
	1	66	5.1