DRAFT PROPOSAL

CONTEXTUAL APPROACH TO MAXIMIZING THE AIR QUALITY, CLIMATE, AND SOCIAL EQUITY BENEFITS OF LIGHT- DUTY VEHICLE INCENTIVE PROGRAMS (MAXINPRO)

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Table of Contents

Abstract

In this project we will establish optimal incentives for the Enhanced Fleet Modernization Program using a household-based and contextual approach. To do this we develop and design an interactive survey with lower income California residents to define optimal car purchasing incentive mechanisms. The objective is to increase market penetration of advanced technology cars with a much lower energy consumption and pollution. The survey is based on a context-aware conceptual framework of the choices people face in scrapping a car from their household fleet or replacing a car. This choice context and the survey we design accounts for the lifecycle stage of each household explicitly, identifies past household car purchases, collects information about the household's social setting and household member relationships to identify barriers and opportunities for car replacement, and casts the incentives within each household's budgeting practices. This leads to a comprehensive understanding of household choices, barriers to choices, lifestyles, and habits. It may also provide ideas for opportunities to define new types of incentives that are not only monetary. Armed with this understanding we design a real-life information provision intervention in which we tailor the information provided to each household. This is done within the boundaries of California policies and ARB ideas of current and potential incentives. The information we provide to households takes two forms: a) facts about advanced technology cars; and b) scenarios of car replacement strategies the household can adopt together with benefits accrued. This information defines the future choices and barriers for each household, and we collect data on the perception of choices and barriers. To identify the amount and the possible existence of incentive thresholds that will trigger a car ownership change, we also design and conduct a stated choice experiment. The analysis of this leads to policy recommendations that, in turn, ARB reviews at the conclusion of the project.

1. Introduction

In this project we will establish optimal incentives for the Enhanced Fleet Modernization Program using a household-based and contextual approach. We view retirement or scrapping of older vehicles and car retirement and replacement actions as household decisions that are heavily influenced by social interactions and household histories. This requires a different type of behavioral model development than is usually found in the technical literature. We also view the decisions leading to a change in the household fleet composition as heavily influenced by the social context within which decisions are made and partially determined by the situational circumstances of individuals. For these reasons, deriving the amount and timing of optimal incentives requires a different approach to data collection than often done in California, and we explain this in more detail later in this proposal.

The ultimate outcome of this project is exactly what the Request for Proposals describes:

1. Identify the appropriate incentive amount relative to the value of the vehicle to promote functional, high-emitting vehicles for early retirement and replacement. This is more likely to be a range of appropriate incentives. It is more likely that thresholds exist that trigger change in behavior as we approach them, but the magnitude of the threshold depends on household context and individual situations.

2. Investigate effective pathways for zero emissions vehicle (ZEV) and near-ZEV adoption by lower-income consumers. Pathways are by definition dynamic contextual processes and we expect to find multiple pathways to ZEV depending on habits, attitudes, barriers, and individual roles in households.

3. Determine the most effective form of incentives to motivate high-emitting vehicle retirement and replacement by lower-income motorists. The type of incentives is also a function of household context, attitudes, habits, and individual situations.

4. Quantify social benefits of the program such as return on investments on each retired and/or replaced high-emitting vehicle, increased quality of life (increased mobility capabilities, and health benefits), and supplementary community economic benefits. This will happen in two stages. The first stage is in the creation of scenarios offered to the respondents of the survey that will contain a detailed explanation of the household benefits when replacing a older vehicle. We will also measure their perception of these benefits and perceive return on investment. The second stage will be quantification and associated recommendations to ARB at the end of the project.

In this proposal, we first describe the conceptual framework. Then, we draw lessons from specialist literature emphasizing ideas that are particularly useful in the design of the survey. This is followed by a flowchart and associated section that describe the data collection and the tasks of the project with schedule and budget.

2. Conceptual Framework of Choice Context

Context here is defined as the entire framework and set of factors describing the objective and subjective circumstances that surround and influence action by an individual and/or a group (in our project, the household facing the decision to scrap a car from its fleet or replace it with another car). We identify three dimensions of interest that are (Goulias and Pendyala, 2013) :

1. **Time** in terms of the life course of an individual, historical time, and time scale;
2. **Space** that includes locations, groups of locations, neighborhood, city, region, country; and
3. **Society** that includes the household and other social networks; and the entirety of laws, rules, and regulations.

A life course perspective offers a theoretical framework that includes many facets in the life of individuals and incorporates time in a natural way. Today this is needed more than ever because of an aging population with diverse attitudes and behaviors. Closer attention is also paid to children and their needs, and major changes continue to take place in labor relations and labor force participation accompanied by increased diversity in social institutions such as the household. Moreover, transportation policy analysis is expanding its scope to include land use, which is strongly influenced by residential location decisions that, in turn, require the study of other decisions such as household formation, labor force participation, fertility, schooling, and the variety of location decisions surrounding residence and job locations. In parallel, a shift in policies is seen, aiming at a betterment of *quality of life* instead of simple economic appraisals, as well as environmental assessments spanning long periods (2000 to 2050 and beyond in California legislative initiatives, for example). Recent attempts to create theories of travel behavior also expanded the sphere of consideration to include many aspects of social life (e.g., time use, human relations and interaction, cognition and perception). It then becomes natural to view changes in a household's car fleet from a comprehensive viewpoint that encompasses the entire life of individuals, also considering their biological and social nature. In this way, it becomes possible to place each person in a more complete spatio-temporal context to identify triggers that will motivate change in behavior. In this proposal, we start from the *life course* approach and then review the context of decisions in car ownership.

A *life*-centered approach considers the entire chain of events characterizing the lives of individuals in a contextual manner from conception to death. Closely related fields are also *life history* and *evolutionary psychology* as well as *life story* approaches. The “principles” of the life course approach are:

A. Historical Time and Place. The individual life course is embedded in historical times and places that are experienced throughout a person’s lifetime, and they shape the life course experience. Examples include geopolitical events and localized conflicts (e.g., conflicts and wars, unification of Europe, collapse of the USSR, dismantling of Yugoslavia), economic fluctuations (e.g., recessions and growth), major natural disasters (e.g., floods, earthquakes, volcanic eruptions), and social and cultural ideologies (e.g., patriarchy, transitions to democracy). These historical conditions and events shape peoples dispositions (i.e., norms, beliefs, attitudes, perceptions and choices) and alter the course of their development. Understanding behavior requires knowledge of the places and socio-historical circumstances that surrounded individual life histories. Under this principle, car ownership decisions are in part determined by the sequence of personal experiences (e.g., at age 16 moving from a European country to the US and getting a driver's license) and major events (e.g., migrating to the US to escape political persecution in the home country) that change this experience.

B. Linked Lives. The lives of individuals are linked with the lives of other individuals through multiple networks of relationships cast within the social and historical context. This is a multilevel interdependency centered on the family/household. In this way an event at a different level (e.g., an economic recession) influences relationships in the family and other social ties.

Micro social or biological events such as a death or a variety of other life changing events may trigger behavioral changes. In addition, family members also plan and organize for the timing of life changing events such as marriage, having children, caring for an older parent, moving into a new residence, finding suitable schools, finding jobs, and pursuing a new hobby. Under this principle, car ownership and use and many other travel behavior facets are heavily dependent and determined by the sequence and type of events other people experience because of the relationships a person has with others. This is of paramount importance in car ownership and given only marginal importance in the extant literature. For example, a teenager reaching driving age may trigger the addition of another car to the household fleet and shift escorting responsibilities to other members of the household. Her later departure from the household "nest" may trigger yet another wave of changes, creating new context for car retirement and replacement in the household.

C. Human Agency. Each individual builds a life course through a complex orchestration of actions within a physical (objective) and imaginary (subjective) stage of opportunities and constraints (barriers). Implied in this is also the ability of families and individuals to adapt to new circumstances by modifying their expectations and behavior in response to internal and external events. Under this principle, travelers move around the physical network while simultaneously maintaining a mental map of where opportunities and paths are located. Moving around in a car modifies these mental maps and creates desires for seeking added opportunities. At the same time, they take action to shape the spatial distribution of these opportunities and the networks used to reach them (e.g., engaging in incentive programs for car replacement).

D. Timing of Lives. The impact on a person's development of a succession of life transitions or events is contingent on when they occur in a person's life. In life course approaches, *time* is considered as being of three fundamental types – *individual, generational,* and *historical*. *Individual time* is also chronological age, and it is used to identify and characterize childhood, adolescence, young adulthood, old adulthood, and end of life. It influences rights (e.g., right to vote, ability to obtain a driver's license), positions (e.g., student), and roles (e.g., breadwinner). These stages are heavily based on culturally and socially defined age periods and expectations. *Generational time* is the age period used to define cohorts, such as the baby boom generation classified as people born between 1946 and 1964. In fact, the baby boomer generation is an important cohort in transportation research and policy because of its size and distinct "character" and "habits" relative to past generations. The third, *historical time*, is a marker of large-scale changes that have a broad impact on civilizations of the earth. Examples are major conflicts and wars, the proliferation of the Internet, climate change, and global economic recession. The passing of time can be viewed as the orchestration of life course events visualized as a sequence of *transitions*. In this case, a *transition* is a discrete life change, which is an event within a *trajectory* (e.g., from living at home to leaving the nest, from a single to a married state, from a working to a retired state). A *trajectory* in this context is a sequence of linked lockstep-like states within a range of behaviors and experiences that can be considered to be a single entity. Typical example is education from the kindergarten to elementary school, middle school, and high school, and on to university. These transitions are accompanied and marked by culturally specific rituals that reinforce them and repeat across generations. Age-grading or age-structuring is also a typical characteristic, at least in western cultures. This is the sequence of transitions that are deemed appropriate at specific ages. In a family trajectory, this sequence may appear as follows: leave home, marry, enter parenthood, complete parenthood, and enter grandparenthood. In an education and work trajectory this may be: exit full-time schooling, enter full-time work, settle on a career, reach the peak of a career, and retire. Violation of the sequence and age-graded transitions may occur. Such violations are often associated with a social meaning or interpretation as well as positive and negative consequences.

E. Lifelong Process. Human development and progression along the age axis is a *lifelong process*, in which the past shapes the future in different ways for individuals who may appear similar when one controls for typical explanatory variables such as age, gender, education, employment. One can envision the past as having a *wave-like* impact on the future that not only influences the generation that experiences a wave forming event, but crosses over to future generations (e.g., becoming a refugee due to political or economic conflicts). The timing of these wave-forming events triggers chain reactions that, when considered together, lead to competitive advantages and disadvantages. Moreover, the combination of transitions and their timing may create waves of inhibition of aspirations or recovery from disasters. Individual and group ability to take advantage of opportunities and fortify against negative impacts varies depending on material and immaterial resources available at specific periods. When resources are available where they are needed, recovery happens (even rapidly) but when they are not available, inhibition is exacerbated and prolonged. Transitions determine propensity to change any type of possession, including cars.

The Person-Process-Context-Time Model

Bronfenbrenner's *person-process-context-time (PPCT) model* (Bronfenbrenner, 2005) is an excellent example of a developmental theory for a coherent life course context definition. In this theory, human development over the life span is a journey through increasingly more complex reciprocal interaction between a human organism and other organisms, objects, and symbols in its environment. In the PPCT model, *person* represents individual differences in physiological and psychological states, tempo, and biological intensity of reactions. *Process* is the stream of psychological acts that are called *proximal processes* and considered to be the primary engines of development. ***Context*** **is the physical, socio-emotional, and mental setting in which behavior takes place.** It is this context that we need to describe with data from our survey and correlate with past and future car ownership decisions.

Of key consideration here is the distinction between proximal and distal interactions. The form, power, content, and direction of proximal processes vary systematically as a joint function of the characteristics of the developing person, the immediate environment (proximal), the remote environment (distal), and the nature of the developmental outcomes under consideration. In this way, it is possible to differentiate the immediate setting (or immediate field or proximal arena) in which activities take place (such as the household, school, social network of friends, or work place) and the much broader context in which the immediate setting is embedded (e.g., the city, social class, ethnic group, state or country). *Time* is considered in its three dimensions of ontogenetic (person development) time, cohort time, and historical time as discussed in the life course approaches above. Triggering behavioral change under this conceptual framework is a ***joint function*** of the characteristics of the persons, their immediate environment(s), their remote environment(s), and the nature of the outcome(s). This is a key consideration and position of the PPCT model that not only recognizes the importance of the joint influences of person and environmental factors on behavior but it also allows for the behavioral "mechanism" to depend on the behavioral outcome. Under a model of behavior of this type, there are multiple levels of intervening influences within an individual, among individuals, and from other sources that can change human development and behavior.

Travel behavior can be placed in the context of a chain of events with the pattern of events characterized by antecedent and subsequent events. Consider an example of the joint decision to become a driver and acquire a private automobile as a developmental process of a person that enters the world of automobility. At the center of PPCT is the *motorist.* Figure 1 is a pictorial representation of the ecology of the developing motorist (described in more detail in Goulias, 2009). The person is characterized by age, gender, level of maturity, physical abilities, and other attributes that are the result of personal development and interaction with the environment. This person develops in relation to her/his family members, schoolmates (and possibly workplace co-workers), and friends. This ecology is composed of settings in which this person lives, studies, works, and interacts. The nature of these settings is physical/material but also symbolic. To capture the proximal influences of these settings on individual development, Bronfenbrenner's microsystems depict the innermost region of the interaction between a person and the environment. These include genetic transmission, physical and physiological states, interpersonal interactions, relations, attitudes, and the immediate physical environment characteristics. Key emphasis here is on the interactions between person and environment, meaning that persons of the same age and gender may display different developmental outcomes of automobility because there are differences in the cars available at home, parent's dispositions toward teenage automobility, schoolmates driving to school, schools allowing parking on their grounds, and workplace locations. At the centre of this enterprise is the physical and cognitive ability to drive a car, which itself is the outcome of past interactions with parents, such as taking driving lessons with parents at earlier ages, as well as biological growth. In addition, teenagers interact with others in microsystems of peer groups that are indicated in Figure 1 in a symbolic way as school and friends. Bronfenbrenner's next level is the mesosystem that describes how the different components of a person's microsystem work together for the developing motorist. For example, with the newly found freedom of movement, the new motorist on the way to school picks up a schoolmate. In the same way, the motorist can go out in the evening with friends. All of this improves the person's skill, power in the social network, confidence of the parents, and position of this empowered person in the different social networks in which he or she resides. The intersection, relationships, and interaction of two or more of these microsystems are referred to as mesosystems in this model. The examples above are of encouragement for automobility, but there could also be barriers and/or inhibitors such as no driving at night, no parking at school, no friends allowed to ride with a teenage driver, and driving limited to work and school purposes only. Of importance in this process is the consideration of change in all of these interactions through a variety of phenomena including, but not limited to, accidents, the entry into automobility of other teenagers, and a variety of events that change family composition, school settings, and friendships. Figure 1 shows yet another systemic level, the exosystem, which includes the other persons and places with which our motorist may not interact directly, but that play a substantial role on the developmental process of driving. These can be the parents' employment and wealth as well as local taxation and insurance regulations, labor structure for employment opportunities, the spatial organization of places, workplace and school support for automobility, and the community policies about driving. The all-encompassing envelope that is more remote and yet exerting substantial influence on the motorist is the *macrosystem*. It includes society's values, rights and responsibilities, culture, and ideologies in relation to automobility (e.g., positions about climate change, environmental justice, equity, and freedom). It also includes socio-political institutions defining the overall setting of policy and the government institutions that develop and implement the rules and regulations (e.g., driving after the age of 15 in the US and 18 in many European countries). Global influences and other institutions include major historical circumstances and events as well as other organizations that influence automobility (e.g., automotive industry, spatial development practices such as urbanization and urban sprawl).

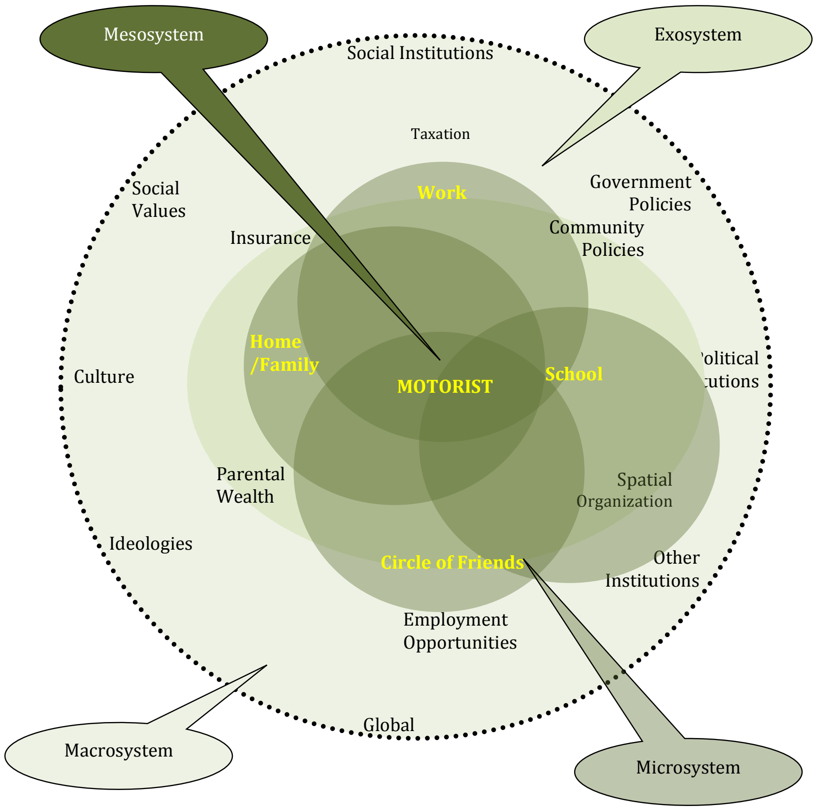

Figure 1 The Multilevel PPCT Model for a Young Motorist

Adding time to the Process-Person-Context in Bronfenbrenner's framework gives us a complete framework. Recall from the life course discussion above that time is individual (age), generational (cohort), and historical (period). In this example of the developing motorist, age at the first experience of driving may be 14-15 years with institutional recognition of driving rights at 16 years (in the US) and 18 years in many other parts of the world. This construct progresses to motorist maturation in later years. Considering age, period, and cohort effects in analyzing human development allows one to account for common experiences shared by a group of persons in an age group and for the differences in experience among generations due to the specific periods in which they lived. Bronfenbrenner (2005), however, emphasizes the need for studying the three temporal dimensions in a system (called *chronosystem*) "to identify the impact of prior life events and experiences, singly or sequentially on subsequent development" (Bronfenbrenner, 2005, p.83). These events and experiences may originate in the external environment or within the person and alter the relationships of the person with the environment. The origin of the events can be at any of the systemic levels in Figure 1. Bronfenbrenner (2005) also distinguishes long-term impacts of life events from the impact of sequences of events/experiences of a person. He also advocates the need to avoid analyses of individual development paths as self-standing, and to account for changes in the environment (in all its rich multilevel structure) in the form of context undergoing change via multiple processes surrounding and interacting with the individual.

There are many different types of events that can alter the individual and the context. These are *physiological alterations* (e.g., hormonal changes that alter physical and social selves), *transitions* (e.g., *age-graded movement* into and out of social roles such as school grades or loss of a parent), and *turning points* (e.g., events that cause reorientation of priorities and lasting alterations of a person's developmental trajectory). All types of events create barriers or offer new opportunities. They may also lead to changes in roles, self-concepts, lifestyles, worldviews, and dispositions towards other people. They are also different in their impact depending on their timing and duration, and the socio-economic characteristics of the individual such as sex, and ethnic and social class. Examples of events include, and are not limited to, marriage, divorce, building a family and birth of children, entering a new intimate relationship, separation, entering school, choosing occupation, engaging in nonoccupational studies, graduation, continuing studies, dropping out of school, job seeking, job loss, retirement, starting first job, starting private enterprise/practice, declaring bankruptcy, moving to another community, leaving home, travelling somewhere far away, moving temporarily to another place, entering military or community service, loss due to death of close member, getting a new apartment, getting a vacation home, change in leisure activities and hobbies, drug use and abuse, committing crime(s), religious engagement, psychological crises, own illness, illness of close member, and accidents. Each of these events can be considered factors of development continuity (e.g., a motorist teenager continues to drive after moving to a new place) but also discontinuity (e.g. leaving the nest and losing access to the parental car). Context plays a critical role because a move from a place where teenagers drive (e.g., the US) to a place where they are not allowed to drive will inhibit driving. Leaving the nest and moving to a place that does not offer alternate options may trigger the purchase of a car (with or without parental financial support). The PPCT model points out that location in different *bioecologies* renders the same experience – such as leaving home – as leading to different outcomes and choices on the part of the individual (motorist in this example). However, the model is less clear, about the dynamics of the process of negotiating with a changed context and the interactions with others in the microsystems. We turn now to the more focused car ownership literature and modeling.

Lessons Learned from the Literature and Our Models

Here, we extract lessons from the literature that help us design a contextual survey to collect data on determinants of car ownership decisions and point out knowledge gaps our search for optimal incentives should fill. Studies in the early- and mid-eighties focus on the demand for battery-electric vehicles (Beggs *et al.*, 1981; Calfee, 1985; Train, 1980). Past studies used small and potentially biased samples with very limited information on household or vehicle attributes. Hensher (1982) studied the demand elasticity of electric cars in Sydney, Australia based on gasoline price, vehicle price, and driving range. The result showed that gasoline price plays a significant role in switching to electric vehicles. In the hypothetical case of the introduction of greatly improved electric vehicles in the market, Calfee (1985) estimated a logit model of vehicle choice in order to predict the kind of cars that would be purchased by multi-vehicle households. While investigating the demand for alternative vehicles technologies, it is essential to make several assumptions on the supply side. Most studies assumed the availability of the potential vehicle technology in the market as well as the existence of refueling and maintenance infrastructure. It is unknown, however, if the persons modeled were aware of the different technologies and the associated benefits. In addition to battery electric cars, other studies (Bunch *et al.*, 1993; Golob *et al.*, 1993) included clean-fuel vehicles such as methanol, ethanol, propane or natural gas. Bunch et al. (1993) used stated preference data and estimated both demand models for vehicle and fuel choice (gasoline or alternative). Following up on this study, Ewing and Sarigollu (1998) conducted a stated choice experiment to examine vehicle-technology choice of suburban driver commuters in Montreal, Canada. For tractability reasons, most earlier studies of car ownership and use have either (a) focused on the vehicle type characteristics of the most recently purchased or the most driven household vehicle (Kitamura *et al.*, 2000, Train and Winston, 2007, Spissu *et al.*, 2009), (b) confined attention to vehicle type characteristics of the most frequently used vehicle (Choo and Mokhtarian, 2004), (c) examined ownership and vehicle type choices for only households with two vehicles or less to reduce the number of possible vehicle type combinations (Mannering and Winston, 1985, West, 2004, and Feng *et al.*, 2005), or (d) used aggregate classifications of vehicle types such as car versus non-car or sports utility vehicles (SUV) versus non-SUV (Feng *et al.*, 2005, Brownstone and Fang, 2009). A few of these studies have also considered the amount of use (annual mileage) of each household vehicle (Mannering and Winston 1985, de Jong, 1990, Feng *et al.*, 2005, Fang, 2008).

In California, the study by Brownstone et al (1996) was based on stated preference/choice data. Six hypothetical alternatives were presented to respondents with a number of randomly distributed attributes within certain ranges. The model was multinomial logit for 1 vehicle and 2 vehicle households. Zero vehicle households were totally disregarded in the model. The study by Brownstone and Train (1999) is innovative from both a practical and a technical point of view. In a stated-choice framework, they model automobile transactions by using jointly stated and revealed preferences data. Another important issue in modeling the demand for alternatively fueled vehicles and individual choices in general is heterogeneity across consumers. In an extension of their previous study (Brownstone and Train, 1999), Brownstone *et al.* (2000) utilized data from a large panel survey in California and estimated joint mixed logit models of stated and revealed preferences for alternative fuel vehicles (AFVs). Although the studies presented are significant in the implementation of stated-choice methods on the demand for AFVs, they are limited in examining the variation of certain attributes, which distinguish AFVs from conventional vehicles.

It is clear that most of studies reviewed here investigated several aspects of AFVs as well as environmental benefits and household purchasing behavior. However, these studies do not address social and behavioral concerns associated with such technologies or the impacts of AFVs on household automobile holdings. Due to data limitations, most of these studies focused only on a few types of AFVs and are based on respondents' stated preferences to AFVs, without taking into consideration that automobile ownership need to be viewed within a larger framework that studies a comprehensive and dynamic automobile transaction behavior. This restriction is unsuitable because people make their future vehicle purchases decisions based on their current holdings and the series of transactions they have had over time. Therefore, a quality survey data collection procedure should be used that includes all competing technologies within an integrated social context modeling framework to provide better forecasting results. In addition to broadening the context, we also face methodological challenges in modeling all dimensions of all vehicles owned by a household. Bhat and colleagues (see Bhat and Sen, 2006, Bhat, 2008, and Bhat *et al.*, 2009) recently proposed the use of a flexible multiple discrete-continuous extreme value model (MDCEV) model. The MDCEV model has a simple closed form structure for the probability expressions, and allows the choice of multiple alternatives jointly. It also incorporates the notion that households own and use different vehicles for different functional purposes (for example, a compact car to drive to work and a van for weekend family getaways) as well as to accommodate different preferences of individuals within a household. That is, households feel a need to have the vehicles they hold, and believe that, over the medium-to-long term, the portfolio of vehicles they hold will provide them the most value and satisfaction. This can be linked to the behavioral microeconomic paradigm that, as a collective entity, the household views vehicle type choice decisions as a case of imperfect substitution, where the use of each type of vehicle provides value along some dimension that the other vehicle types do not. The choice process can be viewed as a case of decreasing marginal utility (or satiation) from the use of any one vehicle type, which leads to variety-seeking based on functionality and/or household member preferences and, therefore, the possibility of owning multiple vehicles of different types.

The most recent articles examining propensity to buy cars that are either electric or hybrid-electric identify the following as the factors influencing this decision. Kihm and Trommer (2014) created a model to analyze potential market advancements for electric vehicles. The model integrated trends in vehicle purchasing behavior using two national travel surveys in Germany – the MiD for private cars and the KiD for commercial cars. They calculated Net Present Value (NPV) to determine whether a purchaser would choose an electric vehicle over their actual car choice in the model. If the NPV of investing in an electric vehicle were positive compared to their current choice, the alternative was selected. The NPV was calculated using the initial investment for drivetrain electrification, discount rate, and cost savings. The initial investment includes equipment and battery costs, subsidies, and an "eco-factor" that allows for environmental attitudes to be reflected in the value of the investment. The influence of the discount rate was measured by "allowing for different scenario values" (op.cit). This was a very important factor for determining savings. The cost savings was represented using the annual fixed cost and per-mile cost. Annual fixed cost includes "circulation taxes, depreciation, and revenues from vehicle-to-grid activity" (op.cit.). Per-mile cost mainly consists of fuel savings, but it also includes "mechanical wear-off costs and mileage-based depreciation" (op.cit). The study found that close to one third of Germany's annual mileage has the potential of replacement by electric vehicles. Hoen and Koetse (2014) performed a stated preference experiment using an online survey of Dutch car owners. The attributes included in their choice model include "car type … catalogue price, monthly costs, driving range, recharging/refueling time, additional detour time to reach a fuel or recharge station, number of available models, and policy measure" (op.cit). Respondents were given three car purchase choices and asked to give their first and second preferences. The attitude towards policy intervention is the only subjective variable included in this study. Driving range, refueling time, and limited availability of refueling options were the most significant barriers to people selecting electric vehicles. As these factors improved, the average preference for electric vehicles increased substantially. Secondhand car buyers are "roughly twice as price sensitive as new car buyers," but besides that they exhibit similar preference patterns. Kim et al. (2014) created a binary discrete choice model that integrated social influence and latent attitude variables. The latent attitudes examined included environmental, economic, battery, technological, and innovation value aspects. They asked participants to answer questions in each of the aforementioned categories using a seven-point Likert scale as a way to measure their attitudes and beliefs about electric cars. Next, situations were presented to participants and they were asked whether they would choose the electric car or not. Each of the situations included a section on social influences. This section consisted of percentages of various social groups owning electric vehicles. These social groups include friends and acquaintances, members of family, colleagues, and friends/peers. Reviews of electric vehicles were also included in this section, using a four-point scale of "only positive," "mainly positive, but some criticism," "mainly negative, but some positive," and "only negative." Objective variables about the cars were also included in the presented situations, looking at cost of an electric car relative to a comparable standard car, cost of electricity relative to gas, range of the electric vehicle, time for battery to charge, maximum speed of the vehicle, and distance to a charging station. The major findings of Kim et al. indicate that reducing fuel costs is what people are most interested in obtaining by switching to electric vehicles. They also found that reviewers' opinions affect people's purchasing intentions more than the share of electric cars in participants' social networks. It would take nearly half of their friends owning electric cars for respondents to follow suit. Larson et al. (2014) surveyed three groups in Manitoba, Canada: experienced electric vehicle users, students, and the general population. Respondents were first asked about their desire for more knowledge about electric vehicles. To obtain consumer attitudes, they asked participants to rate the following car characteristics on a scale of 1 to 5 for their importance in making a purchase decision: reliability, handling in winter conditions, fuel efficiency, operating costs, purchase/lease price, safety, emissions, reputation, vehicle power, vehicle size, and trade-in value (op.cit). Respondents were asked for ratings of importance for electric vehicle-specific factors, including battery range, ability to charge car at home, total cost (purchase price and operating), ability to charge battery at work, ability to charge battery quickly, use of local-produced electricity as fuel, and government subsidy or tax exemption (op. cit.). Respondents also rated barriers to purchase, including high purchase price, vehicle reliability, limited range, high battery cost, access to charging locations, and seven other factors (op. cit). For price assessment, they performed a van Westendorp Price Sensitivity Method, meaning they asked participants to indicate price points for electric vehicles to get a sense of the prices consumers were willing to pay. They asked at what price an electric car would be "too expensive to consider buying," "too cheap so quality comes into question," "expensive so one things carefully before buying," and "cheap so it seems to be a bargain." (op. cit.). The survey also asked one prompted and one unprompted question focused on willingness-to-pay a premium for an electric vehicle. Reliability, handling in winter conditions, fuel efficiency, operating costs, purchase/lease price, and safety were rated at significantly high importance (above 4.0). Barriers to electric vehicle purchase that were rated highly include high purchase price, vehicle reliability, limited range, and high battery cost. The study found that consumers need more accurate, objective information about the cost, range, and reliability of electric vehicles. They also found that the range of prices for electric vehicles is similar to the range for conventional ones. It seems that consumers either do not understand the long-term savings, or they disregard these savings because of uncertainties like "battery lifespan and costs, adequacy of performance, or obsolescence"(op. cit.). Participants seemed to focus on the initial purchasing cost, disregarding fuel savings and operating costs. Depending on the reason for this, policy or education seem to be the best options for increasing acceptance of electric vehicles. Lieven et al. (2011) used a stated preference experiment to analyze Germany's market potential for electric vehicles in various vehicle categories, from micro/city cars to SUVs to luxury cars. Respondents were given a list of vehicle types and asked to select the one they would most prefer with an electric motor. They were also asked to indicate which of the following criteria were important for each of the vehicle types: "price, range, performance, environment, durability, and convenience" (238). Unsurprisingly, prices were found to be important for almost all vehicle categories. The experiment found that "micro/city cars, SUVs/off-roaders, and sports/leisure cars" have the greatest potential for success in the electric vehicle market. Graham-Rowe et al. (2011) assessed 40 UK drivers who were given the opportunity to drive plug-in hybrid and battery electric vehicles for a week. A semi-structured interview directly followed the experience. The interview covered knowledge and awareness, advantages and disadvantages, experiences of driving and charging the vehicles, perceptions of users, responses from others, and purchase intentions. After careful coding of responses, six response categories were identified: cost minimization, vehicle confidence, adaptation to new vehicle demands, environmental beliefs, concerns with the impressions of others, and – at the foundation of all the categories – the perception that electric vehicles are still a "work in progress" (op. cit.). Overall, the study found that purchase intentions were contingent on electric vehicles meeting the "cost, performance, convenience, comfort, and aesthetics" standards of conventional vehicles in the future.

In our work developing SimAGENT for the Southern California Association of Governments (Goulias et al., 2012), we created a car ownership simulator that recreates the decisions within a household (Vyas et al., 2012, Paleti et al., 2013). For any existing vehicle, the household has three options: (1) Keep the vehicle, (2) Dispose the vehicle, or (3) Replace the vehicle (and choose vehicle type and usage level for the replacement vehicle). In addition to evolutionary choice options corresponding to existing vehicles, households may also choose "not to add a vehicle" or "to add a vehicle" (in the latter case, the vehicle type and usage of the added vehicle must be simulated). All of the models in the evolution module consider temporal dependency across transaction decisions. The vehicle type and usage of all replacement/added vehicles are determined using the vehicle type choice model from the vehicle selection module. The vehicle type choice model includes existing vehicle fleet characteristics and the replaced vehicle characteristics as explanatory variables. This captures dependencies between future vehicle type choices (during evolution) and vehicles already owned and getting replaced. All of the models in the vehicle fleet simulator are estimated using a non-conventional dataset that includes comprehensive information on vehicle ownership and usage decisions of households, including current fleet composition, potential future fleet composition, and vehicle evolution plans. The vehicle fleet simulator incorporates a new method to address the problem of multiple vehicle holdings and use, as well as to deal with the gamut of vehicle evolution decisions, all in a comprehensive and implementable forecasting framework. Specifically, the simulator encompasses state-of-the-art household vehicle type choice, usage, and evolution models estimated using a special-purpose 2008-2009 vehicle survey data set collected from 6577 California households by the California Energy Commission (CEC). The survey has three components: (1) a revealed choice (RC) component, which collected information about current and past vehicle holdings and usage, (2) a stated intentions (SI) component, which collected information on replacement plans of existing vehicles and vehicle addition plans, and (3) a stated preference (SP) component, which collected information about vehicle choices that respondents would make under hypothetical policy, price, refueling infrastructure, and vehicle attribute scenarios. Incentives did not receive a prominent role and attention.

Missing from the data and specialist literature is an investigation into the role played by incentives in altering consideration of different options, timing of car ownership changes, and the removal of cost and other barriers. Even more important, the literature does not deal extensively with the issue of knowledge about options and seeking of information. Social influence is reported as important in more recent studies as in Axsen and Kurani (2012), and car marketing sites claim that social networking sites are already influencing 3% of the population (http://www.weworkforyou.com/files/insights/pdf/PolkBrochureFINAL03-17-2011.pdf), while a strong relationship is claimed for social media and advocated as a marketing tool (http://www.dealer.com/assets/APC-Study-21.pdf). Moreover, a direct approach to providing information and influencing beliefs of potential program participants is a preferred way of designing this survey because there is not sufficient time to create a longitudinal (panel) survey and perform an experiment in which we give advanced technology cars to participants. As explained later in the survey design we will use a "marketing" technique in which we first collect data to understand the context in which each household decides to change their automobility. Then, a tailoring information and education program will be developed and delivered to these households. Finally, through a future visioning and a stated-choice exercise we will arrive at estimates of probability of scrapping an older car and replacing a car with conventional or advanced technology car.

3. Contextual Survey

The overall design of this survey is based on Goulias et al. (2012), which is a total survey design that is consistent with the human development conceptual framework and addresses all the data needs of this project. Figure 2 shows the data collection components and their relationship with project activities. On the left hand side of Figure 2 we have a survey of households and detailed characteristics of each person in the household with many variables that define the roles played by each household member (e.g., breadwinner, home duties, school going child). The survey participants in this group are divided into one sample of *program participants* that received incentives and another sample that we want to study and call the *new recruits*. We use survey designs that have high response rates and tested in the CentreSIM project in Pennsylvania that Goulias directed. We also create a setting that has similarities with the TravelSmart and Indimark policy interventions in Australia that Goulias audited twice in Perth and Brisbane and also used in the GreTIA project, which is a longitudinal real-life experiment in Greece .

The method used here is a *before-during-after* method that has a first stage during which we understand the household needs, the objective and subjective context of decision making for car ownership decisions, and past decisions and barriers. In this stage (top left corner of Figure

2), we have the core survey component that will collect household demographics, person characteristics, household car fleet characteristics, and questions about interest in the incentives program and general awareness of options for subsidized scrapping of existing vehicles and replacement with new vehicles.

Each ellipse following the core is a survey component that is tailored to each household and each household member in the household that participates in car ownership decisions. A first group of circles is about past barriers faced in purchasing advanced technology cars (R1) and decisions and acquired habits (R2). These components collect data retrospectively about decisions made in the past and barriers in engaging with incentive programs and/or the purchase of conventional and advanced technology cars. The second group of circles (S1, and S2) collect data on subjective attitudes and perception of power of decision making within the household (i.e., about car purchases and use) and relationships with other persons in the household and outside focused on the use of a car for joint activities (e.g., escorting children to school, doctor appointments and so forth). The next group labeled (O1, O2, O3) collect data on objective household circumstances that influence car ownership and use. Typical data we want to collect are intra-household decisions about capital expenditures in purchasing a vehicle and car use operational costs (e.g. fuel, registration fees, insurance), distances among the three major pegs in everyday scheduling of activities and travel (e.g., home, work locations, and locations of schools), and car allocation to each driver in the household as well as annual miles and usual driving of each car per week. We also use data from other surveys in California (The California Household Travel Survey and data fro the California Energy Commission data) to identify regions of our State where persons reside and to develop a taxonomy of car ownership styles by different groups within the low income segment. In addition, land use is a very important factor of behavior, and we will use an informative database to develop accessibility indicators for every important household location (home, work, and school) in our sample.

The *during* stage is when we communicate with a household about possible options to meet the household's needs and explain any misunderstandings. In this stage we design a component that is, in essence, an information and education intervention with the intention of experimental economics (Gaker et al. 2010). It is tailored to the traveling needs of the respondents, addresses perceived barriers, and provides advantages of replacing an older vehicle with a new conventional or advanced technology car in a succinct and clear way. Using monetary and other comparisons with existing household vehicles helps respondents focus on the requirements of the next step, which is about future actions.

The *after* stage is when we explore if barriers where removed (mostly subjective barriers), finalize future ideas about choices, and identify the level of incentive that will make a change happen. F1 mirrors R1 and F2 mirrors R2. In this way we can find out what happens when we provide tailored information to households. These blocks of questions will first identify the portfolio of options each household considers in making plans for scrapping a car from their fleet and replacing a car. The questions in this block will be of the type: Do you consider purchasing a car? What type of car do you consider? In this way different respondents will include a variety of options. Understanding inclusion/exclusion of options in these portfolios will be further explained by the survey component labeled prospective barriers. This component will have questions of the type "Please list the reasons you did not include an all electric car in your future choices." Then, conditional on these answers, respondents will be asked to participate in a stated choice survey (F3) in which we ask them to make choices between different options in which different values of incentives are used. F3 also aims to measure the incentive threshold at which a change in decision happens (the tipping point). The design of this component will be a function of the answers to the rest of the surveys, and will be done as the final step in a sequence of survey components. With these, we will jointly analyze the behavior of current program participants and newly recruited survey participants in terms of household details, current fleet composition and use, lifestyles, and car assignments within the household. With the data in F3, we will develop latent class cluster discrete choice models and latent attitude discrete choice models, which are state of the art in Discrete Choice Models. Most important is to include all the existing monetary incentive programs as policy variables/option attributes. The stated preference will include a combination of incentives at different amounts and types of incentives for low income families that agree to scrap their "older" car. This will allow us to develop thresholds for different households that depend on the household social context and physical characteristics of the region where they live, work, and go to school.

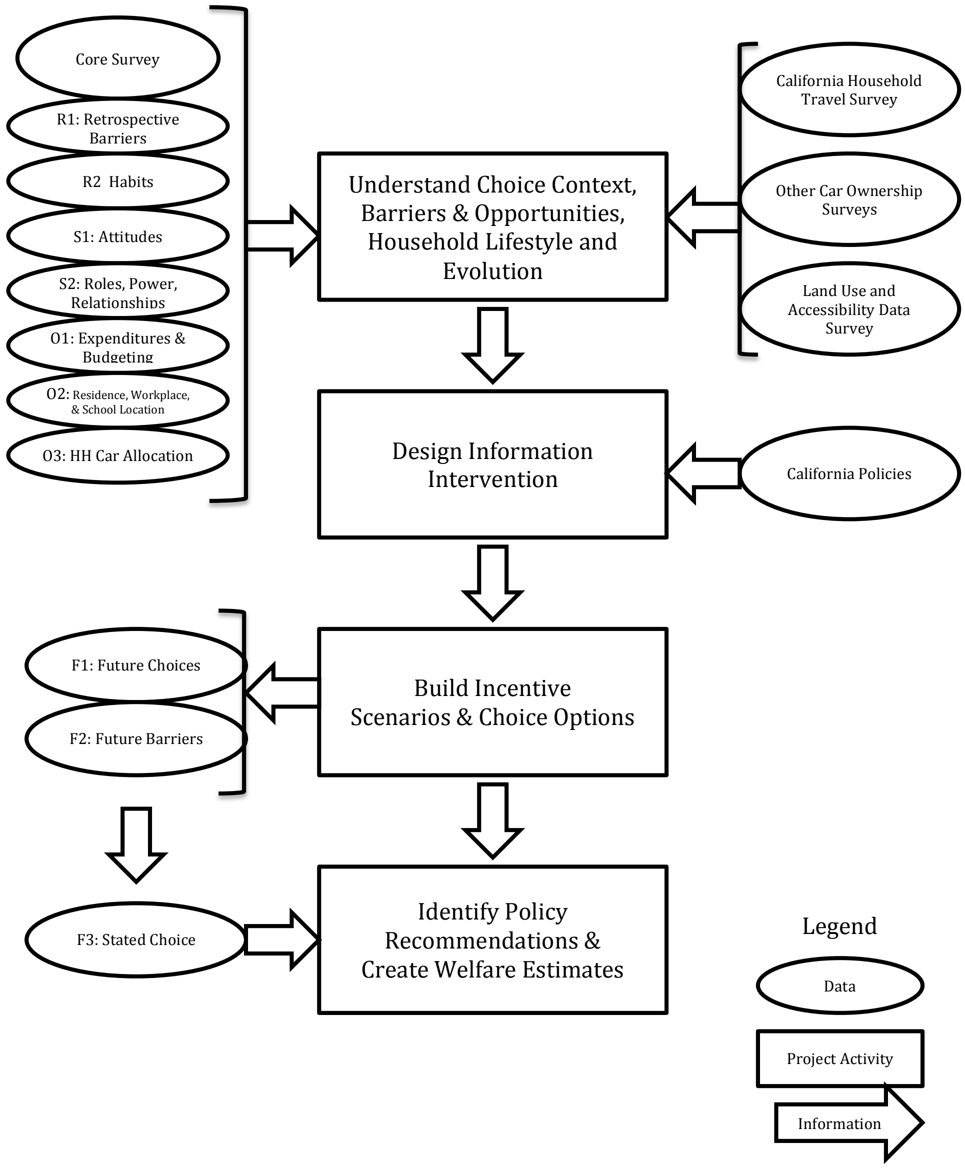

Figure 2 Survey Data Collection and Project Activities

A mapping of the data mentioned in the RfP and the survey design here is provided below. In parentheses we show the survey components that are focused on each of these items in the list provided by the RfP.

1. Demographics of potential EFMP participants (Core Survey)
2. Awareness of the program (Core Survey)
3. Vehicle retirement and replacement motivations of the targeted population (R1, F1, F3)
4. Effective outreach and marketing strategies in disadvantaged communities (S1, O3, R1, R2, F1, F2, F3)
5. Acceptance of alternative forms of incentives, such as access to car share and transit programs, in lieu of vehicle replacement to increase mobility options for participants (S1, O3, R1, R2, F1, F2, F3)
6. Evaluate participation barriers associated with vehicle replacement plus retirement: a) For conventional and advanced clean vehicle replacements; and b) Infrastructure required for plug-in zero emission vehicles (R1, F1, Intervention)
7. Conduct interviews with lower-income consumers, both program participants and potential, eligible participants, to gain a detailed understanding of the motivations and barriers which affect vehicle retirement and replacement patterns using a) Qualitative insight into purchase motivations and barriers (R1, R2, F1, F2); and b) Evaluating effective streams of information most relevant to lower-income consumers that will help increase participation (Intervention).

Sample Size and Sample Composition

The usual computation of sample size determination based on significance in surveys yields small numbers of respondents (somewhere in the order of 100). This small sample size would be a major limitation for our survey because we are also interested in contextual differences among households. For this reason we would like to have households that are at different lifecycle stages such as single persons, couples with no children, couples with children, older couples with no children, older single persons. Note we do not define the exact age groups here because we want to first perform a preliminary analysis of the California Household Travel Survey and test differences among different lifecycle groups in California. The second classification variable we want to use to derive the desired sample size is place of residence. We will use at least three categories that are urban, suburban, and rural. Key distinction among the three types of residential environment is accessibility to activity opportunities and the distances among opportunities. The third variable is employment within each household. For example, we can have a couple with children with both adults working outside their home, a couple with children in which one adult is working outside their home, and couples with children with no adults employed outside the home. Determining in this way sample size we estimate it will yield at least a sample size requirement of at least 1000 households. In addition, based on experience with more recent surveys in California the response rate is extremely low and we estimate that even with the use of advanced methods of recruitment and retention of the sample households we will need to contact at least 5000 households. These estimates are preliminary and they are offered here only as an indication of the sample size magnitude. We will refine the cross-classification variables to use to develop a sampling scheme that better fits also the low income requirement in the sample selection based on other survey data and secondary sources of information as well as availability of information about households from specialized sample provision vendors.

4. Technical plan.

The research work of this project is organized in tasks that overlap with the survey stages. Tasks 1, 2, and 3 are part of the first stage to understand our market. Task 3 is mostly an operations task and is almost entirely in parallel with Task 4, which is analytical. Task 4 uses the data, develops the information intervention, and executes it. Task 5 is the completion of the project.

Task 1 Review and Analyze (Month 1 to Month 9)
In this task, we will first review Californian programs and policies and compare them to European initiatives. We will also assemble all the existing databases and commence a data analysis effort to develop contextual descriptions of choices people make. We will also include policy impacts reports and any data about program participants. We will seek information about characteristics of early adopters/current program participants. Using existing databases, we will describe car ownership markets of low income households using the California Household Travel Survey. We will review in detail car ownership surveys in California, estimate access and accessibility of different geographic areas, and identify the sample to target.

Task 2 Design of First Stage Surveys (Month 7 to Month 12)
With information form Task 1 we will design all the survey components of the first stage in this project (top left hand side of Figure 2). During the last 2 months of this task we will pilot test all survey components and use a focus group to critique and finalize complex survey parts. We will also design and test the web site that is needed in this type of surveys as well as a public campaign with the help of ARB.

Task 3 Survey Execution (Month 13 to Month 24)
The first part of this task is dedicated to recruitment of participants and collection of data in the different components of the first stage. The second part of this task is to provide information about scenarios and options participants have for scrapping and/or replacing their cars. This is the intervention stage described earlier in this proposal. The third part of this task is dedicated to executing the survey components F1, F2, and F3 that are the post information reaction of the respondents.

Task 4 Data Analysis (Month 13 to Month 28)
The first part of this task is dedicated to the analysis of the data collected during the first stage. The second part is data analysis aiming at the development of incentive information scenarios, and the third part is the analysis of the survey components F1, F2, and F3 and computation of welfare gains by respondents when adopting different types of car replacement scenarios.

Task 5 Policy Recommendations (Month 24 to Month 30)
In this task we will create a synthesis of findings from each market segment. We will first provide a description of policy portfolios and for each portfolio we will show expected market segment sensitivity to incentives and the incentive threshold that triggers change. We will also estimate expected impacts (market penetration and environmental benefits) in the form of three plausible futures (optimistic, average, pessimistic). We will also provide an analysis for barrier elimination and the role manufacturers, government agencies (State and MPOs), and advocacy groups could play.

5. Schedule

Tasks	1qtr	2qtr	3qtr	4qtr	5qtr	6qtr	7qtr	8qtr	9qtr	10qtr
1.Review										
2. Design										
3. Execution										
4. Analysis										
5. Policy Rec.										

6. Project management and roles

The PI of this effort is Dr. Konstadinos (Kostas) Goulias who has designed a variety of surveys, has been the project director of the largest microsimulation model in the US called SimAGENT, and directed many projects on attitudes, perceptions, and behavior as well as statistical and econometrics methods to estimate complex dynamic models for the past 25 years. Three Graduate Research Assistants (Jay Lee, Adam Davis, and Elizabeth McBride) will work at a variety of percent of their time depending on the task needs and their expertise. They all have expertise on statistical methods and GIS, they also have excellent communication skills and have worked on a variety of survey designs and data analysis. They also have training in econometric methods and can estimate the models proposed here to estimate the optimal level of incentives.

In this project, we also have a *senior panel of experts* that developed new econometric techniques for car ownership, car use, and type of car purchased, stated preference discrete choice models, and discrete choice model with latent classes and latent variables. They are: a) Professor Chandra R. Bhat from UT Austin, who also worked with his team in the SimAGENT project that Dr. Goulias directed; b) Professor Amalia Polydoropoulou, who developed a variety of discrete choice models and is the director of the GreTIA before-after project; c) Dr. Athina Tsirimpa who developed stated choice experimental settings and estimated latent variable discrete choice models; and d) Professor Pendyala (from Georgia Tech) who developed a variety of car ownership and use models in California, Arizona and also a new method called SimTravel that uses car ownership models that are sensitive to pricing. This panel will review all documents and methods and provide guidance in data collection, analysis, and policy recommendations. The panel will also travel to California and participate in meetings when needed.

7. CV of Principal Investigator

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EDUCATION

University of California Davis	Civil Engineering	Ph.D., 1991
University of Michigan, Ann Arbor	Civil Engineering/ Transportation	M.S.E., 1987
University of Calabria, Italy	Civil Engineering	MS/Laurea, 1986

CURRENT AND PREVIOUS ACADEMIC POSITIONS

Professor of Transportation, University of California Santa Barbara	March 2004 – Present
Professor of Civil Engineering, Penn State University	Sept. 1991 – Aug. 2004

CONSULTING

Has worked in *Australia*, *Germany, Greece, Italy, Japan, the Netherlands, Portugal, and the United States* developing new data collection and modeling techniques, simulation frameworks, and expert reviews of technologies and engineering practice and policies for government agencies and private companies.

LEADERSHIP ACTIVITIES AND PROFESSIONAL MEMBERSHIPS

Associate Director, University of California Transportation Center; Associate Director, University of California Center on Economic Competitiveness in Transportation; Editor-in Chief, *Transportation Letters: The International Journal of Transportation Research;* Emeritus Member, Committee on Traveler Behavior and Values (2009-today). Transportation Research Board of the National Academies. Member, Transportation Research Board Committee on Transportation Demand Forecasting (ADB40) Member, National Research Council - National Cooperative Highway Research Program, Project Panel B08-94 (2013-today); Member, Scientific Committee of Chaire Mobilité sur la mise en oeuvre de la durabilité en transport, Département des génies civil, géologique et des mines École Polytechnique de Montréal, Canada, January 2011 - today; Member of Editorial Advisory Board, *Transportation Research* Part B, Methodological. 2004 - present; Member of Editorial Advisory Board, *Intelligent Transportation Systems Journal: Computing, Communication and Transportation*, G&B Editorial Services Inc. and Taylor & Francis, 2000-present; Member of International Editorial Advisory Board, *Transactions on Transport Sciences, CDV - Transport Research Center, Czech Republic.* 2008-present.

SELECT PROJECTS

2010-12 California Household Travel Survey (CHTS) Management Consultant Number 12-005-C1 and 13-025-C1. Sponsor: Southern California Association of Governments. (October 2011 to June 2013, $75,000). In this project Goulias monitored and supervised portions of the California Household Travel Survey implementation. He also developed data checking methods and provided technical support to CALTRANS steering and administration committees as well as SCAG staff. He also supervised data collection efforts, performed coordination tasks, trained technical staff, and analyzed outcomes.

California Household Travel Survey Pre-test Design (10-046-C1). Sponsor: Southern California Association of Governments. (April 2010 to December 2010, $32,000). In this project Dr. Goulias with Dr. Morrison designed a pre-test for the 2010 California Household Travel Survey (CHTS) and developed a list of data items required for the modeling needs of California to address SB 375 policy questions today and to also prepare for new modeling needs in the future for large. Medium, and small MPOs as well as CALTRANS. The pre-test was later modified by NUSTATS and the CHTS steering committee and was used in data collection.

SCAG Activity Based Travel Demand Model Development. Development of SimAGENT. In collaboration with UT Austin and Arizona State University. (April 2009 to March 2013, $1,400,000). In this two phase project the requirements of California Senate Bill 375 and the regional transportation modeling guidelines will be addressed by developing an activity scheduling model system and insert it into the overall model system of SCAG . The first phase aims at creating a short term solution and the second phase envisions a more precise and accurate model, which was finalized in March 2011. This is a pragmatic solution that uses CEMDAP (Comprehensive Econometric Microsimulator for Daily Activity-travel Patterns). In phase 2 a new tool is designed and interfaced with a variety of other models. The policy tool produced at the end of this project is named SimAGENT (Simulator of Activities, Greenhouse Emissions, Networks, and Travel) herein. Key elements include a synthetic population generator for a region that has six counties, 188 cities, 14 subregions, 38,000 square miles with 19 million residents. The project continues with testing and training and SCAG moved SimAGENT to its operational stage and intends to use as the primary models system of its next Regional Transportation Plan.

A**ctivity Based Travel Demand Model Feasibility Study. Sponsor: Southern California Association of Governments. Contract Number 07-046-C1. Completed in June 2007.** Goulias in this project developed a transitioning multi-phased approach for a new travel demand forecasting model. The envisioned model takes advantage of the state of the practice in activity-based approaches and lays the foundation for the development of a stream of future model improvements that are more behaviorally realistic and credible, flexible in their improvement, provide answers to a variety of policy questions at multiple geographical and social scales, and can take advantage of new technologies and methods as they emerge.

Dr. Goulias also served as the project director of CENTRESIM that is a **time-use/activity survey that he designed and implemented** in Centre County, PA, and an **activity based model for the Centre Region**, a PATH/CALTRANS project on **accessibility in California**, a group of projects for the University of California Transportation Center to **develop travel behavior models**, and a UC Office of the President grant to **develop a new generation of agent-based simulation** with Los Alamos National Laboratories that spans geographically the entire 48 contiguous states of the US. Goulias also served on a variety of peer review panels such as the High Speed Rail Study for California, Travel Model Peer Review Panel for the Metropolitan Transportation Commission, The Cadre of Experts for the Chicago Metropolitan Agency for Planning, the Panel to Study Longitudinal Data Collection for Portland Metro and the development of the activity-based model called DASH, served as Auditor for the Department of Transport of Western Australia and the Department of Transport of Queensland.

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9. Budget and Budget Justification

Large part of the budget includes survey administration and execution expenses such as printing and mailing recruitment letters, specialized website creation and sample information acquisition pre-selected from commercial databases to fit the criteria of the project participants. The expected initial sample is 5,000 households to achieve a sample of at least 1,000 households. The budget also includes incentives for respondents to participate in the survey that will be defined with ARB to be consistent with statewide rules and regulations. We expect this to be an initial monetary incentive that increases with increased participation. This budget also includes salaries and benefits for three Graduate Student Researchers and the Principal Investigator who will perform all of the tasks of survey design, data collection, data analysis, and reporting. It also includes travel to Santa Barbara and consulting subcontracts for senior panel reviewers who will be involved in all project tasks as advisors. Computer support is needed to insure the servers and laboratory equipment is always functioning for data collection and communication with respondents.

Estimated Cost By Task

Task	Labor	Employee Fringe Benefits	Subs. Consultants	Equip	Travel Subsist	EDP	Copy Print	Mail Phone Fax	Materials and Supplies for Data Collection	Survey Cost	Computer Support	Overhead	Total
1	12,646	8,594	8,000				60	20	5,000	11,250	250	3,827	49,647
2	12,646	8,594	8,000				60	20	5,000	11,250	250	3,827	49,647
3	56,908	38,672	36,000				270	90	27,500	61,875	1,125	17,222	239,663
4	31,616	21,485	20,000				150	50	12,500	28,125	625	9,568	124,118
5	12,646	8,594	8,000				60	20	-	-	250	3,827	33,397
Total	126,463	85,939	80,000	-	-	-	600	200	50,000	112,500	2,500	38,271	496,472