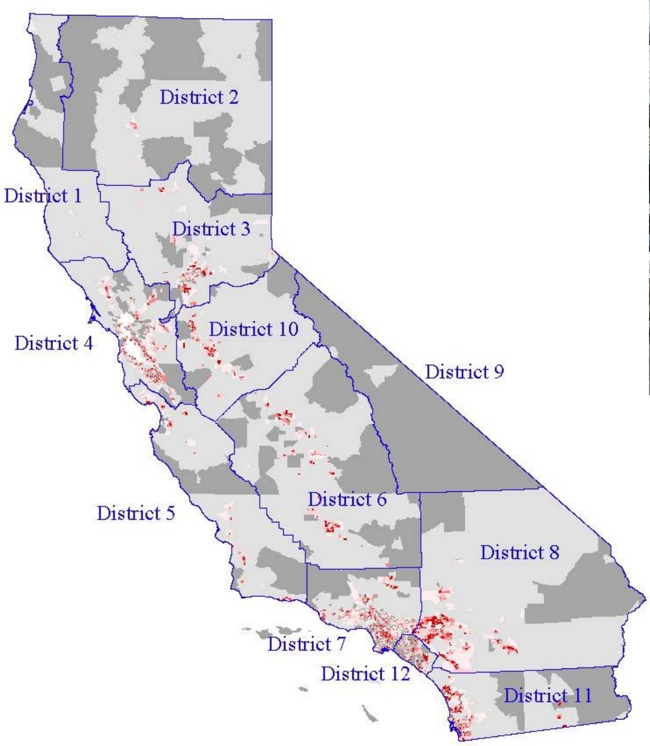
CALIFORNIA TRAVEL TRENDS AND DEMOGRAPHICS STUDY
Final Report

prepared by

Randall Crane, Abel Valenzuela,
Dan Chatman, Lisa Schweitzer, and
Peter J. Wong
Institute of Transportation Studies
University of California, Los Angeles

with

Chris Williamson and Erik Kancler
Solimar Research Group, Inc.



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Randall Crane (Co-Principal Investigator)
Abel Valenzuela (Co-Principal Investigator)
Dan Chatman
Lisa Schweitzer
Peter Wong

Institute of Transportation Studies
School of Public Policy and Social Research
University of California, Los Angeles
Los Angeles, CA 90095

with

Chris Williamson
Erik Kancler

Solimar Research Group, Inc.
973 East Main Street
Ventura, CA 93001

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Executive Summary

The purpose of the Transportation Trend Analysis and Demographic Projection Study was to analyze past population and travel trends, and project future trends, in order to support the state infrastructure and development planning process. Tasks included:

- Projecting population to 2025 for the state of California at the tract level, including socio-demographic variables likely to influence travel choice and opportunity;
- Developing a spatial database so that the Department of Transportation and its planning partners can access and manipulate the projections;
- Implementing and testing an empirical model of travel demand using data from urban areas in California;
- Combining the results of the empirical model and population projections to forecast statewide travel trends at the Census tract level in 2015 and 2025; and
- Explaining how the projected population changes and travel demand trends can be used to inform the planning of the state transportation system.

Demographic Changes and Challenges for Policymaking

We project that the population of California will increase from 33.9 million residents in 2000 to about 48.6 million in 2025, a 44 percent increase. The share of elderly is expected to increase significantly over this period, as is the share of non-White residents, particularly Hispanics.

How will changes in the service population affect travel needs from a policy perspective, and what are some policy options in addressing these needs? What are the policy options to address road congestion and continued expected preferences for automobile travel? The research reported here provides an important input to the State's planning to address these questions.

Travel Demand Trends

Aggregate travel by all modes will increase substantially in California. For example, auto trips are estimated to rise nearly 40 percent from 2000 to 2025. Since most population growth will be in urban centers, traffic congestion will worsen. The following are key findings of our study:

- The number of car trips per capita will decline slightly, and some travel will shift to transit and non-motorized travel. In response to higher congestion, jobs and residences will suburbanize.
- The travel impacts of an aging population will vary by area depending on the projected age distribution. While the oldest drivers drive less often and travel shorter distances, take transit more, and make fewer passenger-serving trips, the middle of the age distribution makes a larger number of auto trips.
- Transit demand is projected to rise as a share of all trips—substantially so in parts of some metropolitan areas. However, the net share is expected to be less than 10 percent in most

Census tracts. The share of walk/bike trips is expected to increase at the same rate, but from a substantially higher base statewide.

- The largest percentage increases in population and travel are projected to occur in the Central Valley and peripheral exurbs/edge cities at the fringe of the state's traditional metropolitan areas, and in the highway corridors linking these areas. The degree to which these will translate into additional road infrastructure demand depends on current and future capacity utilization.
- "Smart growth" land use and governance strategies play a limited though potentially important role in managing transportation demand.
- The evolving ethnic mix of the state has numerous impacts on the transportation system. To the extent that non-Whites and recent immigrants are more likely to have low incomes, access to employment and transit dependence will continue to have both economic growth and equity consequences.

The travel demand projections are based on a number of assumptions, two of which are particularly important. First, we assume that transportation infrastructure will be provided statewide at levels similar to the Bay Area counties in places where land use density and population accessibility are similar. Second, we assume that measured influences of age and race/ethnicity on travel will stay consistent over time. These assumptions are the most reasonable ones available given the inherent uncertainty of forecasting.

Recommendations to the State and the Department of Transportation

- Use the travel projections at the Census tract level statewide to compare expected future impacts on transportation infrastructure given Department of Transportation information on current and future state road capacity by region.
- Acknowledge and plan for inevitable large increases in traffic congestion. Road maintenance and building programs are important, but large scale road infrastructure is extremely costly, even in areas where additional right-of-way is available. Given likely constraints in funding, focus on strategies that manage congestion wisely, such as congestion pricing.
- Be sensitive to the needs of the carless and transit-dependent, particularly in areas that will experience high amounts of auto demand. Such areas may be the appropriate recipients of any funds for paratransit, auto ownership assistance, and van programs.
- Provide state support for walking and biking infrastructure, since these modes have substantially higher shares of travel than transit, and will experience greater increases in demand.
- Target "smart growth" and transit development planning or funding in areas that anticipate high demand for walk/bike and transit modes. Carefully identify areas that will exceed population accessibility thresholds (for example, areas with more than 200,000 population within a five mile radius—see Sections 4 and 7) as the best candidates.

ACKNOWLEDGEMENTS

In addition to the authors listed on the cover page, other individuals contributed to this report. Most of the GIS maps were prepared by Kimiko Shiki. Sheryll Del Rosario and Melissa Hatcher carried out research supporting the demographic projections. We particularly thank Kimiko Shiki, Doug Miller, and Doug Houston for their assistance in creating ArcView scripts to calculate accessibility indices.

In order to complete the work, we solicited data and information from numerous agencies. Planners at the local and regional level throughout the state provided us with their agencies' demographic projections. Regional agency staff graciously shared their travel diary data. In particular, Charles Purvis and Kenneth Vaughn of the San Francisco Bay Area Metropolitan Transportation Commission made the Bay Area Travel Survey available, explained the data set, and provided other data that were key inputs to the travel modeling process. In addition, Pablo Guttierez from the Southern California Association of Governments and Gillian van Oosten Biedler from the Sacramento Council of Governments made their regional travel diary information available.

We conducted our research in a very supportive research environment. We want to thank D. Gregg Doyle and Brian Taylor for making their US Department of Transportation-sponsored literature review on women and transportation available to us. We received the benefit of Dowell Myers's considerable expertise in demography and housing issues. Discussions with colleagues including Brian Taylor, Evy Blumenberg, and Hiro Iseki provided useful feedback. In our business office, Gertrude Lewis, Janet Peltier, Robert Duncan, and Anna Diep managed the administrative side of the project, handled contracts, kept the bills paid, and responded to the research team's questions and requests. At the Center for the Study of Urban Poverty, Gretchen Baumhover provided assistance in arranging travel, meetings, and report preparation.

The upper-left photo on the cover depicts a pedestrian crosswalk at the 12th Street BART station in Oakland. The lower-right photo was taken on Hollywood Boulevard near the Hollywood and Highland development in Los Angeles. The photos are provided courtesy of Terry Parker in the Division of Mass Transportation, California Department of Transportation.

CONTENTS

APPENDICES

FIGURES

MAPS

TABLES

1

INTRODUCTION

In collaboration with its regional and citizen planning partners, the California Department of Transportation is currently developing a long-term, multimodal transportation plan for the state of California. The California Travel Trends and Demographics study was designed to support the data requirements of the statewide plan. The purpose of this project is to enable the State to develop overall policy to accommodate future statewide trends. The research did not include identifying transportation infrastructure needs for specific geographical areas or transportation corridors.

Phase I of the project, completed by UC Berkeley, is a comprehensive overview of the major social and economic forces that will affect transportation in California over the next 25 years. Phase II, conducted by UCLA and its research partner Solimar Research Group, developed population projections by Census tract for years 2015 and 2025, and integrated those projections with Census 2000 geography in a GIS database for the state. Phase III of the research, completed by UCLA, projects travel demand trends to 2015 and 2025, applying several empirical travel models to the projections developed in Phase II.

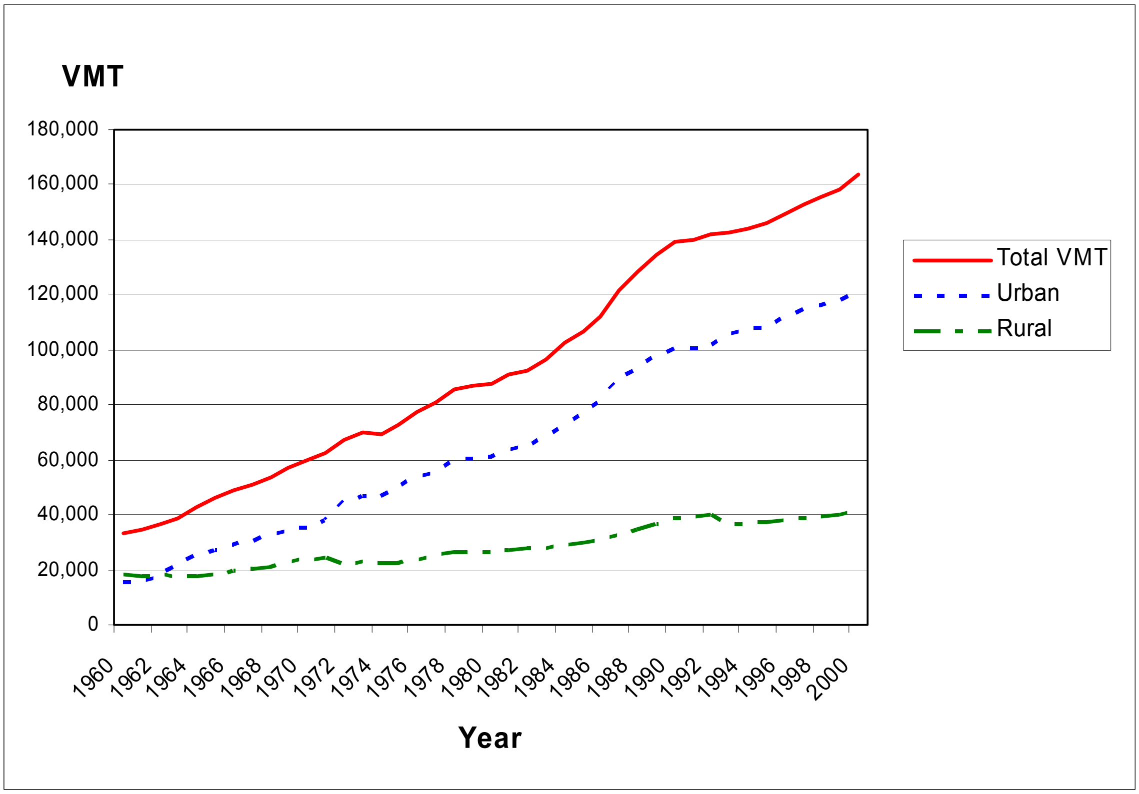
1.1 Policy Context

California's total population is projected to grow by about 15 million residents over the next 25 years. Many newcomers to the state will be recent immigrants, many of whom are young and whose children will grow up and remain in California. But a substantial part of California's growth is expected to come from natural increase, that is, from the state's existing residents having and raising children in California. As the population grows over time, so does the demand for travel in the state (see Figure 1, below).

As metropolitan areas grow and disperse outward, existing communities in the inner cities and in older suburbs contend with spatial isolation from jobs and procedural inequities in growth management decisions. Affordable access to opportunities assumes great importance in the light of growth pressures. Welfare reform and the transition from state dependency to work likewise hinges, in part, on understanding how transportation services can either open up or deny opportunities to vulnerable groups in California.

In addition to concerns about social equity, all Californians have a stake in future land and infrastructure development. Countering residents' need for mobility and housing is the equally compelling need to protect California's unique natural resources from the ravages that have accompanied previous development. Wildfire destruction, utility crises, air quality well below federal standards, and water quality issues loom as the possible consequences of poor planning and foresight. These needs will become more pressing as California's near-capacity transportation system prepares to take on the demands of future growth.

Figure 1. Vehicle Miles Traveled in California, 1960 to 2000



SOURCES: 1960-1972 data from Table VM-2C of "Historical State Highway, County Road and City Street Statistics 1960 –1972" provided by Division of Highways Traffic Branch; 1973-1977 data from "California Table TA-1, Statewide Mileage, Travel and Non-Fatal Accidents" by Highway Planning and Research Branch; 1978-1995 data from the yearly tabulation "Statewide TA-1 Data", Department of Transportation, Traffic Operations Program. Program. 1997-1999 data provided by Traffic Operations publication: 1999 Accident Data on California State Highways, Statewide Travel and Accidents Rates (page 7).

In order to address these complex issues, planning agencies in the state need information on the interactions among socioeconomic, activity, land use, and travel behavior in California over a long planning horizon.

1.2 Research Objectives

We analyzed past transportation and population trends in order to look at the possible consequences of future infrastructure and development policies. The purpose of this project was to provide high-quality population forecasts with substantial geographic and demographic detail, and to understand how demographic and land use changes in the state will affect future travel demand.

Our specific research objectives were to:

- Project population for the state of California at the Census tract level, including socio-demographic variables likely to influence travel choice and opportunity;
- Develop a spatial database and GIS files so that the Department of Transportation and its planning partners can access and manipulate the projections;
- Estimate and test an empirical model of travel in California, based on socio-demographic and policy variables;
- Use the results of the empirical model and population projections to forecast travel in 2015 and 2025; and
- Recommend ways that the research can used to inform planning and policy making.

Given the extent of the work required on this project, in this report we summarize the results of the demographic projections, empirical modeling effort, and travel demand forecasts rather than describing all the results in detail. The appendix to this report contains further information. The detailed demographic projections, travel demand trends, and maps will be made available in electronic form.

1.3 Data

Our study draws on a wide array of local, regional, and national data sources:

- Micro-data and block-group level data from the 1970, 1980, and 1990 US Census that include demographic, employment, and transportation characteristics;
- Data from the Nationwide Personal Transportation Survey (NPTS) of the US Department of Transportation;
- Population projections created and maintained by the California Department of Finance;
- Population projections prepared by local, county, and regional agencies throughout the state of California;
- Population projections to 2011 prepared by the Applied Geographic Solutions, a private company;
- Tract-level data from the 2000 Census that include demographic, employment, and transportation characteristics;
- Travel survey data from the Southern California Association of Governments, the Sacramento Council of Governments, and the Metropolitan Transportation Commission; and
- Data from the 2000-2001 California statewide travel survey.

More detail on the data and methodology for this study is included in each section of the report.

1.4 Research Approach

The research effort for this projection consisted of six stages: a review of relevant literature background information, data collection, population projections, GIS mapping and development, empirical demand modeling, and travel forecasts. Each of these stages is described in a separate section in the remainder of the report.

We used national, state, regional and local data for information about existing population and travel behavior characteristics. The population data were used to construct demographic projections to 2015 and 2025. In order to forecast travel, travel diary data were used to develop and test an empirical model of current travel choices (trips and travel duration), focusing on readily available measures of demographics and land use. Using the coefficients from this model and the demographic projections, we developed travel demand projections for the state of California.

1.5 Organization of the Report

This report is divided into eight sections, including this introduction and appendices:

> *Section 1* summarizes the report goals, data, methods, and findings.
>
> *Section 2* presents and interprets key findings of research on travel behavior, demographics, and urban form.
>
> *Section 3* describes the existing population and current travel patterns in California.
>
> *Section 4* develops an empirical travel model that quantifies relationships between individual travel behavior and demographic and land use variables.
>
> *Section 5* describes population projection modeling methods and describes statewide results.
>
> *Section 6* applies the results of the empirical travel model to the population projections in order to project travel demand trends.
>
> *Section 7* presents conclusions and recommendations.

1.6 Principal Findings and Recommendations

We carried out more than a hundred empirical travel models using the Bay Area survey data, varying by:

- travel measure (trips, and time spent traveling),
- mode (personally operated vehicle, transit, or walk/bike),
- trip purpose (work/school/daycare, non-work, and passenger-serving),
- a set of independent variables used to explain the travel behavior measure (e.g., race/ethnicity, sex, age, household income, household structure, household vehicle ownership, employment status, licensing status, and various measures of land use in and around the household residence zone).

Despite the complexity, some common themes emerge from the basic empirical model that is used for the travel demand forecasts. Age, sex and race/ethnicity are correlated with trip making by mode by purpose, and to travel duration by mode, in the following ways, when controlling for all three factors simultaneously (as well as for gross population density and a five-mile radius population accessibility index, explained below).

First, increasing age up to the 40 to 50 age category is associated with an increasing number of trips for all purposes (work, non-work, and passenger-serving). After that time, increasing age implies a decrease in trip making and travel duration. For example, overall time spent traveling on all modes decreases about five minutes per day for every five-year increase in age over age 50. This difference accelerates rapidly in older cohorts, so that those aged 80 and above travel about 45 minutes to an hour less on average than those in the peak 40 to 50 age range.

Second, those in non-white race/ethnicity categories make fewer trips than Whites, but travel about the same amount of time per day. The difference is apparently because these groups make a higher share of their trips via transit. African-Americans make almost a half-trip less than Whites per day, while Asian Americans / Pacific Islanders and Hispanics make about a third of a trip less per day. Most of these differences are not due to work trips. Controlling for the other variables included in the basic model, Asian Americans / Pacific Islanders and Hispanics make about the same number of auto trips for work/school/daycare purposes, while African Americans make just slightly fewer (about one-tenth of a work trip by car less). Hispanics and African Americans make just slightly more work trips by transit, and Asian Americans / Pacific Islanders and Hispanics make just slightly fewer work trips on foot or bike. In the non-work trip category, the non-White groups make fewer auto trips, averaging about a quarter trip less per day than Whites, and fewer walk/bike trips. African Americans make slightly more non-work transit trips than the other groups (about a tenth of a trip per day).

Third, women currently make fewer work trips than men across age categories, but consistently make more passenger-serving and non-work trips. These differences are primarily due to differences in trips by auto; by mode, women's share of all trips by walk/bike and by transit is higher than men's, to the extent that their number of work trips by transit and walk/bike is very close to that of men for all three trip purposes.

These relationships decline somewhat in importance when household income is added to the models. Higher household income increases trip making by auto and decreases it by transit, with an ambiguous effect on walk/bike trips.

Despite the statistically significant relationships in the Bay Area survey data, the magnitude of the relationships is relatively small, accounting for ten percent or less of individual variation in trip making. Since unobserved factors are clearly more important than observed factors in influencing travel behavior, forecasts based on observed factors must be interpreted with caution.

The empirical models are used to forecast travel demand by Census tract statewide. These projections are mapped for the state, for Department of Transportation districts, and for selected regions in Appendices F through H.

As explained below, the travel projections require careful interpretation and should be thought of as broadly indicative rather than precise. Of course, they primarily show that we can expect travel to be concentrated where the population is most concentrated. Beyond this, some interesting results emerge. For example, under the assumption that transit options are available everywhere, the projections show that the highest per capita demand for transit would be predicted to increase slightly over time in areas that exceed particular density thresholds. In other words, if transit were provided in such places, it would be used at a slightly higher rate over time. These results are discussed in more detail in Sections 6 and 7.

2

DEMOGRAPHICS, LAND USE, AND TRAVEL

In this section we review empirical research in two main areas: the variance of travel behavior and demographics, with special attention to travel of the elderly; and the influence of land uses on travel behavior. The intent of the review is not to describe issues in California, though many of these studies were conducted using California data. Instead, it is to motivate the empirical and forecast models, as well as to assist in interpreting and supplementing the results of those models.

2. 1 Race/Ethnicity, Sex, and Mobility

Research on travel behavior has often concerned itself with urban inequality and economic isolation. Two categories of research stand out: work that has quantified differences in travel by population subgroup (e.g., ethnicity, age, and sex), and "spatial mismatch" research, which has examined the effects of changing urban labor and spatial structures on inner city residents. In this section we focus primarily on representative literature in the first category.

Rosenbloom (1995) finds that women make more person trips per day than do men in the US. However, women make shorter trips, whereas men travel 27 percent more person-miles than comparable women in urban areas and 16 percent more in rural areas. Low income people of both sexes in urban areas and low income women in rural areas work farther from home than comparable people from households making more money. At the very lowest income levels, women workers traveled farther than comparable male workers.

Ethnicity is also thought to influence travel. In general, travel data suggest that white men travel more than all other men, and white women traveled more than all other women. Hispanic women and those from other races make fewer trips than comparable men. In a study of 1995 data from the Nationwide Personal Transportation Survey, the difference between Hispanic men and women on all indicators of travel were two to three times greater than the differences between the sexes in any other grouping (Rosenbloom 1995).

Doyle and Taylor (1999) study variation in metropolitan travel behavior by sex and ethnicity. They find that ethnicity appears to be a more important influence than sex on mode choice and commuting behavior, although sex differences persist, especially by household type. They find that ethnicity plays a major role in commuting distance and duration. For example, African American women have the longest commute times of any group. In addition, women of color, especially those living in central cities, have disproportionately longer commute times, which can be largely explained by their lower incomes, their greater tendency to use transit and walk, their greater household responsibilities, and their lower levels of education. Finally, the authors find that women make more trips per day on average because they make more stops for shopping and household-serving purposes. Working women are likely to chain these errands into their commute trips.

Giuliano (2000) documents racial differences in four travel categories: daily travel distances, time spent traveling, number of person trips, and trip mode. She finds significant differences in the distance and time traveled by different racial groups. Whites travel the farthest and make the most trips, while African Americans have the longest travel durations. Trips made by personal vehicle are the overwhelming majority of all person trips regardless of race/ethnicity. Significant differences exist among racial groups for other modes such as transit and walking. Using multivariate analysis, Giuliano finds that racial and ethnic differences are not only limited to effects explained by different location patterns, but rather by fundamental differences in what motivates travel and location choices. She argues that spatial location patterns seem to provide the best explanation of differences among whites, African Americans, Hispanics, while for Asian Americans, differences reflect different travel choice processes.

Papers by Chu, Polzin, Rey, and Hill (1999) and Polzin, Chu, and Rey (1999) analyze both the amount of travel and mode choice for non-work travel by people of color. Chu et al. (1999) provide rich descriptive data on trip making in 1995 and an analysis of how the rate of travel changed from 1983 to 1995, using the Nationwide Personal Transportation Survey. They find that whites made about two percent more trips than the national average, while trip making for people of color was lower. Among people of color, Hispanics had the highest trip rate (about two percent below the national average) while Asians made the fewest trips (about 15 percent below the national average). They also find that average non-work trip making for non-work travel among the racial and ethnic groups changes little with personal, household, and geographic characteristics. For all racial/ethnic groups, non-work travel increased over time for several different measures of mobility (e.g., person trips, person miles, vehicle trips, vehicle miles, and person hours). Mobility grew at a much faster rate for people of color than for the white population during 1983-1995. Among people of color, Hispanic mobility grew at the highest rate, followed by African-Americans and other groups.

Using descriptive statistics and multivariate analysis, Polzin et al. (1999) find that non-Whites are several times as likely as whites to use public transit for non-work travel and about twice as likely as Whites to walk for non-work travel. African Americans are nine times as likely and other peoples of color are two to three times as likely, as whites to use public transit for non-work travel.

One final factor that may be as important as ethnicity is immigration (Myers and Park 1996). Spain (1997) pointed out that immigrants now make up approximately 10 percent of the elderly population, with the highest proportions of elderly foreign-born living in California, New York, and Florida. Forty-one percent of immigrants who entered the US during the 1980s speak no English. Economically, nearly one-quarter of the older immigrants live in poverty. Immigrants who are poor and are not part of the workforce when they arrive in this country are likely to be permanently limited in their travel options as they age. On the other hand, immigrants who become part of the workforce and have rising incomes may be more likely to have gained automobile access and continue such mobility into old age.

In summary, there are numerous differences among racial/ethnic groups in the frequency, length, duration and mode of travel. As a result, differences exist by income level, because non-white ethnic groups tend to have lower incomes. Second, because these papers are national in scope, they fail to address differences in regional or city/urban contexts. As a result, caution should be taken when analyzing national data, especially when it points to differential outcomes by ethnicity. National figures on most measures of inequality often mask significant differences in social economic indicators regarding the effect of ethnicity.

2.2. Travel and the Elderly

By the year 2030, up to 20 percent of the population of the United States—over 50 million people—will be aged 65 years or more. While this reflects the progression of the "baby-boom" generation into their golden years, it also reflects the fact that health care and medical developments have extended life expectancy for Americans. Those over 80 years of age are in the fastest growing cohort, meaning that there will be a larger-than-ever group of people who are particularly dependent on family, friends, or public transportation services for mobility, and who—in the absence of these—may have seriously limited mobility and life activities.

The increasing numbers of older residents will also be more diverse, in terms of both ethnicity and lifestyle. Spain (1997) found that 87 percent of the elderly were white in 1990, and estimated that if current fertility differentials persist and immigration remains the same, 65 percent will be white, 11 percent African American, 15 percent Hispanic, and 8 percent Asian American in 2050. In a study of Los Angeles 25 years ago, Wachs et al. (1976) observed that the elderly may be as heterogeneous as younger population groups, and a variety of lifestyle groups may exist among older populations of metropolitan communities. Thus, it may be important to identify subgroups of elderly persons on the basis of their past travel behavior. The implication for transportation planning is that as the population ages, the differences among the elderly will become as important as the differences between the elderly and the non-elderly (Spain 1997).

Wachs et al. (1976) noted that one important demographic effect of aging was the creation of single-adult households, most often widows. Spain (1997) found that older women are more likely than older men to be widowed and live alone. She found that the percentage of women aged 75 and over who live alone rose from 37 to 53 percent between 1970 and 1996 (Spain 1997). However, this tendency also varies by ethnicity. Elderly white women are more likely to be living alone than elderly women of color. In addition, elderly white women are more likely to reside in less dense suburban areas and as a result may require different transportation services than needed by the elderly living in extended-family households in inner-city areas.

Critical to the analysis of elderly transportation needs in the future are demographic and geographic trends among senior citizens. If longevity and immigration cause a larger proportion of the elderly to live in the inner city or the suburbs, this will have implications for the types of service likely to be needed. Spain (1997) argues that non-Whites lead more geographically constricted lives than non-Hispanic Whites. Since the older population is predicted to be more racially and ethnically diverse in the future than it is now, the increases in travel associated with baby-boom women's increased independence could possibly be tempered by larger proportions of minorities who are more geographically constricted.

But we cannot be sure that the elderly living in cities tomorrow will have travel patterns similar to the elderly living in cities today, nor that future elderly persons of color will have similar travel patterns. If younger people of color continue to have lower rates of automobile ownership and driver's licensing, and tend to locate in denser central cities with good transit and walking access, as these individuals age they may be continue to rely on public transportation or walking. But if people of color (particularly, immigrants) increase their ownership and use of automobiles at the same rates that women have historically done, this may not be the case.

Increasing per capita travel

Due to both increased licensing rates—particularly among women—and to more active lifestyles later in life, the amount of daily travel per elderly person is expected to increase, independent of the overall size of the elderly population. According to Coughlin and Lacombe (1997), trends indicate that today's seniors are more active than previous generations. The lifestyle of what might be called the 'new elderly' includes many activities that, in years past, may have been considered unusual pursuits for those over 65 (Wachs et al. 1976).

Spain (1997) noted that for today's older married woman, the husband is more likely to be the driver and the wife to travel as a passenger. However, if baby boom women keep their licenses and continue to drive into an advanced age, it would cause an increase in the number of vehicles, number of trips, and miles traveled as compared to the elderly women generation today. In general, as the health of the elderly improves, they are likely to travel similarly to how they traveled when working, but without the commute trip (Coughlin and Lacombe 1997). This similarity has its greatest consequences with respect to women, because elderly women who do not drive now are likely never to have been licensed. In contrast, middle-aged women driving today are much more likely than their foremothers to drive well into old age (Spain 1997).

The impact of health concerns

Health concerns such as the increased need for medical-related urban travel among the elderly make it more difficult for them to travel on their own (Spain 1997). However, frailty does not mean that these seniors no longer wish to participate in out-of-home activities. Alternative transportation services could be made available so that the eldest elderly may maintain as much dignity, independence and choice as possible, for as long as possible (Coughlin and Lacombe 1997). Strategies to accommodate the mobility needs of the elderly should incorporate many modes. In order to facilitate mobility and access for seniors, transportation planning should incorporate elderly residents in all possible roles—as drivers, passengers, transit riders, delivery-recipients, cyclists, and pedestrians.

While the elderly rely primarily on their cars for mobility, there are some trips which do not require automobile access. In 1976, Wachs et al. found that for urban residents in Los Angeles County, a high proportion of trips were made on public transit. However, as overall transit ridership has declined and has also shifted toward commute trips, it is likely that the proportion of trips by the elderly on public transportation has also declined. In a more recent study, Coughlin and Lacombe (1997) suggested that the elderly still walk and even ride bicycles for some trips. The mode choice that the elderly use may largely depend on the quality of options available and the perceived risk involved with each. For example, alternatives to driving, including walking, cycling, and riding transit, may not be appealing if the traveler is physically frail or feels vulnerable in more public travel settings.

Households or individuals without cars or driver's licenses are the most likely to use alternative modes. Spain (1997) found that even when licensed to drive, older women now are more likely than older licensed men to live in a household without a vehicle, 25 percent for women versus 5 percent for men. Even with equalization of licensing rates, given income constraints and longer life expectancy women are still more likely than men to lack access to cars.

Driving safety

Gebers et al. (1993) noted that a substantial number of accidents involving elderly drivers are at least partially attributable to worsening vision, poor physical coordination, cognitive confusion, or other age-related physical and mental impairments. Howe et al. (1994) concurred that older people are more likely to have deficits in visual acuity and peripheral vision, greater susceptibility to glare, and poorer night vision and ability to focus. However, Gebers et al. (1993) cautioned that chronological age per se is not a very good measure of accident risk for individuals, because elders vary considerably in driving skills, physical/mental abilities, point of onset of decline, and rate of decline. Coughlin and Lacombe (1997) noted that although most elderly drivers know their limits and are safe drivers, age-related physical and cognitive deterioration, coupled with the increased likelihood of drug interaction from medical treatment, contributes to some seniors being impaired drivers.

Some drivers may lose the ability to drive safely in their 60s, while others may drive safely well into their 80s. Of course, while individuals vary greatly in the timing of their loss of driving ability, there is an observable higher level of impairment in each successive cohort. Gebers et al. (1993) found that on a per-mile-of-travel basis, drivers over 70 years of age are as likely as teenagers to be involved in automobile accidents. Yet licensing and re-examination procedures do not always reflect what research has shown are the most important factors associated with this increased risk. Further, Spain (1997) noted that developments in health care reforms, medical advances, safer workplaces, and healthier lifestyles may reduce the incidence of chronic disabilities for the elderly in the future. The most likely scenario is that people will stay healthy longer, but will still succumb to functional limitations in later ages (Spain 1997).

Older drivers are often well aware of the tradeoffs between their own mobility and road safety. Gebers, et al. (1993) noted that due to some form of vision impairment, older drivers commonly voluntarily limit or give up night driving and driving under conditions of reduced visibility. They also noted that the elders who had recently given up driving reported more visual problems than the elderly who continued to drive. As a result, when seniors decide to stop driving, it may be due to an awareness of one’s own physical limitations. However, the lack of alternatives to driving may lead some drivers to hold onto their license. For the elderly who have relied on driving throughout their working lives, giving up driving is a serious sacrifice unless various alternative transportation options exist.

Coughlin and Lacombe (1997) also noted that license examiners and officials and physicians are hesitant in recommending suspension of elderly drivers’ licenses because such action may sentence the driver to isolation and dependency. In a 1995 survey of state licensing examiners and supervisors throughout the nation, more than half of the respondents indicated that the lack of readily alternative transportation was an important consideration in revoking an elder's driving privileges. Consequently, state officials should take care to balance safety-related license revocation policies with the availability of alternatives.

Location and auto dependence

Coughlin and Lacombe (1997) argue that the combination of low-density developments and single-family housing patterns, once thought ideal for child rearing, now presents considerable obstacles to meeting the mobility needs of elders who attempt to stay in their suburban homes. Spain (1997) points out that as suburbanites age and worry less about the quality of schools and more about their ability to drive, the high density of cities may become more appealing if there are adequate options that reduce the need to drive. But contrary to these countervailing factors to elderly suburbanization, many retirement communities are often still built on the suburban model where the use of an automobile to meet the majority of a resident's mobility needs remains an underlying assumption of these developments (Coughlin and Lacombe 1997).

2.3 Land Use Influences on Travel

The characteristics of the built environment at different spatial scales are thought to have distinct effects on the travel behavior of households and individuals. Changes in the built environment may influence travel by changing the relative attractiveness of travel modes, altering the time or money costs of travel, or affecting the provision of transportation services (such as transit). Table 1 contains a list of the various urban design and land use aspects that have been theorized to change travel behavior. These questions have been addressed in the empirical literature, as described below. The sections are organized into empirical results relating to four categories of built environment characteristics: development density, accessibility, mixed uses, and street pattern.

Development density

The correlation of density with higher alternative mode use and lower amounts of travel has been widely documented in aggregate, area-based descriptive analysis. Much of the analysis of metro-wide density effects does not deal with many complications inherent in attributing causality, such as controlling for correlates of density (such as transit infrastructure and city size) and the interrelationship of residential location choice and travel decision making. However, this literature provides a useful overview of the observed correlations between metro-area density and travel.

Dunphy and Fisher (1996) investigate relationships between driving, transit use, and density at two geographic scales: cities and zip codes using 1990 data from the Nationwide Personal Transportation Survey (NPTS). City-based aggregate comparisons show an inverse relationship between density and vehicle miles traveled, and a positive relationship between density and transit use. The authors suggest that the road and transit networks also play a large role. Kockelman (1995) investigated commute mode choice as a function of density and income in the San Francisco Bay Area. In an aggregate analysis at the city level, population density was much more strongly correlated with the percentage of workers driving alone to work (correlation of -0.524) than was income (0.213).

Table 1: Built Environment and Land Use Characteristics Thought to Affect Individual and Household Travel Behavior

Site design:
Building setbacks
Placement of garages and parking
Architectural attractiveness
Presence/absence of front porches and picket fences
Design of transit stops
Neighborhood built environment / land use characteristics:
Development density
Availability of commercial, residential, industrial, office, and recreational land uses
Cost, availability, and placement of on-street and off-street vehicle parking
Spatial relationship to regional transportation network and activity centers
Metropolitan/regional built environment / land use characteristics:
Development density
Land use segregation
Development clustering (e.g., share of employment in high-density nodes such as central business district, pattern and size of activity centers)
Transportation network design characteristics:
Percentage of land devoted to roads and parking
Number of street intersections
Curb radius length
Number of curb cuts (driveways)
Rear location of parking and building services
Lineal amount of street and sidewalk
Sidewalk connectivity
Average block size
Loops and cul-de-sacs per mile of road
Average street width
Extent of vehicle/pedestrian network separation
Presence/extent of “traffic calming” devices
Presence/extent street and sidewalk amenities (e.g., trees, benches, lamps)
Number and proximity of transit stops

Some work has investigated the correlations between density and transit service. Pushkarev and Zupan (1977) found that residential density of seven units per acre was needed to make provision of transit services financially feasible in the New York metropolitan region. In a more recent study of Dade County, Florida, Messenger and Ewing (1996) find that residential density of 19.4 dwellings per acre is necessary to support 25-minute headways at the transit agency’s average productivity level (8.4 dwelling units per acre for the “minimum” productivity level).

Studies using aggregate data for Census tracts or municipalities tend to find that higher development density reduces auto use, in some cases dramatically. Holtzclaw (1994) examined the relationship between land use patterns and areawide average household car ownership and VMT in 27 sub-municipalities ranging from 11,000 to 724,000 in population in San Francisco, Los Angeles, San Diego and Sacramento. Holtzclaw regressed average household vehicle ownership and odometer readings on population, household, and residential unit density, as well as the availability of transit, access to commercial establishments, and an index of pedestrian accessibility. He found that higher average residential density was associated with lower auto ownership and less driving. Transit accessibility was also a statistically significant predictor of household VMT. Frank and Pivo (1994) used data from the 1989 Puget Sound Transportation Study to investigate how Census tract average mode choice for shopping and work trips was related to gross population and employment density at both the trip origin and destination, as well as a measure of mixed use. An average of gross population and employment density at the residence and workplace zones was the most consistently significant variable in the six correlations presented.

Dunphy and Fisher (1996) investigated the effect of zip code level population density on household travel. They found that people averaged 3.5 trips per day in lower density zip codes of up to 4,500 residents per square mile, reaching an average of 1.9 personal vehicle trips in areas of 30,000 residents per square mile. In higher density areas the total number of trips per capita by all modes does not decrease very much, but a greater share of bus, rail, and walking trips results in substantially fewer vehicle miles traveled per capita. Dunphy and Fisher also found that density was highly correlated with lower income, lower auto ownership, and shorter distances to the nearest transit stop. In turn, these characteristics are associated with higher transit mode share and lower per capita vehicle miles traveled, possibly explaining much of the correlation of density with travel behavior.

Messenger and Ewing (1996) included the log of combined employment and population density as an explanatory variable in regressions of bus mode share for traffic analysis zones in the urbanized portion of Dade County, Florida. Density was negatively related to bus mode share when auto ownership was included in the model, but was positively related to the proportion of households with no cars or only one car, implying that "as density rises, automobile ownership falls; as automobile ownership falls, density rises" (150). Thus, automobile ownership was a primary influence on travel behavior, as were local jobs-housing balance and transit service. In turn, auto ownership was affected by development density, income, and transit access.

Studies using disaggregate data are more reliable, because aggregate zonal travel conceals important variations and masks relationships between demographics and travel. Some of these disaggregate studies continue to find strong relationships between land use and travel. Kockelman (1995) carried out a disaggregate, trip-based binomial logit regression model for the decision to drive to work, with population density of the residential and workplace Census tract, income, and an accessibility index as independent variables. The accessibility index for origin and destination was the most significant variable in this model, accounting for most of the probability of choosing to drive alone, with income a distant second and density coming in last. However, development density and accessibility were strongly correlated and are conceptually interrelated. The accessibility and density measures were likely both highly correlated with parking costs, congestion, and other factors affecting the analysis.

Many of these authors emphasize the importance of correlates with development density that are not controlled for in their analysis, particularly better transit service, shorter distances to transit stops, and road congestion.

Ewing (1995) regressed household vehicle hours traveled on demographic characteristics and land use variables at both the residential location and the employment location of households in

Palm Beach County. Unexpectedly, he found that higher employment density in the zone of employment location increased the vehicle hours traveled per household. Ewing interpreted this result to mean that "when workplaces are accessible to other activities, so many additional trips are generated as to overwhelm the favorable effect of accessibility on trip lengths" (20). However, the results could be due to slower travel speeds in dense employment areas.

Using a disaggregate data set of households, Sun, Wilmot and Kasturi (1998) found that employment density had a small statistically significant negative impact on total trip-making, but no significant impact on VMT. The authors also found that the correlation of income with population density in Portland was not very significant, but that both auto ownership and household life cycle were significantly correlated with population density. They used a measure of employment density in linear regressions investigating the effect of demographic characteristics and land use on vehicle miles traveled and total trips by households in Portland, Oregon in 1994. Accessibility indices were also included in their analysis and found to be statistically significant in reducing total trips and decreasing VMT. The inclusion of accessibility indices probably accounted for the negligible impact of density, since the index essentially accounts for density simultaneously with mixed use. This is a common finding (e.g., Kockelman 1997).

Schimek (1996) investigated the impact on travel behavior of the gross population density for the residential zip code area, using data from the 1990 Nationwide Personal Transportation Survey. Schimek employed a sequential equations model to first predict vehicle ownership and then vehicle use, and controlled for the endogeneity of residential location, auto ownership, and auto use by using predicted gross population density from an instrumental variables regression in the auto ownership and use equations, instead of observed density. In Schimek's models, income, household size, and the number of workers were more strongly correlated than population density with the number of vehicles in the household and the household vehicle distance traveled. However, a one percent increase in gross density was associated with one-tenth of a car less per household. As for usage, the direct and indirect effects of density combined accounted for a statistically significant reduction of 2,185 personal VMT per percentage increase in density, and a daily reduction of 0.37 household vehicle trips.

In studies using 1990 and 1995 NPTS data, Pickrell and Schimek carried out an analysis of household auto travel using a modeling structure that controlled for income, household size, race/ethnicity, and size of the urban area. The analysis used both gross population density, and density squared, as well as a specification using the residual of density that was not explained by household income, household size, employment status of household members, racial and ethnic characteristics, the size of the urban area, and geographic region. The authors found that population density of residential Census blocks and zip codes reduced household auto trips and the proportion of trips made by auto, but only at levels above 4,000 people per square mile; the most significant reductions were for households in areas above 7,500 persons per square mile, densities "typically found only in central city neighborhoods of the nation's largest urban areas" (Pickrell 1999: 427).

Boarnet and Greenwald (2000) carry out three sets of regression models using 1994 Portland activity diary data. (This work is similar to that of Crane and Crepeau (1998) and Boarnet and Sarmiento (1998); for brevity, these earlier works are not described here.) The authors include a number of variables as built environment measures: gross population density and gross retail density for the residential Census tract, percentage of the quarter-mile-radius area covered by a gridlike street pattern, a pedestrian accessibility index, a dummy variable indicating whether the home is within a half-mile of light rail, and the proportions of multifamily, single family attached, and single family detached housing in the Census tract. In their initial one-stage ordered probability models, population density is associated with an increased number of nonwork auto trips when speeds are not included among the explanatory variables, while retail employment density is negatively related when speeds are included.

In the second model, the authors first regress median trip speed and median trip distance on the built environment measures listed above. Predicted trip speeds and distances from that model are then used as instruments in a second ordered probit model, which does not include any of the built environment measures. The predicted distance from the Census tract level model is statistically significant with the expected sign, while the zip code-level model's predicted distance and the two variables for predicted speed are not statistically significant. This result implies that Census tract level land use characteristics affect the number of car trips by reducing trip distances, but not through average speeds, while zip code-level land use characteristics do not affect the number of car trips.

Finally, in their third set of models, the authors carry out a number of regressions in which predicted land use characteristics (in an instrumental variables procedure) are used to account for the possibility that individuals simultaneously choose their residential locations and make travel decisions based on built environment characteristics. In these regressions, the (predicted) proportion of single family homes *and* the (predicted) proportion of multifamily housing are both positively correlated with the number of auto trips, while (predicted) retail employment density is negatively correlated. Other land use characteristics are not significant in these regressions.

Mixed land uses

A number of other studies focus in particular on how mixed land uses at the sub-metropolitan level affect travel behavior. Cervero (1988) studied the impact of mixed uses in employment centers on commute mode choice using data on 57 suburban employment centers with at least one million square feet of office space in the 26 largest US metropolitan areas. Cervero hypothesized that increased car commuting to such locations is caused by the fact that "those who work in many campus-style office parks are almost stranded in the midday if they don't drive their car to work" and that single use centers are pedestrian-unfriendly because they are dominated by parking. The study employed a stepwise OLS regression process, with the percentage share of commuting by solo auto, carpool, and walk/bike as dependent variables, and selected measures of land use mix and transportation supply as independent variables. Land use measures found to be significant in one or more of these models included the percentage of floor space in office use, retail square footage within a 3-mile radius, jobs-housing balance within a 5-mile radius, and size of the center (number of full-time employees), all with the expected signs. Transportation supply variables found to be significant in one or more models included the number of company vans in operation, density of nearby freeway interchanges, and whether there was a ride share coordinator at the location. Most of the relationships were of moderate or modest magnitude.

Using land use and commuting data from the American Housing Survey (AHS), Cervero (1996) studied the impact of the availability of commercial uses on commute trip mode choice for residents of eleven metropolitan areas. He found that the presence of commercial establishments within 300 feet of the home significantly increased the probability of an individual walking or biking to work and slightly increased the probability of using transit. He also found that the presence of a grocery or drug store farther than 300 feet away but less than 1,000 feet away decreased the use of these alternative modes. However, residential density (as proxied for by characteristics of nearby housing), commute distance and household car ownership were substantially more important predictors of individual mode choice.

Frank and Pivo (1994) included a measure of mixed uses in their study of Census tract average commute mode choice and land use. Mixed use levels at trip origins and destinations were calculated using an "entropy index" based on Cervero (1988: 57) using seven land use categories applied to building square footage from the county assessor. This index was not significant when density, demographics, and transit service were controlled, except in one case: the commute walking share was significantly related to mixing of uses at both workplace and residence, although not as strongly as to densities.

Ewing (1995) examined a number of different characteristics of land use with respect to total vehicle hours of travel. He separated land use measures for the workplace and the residential location, and included one mixed use measure in his model for the residential location, which was a measure of jobs-housing balance. Other variables for land use were accessibility indices and employment density. The mixed use measure was not significant in his model.

Kockelman (1997) carried out several disaggregate multiple regression models of varying types to investigate the relative significance and influence of a variety of measures of urban form on household vehicle kilometers traveled, automobile ownership, and mode choice. After demographic characteristics were controlled for, measures of accessibility, land use mixing, and land use balance were statistically significant with respect to all measures. In some cases, land use measures were found to be more relevant than demographic characteristics. Except for the vehicle ownership models, the impact of density was negligible after accessibility was controlled.

Studying residents of Austin, Handy and Clifton (2001) found that the availability of local shopping opportunities in neighborhoods was correlated with a higher number of long-distance shopping trips and a somewhat lower use of auto for local trips. The authors did not control for the size of stores. In focus groups with respondents as well as a follow-up regression analysis, other factors than distance appeared to also be important in mode choice of local shopping trips, such as having to cross busy streets to get to stores and other pedestrian amenities, as well as the person's strolling frequency (intended to proxy for basic attitude toward walking). Based on interviews with respondents, the authors suggest that most walk trips to the store replace driving trips rather than being additional trips.

Accessibility

Accessibility measures are typically based on the "gravity model," consisting of sums of employment by zone (or, less commonly, residential population) divided by an exponential function of distance from the measurement zone. Most accessibility measures include all possible trip destinations, limited only by the geographical coverage of the data set, and the measures often distinguish between types of employment or residential population.

Some researchers distinguish between local and regional accessibility. Handy's (1992) measure of local accessibility is essentially a measure of retail, service, and "other" employment within the traffic analysis zone, divided by an exponential function of average intra-zonal travel time, while her measure of regional accessibility is similar to other gravity model-based measures. Handy found that for shopping trips regional accessibility was sometimes more strongly correlated with travel behavior than neighborhood accessibility, although they are clearly complementary and often act as consumption substitutes.

Ewing, Haliyur and Page (1994) found that higher employment accessibility in selected communities in Palm Beach County, Florida was correlated with a greater tendency to chain trips in "multipurpose tours" by car rather than making numerous separate car trips. Multipurpose tours were also more commonly characterized by carpooling. While transit and walking modes were rarely used in the county, carpooling was relatively common. The authors conclude that high residential accessibility seems to be associated with fewer vehicle hours traveled, but not with higher transit or walk share.

In a follow-up study, Ewing (1995) used a travel diary data set of 548 households and regressed vehicle hours of travel on socio-demographic characteristics and land use variables, both at the place of work and at the place of residence. He constructed four accessibility indices for the residential location: work, shopping, social-recreational, and other. For the workplace, he constructed a general accessibility index for all activity types. Zonal employment density was also included in the model. The accessibility index for home-based other trips, which measures the proximity of all possible destinations to the residential location (other housing, all job types, and school enrollment), was significant, but the other accessibility indices were not. Ewing concludes that regional accessibility to all types of land use is a more important predictor of travel decisions than employment-only or shopping-only measures.

Summary

The literature relating built environment and land use characteristics to travel choices does show moderate to modest relationships between reduced auto use and higher development density, a greater presence of commercial activities in residential areas, and higher accessibility indexes. However, in the more methodologically sophisticated studies, the relationships are often more difficult to discern. The literature suggests that accessibility measures may be more strongly related to lower car use than the more direct measures of development density or mixed land uses. However, this may be because high accessibility is even more correlated with high road congestion, better transit, and a higher quality pedestrian environment than those other measures. Such correlations are largely unexplored empirically, though often noted and commented upon.

2.4 Lessons for the California Demographics and Trend Study

The primarily descriptive literature on travel behavior leaves many questions about mobility and equality in travel, even if it does establish differences in travel by sex, race, disability status, and age. One important consensus, however, has arisen out of the travel behavior literature. Although travel differs among women according to ethnicity, women of all ethnicities tend to travel differently than similarly situated men. This seems to result from different work types and responsibilities between women and men, both in the home and out (Hanson and Pratt 1995; Handy 1996).

Ethnicity and race variables, however, are somewhat different. Unlike differences in household and work activities that has explained differences in travel by sex, differences in travel by ethnicity are likely attributable to class and to spatial segregation (which overlaps with class). Class differences between different ethnic groups pertain not just to income, but to differences in asset wealth, social networks, stigmas attached to work and private life, and residential segregation. Thus, aggregate measures of ethnicity—that is, treating ethnicity in isolation from these factors, may lead to misleading conclusions. Thus, our modeling efforts will be careful to test for differences in travel by ethnicity, but the interpretation of model results must recognize the myriad dynamics for which ethnicity provides a proxy.

Similarly, age as an explanatory variable in urban travel models conveys a lot of information about ability and health status, income, and license possession (at both young and old ages). All of these factors influence aggregate levels of demand for total travel and travel by various modes. Perhaps more importantly, a knowledge of age enriches the policy choices and recommendations that the modeling and forecasting support.

Perhaps more than anything else, the travel behavior literature establishes the need to consider the interactivity of race, class, sex, immigrant status, and age on individual travelers. Although these factors are treated separately in the preponderance of the literature, they influence individual opportunity for travel and economic citizenship. Including socio-economic variables will—if treated simultaneously—add many dimensions to the empirical model and the subsequent travel forecasts, thus complicating the analysis and the computational demands. Yet, this level of detail is exactly what is needed if the forecasts are to guide the state's decision-making and improve Title VI compliance.

Similar problems challenge efforts to capture the effect of land use on travel behavior. On one hand, the literature is entirely consistent with the theory that land use affects travel in the basic ways: by changing the relative utility of travel by mode; by changing the relative time and money costs of travel by mode; by affecting the provision of transport service; and through dynamic effects. On the other, it is difficult to assess the relative contributions of these different effects to observed travel behavior patterns. Most studies assume that land use affects travel either by changing the relative utility of modes, or by affecting the relative cost of traveling. Some authors make it clear that they are aware of both substitution and budget effects, but they do not always explicitly investigate both.

Our review of this literature relating land use and travel suggests two main conclusions. First, threshold effects are likely to be important both conceptually and empirically. This suggests that instead of modeling the effects of land use with continuous variables, it may be appropriate to segment the variables with dummies to represent thresholds. Second, interactive effects are also important, implied most strongly by the accessibility index results.

The next section describes the existing demographic and travel behavior in California, providing a link between the general themes developed in this section and the empirical research discussed in the latter sections.

3

CALIFORNIA TRAVEL TODAY & YESTERDAY

This section takes a brief look at the data that are available on current travel in California. Many datasets that have information on ethnicity, sex, income, and travel behavior are not sufficiently disaggregated to convey the context-sensitive data most useful for good planning. Those datasets that are sufficiently disaggregated to provide in-depth information on personal activities often do not contain income data or ethnicity, or they are not available for the state as whole. Our discussion focuses on the 2000 Census, the Nationwide Personal Transportation Survey, the 2001 California Statewide Household Travel Survey, and data from travel surveys carried out in the San Francisco Bay Area, the five-county greater Los Angeles metropolitan region, and the Sacramento area.

Aggregate travel flow tends to be characterized in five major ways: trip purpose, temporal distribution, modal distribution, trip length, and spatial distribution. This categorization provides a useful way to organize our discussion of travel behavior in California.

3.1 Trip Purpose

Based on 1995 data from the Nationwide Personal Transportation Survey (NPTS), about half of person trips and a third of person miles in the US are attributable to family and personal business, which includes shopping, running errands, and trips to drop off or pick up passengers. A quarter of person trips and 31 percent of person miles are for social/recreational purposes. Travel to and from work accounts for 18 percent of person trips and 23 percent of person miles (FHWA 1995: 11). Passenger-serving trips, where the main activity is to pick-up or drop off a passenger, make up 11 percent of trips by women and seven percent of trips by men; almost all passenger-serving trips are made in private vehicles (FHWA 1995: 16).

In the early part of the century, most travel was attributed to trip to work and back. Since that time the prevalence of other kinds of trips has increased greatly. According to the Federal Highway Administration, about 80 percent of the current miles traveled by individuals in the US are for non-work purposes.

Many non-work trips occur during the week, but a large number of these trips occurs on the weekend. As a result, Sunday and Saturday are typically the days with the highest trip making. But shopping trips are spread fairly evenly throughout the week, with 77 percent of shopping trips occurring on weekdays (FHWA 1995: 15). In fact, many shopping trips are likely often chained with work trips.

Table 2 (below) shows the distribution of trip purpose for travelers by region in California.

Table 2. Percent of Weekday Trips by Purpose in California

Region	Home-Other	Other-Other	Work-Other	Home-Work	Home-Shopping
Western Slope/ Sierra Nevada	38%	26%	9%	19%	8%
AMBAG	38	21	12	21	8
MTC	39	23	12	18	8
SACOG	38	21	11	21	9
SCAG	49	20	9	21	1
Rural	37	25	11	19	8
Butte	37	27	10	16	9
Fresno	38	14	10	30	9
Kern	39	18	10	26	6
Merced	38	21	10	24	7
San Diego	41	23	11	17	7
San Joaquin	39	20	9	24	8
San Luis Obispo	42	24	9	17	9
Santa Barbara	43	21	10	18	8
Shasta	37	25	10	19	8
Stanislaus	38	17	10	29	6
Tulare	38	26	8	17	11
Statewide	43%	21%	10%	20%	5%

Source: 2000-2001 California Statewide Household Travel Survey Final Report, Table 8.11. Data are for households living in single-family homes, though the data for households in multifamily units are similar.

These statistics are remarkably uniform across regions. Home-to-work trips account for only about 20 percent of weekday trips statewide, with lows in San Luis Obispo and Tulare. This is close to the national figure of 18 percent (based on 1995 NPTS data). Some variation exists, however. Home-to-work trips accounted for more than 26 percent of trips in Fresno, Stanislaus, and Kern counties. Thus, nonwork trips account for about 75 to 80 percent of weekday trips across California regions.

The findings are very similar for the major California urban regions. We examined three sets of travel diary databases: a 1991 survey carried out in the five-county greater Los Angeles metropolitan area by the Southern California Association of Governments (SCAG); a 2000 survey of Sacramento area residents commissioned by the Sacramento Area Council of Governments (SACOG); and a 2000 activity diary survey of the nine-county San Francisco Bay Area (BATS) administered by the Bay Area Metropolitan Transportation Commission (MTC).

For these data, we grouped trip destinations into four main categories: work/school/daycare; non-work trips; passenger-serving trips, where the main activity is to pick-up or drop off a passenger; and at-home activities, where the home is the final trip destination. Table 3 shows summary statistics based on this grouping.

Table 3. Trip Purpose by Metropolitan Region

Primary activities	Bay Area	LA area	Sacto.
Work/school/daycare	18.8%	22.8%	16.2%
Non-work	32.3	34.5	29.3
Passenger serving	12.4	7.7	7.4
At-home activities	40.4	35.0	47.0

As shown above, work, school and day care trips made up about 23 percent of the trips in the Los Angeles region, almost 19 percent of the Bay Area trips, and over 16 percent of the Sacramento trips. Roughly a third of trips were considered non-work trips, to access activities such as shopping, social activities, recreation, banking and personal business. Another way to look at the data is to eliminate the at-home activities category because it largely represents the return to home trips after the primarily purpose outbound trips. Once the at-home activities are eliminated, the percentage of work trips increases to 40 percent for the Los Angeles region and 30 percent for both the Sacramento area and the Bay Area, while the percentage of non-work trips jumps to 50 percent in the Los Angeles region and the Bay Area, and 60 percent for the Sacramento region.

3.2 Temporal Distribution

In urban areas, the highest traffic flows occur during the morning and evening commutes. These flows are typically about twice as high as flows at other times of day, and can last for up to four hours in some congested metropolitan areas. The evening peak period is often longer and more intense than the morning commute period.

The work trip is an important contributor to the daily peak periods during the week. Peak commute travel is three to four times as great as non-peak commute travel. However, on average across the United States, during the 6 to 9 a.m. peak commute period less than 40 percent of all trips are trips to and from work, and during the 4 to 7 p.m. peak period the share falls to less than 20 percent (FHWA 1995: 14).

Although the commute remains an important trip, it is declining as a share of all trips. This is because it is generally not as flexible in terms of scheduling as non-work trips, and because for the individual worker, the trip to work often dictates when, where and how his/her other travel is accomplished (FHWA 1995: 12). In other words, workers often carry out non-work trips on the way to and from work, and this contributes to the peaking patterns.

Trips for non-work purposes soften the overall peaking pattern somewhat by keeping flows high during the rest of the day. For example, about half of the shopping trips occur between 9 a.m. and 3 p.m., and social/recreational trips (including eating out) exhibit a major peak between 6 p.m. and 10 p.m. (Barber 1995: 85). The overall peaking pattern is also muted by truck traffic which accounts for 15 percent of all vehicle trips in urban areas. Truck trips tend to be on the road network between the peak commute times, i.e. during typical business hours (Barber 1995: 86).

Data on trip timing (peak and off-peak) are difficult to come by. They were available from the Los Angeles area and Sacramento area travel diaries, but not from the Bay Area data because a substantial portion of that data was collected on the weekends where peak and off-peak are not easily defined. The Sacramento and L.A. data were grouped into three categories: 1) morning peak, between 6 am to 9 am; 2) evening peak, between 3:30 pm and 6:30 pm; and 3) non-peak, all other times throughout the day.

Table 4. Trip Timing

Temporal Category	LA area	Sacto.
Morning peak	21.1%	16.0%
Evening peak	24.9	19.7
Non-peak	54.1	64.3

Of the 137,055 trips in the Los Angeles database, 21 percent occurred during morning peak hours and 25 percent occurred during evening peak hours; more than half occurred during non-peak hours. The Sacramento distribution (43,086 trips in the survey database) was 16 percent during peak hours, 19.7 percent during evening hours and over 64 percent during non-peak hours. Both the Los Angeles area and Sacramento area distributions suggest that the evening peak commute is more intense than the morning commute.

3.3 Modal Distribution

In US urban areas, transit trips account for less than ten percent of commute trips. For all trip purposes nationwide, the transit share is about two percent. Nationwide, school buses account for almost as many person trips as public transit (FHWA 1995: 17). In metropolitan areas, the share for walking and biking combined is generally higher than the combined transit/school bus share, regardless of population density (Ross and Dunning 1997: 16). About 44 percent of transit trips take place during peak commute periods (FHWA 1995: 17). This is a much stronger peaking pattern than for overall travel, which is dominated by personal vehicle trips.

Transit use nationwide hit its peak after World War II, when almost 23 billion yearly trips were made on transit. It fell off dramatically afterwards, and has steadily declined as a percentage of all trips since leveling off in 1960 at billion yearly trips (Barber 1995: 89). There has been a gradual spreading of peak daily period for all travel, but for public transit the peak has remained intense or become more intense, because for non-work off-peak trips, transit is particularly uncompetitive with personally operated vehicles.

To examine urban modal distribution in California, we summarized modal information from our three urban travel databases into five categories: 1) car/van/truck/motorcycle, including all private vehicle trips; 2) public transit including bus and rail; 3) walking trips; 4) bicycle trips; and 5) school bus trips. In the Los Angeles and Sacramento regions the private vehicle category was the mode of choice for roughly nine out of ten trips. Private vehicle use in the Bay Area was slightly lower than the other two regions, at eight out of ten trips. Even during peak commuting hours, private vehicles accounted for 84 to 95 percent of the trips in the Los Angeles and Sacramento regions. Total walking trips accounted for five percent of trips in the Sacramento region, eight percent in the Los Angeles region, and 11 percent in the Bay Area. Public transit accounted for about one percent of the trips in the SCAG and SACOG region. Although the percentage of trips on public transportation in the BATS region was three times the size of the other regions at 4.5 percent, it is still less than five percent of total trips for the region. Within the public transit trips, over 50 percent of the transit trips in the SCAG region were during the peak commuting hours. In comparison, only 37 percent of the transit trips in the SACOG region occurred during peak commuting hours. One plausible explanation on the difference between these two regions in transit use during commuting hours is that SCAG is a more heavily urbanized region than SACOG and as a result have more developed public transit corridors such as the Metro Blue Line, Metrolink and the El Monte Busway to facilitate commuter travel during peak hours.

Table 5. Travel Mode by Travel Time from SCAG and SACOG

	SCAG				SACOG			
	morn peak	even peak	non-peak	Total	morn peak	even peak	non-peak	Total
Personal vehicle (motorized)	84.2%	91.0%	88.2%	88.1%	94.9%	90.4%	90.9%	91.0%
Public transit	1.3	0.9	0.8	1.0	0.5	1.7	1.1	1.2
Walk	9.3	5.9	8.2	7.8	3.7	4.8	5.2	5.0
Bicycle	1.2	1.2	0.9	1.0	0.8	2.0	1.6	1.6
School bus	3.1	0.5	1.4	1.5	0.1	0.9	1.1	1.0
Other/dk	0.9	0.5	0.5	0.6	0.1	0.2	0.2	0.2
	BATS				Rural			
Personal vehicle (motorized)	—	—	—	82.1%	—	—	—	92.2%
Public transit	—	—	—	4.5	—	—	—	0.5
Walk	—	—	—	11.0	—	—	—	3.9
Bicycle	—	—	—	1.4	—	—	—	0.5
School bus	—	—	—	—	—	—	—	2.7
Other/dk	—	—	—	0.0	—	—	—	0.0
	Statewide							
Personal vehicle (motorized)	—	—	—	90.0%				
Public transit	—	—	—	1.7				
Walk	—	—	—	6.0				
Bicycle	—	—	—	0.6				
School bus	—	—	—	1.4				
Other/dk	—	—	—	0.4				

SOURCE: California Statewide Household Travel Survey 2001, Table 8.9, SACOG and SCAG trip information.

3.4 Trip Length

Average trip distances are greater in larger cities, but the spatial structure (i.e. density) of a city is related to average trip distance, with denser cities having shorter trip distances on average, controlling for city size. On average, work trips are longer, in both distances and time, than non-work trips. The distance of average commute trip lengths has been rising somewhat over time, while the average time of the work trip has remained relatively constant until recently (Barber 1995: 94-96).

Although we do not have distance-based information in the travel dairies, the SACOG data set has a variable on the time duration of each trip. We grouped the trip duration data into seven categories: 1) 5 minutes or less; 2) 6-10 minutes; 3) 11-15 minutes; 4) 16-20 minutes; 5) 21-30 minutes; 6) 31-45 minutes; and 7) more than 45 minutes.

Table 6. Trip Length in Minutes

	SACOG		
Minutes	**Work**	**Non-work**	**Passenger serving**
5	15.0%	42.5%	12.2%
6-10	16.6	39.3	10.8
11-15	19.9	35.9	9.3
16-20	23.7	32.0	8.1
21-30	27.3	29.7	6.3
31-45	29.1	29.7	6.0
more than 45	27.6	29.8	4.6

Of the 33,954 trips in the SACOG travel, 66 percent of the trips were 15 minutes or shorter and only ten percent of the trips were over 30 minutes. By tabulating trip duration with trip activities, we can get a distribution of the types of destination activities and corresponding travel duration. For trips, 5 minutes or less, over 42 percent of the trips were for non-work related travel which is consistent with the literature that work trips are generally longer than non-work trips. In fact, over 71 percent of non-work related trips were 15 minutes or less compared to 55 percent of the work related trips were 15 minutes or less. Furthermore, passenger-serving trips where the driver is picking up or dropping someone else off at a destination also tend to be shorter than work trips with 76 percent of these trips taking 15 minutes or less.

The data from the California Travel Survey demonstrates similar characteristics to the SACOG data. These data are shown for the SCAG region and for the rural sections of the travel survey in Figure 2 and Figure 3. The data shown are for all trips, and they show a significant skew; that is, most trips are of comparatively short duration.

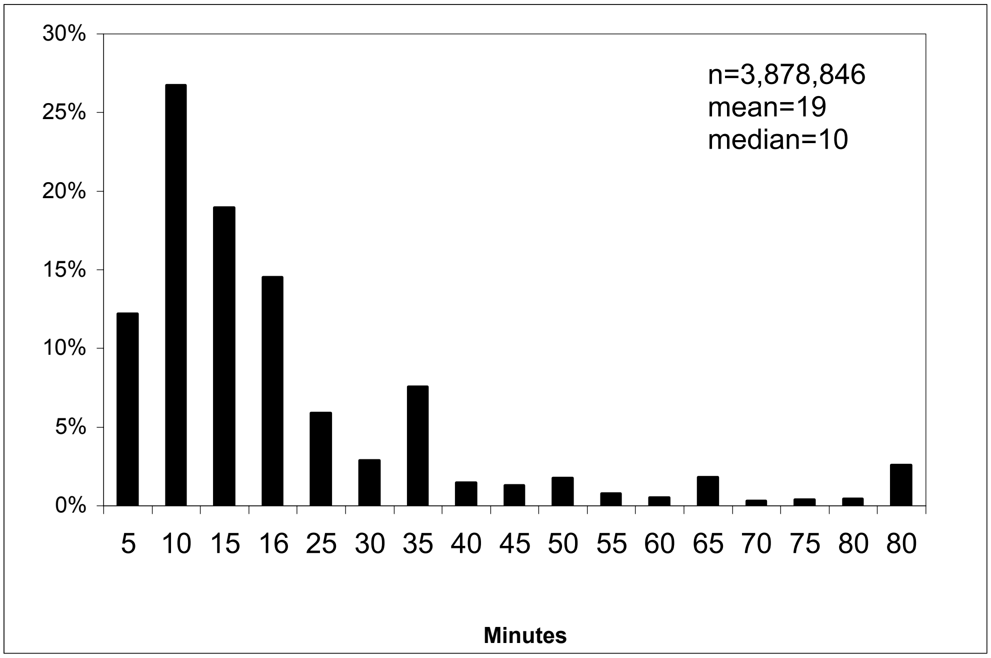


Figure 2. Trip Duration in Rural Regions

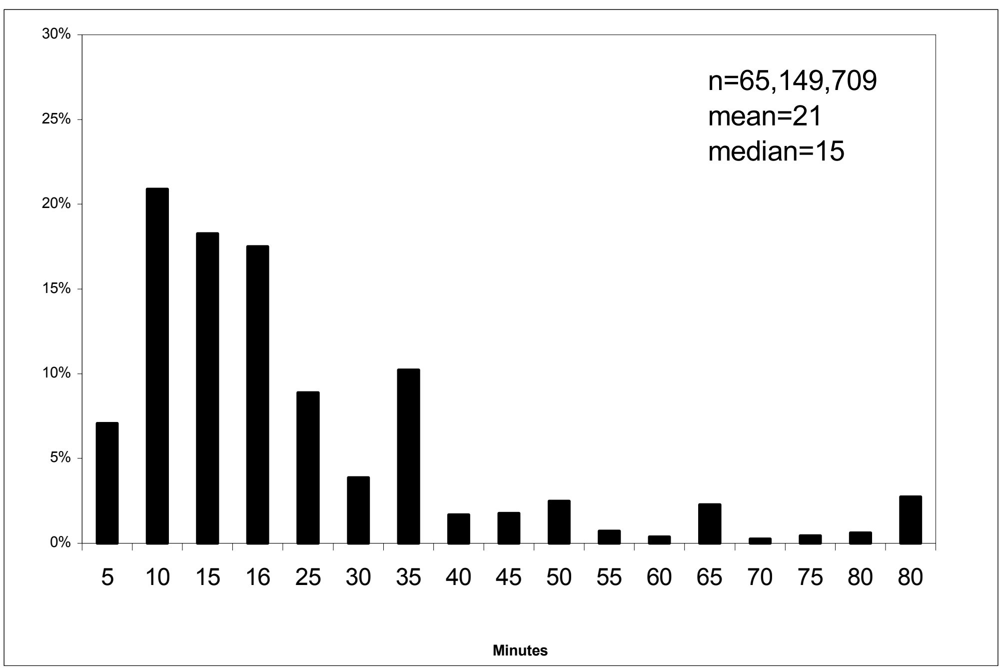


Figure 3. Trip Duration in Los Angeles Region

3.5 Individual and Household Travel Behavior

Individual/household and travel patterns, licensing rates, and vehicle ownership vary by sex, income and race and ethnicity. These differences begin to explain some of the aggregate travel patterns discussed previously.

Variations by sex

As discussed in the previous section, women exhibit markedly different travel patterns from men. According to Pucher, Evans and Wegner (1998: 27), "The main differences between men and women are the much higher incidence of carpooling by women, their greater use of buses and taxis, and their much lower rate of bicycling. Women are also much more likely to travel at off-peak periods, to make a lower percentage of work trips, and to make shorter trips than men."

In 1990 women made more overall trips, but fewer vehicle trips, then men and they traveled fewer miles because their trips were shorter. These differences were partially attributable to differences in income, licensing and auto ownership among men and women. But they are also largely due to differences in responsibility for household activities (Rosenbloom 1995: 2.9).

The greater use of buses and taxis by women has been diminished over time. As women become more likely to be employed, they continue to bear the majority of the responsibility for household functions such as shopping, child-related activities, and elder care (Rosenbloom 1995). Employed women often find the use of transit and non-motorized modes inconvenient, because these modes do not easily enable chains of trips to accomplish several different purposes, a necessary adaptation to a more constrained time budget. Women also make two thirds of passenger serving trips, which are carried out almost exclusively in privately owned vehicles (FHWA 1995).

Variations by income

Transit users are much more commonly from low-income households, but peak users tend to have higher incomes than off-peak users. (Pucher, Evans, and Wegner 1998) There are not significant income differences in peak and off-peak travel for personally operated vehicles. (Barber 1995: 87) In general, higher income people tend to make more trips of longer duration, increasingly in personally operated vehicles (Pucher, Evans, and Wegner 1998). A study of transportation and minority women's employment in New York showed that higher income groups have consistently higher use of auto modes. (McLafferty and Preston 1998: 363)

Income appears to have its strongest effects on travel behavior by increasing the likelihood of owning an auto. Ethnic/racial differences in travel behavior often appear to be insignificant when auto ownership is taken into account. For example, Johnston-Anumonwo (1998) found that when travel times of auto users are compared, ethnic/racial differences often are reduced or disappears completely.

Variations by race/ethnicity

Despite making up a minority of the population, non-Anglos accounted for almost two-thirds of transit riders in the US in 1995 (Pucher, Evans, and Wegner 1998: 15). In urban areas, Anglos use public transit for 1.9 percent of trips, while African Americans use it for 10.3 percent of the trips and Hispanics for 7.5 percent of trips; the average African-American person makes six times as many trips by transit as the average Anglo (95 versus 15 per year). But for all three groups in urban areas, walking is more prevalent than transit use, at 7.2, 17.3 and 12.9 percent respectively (Barber 1995: 94).

Part of the reason for this greater use of transit and walking is lower car ownership. Based on 1990 NPTS data, Pisarski found the on average, more than 30 percent of African-American households do not own vehicles, and in central cities the number is over 37 percent. Hispanics have an overall rate of vehicle-less households of 19 percent, with the central city rate rising to 27 percent (Pisarski 1996: xv).

Another reason that minority groups drive less than Anglos is that they are less likely to have driver's licenses. While 90 percent of all White women 16-64 were licensed, only 70 percent of African-American women and 66 percent of Hispanic women had a license (Rosenbloom 1995: 2.6).

Johnston-Anumonwo's literature review suggests that there are racial differences in travel behavior that are not entirely explained by various control factors such as auto ownership, income, occupation, and domestic role. It is not clear from her review whether other factors such as education have been controlled for. But her review does suggest that a large share of differences is explained by these factors, particularly auto ownership. Auto ownership, in turn, can be largely seen as a function of income.

Car licensing

Between 1969 and 1990, the population of the United States increased 21 percent, from 197 million to 239 million people. Licensed drivers increased at a rate substantially greater than population growth. The number of male drivers increased 38 percent, while the number of female drivers increased 84 percent. (Lave, 1993) In California, both the growth in population and license drivers are even more dramatic. The California population increased by more than 50 percent from 19.7 million in 1969 to 30 million in 1990. For the same time period, licensed drivers increased by 75 percent from 11.4 million to 19.9 million in 1990.

Our examination of the SACOG, SCAG and BATS travel dairies revealed that a very high percent of Californians are licensed to drive. Of the 7,756 persons in the SACOG sample that are 14 years of age and above, over 89 percent of them are licensed drivers with over 91 percent of the men and 88 percent of the women licensed to drive. Similarly, in the 1991 SCAG travel diaries, of the 31,146 persons age 14 and above, 89 percent are licensed drivers with over 92 percent of the men and 86 percent of the women licensed to drive. The licensing rates in the BATS region were very similar to the two other regions with over 91 percent of the 14 and over licensed to drive. In fact, over 95 percent of people between the ages 40 to 44 surveyed in the travel dairies have licenses, which suggests that the number of license drivers in California has probably reach a saturation point. Further examination of licensing rates within the age categories further revealed that licensing rates remain over 90 percent for driver up to 75 years of age. After age 75, the number of licensed drivers began to drop.

Table 7. Percentage of Licensed Drivers by Age and Sex

	SACOG			SCAG			BATS		
Age category	Male	Female	Total	Male	Female	Total	Male	Female	Total
14 to 17	33.5	30.5	32.1	32.8	35.8	34.3	31.1	31.5	31.3
18 to 20	83.0	74.1	78.9	79.0	70.6	74.6	84.4	85.2	84.8
21 to 24	88.1	90.2	89.2	88.7	80.2	84.2	92.5	90.1	91.1
25 to 29	92.8	92.9	92.9	92.8	86.5	89.5	95.5	94.7	95.3
30 to 34	90.5	91.9	90.9	95.4	91.7	93.5	96.9	97.3	97.2
35 to 39	94.6	91.3	92.9	96.5	93.4	94.9	98.6	97.0	97.8
40 to 44	93.9	98.0	96.0	96.6	93.7	95.0	98.7	97.1	97.9
45 to 49	95.7	96.2	96.0	97.4	92.5	94.9	97.8	97.4	97.6
50 to 54	95.4	96.5	96.0	97.8	93.1	95.3	98.2	97.0	97.6
55 to 59	97.1	95.8	96.4	97.4	91.7	94.4	98.8	96.5	97.6
60 to 64	95.8	94.6	95.0	96.3	88.8	92.4	98.4	95.3	96.8
65 to 69	94.5	90.1	92.3	96.5	86.8	91.1	97.6	93.4	95.4
70 to 74	97.0	88.3	92.5	94.5	86.4	90.0	96.4	91.8	93.9
75 to 79	91.6	84.9	88.1	90.9	74.2	81.3	91.7	86.5	88.9
80 to 84	95.0	72.1	83.1	79.6	60.8	68.0	89.9	72.3	80.1
85 to 100	80.2	58.2	65.5	73.1	37.3	49.6	67.6	39.2	50.2
Total	90.7	87.8	89.1	91.9	86.1	89.2	92.2	90.2	91.3

3.6 Car Ownership, Household Size and Income

The number of household vehicles has more than doubled in the last thirty years. From 1969 to 1995, a period in which household size decreased by 17 percent, the number of cars per household increased from one to two. (FHWA 1995: 3) The ratio of cars per licensed driver has also increased nationally. The number of vehicles per licensed driver has increased from 0.7 in 1969 to 1.01 in 1990. (Lave 1993) In contrast to the national ratio, California's vehicle to licensed driver dropped between 1969 to 1990 period. In fact, it was almost a mirrored opposite of the national trend. California had 11.42 million licensed drivers and 11.45 million passenger and commercial vehicles, which is virtually one vehicle per licensed driver for a ratio of 1.0. In 1990, California had a population of 30 million and 22 million vehicles for a ratio of 0.73.

However, the more meaningful of the two car ownership measurements is the household number, because it is the availability of a car to the household that mostly determines the ability of licensed drivers to have access to a vehicle. In fact, it is through the household measurement that we can get information on car ownership of demographic subgroups such as African Americans and Hispanics. Using 1990 NPTS data for the US, Pisarski found that on average more than 30 percent of African-American and 19 percent of Hispanic households do not own vehicles, and in central cities the number is over 37 percent for African-Americans and 27 percent for Hispanics (Pisarski 1996: xv).

The data on the number of vehicles per household across the three regions were very similar. Between 2.5 percent to slightly over 4 percent of the households in the three data sets do not own vehicles which means 96 percent of the households surveyed in the SCAG, SACOG and BATS travel diaries own at least one car. Of the households with cars, almost half of them have two vehicles.

Table 8. Vehicles per Household in California Regions

Vehicles Per Household	So. Ca.	Sacto.	Bay Area
None	4.2%	4.3%	2.5%
One Vehicle	27.9	30.3	21.1
Two Vehicles	45.1	42.0	49.4
Three Vehicles	14.9	15.9	19.6
Four or more	7.9	7.5	7.5

SOURCES: SCAG (1991), SACOG (2000), and MTC (2000) travel surveys.

Further examination of the vehicle and household size variables revealed that smaller households are more likely to be without a car. Seventy-three percent of households without vehicles were one-person households. In fact, households with two or less persons accounted for over 90 percent of the households not owning a car. In contrast, households with more than two persons own cars at very high rates. The data sets show that 97 percent of SCAG and 98 percent of SACOG households with more than two persons have at least one car.

Another way to look at vehicle ownerships is to examine the ability of a household to afford a vehicle. For example, transit users are much more commonly from low-income households. As a result, income appears to have its strongest effects on travel behavior by increasing the likelihood of owning an auto.

We grouped the income data into five categories: 1) low-income (less than $15,000); 2) medium-low income ($15K to $30K); 3) medium-income ($30K to 50K); 4) medium-high income ($50K to $75); and 5) high income (above $75K).

Table 9. Vehicles per Household by Income: SCAG

	Vehicles per Household				
Income categories	None	One	Two	Three	Four or more
$15,000 or less	71.0%	26.2%	6.1%	4.1%	5.3%
$15,001 to $30,000	16.2	35.1	18.3	12.7	11.6
$30,001 to $50,000	8.0	26.8	32.2	27.0	23.3
$50,001 to $75,000	2.3	8.1	25.0	29.2	26.1
$75,001 or greater	2.5	3.9	18.4	27.1	33.7
Total	100.0	100.0	100.0	100.0	100.0

The above table from the SCAG travel data shows that 71 percent of the households without cars are in the low income category. In fact, households earning less than the $30,000 threshold accounted for 87 percent of the households without cars. In comparison, only five percent of the household earning more that $50K do not own a car.

Table 10. Vehicles per Household: SACOG

	Vehicles per Household				
Income categories	None	One	Two	Three	Four or more
$14,999 or less	59.4%	16.9	4.5	2.5	1.5
$15,000 to $29,000	25.2	33.8	12.1	7.4	5.6
$30,000 to $49,999	10.2	28.0	25.9	22.8	21.3
$50,000 to $74,999	2.6	13.1	26.8	27.7	31.0
$75,000 or greater	2.6	8.1	30.7	39.6	40.7
Total	100.0	100.0	100.0	100.0	100.0

Table 11. Vehicles per Household: BATS

	Vehicles per Household				
Income categories	None	One	Two	Three	Four or more
$15,000 or less	16.8%	2.7%	0.2%	0.2%	0.2%
$15,001 to $30,000	37.7	20.0	4.4	2.3	1.7
$30,001 to $50,000	23.9	30.0	14.6	10.5	8.6
$50,001 to $75,000	14.6	23.9	23.7	22.7	15.8
$75,001 or greater	7.1	23.4	57.1	64.3	73.9
Total	100.0	100.0	100.0	100.0	100.0

The SACOG data in Table 10 shows that the vehicle per household by income data is very similar to the SCAG data. Nearly 60 percent of the households without cars are in the low income category and only five percent of the households earning over $50K do not own a car. Table 10 shows that the BATS data on vehicle per household by income are more varied than the other two regions. For example, over 60 percent of the household without cars have incomes between $15K to $50K and over 20 percent of households without cars have household earnings of $50K and greater. One plausible explanation on the difference between the BATS results and the two other regions might be that the more heavily urbanized land use patterns in the BATS region affects the rate of vehicle ownership. As a result, in developing our empirical models, we can control for some of the variations such as land use for better predictability.

4

EMPIRICAL TRAVEL MODELING

This section of the report describes the data, assumptions, conceptual bases, and results of the empirical travel models. Two types of model are developed. The first model is applied directly to the Phase II demographic forecasts and relies on the basic demographic variables provided in those forecasts: age, sex and race/ethnicity. In addition, two simple measures of land use are included in the forecast models: gross residential density and a population accessibility index. The second type of model goes beyond this basic set of variables to investigate other important correlates of travel, such as household income, the presence of children in the household, and a wider variety of land use characteristics.

4.1 Notes on Empirical Models

Since travel is complex, empirical investigation of travel behavior takes into account numerous potential causal factors. The most sophisticated empirical models use finely detailed household- or individual-level data, including household and individual socioeconomic characteristics; characteristics of available transportation services, such as financial costs, travel times, and level of service; and land use patterns near activity locations such as the residence and the workplace.

Random utility theory

Much empirical work investigating travel behavior is based on random utility theory. Random utility theory assumes that individuals seek to make choices that maximize their "utility," or happiness. These choices are based on their preferences, which are influenced by both observable variables (such as their socioeconomic characteristics) and unobservable variables (such as their idiosyncratic tastes). The utility associated with these choices is treated as a random variable to reflect the fact that some determinants of people's preferences cannot be attributed to observable characteristics, as well as other factors including modeling errors, missing attributes of travel choices (such as reliability and comfort of travel modes), imperfect data collection, and perception errors (Ben-Akiva and Lerman 1985).

In discrete choice travel behavior models based on random utility theory, observed characteristics of the decision-maker often include automobile ownership, income, and household size. Observed characteristics of travel choices often include travel time and out-of-pocket cost. However, choice-specific measures are often challenging to find good measures for.

Some measures of travel behavior, such as vehicle miles traveled (VMT), do not lend themselves well to use of the discrete choice method because they are continuous measures. However, choice-based elements enter into the VMT question, as car ownership is both an important determinant of VMT and is a choice-based process. Joint discrete-continuous models combine elements of conventional econometric demand models with discrete choice models, and are used to investigate such questions (e.g., Train 1986; de Jong 1997).

The choice-based approach has been criticized because that travel behavior is a dynamic process not entirely planned in advance, and discrete choice modeling implicitly assumes choices can be made in advance for the entire analysis period in question (typically a day) (Ettema and Timmermans 1997b). Even when dynamic effects such as uncertainty and congestion are included as explanatory variables in a choice-based model, this means that modeled outcomes are better thought of as representing long-term equilibria after a period of stasis in the socio-demographic and physical environment, rather than information that can be used to predict short-term responses to changes in those variables. However, because these same criticisms are applicable to the four-step approach, the choice-based econometric approach is clearly preferable to it.

Another criticism of the microeconomic approach is that it treats trips, trip chains, or tours as though they were discrete goods, when in fact the motivation for travel is to participate in a schedule of activities. For example, such models cannot show how socioeconomic trends, evolving land use patterns, or policy changes might affect the relative rate of participation of in-home and out-of-home activities and therefore influence travel patterns in numerous ways (Bhat and Koppelman 1999).

Activity-based models

Activity-based forecast models often use some of the same econometric techniques as trip- and tour-based models, such as the nested logit. Like the more commonly employed trip- and tour-based forecast models, they are carried out at a disaggregate (household and individual) level and rely on simulation procedures to provide needed population and employment inputs for forecasting. Few, if any, activity-based travel forecast models are employed in practice, but there is a fairly large literature discussing theoretical developments, applying models to test cases using actual forecast situations, and addressing barriers to implementation.

Utility-based activity models often rely on the familiar nested or multinomial logit model to describe the daily scheduling process; Ettema and Timmermans (1997) characterize this as a "straightforward extension" of the use of those models in modeling trips or tours directly, since the choice process is simply made more complex by first choosing activities and then moving on to ramifications for trip-making. Such an approach does not usually take into account the possibility that activity participation (and subsequently the travel pattern) does not always occur as planned.

Aggregate versus disaggregate models

Disaggregate and aggregate models serve different purposes. Aggregate models capture the service volume demanded on urban transportation networks as a whole. Such models proved valuable during the 1950s and 60s for the large-scale, long-range infrastructure planning needed to implement the interstate highway program. Disaggregate models—better at predicting individual responses to short-term and marginal changes—have become more prevalent since the 1970s, when the emphasis began to shift from building major systems to managing them (Fisher 2000; Hanson and Schwab 1986).

Since forecasting typically relies on population and employment projections provided on a zonal basis, some problems relating to aggregation remain because the data must still be transformed to an aggregate level. Translating any disaggregate econometric model, whether it is trip-based, tour-based, or activity-based, to a forecasting setting in which zone-based population projections are commonly relied upon, is a challenge. Ben-Akiva and Bowman (1998) note that a common approach is to generate a simulated disaggregate population for the area (or subareas) of interest. Another way to deal with these problems is to estimate distributions within zones, but this does not appear to have been frequently put into practice. Richards and Ben-Akiva (1975: 14) state that “the practical problem involved is the prediction of the distribution of the independent variables and not simply their means.”

4.2 The Bay Area Travel Survey

The models developed for this research are based on the Bay Area Travel Survey (BATS) administered to residents of the nine Bay Area counties between February 2000 and February 2001. Excluding a special MTC panel of 1,110 people, there are 33,570 individuals represented in the BATS database, in 14,561 households, for an average household size of 2.3 persons per household. The survey was carried out over two days between February 2000 and February 2001, with individuals surveyed during all weeks of the year excepting traditional holiday periods. The two-day periods were primarily weekdays, but about 40 percent of the sample was surveyed over a two-day period including both a weekend day and a weekday (i.e., a Friday and Saturday, or a Sunday and Monday).

Three primary travel measures are used in our analysis: trips, travel duration, and mode. The basic units of analysis are trips and travel time. Trips are investigated by mode by purpose, while duration is investigated by mode.

Trips

Aggregating all travel activities in the activity database to the person level, the number of trips per person ranges from 0 to 37, with a mean of 7.72 and a fairly large standard deviation of 4.69. See Figure 4 (below).

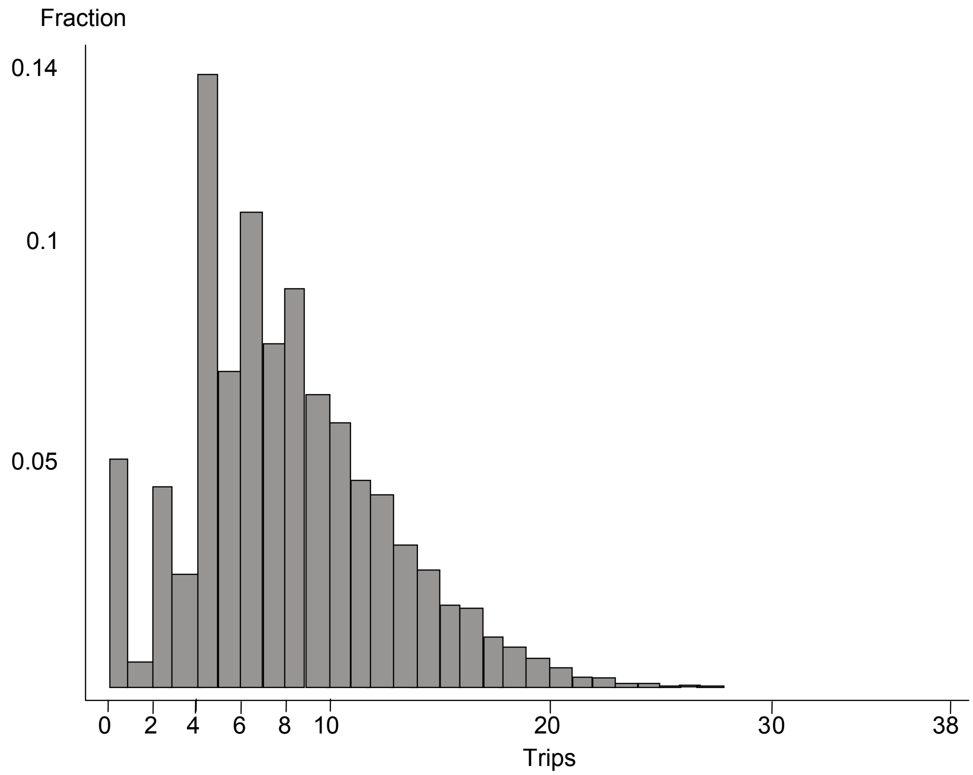


Figure 4. Trips per Person (Simple Definition)

SOURCE: Trip File and Activity File, Bay Area Travel Survey, 2000
Universe: All individuals excluding MTC Panel (n=33,570)

We modify the simple definition of trips to account for two phenomena. First, as is visible in the above graph, the distribution of trips is erratic. This is partially because travel activities tend to be clustered in twos and threes, with a trip away from home followed by a return trip home. It is more common to conceptualize travel in terms of trips away from home (followed by a return trip), and it is easier to model because the distribution is more regular. Second, travel between locations often involves a sequence of several travel activities by different modes, often referred to in the literature as “trip segments.” For the purposes of the trip analysis, these sequences of trip segments are more easily understood and modeled as single trips.

Accounting for both of these phenomena results in the distribution of trips shown in Figure 5 (below):

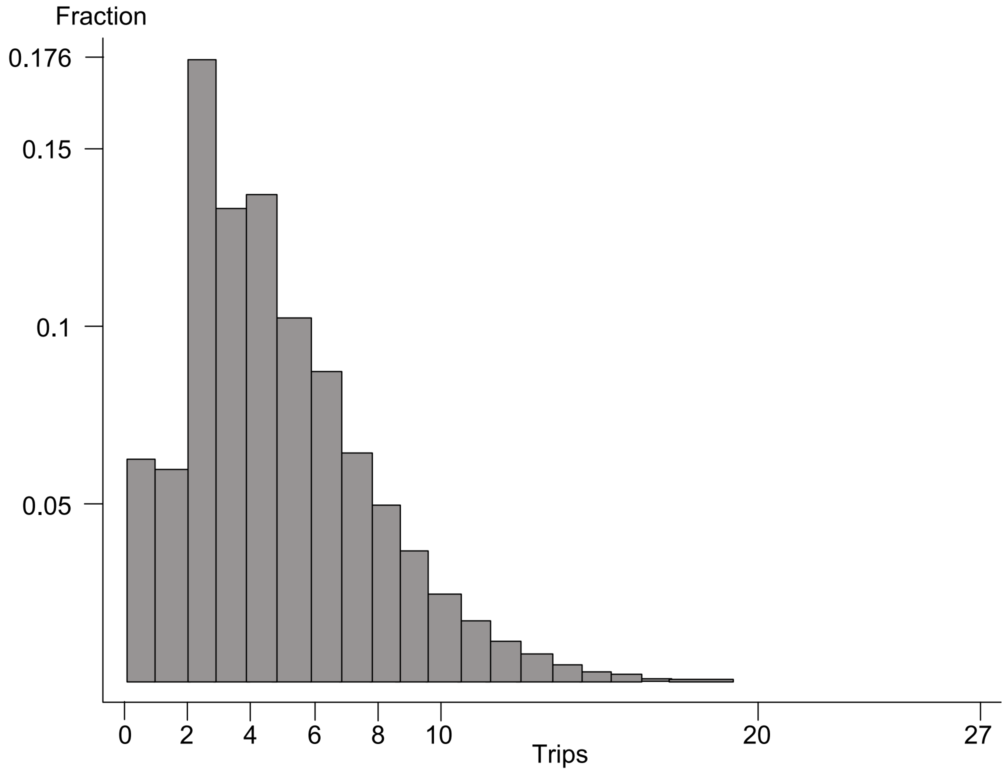


Figure 5. Trips Per Person (Refined Definition)

SOURCE: Trip File and Activity File, Bay Area Travel Survey, 2000
Universe: All individuals excluding MTC Panel (n=33,570)

Individuals of all ages made an average of 4.9 trips away from home over the two-day sample period, or about 2.5 trips away from home per day. About 6 percent of the sample did not make any trips away from home during the two-day sample period.

Trips by purpose

There are 767,289 activities in the activity database corresponding to the 33,570 individuals in the sample, for an average of 23 reported activities per person for the two-day sample period. These are listed in Table 12 (below).

Table 12. Activities by Type

Activity	Frequency	Percent
Travel	269,605	35.14
Household/ Personal Care	112,750	14.69
Meals	54,848	7.15
Recreation/Entertainment	28,508	3.71
Sleep	117,491	15.31
Work-related	45,898	5.98
School/daycare	15,661	2.04
Shop at home	410	0.05
Shop away from home	26,880	3.5
Personal Services	13,108	1.71
Social Activity	9,099	1.19
Relax	16,408	2.14
Civic	4,439	0.58
Sick/medical	3,841	0.50
Nonwork Internet	2,207	0.29
Passenger-serving	10,950	2.73
Transfer	18,617	2.43
Out of town (etc)	166	0.02
Other nonreported	1,665	0.22
Don’t know	4,636	0.60
Refused	106	0.01
Total	767,289	100

SOURCE: Activity File, Bay Area Travel Survey, 2000
Universe: all activities

We assigned trip purposes based on the nature of the activities immediately following trips. Table 13 (below) shows activities following trips away from home.

In order to carry out trip purpose modeling, we assign trip purposes to four categories: “work,” “non-work,” “passenger-serving,” and “unknown/refused.” The “work” category consists of trips followed by work and work-related activities as well as trips followed by school activities or (for young children) day care. All three activities are typically pre-scheduled and so are included in the same category. The “passenger-serving” category consists of trips followed by drop-offs or pickups. The “non-work” category includes all other activities immediately following trips away from home, such as shopping, meals, recreation and entertainment activities, and personal service activities. A fourth category, unknown purpose, is used to truncate the sample when reporting information on or analyzing trips or duration by trip purpose. About 2.5 percent of individuals (or people interviewed about other individuals in their household) do not report activity type following one or more trips away from home during the two-day survey period.

Table 13. Trips Away from Home, By Purpose

Activity	Frequency	Percent
Household/ Personal Care	1,585	0.99
Meals	18,920	11.77
Recreation/Entertainment	12,836	7.98
Sleep	276	0.17
Work-related	38,598	24.01
School/daycare	12545	7.8
Shop at home	206	0.13
Shop away from home	26,370	16.4
Personal Services	11,448	7.12
Social Activity	6,842	4.26
Relax	913	0.57
Civic	3,940	2.45
Sick/medical	3,428	2.13
Nonwork Internet	66	0.04
Passenger serving	19,943	12.4
Miscellaneous	1,665	1.04
Don't know	1,137	0.71
Refused	48	0.03
Total	160,766	100

SOURCE: Activity File, Bay Area Travel Survey, 2000

Universe: trips followed by out-of-home activities

Table 14 (below) shows the breakdown of various purposes included within the nonwork category, the most complex of the four. Four of five nonwork trips are for the purpose of shopping, meals out, recreation/entertainment, or personal services.

Table 14. Trip Purposes Included in Nonwork Category

Activity	Frequency	Percent	Cumulative
Household/ Personal Care	1,585	1.83	1.83
Meals	18,920	21.79	23.62
Recreation/Entertainment	12,836	14.78	38.40
Sleep	276	0.32	38.72
Shop at home	206	0.24	38.95
Shop away from home	26,370	30.37	69.32
Personal Services	11,448	13.18	82.51
Social Activity	6,842	7.88	90.39
Relax	913	1.05	91.44
Civic	3,940	4.54	95.98
Sick/medical	3,428	3.95	99.92
Nonwork Internet	66	0.08	100
Total	160,766	100	

Trips by mode

Travel mode is provided in great detail in the BATS survey database. Below is a somewhat simplified version. Table 15 shows mode for all trips, regardless of destination or segmentation.

The second table shows mode only for trips away from home and for the final segment of trips with multiple segments.

Table 15. Travel Mode for All Trips and Trip Segments

Activity	Frequency	Percent
Car-POV	227,744	81.74
Walk	30,612	10.99
Bus	6,618	2.38
Light Rail	4,624	1.66
Bike	3,791	1.36
Unknown	2,472	0.89
Light Rail	1,060	0.38
Carpool	762	0.27
Air	381	0.14
Taxi	311	0.11
Ferry	256	0.09
Total	278,631	100

SOURCE: Activity File, Bay Area Travel Survey, 2000
Universe: activities following trips

Table 16. Travel Mode for Trips Away from Home

Activity	Frequency	Percent
Car-POV	143,877	86.50
Walk	15,538	9.34
Bus	2,266	1.36
Light Rail	1,886	1.13
Bike	1,101	0.66
Unknown	612	0.37
Light Rail	434	0.26
Carpool	265	0.16
Air	183	0.11
Taxi	146	0.09
Ferry	24	0.01
Total	166,332	100

SOURCE: Activity File, Bay Area Travel Survey, 2000
Universe: activities following final segment of trips not terminating at residence

Note that rail is substantially less well-represented when trip mode is defined as the mode of the final trip segment for travel away from home. This may be because rail use often requires a further transfer to reach the final destination. This would explain why the rail and light rail categories are a substantially lower percentage of trips when trips are defined as sequences of segments and mode for the sequence is assigned based on the mode of the final segment.

We aggregate mode information into three categories. Personally operated vehicle (POV) includes any vehicle operated by an owner, including cars, trucks, vans, motorcycles, and carpools. POV also includes taxi trips, which are a very small share of total trips. The transit category includes bus, light rail, or rail. Ferry is excluded (and has a very small share). The third mode combines trips on foot or bicycle. Finally, some trips have no mode of travel reported.

People reporting one or more trips with unknown mode are not included in the analysis, which truncates about three percent of the sample. Finally, airplane trips are not modeled, but individuals making one or more air trips during the two-day survey period are still included in the analysis.

Figure 6 shows the distribution of POV trips for individuals in the survey. About 13 percent of the sample makes no POV trips away from home at all over the two-day period. About half the sample makes four or more such trips.

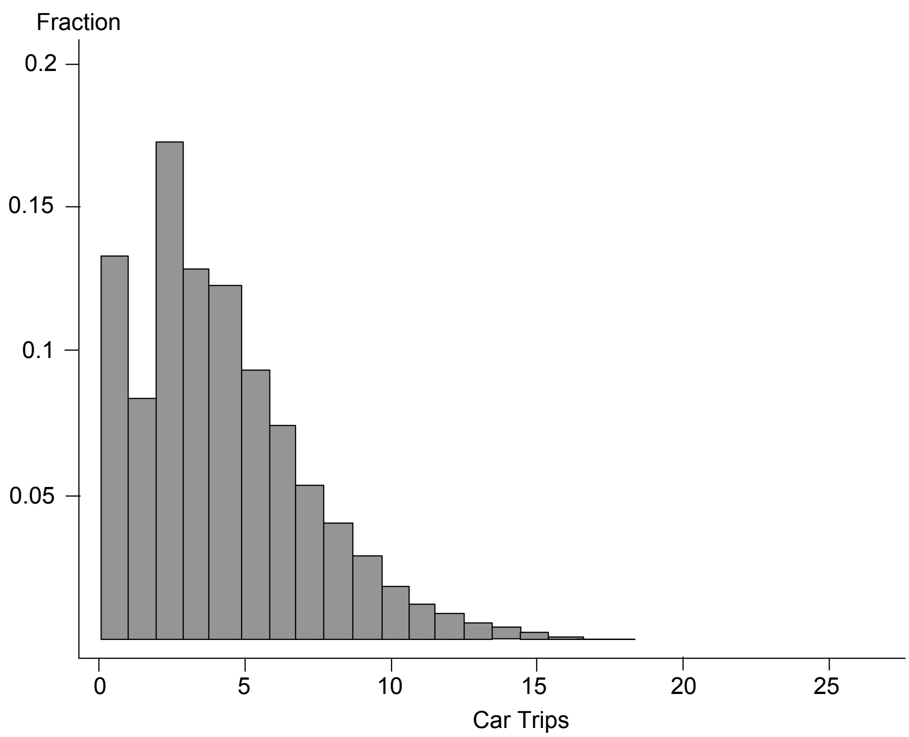


Figure 6. Auto Trips Per Person, Two-Day Period

SOURCE: Activity File, Bay Area Travel Survey, 2000

Transit trips are substantially less frequent. About 95 percent of the sample made no transit trips over the two-day survey period. Figure 7 (below) shows the distribution of transit trips among those who made at least one trip.

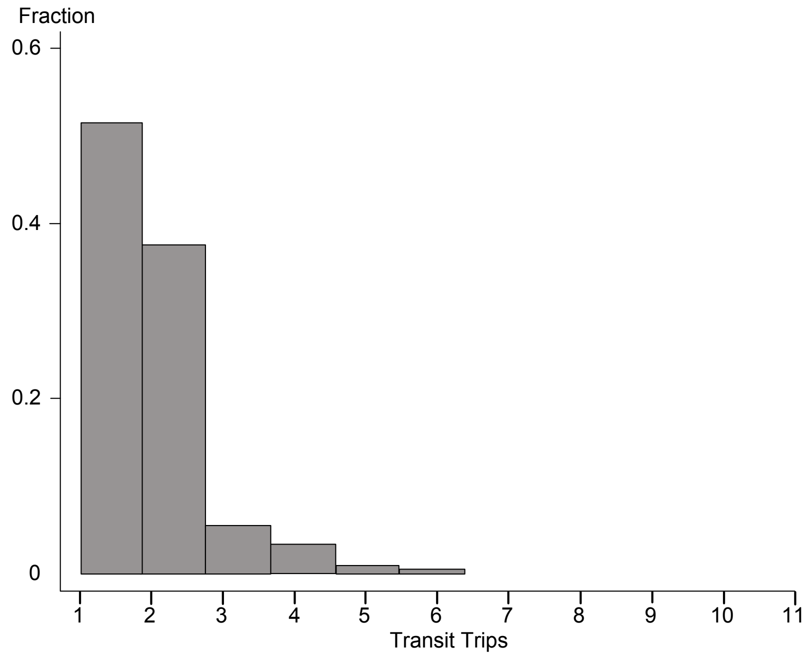


Figure 7. Transit Trips Per Person for Transit Riders

SOURCE: Activity File, Bay Area Travel Survey, 2000
Universe: individuals with one or more final segments of trips away from home using bus, rail or light rail.

As noted above, this summary information is for final segments of trips whose final destination is away from home. When all trips are included, such as trips returning home and all trip segments, the percentage of individuals making at least one trip on transit increases from 5 to 10 percent, and the mode split for aggregate trips sample-wide increases from 1.9 to 4.1 percent. For the purpose of the trip analysis by purpose and mode, we are comfortable with characterizing mode using only the final segment for trips whose destination is away from home. However, for comparison purposes, it is useful to also examine travel duration by mode, which includes all travel activities.

With both definitions of trips, walking and biking comprises a substantially higher share of travel than transit. For all travel activities, walking and biking make up 12.3 percent; for the final segment of trips away from home, 10.5 percent.

Travel duration

Average travel time by mode is similar across the major mode categories in the Bay Area sample. Walk/bike trips and POV trips are both between 24 and 25 minutes in duration on average. Transit trips are a bit shorter at between 21 and 22 minutes. This concurrence may reflect a preference for trips not to exceed a certain threshold, regardless of mode, at least to the extent that individuals have choices of mode.

Table 17. Average Trip Duration by Mode

Mode	Duration (minutes)
Car/POV	24.72
Transit	21.48
Walk/bike	24.17
Ferry	8.61
Air	292.65
Unknown	47.41

Source: Activity File, Bay Area Travel Survey, 2000

Universe: all trips (includes trips with duration coding errors)

Among individuals in the Bay Area, Table 18 shows the mean cumulative travel time for all travel activities (including all trip segments and trips returning home), over a two-day period.

Table 18. Total Travel Duration by Mode, 2-Day Period

Mode	Duration (minutes)
Car-POV	150.3
Transit	6.3
Walk/bike	21.0
Total	180.9

Source: Activity File, Bay Area Travel Survey, 2000

Universe: individuals w/ full mode info, no duration coding errors (n=31,179)

Note: Total does not equal sum, due to omitted modes (e.g., ferry, air)

4.3 Demographic Characteristics

The basic empirical travel models include all of the variables in the BATS dataset that are also available in the statewide demographic projections for 2015 and 2025. Those variables are age, race/ethnicity, and sex. Below we summarize the results of initial investigations of these variables.

Race and ethnicity

The 2015 and 2025 Census tract demographic projections categorize people as falling within one of five exclusive categories: non-Hispanic Asian-American and Pacific Islander, non-Hispanic African-American, non-Hispanic White, non-Hispanic Native American, or Hispanic. About ten percent of the BATS respondents did not classify themselves as falling within one of these canonical race/ethnicity categories. We carried out a systematic review of these individuals and in most cases assigned them to one of the categories in order to preserve the usability of the data as much as possible. However, some respondents were not classifiable and so are reported here as "3+ race/ethnic categories." Finally, for 3 percent of individuals, information was unavailable due to proxy interviewing or because respondents refused to answer.

Table 19. BATS Survey Respondents by Race/Ethnicity

Race/Ethnicity	Frequency	Percent
White	25,873	77.01
Asian/Pacific Islander	3,292	9.81
Hispanic	1,815	5.41
African American	1,140	3.40
Native American	190	0.57
3+ Race/Ethnic Categories	339	1.01
Did not report	921	2.74
Total	33,570	100.00

Source: Activity File and Person File, Bay Area Travel Survey, 2000

Based on our investigation of recently released Census data for several Bay Area counties, this sample is not representative of the distribution of individuals among race/ethnicity categories in the Bay Area in 2000. Non-White individuals are generally significantly under-represented in all categories. This does not necessarily raise a concern about the validity of the modeling carried out here, since race/ethnicity is explicitly controlled for in the models. However, to the extent that unobserved characteristics relevant to travel, such as access to transportation infrastructure, household assets, and education, vary along with race and are not included in the empirical models, there is a possibility that the unrepresentative sample creates bias.

There appears to be rough parity among racial/ethnic groups in work/school trips, with the exception of Native Americans, who have fewer work trips on average without controlling for other variables such as age (see Table 20. Average Trips by Racial/Ethnic Group By Purpose). There appear to be some bigger differences in the non-work trip category, with the margin between Whites and other groups being fairly substantial.

When tabulating the average number of trips by mode (in Table 21) for the different racial/ethnic groups, there are two striking things to point out. First, the gap between Whites and African Americans in trips made via personally operated vehicles is quite large—more than a half trip per day (i.e., 1.13 trips per two-day period). Similarly, African Americans are substantially higher than the other groups in transit trips. However, note that the transit mode share even among African Americans is substantially less than 10 percent. The walk/bike share is at least twice as high as the transit share for all racial/ethnic groups.

Table 20. Average Trips by Racial/Ethnic Group By Purpose

Ethnicity	Work/ school	Non-work	Passenger - Serving
White	1.45	2.67	0.56
Asian/Pacific Islander	1.49	2.00	0.63
Hispanic	1.48	1.90	0.64
African American	1.42	1.76	0.50
Native American	1.18	1.75	0.68
3+ Race/ Ethnic Categories	1.45	2.17	0.42

Source: Activity File and Person File, Bay Area Travel Survey, 2000

Universe: Individuals reporting race/ethnicity (n=32,649)

Table 21. Average Trips by Racial/Ethnic Group by Mode

Ethnicity	POV	Transit	Walk/Bike
White	4.11	0.07	0.49
Asian/Pacific Islander	3.60	0.1	0.41
Hispanic	3.50	0.13	0.39
African American	2.98	0.22	0.49
Native American	3.16	0.10	0.35
3+ Race/ Ethnic Categories	3.37	0.17	0.49

Source: Activity File and Person File, Bay Area Travel Survey, 2000

Universe: Individuals reporting race/ethnicity (n=32,649)

Age

Age is often represented in regression models as a continuous variable, sometimes with the addition of a squared term to represent some expected nonlinearity in the relationship between age and the amount of travel. For example, travel may (on average) initially increase with age but at a slower rate as people get older, eventually decreasing in the older age categories. Figure 8 (below) shows the modeled relationship between age and total trips when age is represented as a continuous variable and the squared and cubed value of age is also entered into the model.

A more flexible way of representing such nonlinearity in the relationship between age and the amount of travel is to carry out a "piecewise" regression in which the age distribution is broken up into groupings. This method is particularly well suited to this particular travel forecasting situation because the age distribution in the Phase II demographic forecasts has already been broken up in this way, into twenty age categories ranging from 0 to 4 years old up to 85 years and up. This is shown in Figure 9 (below).

A statistical test of model fit shows that a piecewise representation of age is far superior to a representation of age with a combination of linear and exponential terms, and so this is the way that we represent age in the empirical models.

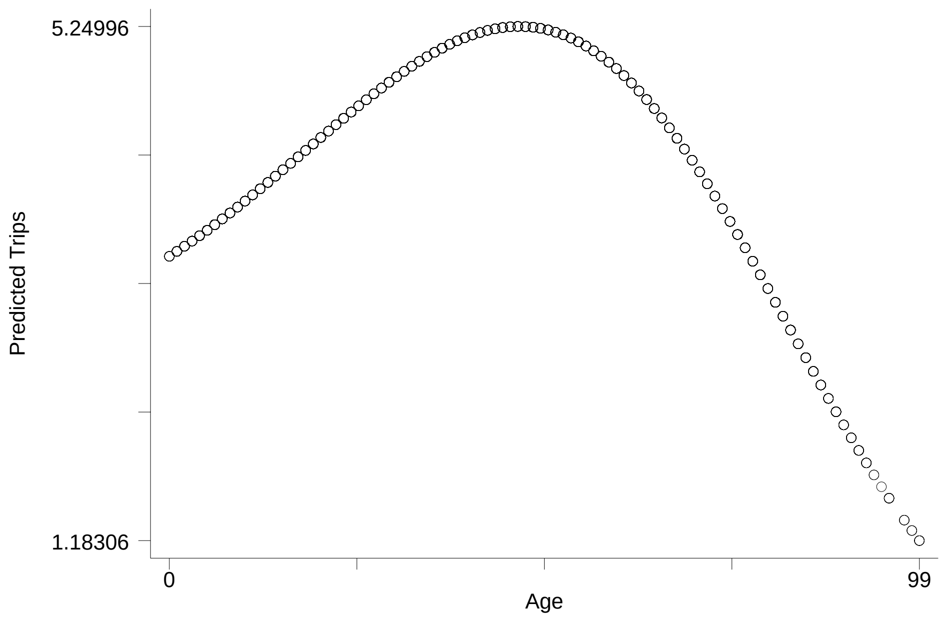


Figure 8. Predicted Trips using Age, Age Squared, and Age Cubed (Negative Binomial Regression)

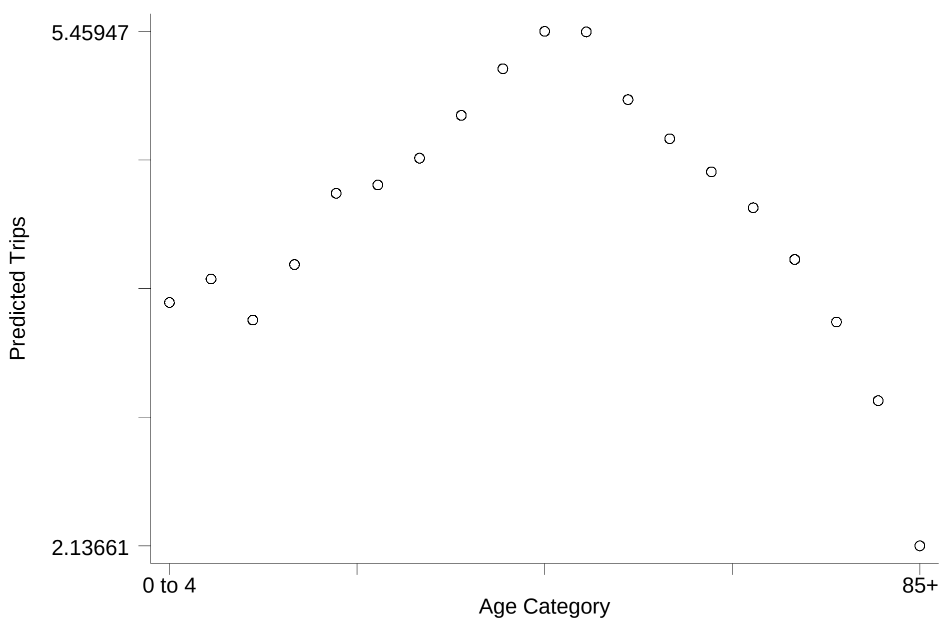


Figure 9. Predicted Trips Using Age Categories (Negative Binomial Regression)

The sample of respondents is distributed by age category as follows (see Table 22. below).

Table 22. Persons by Age Category

Age	Frequency	Percent
0 to 4	1,512	4.61
5 to 9	2,111	6.44
10 to 13	1,776	5.41
14 to 17	1,598	4.87
18 to 20	723	2.20
21 to 24	915	2.79
25 to 29	1,918	5.85
30 to 34	2,573	7.84
35 to 39	2,963	9.03
40 to 44	3,121	9.51
45 to 49	3,201	9.78
50 to 54	3,032	9.24
55 to 59	2,256	6.88
60 to 64	1,585	4.83
65 to 69	1,225	3.73
70 to 74	1,043	3.18
75 to 79	748	2.28
80 to 84	312	0.95
85 to 100	183	9.56
Total	32,801	100

SOURCE: Bay Area Travel Survey, 2000

Sex

About 54 percent of the BATS 2000 sample is female. The following tables report mean trip making for three major trip purposes: work/school, non-work, and passenger-serving.

We test later whether the observed differences are statistically significant, but on this first look there seem to be some non-trivial differences. Women average a total of about 4.9 trips away from home over the two-day survey period, while men average about 4.5 trips. Recall that these are trips (or combined trip segments) away from home. For the unrefined definition of trips the figures are 7.9 and 7.5 for females and males respectively (8.3 and 7.8 for adults).

Table 23. Average Trips by Sex by Purpose, All Ages

Sex	Work/ school	Non-work	Passenger - Serving	Total
All Ages				
Male	1.60	0.43	4.33	4.33
Female	1.32	0.69	4.72	4.72
Adults				
Male	2.30	1.70	4.54	4.54
Female	2.70	1.32	4.94	4.94

SOURCE: Bay Area Travel Survey, universe: individuals 18 and older with full trip purpose and sex information (n=25,928)

Women make fewer work trips, but more non-work and passenger serving trips. Whether these differences are statistically significant when controlling for other determinants of travel is tested in the next section.

Similarly, by mode women and men show different patterns. As shown in the tables below, women and men make nearly the same amount of trips by transit and by walking or biking as men, but they make about 0.4 more trips per day by personally operated vehicle (whether as a driver or a passenger).

Table 24. Average Trips by Sex by Mode

Sex	POV	Transit	Walk/Bike	Total
All Ages				
Male	3.74	0.09	0.50	4.33
Female	4.17	0.08	0.46	4.72
Adults				
Male	3.94	0.08	0.52	4.54
Female	4.39	0.07	0.48	4.94

SOURCE: Bay Area Travel Survey, universe: individuals 18 and older with full trip purpose and sex information (n=25,928)

Discussion of demographic variables

When forecasting with zones, differences in travel behavior by males and females may seem likely to be of interest only when forecast zones (Census tracts) have a preponderance of one or the other sex. Since this may frequently occur in institutional settings such as prisons or college dormitories, where the model developed here may be less applicable, the value of using sex in the forecast model may seem low.

However, women tend to be a greater proportion of the population as it ages. In turn, women and men have differences in licensing rates, particularly in older cohorts contemporarily, and in the tendency to give up driving as they age. Licensing rate parity is likely to be more common in the future if current trends project forward. See Figure 10 (below) for a graph showing licensing by age for the BATS 2000 sample. It is less clear whether women will continue to cease driving earlier than men. This certainly depends in part on whether other transportation alternatives are available, such as transit, paratransit, family members available to chauffeur, as well as whether the resources available to purchase fee-for-service transportation such as taxi service.

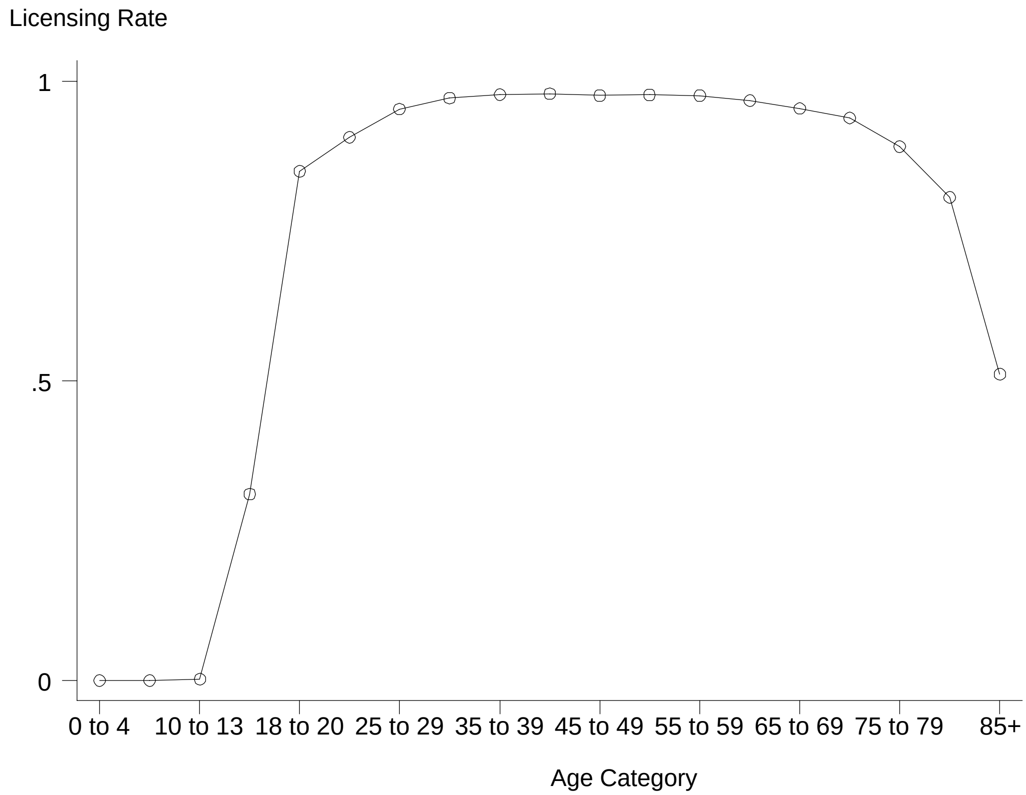


Figure 10. Licensing Rates by Age Category

SOURCE: Bay Area Travel Survey

Universe: individuals 18 and older with full trip purpose and sex information (n=25,928)

The licensing rate in the Bay Area is quite high in all cohorts. Men and women have approximately the same level of licensing through the 30 to 34 age cohort, but men are slightly higher at all levels. In older age cohorts, the differences are more drastic. Women in older cohorts have substantially lower rates of licensing than men. This is likely to change in the future, because the younger cohorts are essentially at licensing parity (see Table 25, below).

Licensing is investigated to some extent in the more elaborate empirical models presented later in this section. Because licensing and travel behavior are causally related to the same demographic characteristics, licensing cannot be interpreted as a causal factor in travel behavior with the data available to us. The same is true of vehicle ownership (controlling for income).

4.4 Land Use Variables

In addition to the demographic variables, we include two variables to represent land use in the initial empirical model: gross population density of the regional transportation analysis zone (TAZ) and an index for population accessibility using information on surrounding zones (see below). These particular variables are investigated first because they can be generated for the statewide projections using Census tract geography. The 1,099 regional TAZs are fairly large, averaging 6.3 square miles in area (4,037 acres).

Table 25. Licensing Rates by Age and by Sex

Age	Male	Female
14 to 17	0.31	0.31
18 to 20	0.85	0.85
21 to 24	0.92	0.89
25 to 29	0.96	0.95
30 to 34	0.97	0.97
35 to 39	0.99	0.97
40 to 44	0.99	0.97
45 to 49	0.98	0.97
50 to 54	0.98	0.97
55 to 59	0.99	0.97
60 to 64	0.98	0.95
65 to 69	0.98	0.93
70 to 74	0.99	0.91
75 to 79	0.98	0.87
80 to 84	0.98	0.73
85 to 100	0.69	0.39

A total of 1,043 regional TAZs are represented in the travel survey by resident households. With 33,570 individuals and 14,561 households, that represents an average of 32 people, or 14 households, per zone. Land use characteristics are reported based on this geography, so that all individuals and households within a given zone are assigned the same land use variables.

Gross residential density

The gross residential density of the regional TAZ in which each traveler lived at the time of the survey (in 2000) is calculated by taking estimates of 2000 total population from the Metropolitan Transportation Commission and dividing by the area of the zone in acres. The resultant density factor is thus in units of total population (i.e., including non-household population living in institutions, dormitories, and prisons) per gross acre (i.e., including streets, nonresidential uses, and non-developable land):

$$GROSSRESDEN = \frac{zone\_pop}{zone\_area}$$

In the nine-county Bay Area, gross residential density by TAZ varies a great deal depending on location. It ranges from a low of 3 residents per acre in Napa County to a high of 39 residents per acre in San Francisco County. Figure 11 (below) shows the gross density range for zones represented by survey respondents (thus, zones are represented in the sample weighted by the number of surveyed individuals residing in the zone).

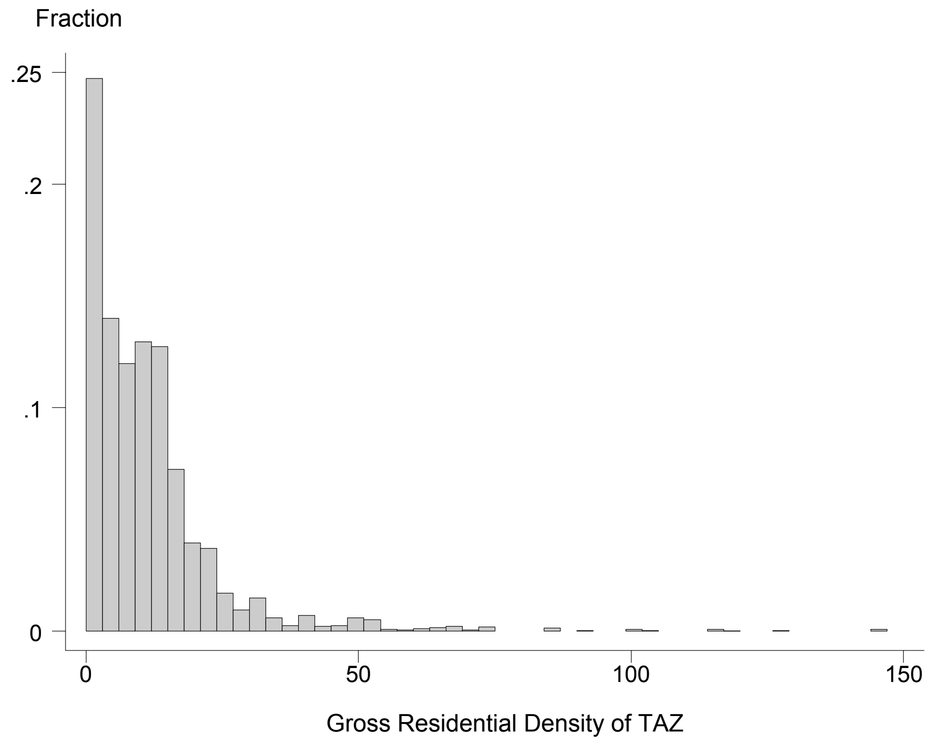


Figure 11. Gross Residential Density for Respondent Transportation Analysis Zones

Source: Bay Area Travel Survey, 2000 MTC Zonal Data, 2000

Simple OLS regressions of trips by various modes on gross residential density are essentially equivalent to carrying out a simple correlation analysis. These regressions show that gross residential density has a statistically significant correlation with the number of trips away from home for all purposes and all modes. These initial simple tests show the following:

- People living in TAZs with a higher number of residents per acre make more trips away from home than those in lower density TAZs.
- Higher residential density is associated with more trips to work, school and daycare, more trips for non-work purposes, and fewer passenger-serving trips.
- Higher residential density is associated with fewer trips made by car, more trips made by transit, and more trips made by walking or biking.
- For the most part, the magnitude of the relationships is low. The fact that the relationships are statistically significant is in part a function of the large data set. For example, those living in the highest residential density TAZs (above 80 persons per acre, less than one percent of the sample) make about half a trip more per day than those at the very lowest level (between 0 and 2 persons per acre). This is an increase of about ten percent increase in tripmaking for a density increase of a hundredfold (that is, ten thousand percent). Note that this is before controlling for all other factors that might be correlated with gross residential density.

Population accessibility

The population accessibility index (POP_ACCESS) is generated by summing the population of each zone within five miles of the residence zone and dividing by the square of the distance for any zones greater than one mile away. In mathematical notation:

$$POP\_ACCESS = \sum_i \frac{zone\_pop}{centroid\_dist} + \sum_j \frac{zone\_pop}{centroid\_dist^2}$$

where *i* refers to the set of zones within one mile of the household residence zone, and *j* are the zones between one and five miles away. The five mile distance was chosen in order to maximize the area included in the summation of population while minimizing the problems with fringe areas at the borders of the region and (for the projections model) borders with other states, because the data does not include information about some nearby zones for such fringe zones.

In the Bay Area using the regional TAZ geography, the population accessibility variable ranges from 4,350 to 255,000 population. Figure 12 (below) shows its distribution in the sample of survey respondents.

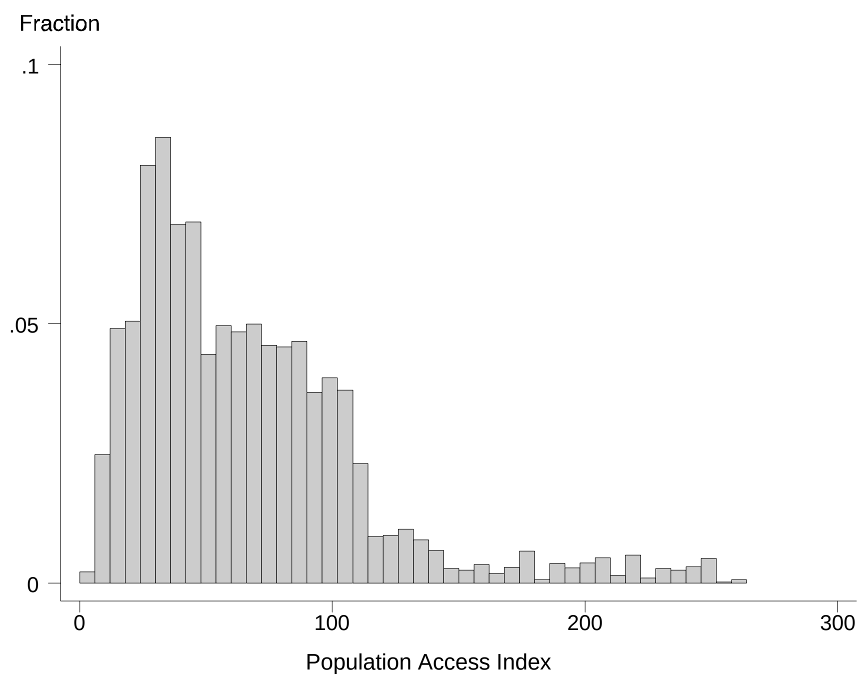


Figure 12. Population Access Index for Respondents by Transportation Analysis Zones

As with gross residential density, we carried out a number of simple regressions using the dependent variables described previously. When accessibility is represented as a single continuous variable, lower population accessibility increases overall trip making by a small amount. This is a linear effect because the accessibility value is represented linearly. In initial testing of the forecast model, this results in high projected per capita travel in remote zones, probably much higher than we would expect. Representing this variable nonlinearly with thresholds provides a better fit. We tested this specification against ones in which accessibility is logged, when squared and cubed terms are added, and found that the thresholds technique is statistically superior.

The population accessibility index is highly correlated with other indices calculated using the MTC travel model zone-to-zone peak travel times by drive alone vehicle and transit. Those accessibility indices are calibrated to the MTC travel model, and rely on specific knowledge of regional network conditions. Thus they cannot be replicated in the projections model. We tested these alternative accessibility indices in models of trips and travel duration by mode by purpose, and found that the simple five-mile accessibility index fit the data as well or nearly as well as the more sophisticated MTC indices in many cases.

The population accessibility index is also highly correlated with the residential density index. This is not surprising since they are both residential population measures. We have used both land use measures in the models, but using only one or the other at a time results in a higher level of statistical significance due to collinearity.

Discussion of land use variables

The statistical significance of the land use variables is the initial simple regressions undoubtedly partly due to their correlation with a number of other static and dynamic features of the travel environment. First, higher density and greater population accessibility within a five-mile radius are likely correlated with the distance to activity centers such as downtowns. This implies that increasing the gross residential density of single zone without concurrent changes in the larger urban spatial structure is unlikely to show a travel effect. Second, higher density areas have better transit service and more congestion on roads. Also, some higher density areas in the Bay Area were built for good pedestrian access before the dominance of auto use. In such cases, the apparent effect of density and population accessibility is partially attributable to the increased attractiveness of alternative modes in comparison to auto use.

4.5 Basic Travel Models

Our first multiple regression models use all the information available in the demographic projections, as explained above. We use negative binomial regressions to model the number of trips taken by each individual in the data set, dropping individuals who lacked a complete set of the dependent variables, who had incomplete mode reporting information, or who had incomplete trip purpose information. Of the 33,570 individuals in the full data set, 30,375 (90 percent) are used. To model travel duration, we use ordinary least squares, excluding those with unfixable coding errors and other intractable problems with duration reporting.

Independent variables

Using the same basic group of explanatory variables, each of the following measures of travel behavior, created by using the activity file and the person file in the BATS database, is investigated separately. The initial results of those investigations are used to predict travel for all

Census tracts in the state. Because the Bay Area Travel Survey took place over two days, the independent variables are for a two-day period.

- Total trips
- Work trips by personally operated vehicle
- Work trips by transit
- Work trips on foot or bicycle
- Nonwork trips by personally operated vehicle
- Nonwork trips by transit
- Nonwork trips on foot or bicycle
- Passenger-serving trips by personally operated vehicle
- Passenger-serving trips by transit
- Passenger-serving trips on foot or bicycle
- Total cumulative travel duration
- Travel duration by personally operated vehicle
- Travel duration by transit
- Travel duration on foot or bicycle

Dependent variables for basic travel models

Each of the independent variables requires a separate model. Furthermore, while modeling total trips and total travel duration is a natural way to begin the investigation, there are numerous reasons to expect that prediction results will be more reliable if those variables are further subdivided into the subcategories by mode and purpose as noted in the list above. For example, we would expect that particular land use measures (such as retail and service employment density, a proxy for mixed-use development) are likely to have different effects depending on the purpose of the trip (such as non-work activities like shopping and recreation/entertainment, vs. work activities).

For each of the basic models we use the same group of explanatory variables, namely all of the variables available in the demographic projections. This is in order to maximize the amount of variance accounted for in the travel demand trend projections.

In our initial explorations of the data (see above), we found that age, population density, and the population accessibility index were better represented as categorical variables than as continuous variables. This was as we expected, because representing them in this way accounted for nonlinearity or threshold effects that are discussed in the literature. For example, once children reach driving age, many of them rather rapidly begin taking many more automobile trips. Similarly, we would expect a steep drop-off in work trips on average for people reaching retirement age. In the case of land use, there are several examples of potential threshold effects. For example, development density tends to be correlated with the availability of transit at particular density thresholds, which might lead to an increase in transit trips (and a decrease in auto trips) at a particular density level.

Therefore we broke the continuous variables into groups. In the case of age, we used the same 19 categories as those available in the Phase II demographic projections (see below). For both the gross population density variable and the population accessibility index, we created about ten categories of approximately equal size.

Breaking up the land use variables into categories, rather than representing them as continuous variables, was also particularly useful in solving two problems with applying the empirical model for forecast purposes. First, the Bay Area zones (regional transportation analysis zones) are larger than the statewide zones (2000 Census tracts, with very slight modifications). This appears to increase the calculated population accessibility index levels in the statewide zonal data. Representing the data categorically mitigates the mismatch between the two measures. Second, because large population increases are projected for forecast years, many zones exceed the highest gross density values and highest population accessibility values found in the Bay Area data. Because we do not have enough data to confidently estimate the effect of out-of-range density figures, it is more appropriate to treat such zones the same as other zones in the top tenth of the Bay Area sample.

Thus, there are a total of 45 basic demographic and land use variables: five variables representing race/ethnicity; one variable representing sex; 18 variables representing age; nine variables representing gross population density of the transportation analysis zone; and twelve variables representing the population accessibility index.

Results from the basic trip count models

Results from the basic trip count models are presented in Table 26 (following this page) and Table 29 (p. 62). The tables compactly present the empirical relationships between trip making and a limited set of demographic and land use variables, for ten models: total trips, and nine models of trips by purpose by mode (three purpose categories by three mode categories). The regression results are split into two tables because of space limits: Table 26 shows the demographic variables, and Table 29 shows the land use variables included in the model.

Both tables report incidence risk ratios, which are estimates of how the number of trips in the variable category compares to that in the base category. If the estimated ratio is large enough, or the variance in the sample is small enough, the estimate will be statistically significant and will indicate that the variable seems to be strongly associated with a difference in trip making between two or more groups.

For example, examine the results from the empirical model of total trips. This model is summarized in the first column in both tables. The travel behavior being explained is the total number of trips away from home taken by individuals using all modes and for all purposes. Looking specifically at Table 26, which reports results for demographic variables, the incidence risk ratio for women compared to men is 1.085 (this is the figure in the upper left hand corner of the table). This means that women are estimated to make 1.085 times the number of total trips that men make, when controlling for their race/ethnicity, their age, and the density and population accessibility of their residential zone.

The number below the incidence risk ratio is the Z-statistic. When this figure is large, it denotes that the amount of estimation error is small enough, or the estimated magnitude large enough, that a real (non-zero) relationship exists. Three asterisks denote a 99 percent probability, two asterisks a 95 percent probability, and one asterisk a 90 percent probability of statistical significance. In the case of the incidence risk ratio (IRR) for women making trips by all modes and purposes, the statistic is highly significant and it is clear that women make more trips than men regardless of race/ethnicity, age, or land use characteristics.

Many of the empirical regression model results are similar to those already pointed out in the simple tabulations in the previous section, meaning that even when we control for other correlates they appear to be strong correlations.

Table 26. Basic Trip Count Model, Part 1: Demographic Variables

		POV Trips by Purpose			Transit Trips by Purpose			Walk/Bike Trips By Purpose		
	Total Trips	Work/ School/ Daycare	Nonwork Activities	Pass.- Serving	Work/ School/ Daycare	Nonwork Activities	Pass.- Serving	Work/ School/ Daycare	Nonwork Activities	Pass.- Serving
Female	1.085	0.827	1.204	1.521	0.883	0.888	1.715	0.771	1.011	1.835
	(11.28***)	(15.66***)	(17.41***)	(16.09***)	(1.89*)	(1.22)	(1.82*)	(7.11***)	(0.34)	(5.27***)
Asian/Pac. Isl.	0.871	0.979	0.801	1.053	1.208	1.075	1.031	0.735	0.636	1.287
	(7.85***)	(0.95)	(7.62***)	(1.02)	(1.71*)	(0.4)	(0.08)	(4.50***)	(6.15***)	(1.21)
Hispanic	0.864	0.956	0.773	1.117	1.698	1.502	0.456	0.744	0.597	0.843
	(6.24***)	(1.56)	(6.58***)	(1.66*)	(3.89***)	(2.21**)	(0.99)	(2.83***)	(5.15***)	(0.56)
African American	0.799	0.867	0.671	0.895	2.832	2.222	6.879	1.021	0.691	0.93
	(7.19***)	(3.20***)	(7.24***)	(1.11)	(5.44***)	(3.61***)	(4.98***)	(0.2)	(2.88***)	(0.19)
Native American	0.767	0.76	0.657	1.47	1.567	1.419	0	0.671	0.686	0.415
	(3.79***)	(3.07***)	(3.97***)	(1.73*)	(0.91)	(0.68)	(56.97***)	(1.43)	(1.41)	(0.78)
3+ Ethnicities	0.921	0.981	0.879	0.759	1.404	2.584	4.967	1.101	0.851	1.204
	(1.68*)	(0.29)	(1.67*)	(1.69*)	(1.45)	(2.57**)	(1.93*)	(0.54)	(0.81)	(0.28)
Age 0 to 4	0.691	0.361	0.847	0.935	0.449	0.434	0.199	0.258	0.961	3.252
	(14.34***)	(22.74***)	(4.60***)	(0.95)	(2.46**)	(1.97**)	(1.75*)	(7.14***)	(0.39)	(3.91***)
Age 5 to 9	0.716	0.668	0.737	0.56	2.844	1.462	0.883	1.333	0.71	0.891
	(16.57***)	(13.31***)	(9.41***)	(9.10***)	(6.23***)	(1.26)	(0.17)	(3.11***)	(3.40***)	(0.28)
Age 10 to 13	0.668	0.588	0.631	0.463	4.219	2.525	1.173	1.828	1.002	1.272
	(19.84***)	(15.78***)	(12.81***)	(11.48***)	(9.50***)	(3.72***)	(0.26)	(7.04***)	(0.02)	(0.73)
Age 14 to 17	0.722	0.791	0.627	0.513	3.504	2.069	0	1.468	0.965	0.539
	(15.11***)	(7.36***)	(12.69***)	(8.85***)	(7.77***)	(3.17***)	(32.59***)	(4.07***)	(0.37)	(1.48)
Age 18 to 20	0.827	0.929	0.82	0.499	1.516	1.182	1.177	1.219	0.732	0.21
	(6.05***)	(1.76*)	(4.11***)	(6.73***)	(1.61)	(0.5)	(0.19)	(1.47)	(2.16**)	(2.33**)
Age 21 to 24	0.833	0.93	0.759	0.407	1.977	1.708	2.205	1.454	1.138	0.701
	(6.55***)	(1.87*)	(6.10***)	(8.33***)	(3.71***)	(1.87*)	(1.23)	(3.14***)	(1.13)	(0.8)
Age 25 to 29	0.862	0.844	0.841	0.519	1.444	1.489	0.722	1.468	1.284	0.466
	(6.85***)	(5.33***)	(4.83***)	(8.53***)	(2.25**)	(1.85*)	(0.41)	(4.54***)	(2.90***)	(1.91*)
Age 30 to 34	0.906	0.889	0.867	0.79	1.545	1.073	1.806	1.132	1.194	1.876
	(5.09***)	(4.24***)	(4.70***)	(3.94***)	(2.75***)	(0.33)	(1.05)	(1.51)	(2.11**)	(2.26**)
Age 35 to 39	0.971	0.92	0.921	1.063	1.197	0.959	0.774	1.005	1.001	2.842
	(1.64)	(3.20***)	(2.96***)	(1.18)	(1.15)	(0.19)	(0.36)	(0.06)	(0.02)	(4.17***)
Age 40 to 44	1	0.961	0.975	1.114	1.042	1.019	0.919	0.887	0.899	2.739
	(0.02)	(1.58)	(0.95)	(2.09**)	(0.26)	(0.08)	(0.12)	(1.4)	(1.31)	(3.81***)
Age 50 to 54	0.919	0.968	0.997	0.585	0.973	1.562	0.494	0.926	0.908	0.596
	(4.70***)	(1.27)	(0.11)	(8.80***)	(0.15)	(2.11**)	(0.92)	(0.9)	(1.12)	(1.53)
Age 55 to 59	0.875	0.846	1.049	0.417	0.931	1.059	0.129	0.706	0.905	0.295
	(6.52***)	(5.26***)	(1.66*)	(11.59***)	(0.36)	(0.24)	(2.69***)	(3.57***)	(1.12)	(2.52**)
Age 60 to 64	0.834	0.623	1.135	0.406	0.854	1.656	0.333	0.434	0.959	0.107
	(7.70***)	(10.90***)	(3.93***)	(8.90***)	(0.67)	(2.07**)	(0.91)	(6.50***)	(0.39)	(3.08***)
Age 65 to 69	0.786	0.358	1.233	0.392	0.182	1.774	0.858	0.214	0.903	0.207
	(9.16***)	(14.96***)	(6.45***)	(9.89***)	(3.61***)	(2.05**)	(0.17)	(6.97***)	(0.93)	(2.52**)
Age 70 to 74	0.727	0.166	1.226	0.385	0.213	2.08	0	0.15	1.065	0.16
	(10.58***)	(18.92***)	(5.65***)	(8.58***)	(2.67***)	(2.83***)	(29.54***)	(7.98***)	(0.54)	(2.52**)
Age 75 to 79	0.645	0.093	1.124	0.341	0.13	3.087	0	0.079	0.811	0.231
	(12.72***)	(18.38***)	(2.95***)	(8.36***)	(2.71***)	(3.35***)	(30.82***)	(7.25***)	(1.56)	(1.96**)
Age 80 to 84	0.558	0.059	1	0.228	0.111	3.895	0	0.12	0.811	0.281
	(11.74***)	(11.33***)	(0)	(7.06***)	(2.18**)	(2.96***)	(31.06***)	(4.37***)	(0.85)	(1.22)
Age 85 and Up	0.39	0.046	0.693	0.238	0	1.882	0	0	0.486	0
	(11.05***)	(7.16***)	(4.16***)	(4.94***)	(75.53***)	(0.84)	(30.87***)	(103.32***	(2.23**)	(50.16***)

We discuss Table 26 (above) first. The demographic variables are categorical explanatory variables, which represent the relative effect on an individual's trip making tendency of being in a particular category for a characteristic type (e.g., race or sex). The relevant comparison is with the category within each characteristic type that is omitted from the regression equation. The omitted category is represented in the constant term (in the case of the negative binomial regressions, the constant is not reported). For age, for example, the omitted category is age 45 to 49 (the largest single cohort). For sex, the omitted category is male; for race/ethnicity, the omitted category is White.

Trip making by sex. Controlling for race/ethnicity, age, and characteristics of land uses near the household residence location, women make about eight percent more trips than men. Women make fewer work/school trips, more nonwork trips, and more passenger serving trips, particularly by car but also via walking or biking. The transit trip-making of women cannot be statistically distinguished from men's in this model. These results may be partially attributable to average employment status and household roles, not controlled for in this model.

Trip making by race/ethnicity. Controlling for age, sex, and characteristics of land uses near the household residence location, those identifying themselves as Asian-Americans / Pacific Islanders, African Americans, Hispanics, or Native Americans make fewer total trips than those identifying themselves as Whites. The overall trip making tendency of members of these groups in the Bay Area sample is closer to each other than to Whites.

In this Bay Area sample, those identifying themselves as African Americans are substantially less likely than Whites to make auto trips for any trip purpose, and are substantially more likely to make transit trips than the other racial/ethnic groups. African Americans may be more likely to live in areas with good transit access, or they may be less likely to own and use cars. African Americans in the sample are concentrated in Alameda and San Francisco Counties, areas with the most developed bus systems and some of the highest congestion and parking costs. Both explanations imply that further analysis of household income and transit availability would be useful.

Those identifying themselves as Asian Americans / Pacific Islanders and Hispanics are less likely to make work or nonwork trips on foot or bicycle than those identifying themselves as Whites or African Americans.

Those identifying themselves as Native Americans in the Bay Area are substantially less likely to use personally operated vehicles in comparison to Whites. Because Native Americans make up such a small percentage of the sample, other ratios are not statistically significant, but there is some evidence here that Native Americans are more likely to make passenger-serving trips by car than members of other racial/ethnic groups, are frequent transit users (except for passenger-serving purposes), and are infrequent users of the nonmotorized modes.

A sixth race/ethnicity category, "Three or More Race/Ethnicity Categories," is included in the model to account for as many people in the BATS survey as possible. This grouping appears more or less similar to Whites, with the exception of possibly greater transit use, although only the IRR for nonwork activities is statistically different from one.

Trip making by age. Controlling for race/ethnicity, sex, and characteristics of land uses near the household location, overall trip making by age cohort peaks within the 35-to-50 age range. Those in the 18-to-29 age range make about 80 to 85 percent of the total trips of the 40-50 cohort. This is notable, as it shows that trip making accelerates rapidly once the age of majority is attained and stays relatively steady for a decade or so. Overall trip making appears to decline steadily after the age of 65, as shown in Table 27.

Although this may change in the future with the delay in the average retirement age, work trips drop off dramatically after age 59 in the current data. For younger people, work/school trips are more frequently taken by 18-to-24 year olds than by the 25-to-34 cohort. As shown in Table 27 (below), this appears to because the younger cohort spends a lot of time both working and going to school (controlling for other factors).

Table 27. Average Number of Work and School/Daycare Trips by Age Category

Age	School/Daycare	Work/Related
0 to 4	0.64	0.01
5 to 9	1.39	0.01
10 to 13	1.36	0.03
14 to 17	1.43	0.22
18 to 20	0.79	0.98
21 to 24	0.40	1.46
25 to 29	0.18	1.57
30 to 34	0.13	1.61
35 to 39	0.14	1.61
40 to 44	0.15	1.62
45 to 49	0.11	1.74
50 to 54	0.08	1.69
55 to 59	0.05	1.51
60 to 64	0.04	1.08
65 to 69	0.05	0.59
70 to 74	0.03	0.28
75 to 79	0.04	0.14
80 to 84	0.03	0.09
85 to 100	0.04	0.07

Source: Activity File and Person File, BATS 2000
Universe: all persons, excluding MTC panel (33,570)

Nonwork auto trips are least common for the 14-to-17 cohort, and rise steadily afterwards to peak at the 70-to-74 cohort. In the 80-to-84 cohort, the rate of nonwork auto trips is still higher on average than the under-40 crowd. This is significant because nonwork trips are the highest share of trips. Note that while people in the older age cohorts are taking more car trips, the analysis currently does not control for whether they are driving or being driven.

If the elderly are being driven around, it is probably by their sons and, particularly, daughters (see previous discussion). The age 35-to-49 group makes more passenger-serving auto trips than the other age cohorts. Passenger-serving auto travel drops off dramatically after age 50.

School buses are included in the transit mode category for the purpose of this analysis, and make up 22 percent of transit trips away from home in the activity file. The transit share for work/school by age cohort reflects this, with the 5-to-17 cohort showing substantially higher rates.

Starting at age 65, as people age, they become substantially more likely to make non-work trips by all modes, but particularly by transit, when controlling for race/ethnicity and land use characteristics. However, the transit share is still quite low even for non-work trips in older age cohorts; see (below). (Note that because the simple tabulation does not control for other variables included in the regression model, the effect is somewhat less dramatic, but the share information is useful.)

Table 28. Average Nonwork Trips, by Age and by Mode

Age	POV	Transit	Walk/Bike
0 to 4	2.01	0.01	0.22
5 to 9	1.78	0.02	0.15
10 to 13	1.52	0.04	0.20
14 to 17	1.53	0.02	0.21
18 to 20	1.94	0.05	0.20
21 to 24	1.75	0.05	0.38
25 to 29	1.87	0.03	0.47
30 to 34	2.00	0.02	0.42
35 to 39	2.18	0.02	0.30
40 to 44	2.38	0.02	0.26
45 to 49	2.43	0.02	0.28
50 to 54	2.42	0.03	0.25
55 to 59	2.55	0.03	0.24
60 to 64	2.77	0.03	0.23
65 to 69	3.05	0.03	0.22
70 to 74	3.01	0.04	0.26
75 to 79	2.78	0.05	0.24
80 to 84	2.46	0.06	0.20
85 to 100	1.67	0.03	0.10

Source: Activity File and Person File, BATS 2000

Universe: all persons, excluding MTC panel (33,570)

Table 29. Basic Trip Count Model, Part 2: Land Use Variables

		POV Trips by Purpose			Transit Trips by Purpose			Walk/Bike Trips By Purpose		
	Total Trips	Work/ School/ Daycare	Nonwork Activities	Pass.-Serving	Work/ School/ Daycare	Nonwork Activities	Pass.-Serving	Work/ School/ Daycare	Nonwork Activities	Pass.-Serving
Res Den > 2/Ac.	1.02	1.006	0.997	1.057	0.911	0.839	1.268	1.237	1.112	1.818
	(0.9)	(0.21)	(0.08)	(0.85)	(0.6)	(0.71)	(0.38)	(2.07**)	(1.02)	(1.76*)
Res Den > 4/Ac.	1.021	1.063	1.038	0.859	0.701	1.601	1.162	1.027	1.142	1.487
	(0.83)	(1.84*)	(1)	(1.94*)	(1.92*)	(1.65*)	(0.23)	(0.26)	(1.23)	(1.18)
Res Den > 6/Ac.	0.939	0.937	0.921	1.008	1.232	0.84	0.7	0.943	0.919	0.754
	(2.92***)	(2.11**)	(2.48**)	(0.12)	(1.22)	(0.72)	(0.6)	(0.64)	(0.92)	(0.86)
Res Den > 10/Ac.	0.996	1.027	0.981	1.127	0.724	0.778	0.589	0.902	0.864	1.293
	(0.21)	(1.02)	(0.69)	(2.09**)	(1.97**)	(1.24)	(0.88)	(1.36)	(1.90*)	(0.97)
Res Den > 15/Ac.	0.983	0.987	0.921	0.93	1.543	1.33	1.773	1.274	1.402	1.423
	(0.92)	(0.53)	(2.97***)	(1.22)	(3.36***)	(1.52)	(1.11)	(3.43***)	(4.75***)	(1.47)
Res Den > 25/Ac.	0.996	0.873	0.907	0.874	1.251	1.604	0.576	1.445	1.415	0.999
	(0.12)	(2.93***)	(1.75*)	(1.29)	(1.29)	(2.02**)	(1.02)	(4.08***)	(3.93***)	(0)
Res Den > 45/Ac.	1.043	0.822	0.955	1.011	1.29	1.264	0	1.197	1.295	0.958
	(1.01)	(2.20**)	(0.55)	(0.06)	(1.23)	(1.12)	(33.71***)	(1.64)	(2.47**)	(0.08)
Res Den > 65/Ac.	0.994	0.738	0.892	1.129	1.024	0.605	1.3E+07	1.319	1.196	3.426
	(0.1)	(2.05**)	(0.94)	(0.46)	(0.09)	(1.47)	(17.86***)	(1.74*)	(1.32)	(1.70*)
Res Den > 100/Ac.	0.94	1.138	0.888	0.347	1.256	2.484	0.276	0.902	0.723	0.403
	(0.63)	(0.52)	(0.56)	(1.96*)	(0.71)	(1.91*)	(1.79*)	(0.46)	(1.62)	(1.04)
Pop Acc > 20,000	1.038	1.071	1.025	1.09	1.065	0.778	9263592	1.234	0.846	0.916
	(1.4)	(1.91*)	(0.67)	(1.07)	(0.33)	(0.85)	(35.81***)	(1.61)	(1.36)	(0.22)
Pop Acc > 30,000	1.032	0.932	1.04	1.164	1.109	1.165	0.529	1.127	1.201	0.501
	(1.46)	(2.31**)	(1.22)	(2.29**)	(0.64)	(0.62)	(0.95)	(1.23)	(1.87*)	(2.13**)
Pop Acc > 40,000	0.963	0.996	0.949	0.937	1.159	1.162	1.903	0.957	1.059	1.518
	(1.68*)	(0.12)	(1.62)	(0.96)	(0.87)	(0.64)	(0.97)	(0.45)	(0.56)	(1.09)
Pop Acc > 50,000	1.04	1.012	1.09	0.847	1.235	0.596	0.37	1.28	1.002	0.878
	(1.62)	(0.35)	(2.45**)	(2.21**)	(1.17)	(1.68*)	(1.25)	(2.47**)	(0.02)	(0.38)
Pop Acc > 60,000	1.042	1.031	1.027	1.126	0.845	1.322	0.547	1.015	1.338	0.546
	(1.56)	(0.81)	(0.69)	(1.44)	(0.87)	(0.85)	(0.66)	(0.14)	(2.59***)	(1.66*)
Pop Acc > 70,000	1.015	0.991	0.987	1.066	1.301	2.141	7.668	1.154	1.027	2.683
	(0.56)	(0.25)	(0.33)	(0.81)	(1.43)	(2.82***)	(2.51**)	(1.39)	(0.26)	(2.94***)
Pop Acc > 80,000	0.958	1.015	0.949	0.915	0.729	0.569	1.377	0.959	0.947	0.451
	(1.63)	(0.42)	(1.3)	(1.13)	(1.61)	(1.96*)	(0.44)	(0.41)	(0.53)	(2.23**)
Pop Acc > 90,000	1.003	1.009	1.043	0.864	1.148	0.775	0.711	0.825	1.04	0.719
	(0.12)	(0.23)	(0.94)	(1.58)	(0.56)	(0.73)	(0.5)	(1.72*)	(0.35)	(0.83)
Pop Acc > 100,000	1.031	0.929	1.006	1.012	1.167	2.671	0.774	1.341	1.53	1.244
	(1.13)	(1.88*)	(0.14)	(0.14)	(0.67)	(3.20***)	(0.31)	(2.82***)	(4.07***)	(0.65)
Pop Acc > 125,000	0.993	0.937	0.943	1.211	1.848	1.576	0.656	1.139	0.973	1.58
	(0.2)	(1.07)	(0.9)	(1.61)	(2.97***)	(1.62)	(0.35)	(1.11)	(0.23)	(1.02)
Pop Acc > 150,000	0.956	0.908	0.948	0.759	1.085	1.275	16.757	1.149	1.143	0.898
	(1.11)	(1.29)	(0.72)	(1.80*)	(0.41)	(1.01)	(2.32**)	(1.12)	(1.07)	(0.23)
Pop Acc > 200,000	1.08	0.88	0.921	0.717	1.4	1.506	0	1.318	1.485	0.579
	(1.85*)	(1.5)	(1.02)	(1.82*)	(1.76*)	(1.93*)	(42.99***)	(2.54**)	(3.67***)	(1.08)
Observations	30375	30375	30375	30375	30375	30375	30375	30375	30375	30375

Robust z statistics in parentheses

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 29 (above) shows the effects of the remaining variables in the basic trip count model: gross residential density (“Res Den”) and population accessibility thresholds (“Pop Acc”). Like the demographic variables, the land use variables are also represented categorically. The omitted category for gross residential density of the TAZ is “less than 2 residents per acre.” The omitted category for the population accessibility index is “less than 20,000 population” (recall that the measure discounts for distance, so it is not a simple sum of the total population within a five-mile radius).

Interpreting the incidence risk ratios for the land use variables is different than for the demographic variables. Individuals are assigned to multiple groups depending on the density of the zone in which they live. Therefore, each variable represents the incremental effect of living in a zone that exceeds the threshold.

The land use variables are fairly blunt measures of land use characteristics thought to influence travel. But even with more refined measures of land use, we did not necessarily expect to see overall trip making—that is, individuals’ trips made by all modes and or all purposes, combined—to be strongly affected by density and population accessibility. Instead, we hypothesized that higher gross residential density would be generally positively correlated with the number of trips by alternative modes and generally negatively correlated with the number of trips by personally operated vehicles. The net effect for total trip making would therefore be ambiguous, and possibly not discernable, but the mode share (trips and duration) might be more clearly related.

The reasons for this hypothesis are twofold. First, transit is provided in the Bay Area at higher network density and service frequency in denser areas, due to economies of scale and for historical reasons. Similarly, better pedestrian amenities (such as protected sidewalks, pedestrian-oriented shops, and the like) may be more common in older, more densely developed parts of the Bay Area, such as the central parts of San Francisco, Oakland, Berkeley, and other older cities. Such effects might make such modes more attractive, holding the ease of car travel constant. Second, auto travel tends to be a less attractive mode choice in time and money terms in and around densely developed parts of the metropolitan area, because such areas typically have more congested roads and higher-cost or scarcer parking.

Trip making and gross residential density. Only one residential density threshold, greater than six persons per acre, is statistically significant in relation to *total* trips. People living in such areas make slightly fewer trips than those living in either more sparsely settled areas or areas dominated by non-residential uses. In general, the gross residential density variable appears to have little or no relationship with total trips, as expected (see discussion above).

For POV trips, several gross residential density thresholds are associated with a reduction in auto trips from the low gross residential density base case, controlling for age, race/ethnicity, sex and population accessibility. For work auto trips, the thresholds are greater than six, 25, 45, and 65 persons per acre; for each step, trips are reduced approximately five percent from the baseline case (less than six residents per acre). For nonwork auto trips, the thresholds are above six and above 15 residents per acre.

Turning to transit trips, the results are somewhat confusing. There is a statistically significant reduction in transit trips from the low-density base case to the individual numbers of trips. This may be partially driven by the fact that the transit mode has a relatively small representation in the sample. It may also be an artifact of the coding process in which the final trip segment determined the mode to which segmented trips were assigned for the purpose of analysis.

Finally, walk trips to work, school, and daycare get a boost at the very first threshold, more than 2 persons per acre, and two more big jumps at greater than 15 and greater than 25 persons per acre. A similar pattern exists for nonwork trips. The incidence risk ratios continue to be large in mean, but statistically insignificant because of small numbers, at higher density levels.

A model interpretation problem related to small cell size occurs with respect to passenger serving trips by transit. There are apparently no individuals making such trips who live in zones between 45 and 65 persons per acre. The zero coefficient followed by the very large positive coefficient reflects this problem. Although this is the same model used for the trip forecasts statewide, the impact on the total trip profile is very small. (A similar phenomenon occurs in the same model for the population accessibility variable in the less-than-20,000 category.)

It is interesting to note that marginal effects on trip making by mode exist at relatively low density levels (e.g., 15 and 25 persons per acre).

The mode results may be due to gross residential density's association with road congestion and parking costs. This possibility is important for interpreting the forecast model results, because it suggests that the future impact of high gross residential density may be dependent on the extent to which road congestion and parking costs also increase.

Trip making and residential population accessibility. Like the gross residential density variable, the population accessibility index is not particularly strongly related to overall trip making. For work/school/daycare trips, there is an initial increase of trips at the over 2 residents per acre threshold, and a reduction at the next level (over 4 residents per acre). Without controlling for employment status, this is difficult to interpret. For the highest levels of population accessibility—that is, greater than 200,000 people in zones within 5 miles (discounted by the square of distance)—the coefficients on their own suggest fairly large effects compared to the previous level (over 150,000 residents). Reductions in POV trips by all modes are on the order of around 10 percent, increases in transit trips between 40 and 50 percent for both nonwork and work trips (although the predicted share is still less than 10 percent), and increases in walk trips are also quite high. Although the coefficients for transit trips and car trips are not statistically significant at a high level, the forecasts will reflect their magnitude, which will have a large impact to the extent that zones with population accessibility greater than 200,000 emerge in 2015 and 2025.

Table 30. Basic Travel Duration Model, Part 1: Demographic Variables

	Total Travel Time	POV Travel Time	Transit Travel Time	Walk/Bike Travel Time
Female	-10.219 (4.12***)	-5.846 (2.66***)	-0.7 (1.04)	-0.133 (0.13)
Asian / Pacific Islander	-0.721 (0.15)	-2.542 (0.64)	5.48 (2.44**)	-1.333 (0.61)
Hispanic	-7.52 (1.16)	-8.633 (1.66*)	5.302 (2.40**)	-0.792 (0.26)
African American	-0.435 (0.07)	-12.793 (2.21**)	11.892 (3.60***)	1.272 (0.5)
Native American	-18.488 (1.04)	-13.974 (0.78)	2.612 (0.8)	-7.673 (2.22**)
3+ Ethnicities	0.212 (0.02)	-2.332 (0.27)	7.875 (2.69***)	-2.37 (0.69)
Age 0 to 4	-96.117 (13.82***)	-81.131 (13.03***)	-4.331 (1.98**)	-7.841 (3.38***)
Age 5 to 9	-98.827 (16.06***)	-88.211 (16.15***)	0.249 (0.12)	-8.803 (4.28***)
Age 10 to 13	-94.102 (15.78***)	-101.452 (20.02***)	6.609 (2.90***)	-0.738 (0.3)
Age 14 to 17	-65.626 (8.82***)	-81.686 (13.02***)	8.567 (3.31***)	5.463 (1.65*)
Age 18 to 20	-23.222 (2.42**)	-23.037 (2.61***)	4.509 (1.35)	-3.35 (1.23)
Age 21 to 24	-14.683 (1.49)	-25.33 (2.91***)	4.071 (1.49)	6.53 (1.49)
Age 25 to 29	-8.065 (1.08)	-21.823 (3.63***)	3.222 (0.91)	8.749 (2.57**)
Age 30 to 34	-15.163 (2.10**)	-20.514 (3.29***)	1.036 (0.39)	4.225 (1.52)
Age 35 to 39	-9.276 (1.4)	-16.397 (3.00***)	0.08 (0.03)	5.48 (1.83*)
Age 40 to 44	0.744 (0.11)	4.958 (0.82)	-0.748 (0.33)	-2.485 (1.05)
Age 50 to 54	-9.325 (1.37)	-7.583 (1.28)	-0.738 (0.34)	0.892 (0.33)
Age 55 to 59	-21.158 (3.19***)	-19.974 (3.48***)	-0.822 (0.39)	1.31 (0.49)
Age 60 to 64	-20.03 (2.39**)	-19.183 (2.60***)	-0.175 (0.08)	2.096 (0.57)
Age 65 to 69	-26.67 (2.79***)	-21.257 (2.38**)	-0.568 (0.23)	-1.857 (0.7)
Age 70 to 74	-52.784 (6.60***)	-46.841 (6.42***)	-1.637 (0.75)	-1.571 (0.6)
Age 75 to 79	-57.649 (5.90***)	-54.441 (6.42***)	-0.506 (0.22)	1.075 (0.23)
Age 80 to 84	-80.287 (8.54***)	-70.544 (8.23***)	0.713 (0.21)	-6.634 (2.38**)
Age 85 and Up	-125.582 (10.15***)	-108.693 (9.99***)	-3.239 (1.48)	-9.708 (1.70*)

Results from the basic travel duration models

The duration model results are shown in Table 30, above, and Table 31, below. They are similar in some respects to the trip models. Several results are of particular interest.

Although women make more trips by auto, the duration model shows that they travel for a shorter cumulative travel time by auto than men (see Table 30). This may be due to a higher share of work trips for men, which tend to be longer in distance and duration. The effect is quite small—about five minutes less on work trips over a two-day period, and ten minutes less overall. This is only about two percent of the average (see the constant term in Table 31, below).

Asian Americans / Pacific Islanders, Hispanics, and African Americans all travel more than Whites on transit modes. Recall that only African Americans were different from Whites on the transit dimension for the trip model. Again, however, the effect is relatively small in comparison to the constant term: these groups travel on average five to ten minutes more per day. This aggregate effect likely is the result of a higher usage rate of transit, rather than a difference in overall travel duration.

Controlling for other factors, travel duration increases as individuals age, up to the 40-50 age cohort, with a decline afterwards, consistent with the overall trips model. This overall travel duration pattern is driven by the auto duration pattern. The highest average tripmaking on transit is in the 14 to 17 cohort, with declines afterward, a partial increase in the 80 to 84 cohort, and a steep decline in the 85 plus cohort. In combination with the trips model, which showed a positive correlation between age in upper age cohorts (particularly for non-work trips), this result suggests that elderly people make transit trips that are quite short in duration, perhaps where younger people would be more likely to walk.

Gross residential density at the 6 persons per acre level and above is again associated with less travel by car: about 16 minutes over a two day period (see Table 31). About 13 minutes of this reduction is apparently associated with fewer work trips. Again, without controlling for employment status, it is difficult to interpret work trip effects.

Gross residential density at the 25 persons per acre level is particularly strongly associated with mode-specific effects. At that level, there is a reduction of auto travel of 24 minutes per two-day period, with a concurrent increase in walk/bike duration of 9 minutes, and transit duration of about six minutes (statistically significant at only the 90 percent confidence level)

The highest level of population accessibility is again significant in the travel duration models, as it was for the trip models. Net travel time is *increased* by over 36 minutes, by far the largest magnitude effect of any variable in the duration models. The net effect apparently reflects a slight, statistically insignificant reduction in auto travel time with a concurrent increase in both transit duration and walk/bike duration.

Table 31: Basic Travel Duration Model, Part 2: Land Use Variables

	Total Travel Time	POV Travel Time	Transit Travel Time	Walk/Bike Travel Time
Res Den > 2/Ac.	1.634	-2.04	0.511	1.755
	(0.28)	(0.37)	(0.46)	(0.89)
Res Den > 4/Ac.	4.443	2.724	-0.662	1.156
	(0.64)	(0.44)	(0.79)	(0.41)
Res Den > 6/Ac.	-16.067	-13.973	1.504	-2.115
	(2.57**)	(2.55**)	(1.41)	(0.78)
Res Den > 10/Ac.	-0.818	6.093	-1.331	-5.79
	(0.16)	(1.33)	(1.08)	(2.59***)
Res Den > 15/Ac.	5.827	1.451	0.248	3.716
	(1.26)	(0.34)	(0.32)	(1.93*)
Res Den > 25/Ac.	-4.584	-23.569	6.198	9.302
	(0.53)	(3.13***)	(1.94*)	(2.29**)
Res Den > 45/Ac.	-11.419	-10.128	-3.945	3.751
	(0.76)	(0.84)	(0.43)	(0.58)
Res Den > 65/Ac.	13.888	-14.22	6.403	10.772
	(0.62)	(1.09)	(0.43)	(1.05)
Res Den > 100/Ac.	-40.097	-19.235	-1.029	-0.492
	(1.4)	(1.15)	(0.05)	(0.03)
Pop Acc > 20,000	1.651	2.426	-1.217	2.029
	(0.25)	(0.4)	(1.29)	(0.92)
Pop Acc > 30,000	2.815	-1.307	-0.591	3.14
	(0.47)	(0.23)	(0.53)	(1.55)
Pop Acc > 40,000	-3.847	-2.336	1.452	-0.846
	(0.64)	(0.43)	(1.5)	(0.41)
Pop Acc > 50,000	-0.465	-5.495	2.169	1.443
	(0.07)	(0.97)	(1.2)	(0.61)
Pop Acc > 60,000	1.737	1.895	-1.446	1.788
	(0.25)	(0.32)	(0.67)	(0.55)
Pop Acc > 70,000	0.047	-6.605	-0.897	5.352
	(0.01)	(1.06)	(0.75)	(1.6)
Pop Acc > 80,000	-7.923	-1.707	-0.927	-2.723
	(1.16)	(0.28)	(0.96)	(0.94)
Pop Acc > 90,000	0.932	0.891	0.752	-1.467
	(0.14)	(0.14)	(0.54)	(0.51)
Pop Acc > 100,000	7.656	-2.362	0.725	8.89
	(1.1)	(0.38)	(0.48)	(2.75***)
Pop Acc > 125,000	10.888	0.767	10.39	-0.139
	(1.03)	(0.08)	(2.78***)	(0.03)
Pop Acc > 150,000	8.277	-3.137	-1.463	14.662
	(0.64)	(0.27)	(0.32)	(2.82***)
Pop Acc > 200,000	36.82	-11.032	21.648	22.58
	(2.06**)	(0.87)	(1.89*)	(2.94***)
Constant	227.655	207.127	3.272	11.547
	(31.79***)	(31.76***)	(1.57)	(5.05***)

4.6 Complex Travel Models

The forecast procedure (see Section 6) uses results only from the simplest empirical model, and therefore does not control for characteristics included in the more complex empirical models. These important omitted variables include income, household characteristics, the distribution of employment or the characteristics of nonresidential land uses, and micro-level land use characteristics (such as net residential density and the density of the street grid). In the future, correlations between these variables and race/ethnicity, age, gross residential density of the household zone, and population accessibility may change, in some cases drastically. This in turn would imply that the broad trends implied by the forecasts could change. For example, the modeled relationships between age and travel depend in part on current rates of driver's licensing and vehicle ownership among the elderly. However, these are likely to rise in the future because current cohorts have much higher rates of licensing than older cohorts did at that age.

To further investigate the nature of the relationships between the basic demographic and land use variables included in the forecast models, we carried out a series of models adding key variables in each category, as described below.

Enriched demographic models

Appendix Tables C1 to C14 (p. 113) present the results of seven further iterations of each of the 14 basic travel models. The enriched demographic models investigate how the following demographic characteristics, in addition to the basic set of demographic and land use variables, affect travel or are correlated with it:

- Household income, and square of income
- Employment status
- Professional employment status
- Presence of children in the household
- Single parent/head-of-household status
- Household size
- Driver's licensing status
- Vehicles per licensed driver in the household

In general, accounting for these other important covariates of travel can lead to a reduction in the apparent effects on travel behavior of some variables, while occasionally causing other variables to become more clearly related.

The following is a summary of the most important findings for the purposes of interpreting the application of the basic empirical model in forecasting travel demand trends:

Even when numerous other demographic and economic variables are accounted for, non-White racial/ethnic groups continue to make substantially fewer trips than Whites--in particular, fewer nonwork trips by POV. Non-White groups also make more transit and walk/bike trips to work.

This may still be a function of the level of spatial segregation by race/ethnicity combined with transit availability, however.

In general, including the additional demographic and economic variables sometimes reduces the magnitude of the relationships found in the basic models, but does not change the statistical significance of the relationships already described in the previous section. For example, because household income is correlated with age but slightly more closely correlated with trip making by POV for nonwork purposes, the effect of increasing nonwork trips by POV attributed to aging is reduced somewhat.

In short, the additional income, household type, and employment information leads to a more complete model and mitigates the apparent effects associated with race/ethnicity, sex, and age to some extent. The basic relationships do not change very much, however.

Enriched land use models

As with the enriched demographic models, Appendix Tables D1 to D14 (p. 129) present the results of nine further iterations of each of the 14 basic travel models that include further land use measures that are thought to be associated with travel behavior. The land use model iterations investigate how the following land use features in and near the residential transportation analysis zone, in addition to the basic set of demographic and land use variables, affect travel or are correlated with it:

- Street Density
- Extent of Development in Zone
- Net Residential Density (Residents / Residentially Developed Acres in Zone)
- Net Commercial Density (Employees / Commercial Developed Acreage)
- Combined Commercial and Employment Density ([Residents + Employees]/Developed Acres)
- Employment Accessibility Index (5-Mile Radius)
- Retail Accessibility Index (5-Mile Radius)
- Services Accessibility Index (5-Mile Radius)
- County Dummy Variables (Representing County-Specific Land Use and Transportation Infrastructure Characteristics)

In brief, we find that the simple land use variables included in the basic forecast model—gross residential population density and residential population accessibility—are somewhat sensitive to the inclusion of other variables. Other relationships are fairly robust.

As with the previous models, the six-persons-per-acre threshold continues to be associated with a lower amount of travel than the lower density zones. However, when all of the other land use measures (noted above) are entered in the equation, the following three variables have the most significant relationships: *net* residential density, the employment accessibility index, and the service accessibility index.

The county dummy variables are not statistically significant in the total trips model, but San Francisco County has a much higher transit work share when controlling for all of the land use variables. Marin and Santa Clara have respectively more and fewer work/school trips by walking or biking than the other seven Bay Area counties.

For work trips by all modes, the retail and services accessibility indices are significantly different from one and working in opposite directions.

Street density is highly correlated with more nonwork trips on transit and walk/bike, but not with fewer nonwork auto trips, implying an accessibility benefit to the individual of dense street grids, without a reduction of demand for road use.

5

POPULATION PROJECTIONS

The spatial distribution and amount of travel statewide depends largely on the spatial distribution and amount of population, and the characteristics of that population. As noted in previous sections, it is useful to know as much as possible about their expected personal characteristics, such as their ethnicity, sex, and age.

The population projections were carried out by Solimar Research Group; their methodology is described below. A previous presentation to Department of Transportation staff reviewed the results of the projections using the datasets described in Appendix A. That presentation and the data sets were provided as a previous deliverable and are not reproduced here. However, we have provided maps in Appendix E showing population density by Census tract statewide and for three regions within the state.

5.1 Projection Methodology

The US Census Bureau prepares national and state population projections in cooperation with state-level planning and budget agencies. In California, the Department of Finance (DOF) Demographic Research Unit is responsible for working with the Census Bureau. Both the Census Bureau and DOF use the cohort survival method. The Census Bureau uses Federal administrative datasets to estimate and project national and state in- and out-migration while DOF utilizes California state administrative data such as driver's license and state income tax addresses, school enrollment, and county-level vital records to estimate and project county populations. Both the Census Bureau and DOF benchmark their projections to the decennial Census.

At geographies below the county level, annual estimates and projections are usually based on net housing unit change and group quarters (GQ) population, another principal projection methodology. (Other methodologies include modeling growth based on various environmental and other spatial rules, or using local land use plans to estimate time to "buildout.") The permit and GQ data are provided annually to DOF by the 58 counties and over 500 city governments, usually planning and building departments. Regional Transportation Planning Agencies (RTPAs) and Metropolitan Planning Organizations (MPOs) periodically prepare small-area population, employment, and housing projections at the Census tract or traffic analysis zone (TAZ) level, but rarely with age and sex detail.

The original proposal was to assemble existing RTPA and MPO projections for 43 RTPA and MPO counties and use them as a guide to "roll down" DOF's 2015 and 2025 county-level population projections to the 7,049 Census 2000 Census tracts. Then, we would roll down DOF projections in the remaining counties which typically had small clustered populations. The plan was not to create new projections, but to assemble and manipulate existing projection datasets created by the MPOs and any other county and/or local governments. While not the ideal way to create small-area projections, this method does have the credibility of using existing official datasets, assuming they are of recent and similar vintage within time and budget constraints. It also provided a way to bring local knowledge into the state-level projections, by recognizing that local and regional actors have better, more context sensitive information.

We spent several months soliciting MPOs and city and county planning departments for any and all demographic projections they had available. Except for the San Diego Association of Governments, local and regional agency projections were housing-unit based, not cohort survival. Few tract-level MPO projection datasets were available. Housing unit projections do not have the race and age detail requested by the Department of Transportation. Additionally, no RTPA or MPO had yet revised its projections to include the results of Census 2000, which showed population changes different from DOF in some areas.

In addition, in October 2001 the Census Bureau rescinded its earlier estimates of Census 2000 net error (undercounts and overcounts) that the DOF was planning to incorporate in revised projections for the state's budget. The DOF's estimates and projection now seem high compared to the unadjusted Census 2000 data. The 1998 DOF projections used adjusted 1990 Census data and fertility rates from the 1980s which are now considered high, at least for Hispanics, and which may represent more of a spike in rates rather than a permanent pattern. DOF plans to revise county-level projections by summer 2002 and to complete a new set of long range projections by 2003. The 1998 DOF series may overestimate growth in counties with relatively high Hispanic birthrates and high 1990 Census undercounts. In the following counties over 50 percent of 1998 births where Hispanic, according to a recent UCLA study: Colusa, Merced, San Benito, Santa Cruz, Monterey, Madera, Fresno, Kings, Tulare, Kern, Santa Barbara, Los Angeles, San Bernardino, Riverside, and Imperial.

5.2. Revised Methodology

In the light of problems with Census counts and local projection availability, we revised our methodology to include a recently-completed, tract-level, commercially produced set of projections produced by Applied Geographic Solutions, a private firm located in Thousand Oaks. The projections incorporate Census 2000 data and include a wide range of core demographic variables for 2001, 2006, and 2011 covering five broad topic areas: population, households, income, labor force, and dwellings. These are summarized in Table 32 (below).

The AGS projections are also in Census 2000 tract geography, reflecting the numerous tract splits, boundary adjustments, incorporations and annexations since the 1990 Census. In contrast, all regional and local projections were created in 1990 Census geography and do not incorporate Census 2000 results.

Table 32. Variables Available from AGS

Population by household type (family, non-family, group quarters)
Households
Households by type (family, non-family)
Households by size of household
Households by age of head of household
Household type (e.g. lone parent male family with children)
Average Household Size
Population by age (19 age breaks)
Population by age and sex (38 breaks)
Population by sex
Population by race
Population by Hispanic origin
Population by race and Hispanic origin (e.g. white Hispanic, white non-Hispanic)
Hispanic origin by nationality (e.g. Mexican, Cuban)
Population by Marital Status
Population by Educational Achievement
Labor Force Employment Status
Labor Force Occupation
Labor Force Industry
Aggregate Income (family, non-family households, group quarters)
Household income distribution (15 breaks)
Family income distribution (15 breaks)
Extended Upper-Income distributions
Median and average income (family, household)
Disposable income distribution
Age of head of household by income
Vacant Dwellings
Tenure
Vehicles Available, Total and by number per household

We extended the AGS 2011 projections to 2015 and 2025 by using the 2001 to 2011 AGS trend. There are trade-offs to using this method. It is based only on a 10-year period, but it does stay within one dataset and incorporates Census 2000 data which were used in creating the 2001 estimates.

The 2015 and 2025 tract population projections were "raked" to DOF county totals even though there is evidence that the 2015 and 2025 DOF projections are probably high, especially in the young Hispanic cohorts. Raking is iteratively adjusting cell data to sum to known marginal totals. It is used to adjust one set of projections so they total to the marginal row and column totals of another, usually at some higher geographic summary level. We raked tract 2015 and 2025 projections once to match DOF county projections. Race and age data were not raked.

Using the AGS data, counties had to be increased by 10 to 20 percent to match the DOF projections, meaning past growth rates that were the basis of the AGS data were lower than DOF's anticipated future. DOF now expects the next round of full projections, slated for 2003 release, to come in 10 percent lower than the 1998 series on which we based the rake. DOF's interim revision to the 1998 series, completed after Census 2000 was released, actually shows a small increase for 2015, but then reductions later as lower birth rates play out over time. Raking of age and race after two large extrapolations (extending AGS 2011 to 2015 and 2025 and raking to DOF) would introduce even more error in the population totals.

We then performed seven quality checks, county by county. The purpose of these checks was to identify suspicious tracts for possible population reassignment within the same county. This is the point where we were able to use local projection data, translated into Census 2000 tract geography.

The entire state was evaluated in several regions: Southern California; the Central Valley and Coast; the Bay Area, Sacramento, Lake Tahoe and southern Sierra; and Northern California. The seven checks were:

- DENSITY: identify tracts that had the largest increase in density relative to approximately 90% of the county 2025 'norm.'
- GROUP QUARTERS: identify tracts with large GQ population as possible corrections related to the Census 2000 GQ errors documented by DOF.
- HIGHEST INCREASES: identify tracts with unusually large population increase relative to overall county and other tracts.
- SMALLEST INCREASE (OR LOSS): identify tracts with substantial decrease, or significantly less increase relative to other nearby tracts.
- DENSITY CHANGE: identify tracts with the largest increase in density since 2000 relative to other local tracts.
- ENVIRONMENTAL: overlay population patterns with several environmental and open space GIS themes to check for unreasonable population increases in parks, water areas, etc.
- COMPARISON WITH OTHER PROJECTIONS: Solimar projections to local projection datasets from SCAG, ABAG, SANDAG, SAGOC, and the Great Valley Center.

About 300 tracts (4 percent of the total statewide) were individually investigated and we determined how much, if any, population to reassign within each county. This was done with a weight that moved nearby population equally across all age and race cohorts. About 15 other tracts had to be filled with a nearly tract's data, a substitution. The resulting race and age, county and state totals differ from DOF race and age projections by varying amounts.

There are 19 Census 2000 tracts that are in multiple parts, mostly in Riverside County in the Palm Springs area. Each set of tract polygons was compared to USGS topographic maps and a determination was made to place population among the parts. The result increased the data and map records to 7,115, even though there are 7,049 tracts in the state. The part tracts are given an incremental suffix and treated as unique records (see Appendix A).

There were 15 instances of group quarters, usually prisons, being in the wrong Census geography, and these large populations skewed that tract's projections up and the correct tract's projection downward. There were several tracts, such as Camp Pendleton, where the AGS projections dramatically lowered population without an apparent 'reason' based on a 1980 to 2000 trend. These tracts were repaired as best possible but are probably not accurately reflecting race and age. No attempt is made to create, place, or populate new prisons, military bases, or campuses such as CSU Channel Islands.

5.3 Confidence in Results

DOF and most all other planning agencies have started or plan to start new projection series using Census 2000 data. DOF has filed a Freedom of Information Act action with the Census Bureau to obtain detailed adjustment factors that the DOF may use in its post-Census 2000 projections. These yet to be completed projections will be superior to our projections, although not necessarily at the tract level with age and race.

The projections are geographically conservative, in that they are based on a 1980 to 2000 time series, and therefore tend to predict increasing density in existing developed areas rather than conversion of non-urban land. Generally, high growth is projected to occur in areas where high growth occurred between 1980 and 2000, and other areas are projected to experience an increase in density on par with the overall county's increase in density, with some exceptions.

The projection methodology does not always allow tracts now in total agricultural use to convert to urban use, with the exception of areas designated by the Great Valley Center as a high growth probability. Population was added to tracts in partial non-urban use with some past growth, sometimes in large relative numbers. This approach may differ from regional government projections that may use local General Plans or other future development assumptions and/or growth models that allow spill-over development into agricultural land.

The result is tract projections that favor existing developed areas and minimize geographic expansion into previously non-urban tracts. This approach is generally supported by research that suggests future development will more frequently occur in already developed areas. Land use and growth analysts generally consider development between 1980 and 2000 as the beginning of a trend towards higher density and less sprawl compared to the 1950 to 1980 period. Between 1980 and 2000, many local governments slowed development of adjacent raw land and created development impact fees in response to Proposition 13. Developers responded with more multifamily development in the 1980's followed in the late 1990's with more compact single-family development in existing urban areas. This is likely to continue due to the following trends:

- Increasing open space acquisition around urban edges,
- Growth control and management initiatives and ballot measures,

- Government and developer interest in "smart growth,"
- Increasing costs of extending urban services to raw land,
- Environmental protection of habitats and other sensitive undeveloped land,
- Efforts to reduce liability for multifamily condominium latent defects,
- Federal, state, and local brown field remediation efforts encouraging infill, and
- Continued interest and development of mass transit in urbanized areas.

The projections do not "age in place" as is customary with cohort-survival models. Aging a population eventually empties out the housing, which is unrealistic. We assume that over the long run, aging households are replaced by younger households generally reflecting the period 1980 to 2000.

Projections of race/ethnicity also reflect the increasing diversity of the last two decades and assume it continues. The introduction of the "Two or More" tabulation in Census 2000 complicates projections as that population is added into the "Others." Hispanic origin is the only consistent datum between the 1990 and 2000 Censuses. A better indicator of future race/ethnicity data may be birth records and primary school enrollments. Age the under age 10 population by 25 years and you will have a large share of your future population, assuming the majority stay in the same area.

Our projections should be considered an interim best-effort series, with higher confidence in the 2015 projections compared to the 2025 because the 2015 data are only three years extended from the AGS 2011 projections. No one tract projection should be considered alone, but in relation to its adjacent tracts. In other words, there is more confidence in the 2015 population in an area than in any one tract.

In summary, tract data should be interpreted as follows:

1. The less raking from AGS 2011 to DOF 2015, the better.
2. Data for 2015 is better than 2025.
3. Larger populations are more accurate than smaller populations.
4. Tracts with large prisons and military may be significantly off in race and age.
5. Total population is better than age and race data.

Projections inherently have larger errors over longer time periods and for smaller areas. When combining small area long term projections, the error compounds. In general, DOF estimates its statewide projections have error of plus or minus one percent for every year removed from a decennial Census. This implies that DOF county-level projections for 2025 have an error of plus or minus 25 percent, with some variation depending on the size of the county.

John Long, a senior Census Bureau analyst, has stated that about 10 percent of the apparent increase in the US population between 1990 and 2000 could be attributed to a better count of minority populations. This, taken with the recent decline in Hispanic birth rates, is evidence that the 1998 DOF projection series is running about 10 percent too high.

In a sense, these projections were created at the worst possible time, at the end of the ten-year decennial Census lifespan and before any planning agencies had completed new housing-unit based projections using Census 2000 data (housing-unit projections are better for small area projections). In about a year, DOF and many regional agencies will have completed new projections that would yield a more reliable statewide database. We recommend maintaining tract-level projections on an ongoing basis.

6

TRAVEL FORECASTS

Travel demand trends for 7,000-plus Census tracts in California are described and presented in this section. Selected maps of the demand trends can be found in the body of this and the next section, with an additional 32 full-page maps located in Appendices E, F, and G.

6.1 Methodology

The empirical models estimated in Section 4 are based on individual (disaggregate) data. However, for the forecasts, we do not have a simulated population of individuals for the state. The Phase II demographic projections consist of estimated aggregate characteristics of all the residents of modified Census tracts for the years 2015 and 2025. In addition, we use recently released Census figures for 2000 to create a baseline forecast in the same geography; these are also zonal aggregate data. The 2000 base year is used in order to calculate projected trends over time.

Initially, we applied the empirical models in a forecast process by calculating per-capita values for each of the categorical values in a tract with 2000, 2015, and 2025 data, using the model to generate a predicted travel outcome for each zone as though it were an individual traveler with percentages of particular "traits;" e.g., 15 percent Hispanic, 2 percent aged 0 to 4, and so on. Since the constant term and the land use variables do not vary among individuals within a Census tract (i.e., Census tracts are used to calculate the simple land use variables instead of TAZs), those variables can be represented without modification. The final step in creating the forecasts using this method is to inflate the per-capita estimates of travel to the zone level by multiplying by the total population of the zone.

Given a simple linear-in-parameters model (such as ordinary least squares) whose only terms varying within zones are categorical (or are represented categorically), this procedure is mathematically equivalent to creating a population conforming to the zonal distribution of individuals. However, with a non-linear model such as the negative binomial regression (the procedure used for the empirical trip models described in Section 4), the average effects are not linear, and this procedure generates trip estimates that are generally downward-biased.

For the purpose of creating correctly modeled trip demand trends, therefore, we carried out what amounted to a simulation of the population in California falling within all of the possible subcells represented by the independent variables in the model. Because there are no interaction terms in the basic empirical model (e.g., no representation of age by sex in explaining travel behavior), we can assume for modeling purposes that the distribution of age by sex by race/ethnicity is uniform.

Before making this assumption, we carried out an extensive regression analysis of the interactions of sex, age, and race, and found that interacting sex and age improved the model significantly (in a statistical sense) by accounting for differences in travel, particularly among elderly men and women. (This is alluded to in Section 4 in the discussion of licensing.) However, it was in the end beyond the scope of this project to simulate the distribution of age by sex at the Census tract level statewide, and the magnitude of the effects was not large enough to suggest that trip or duration forecasts would be changed very much.

The 7,115 Census-tract-based zones in the California data set were therefore each divided into 190 subcells created by the intersection of five race/ethnicity categories, two sex categories, and nineteen age categories. A percentage of each zone was assigned to each of the 190 subcells to reflect the distribution of the population in that zone that fell within the categories. The resultant data set consists of 1.35 million observations that are used to estimate the relevant travel behavior and are then re-aggregated to the Census tract level.

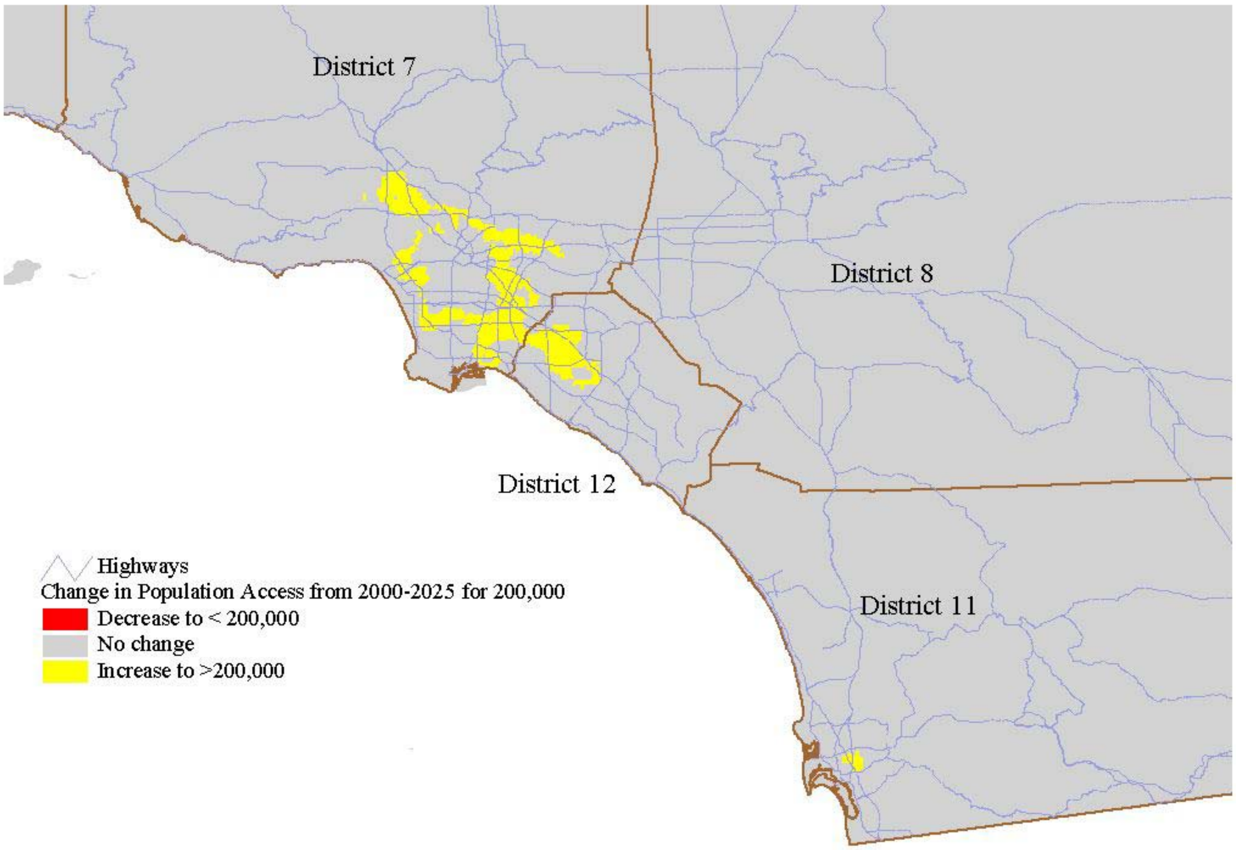
Interpreting Forecast Results

The travel forecasts are based on applying the estimated coefficients regardless of the level of statistical significance, because for forecast purposes this is preferable to ignoring estimated effects present in the empirical data. Even in cases where estimated effects are statistically insignificant, this procedure is entirely unproblematic as long as the coefficients are small, or when the group represented by the coefficient is a small share of the population of the zone to which the forecast model is applied. However, some Census tracts may contain a high percentage of individuals falling in a population category whose travel tendencies are estimated as being substantially different from other groups but where the coefficient representing the difference is estimated with high error. In such cases, the resulting estimate of travel for that Census tract is more error-prone than the estimates for other tracts.

This is easiest to illustrate in the case of race/ethnicity, since segregation by race/ethnicity is somewhat more common than that by age or sex. The within-subgroup coefficients (i.e., mean values) for trip making by Native Americans are in many cases large with respect to other race/ethnic groups, but are estimated with significant error, due in part to small sample size. Zones that are predominantly composed of Native Americans will have substantial projected differences from other zones, based on the mean value of coefficients, but the variance associated with those estimates will be ignored since only the mean is reported.

Projected high increases from 2000 to 2025 in transit ridership and walking in zones in Los Angeles (from San Pedro/Long Beach up the 710 corridor, and as far north as San Fernando), South San Jose, and the San Diego area are largely due to the preponderance of zones in those areas exceeding the 5-mile-radius population accessibility index value of 200,000 persons (see Map 1, below). In the empirical analysis, this population accessibility threshold is associated with substantially higher alternative mode shares in both the trip count model and the travel duration model. However, the expected magnitude of mode shift in the future on a statewide basis is somewhat more contingent than the projections imply. This is because the effect appears to depend to some degree on the correlation between population accessibility and other factors, such as retail and services employment in the surrounding area, that appear to have a more direct influence on travel.

Map 1. Areas Newly Exceeding Population Accessibility of 200,000, Southern California Area, 2000 to 2025



The demographic projections at the tract level are predicated on the assumption that tract-level trends of the past 20 years will continue for the next 25 years. Thus, in some core city areas the demographic forecasts show population density decreasing. However, in most places population density is increasing. Consistent with the basic empirical model, the forecasts reflect this change by decreasing the share of trips carried out in personal vehicles and increasing the share made using alternative modes in those areas, all else equal. Other changes, such as an aging of the population or a racial/ethnic transition, can mask these effects.

The projected per-capita shift to alternative mode use in many locations could be understated if road congestion increases non-linearly on existing roads, few roads are built, and grade-separated transit is provided in those areas, because under those conditions transit use is likely to become easier and car use more difficult. However, in our judgment the forecasts of increased alternative mode use (in particular, increased transit use) are more likely to be overstated, if only because demographic trends towards greater car use, though slowing in pace, are likely to continue. Such trends cannot be reflected in the empirical model used to build the travel forecasts.

6.2 Statewide Forecast Results

Based on available data for both population projections and the empirical travel models, projections were prepared for three main categories of travel demand at the Census tract level for 2000, 2015 and 2025: number of trips, mode of travel, and trip duration.

The key summary results at the statewide level are presented in Table 33. Total trips are projected to rise by over 31 million, or roughly 44 percent between 2000 and 2025, while the time spent traveling is projected to rise by 48 percent. The increase in total trips matches the increase in population very closely, while the increase in time spent traveling is somewhat higher.

However, there is considerable variation by trip purpose and by travel mode. Nonwork trips increase by more than either work or passenger-serving trips, for example. Among the major transportation modes, walking and biking trips are projected to rise by nearly 80 percent, substantially more than auto trips, while the time spent in transit trips will also rise by about that proportion.

Table 33. Total Trip and Trip Duration Trends, 2000 to 2025

	2000 Trips/Hours Per Day	% of Total	2025 Trips/Hours Per Day	% of Total	Difference Between 2000 & 2025	% Change
Trips By Purpose						
Work/school/day care	23,668,377	34%	34,243,291	34%	10,574,914	45%
Non-work	38,032,764	54%	55,970,812	55%	17,938,048	47%
Passenger-serving	8,866,378	13%	11,643,536	11%	2,777,158	31%
Total	**70,567,518**		**101,857,639**		**31,290,121**	**44%**
Trips By Mode						
Personal vehicle	58,715,864	83%	80,999,107	80%	22,283,243	38%
Transit	2,426,976	3%	4,162,933	4%	1,735,957	72%
Walk/bike	9,424,679	13%	16,695,599	16%	7,270,920	77%
Total	**70,567,519**		**101,857,639**		**31,290,120**	**44%**
Duration (hrs) Per Day						
Personal vehicle	40,373,931	78%	56,457,160	74%	16,083,229	40%
Transit	3,643,950	7%	6,479,390	8%	2,835,440	78%
Walk/bike	7,684,459	15%	13,329,603	17%	5,645,145	73%
Total	**51,702,339**		**76,266,153**		**24,563,814**	**48%**

These results are easier to interpret when accounting for population growth. The per capita statewide results are in Table 34. Overall travel is increasing just faster than population growth, but this masks some changing trends in trip purpose and mode.

In particular, while the absolute demand for car trips is projected to increase statewide by 38 percent, it is projected to fall by a few percent on a per capita basis. The per capita mode shares of transit and biking/walking are thus forecast to rise significantly.

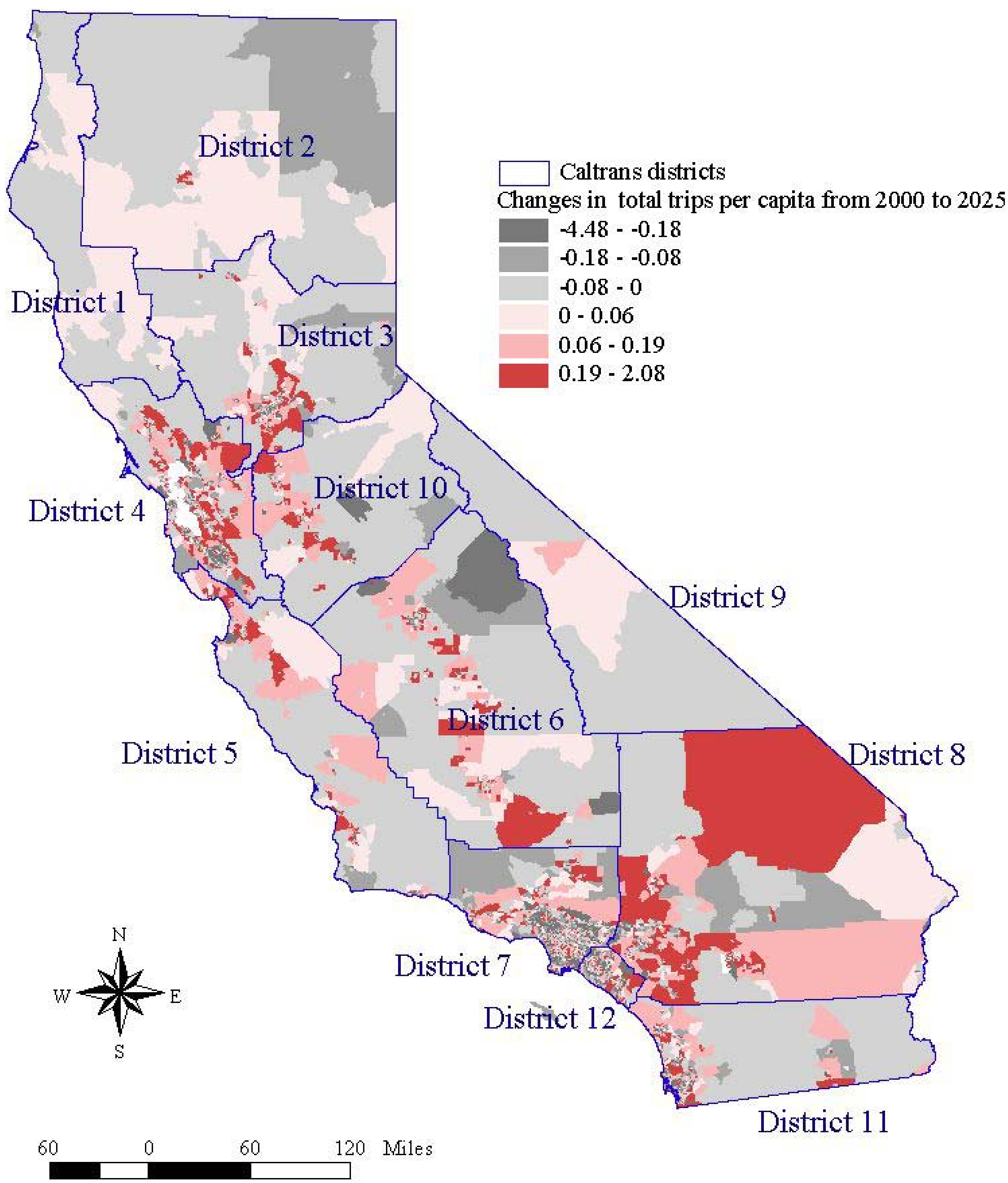
Table 34. Daily Per Capita Trip and Travel Duration Trends, 2000 to 2025

	2000	2025	Difference	Percent Change
Trips By Purpose				
Work/school/day care	0.70	0.70	0.01	0.8%
Non-work	1.12	1.15	0.03	2.5%
Passenger-serving	0.26	0.24	(0.02)	-8.5%
Total	2.08	2.10	0.01	0.6%
Trips By Mode				
Personal vehicle	1.73	1.67	(0.07)	-3.9%
Transit	0.07	0.09	0.01	19.5%
Walk/bike	0.28	0.34	0.07	23.4%
Total	2.08	2.10	0.01	0.6%
Duration (hrs)				
Personal vehicle	1.19	1.16	(0.03)	-2.6%
Transit	0.11	0.13	0.03	23.9%
Walk/bike	0.23	0.27	0.05	20.9%
Total	1.53	1.57	0.04	2.8%

The Census-tract-level travel demand projections are discussed below by using statewide and regional maps. (The data are being made available in electronic form on the compact disc provided along with this report.) We present travel trend maps at three levels of spatial detail: the entire state, southern California, and the Bay Area/Sacramento region.

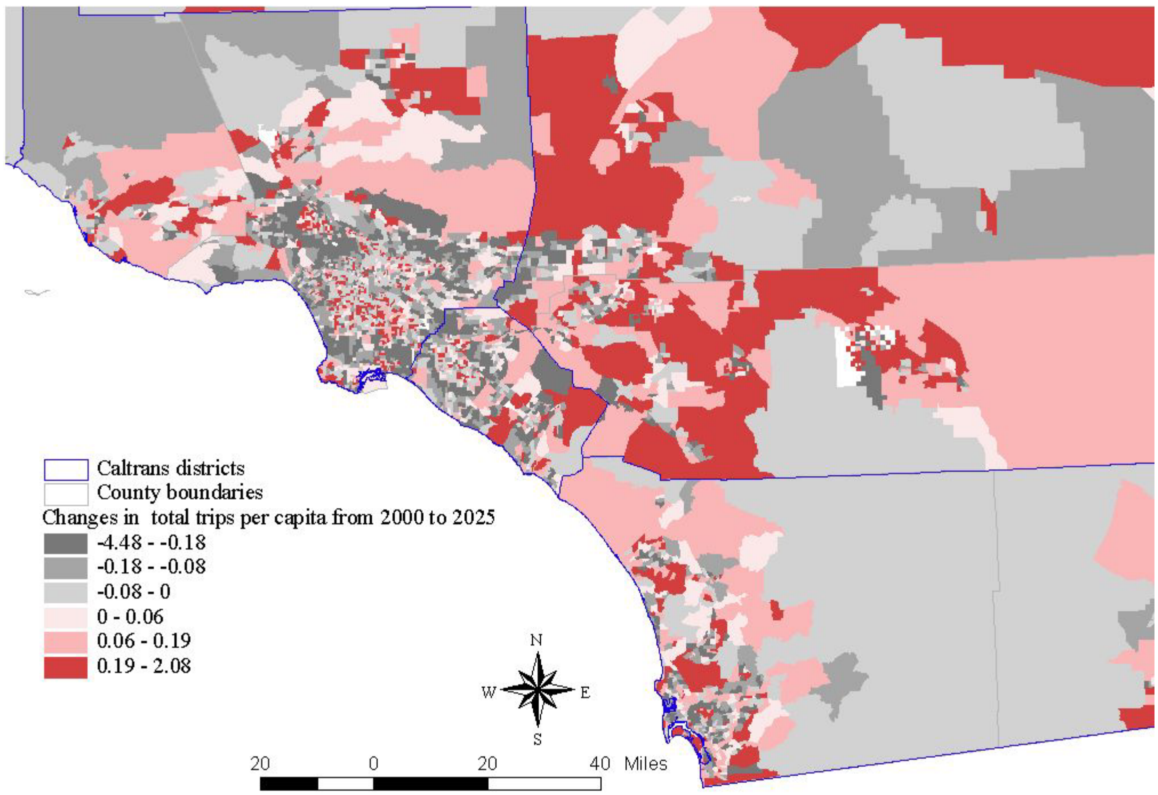
Map 2 projects the change in total trips per capita from 2000 to 2025, with red illustrating the Census tracts with the greatest growth on a per capita basis. (Some Census tracts are very large, due to low population density in those areas.) Generally, we see the largest projected per capita increases in the fastest growing peripheral areas. This appears to be for two reasons. First, newly urbanizing areas are also experiencing an increase in the middle age cohorts, which have the highest travel rates in the Bay Area survey. Second, people living in very low-density parts of the Bay Area travel quite a bit less than those living in areas that are marginally urbanized. This is probably because there are relatively few nearby land uses to generate out-of-home activity participation. As density increases in the peripheral parts of the state from 2000 to 2025, the initial stages of urbanization lead to higher per capita travel.

Map 2. Absolute Per Capita Trip Growth, 2000 to 2025 (Trips per Person per Day)



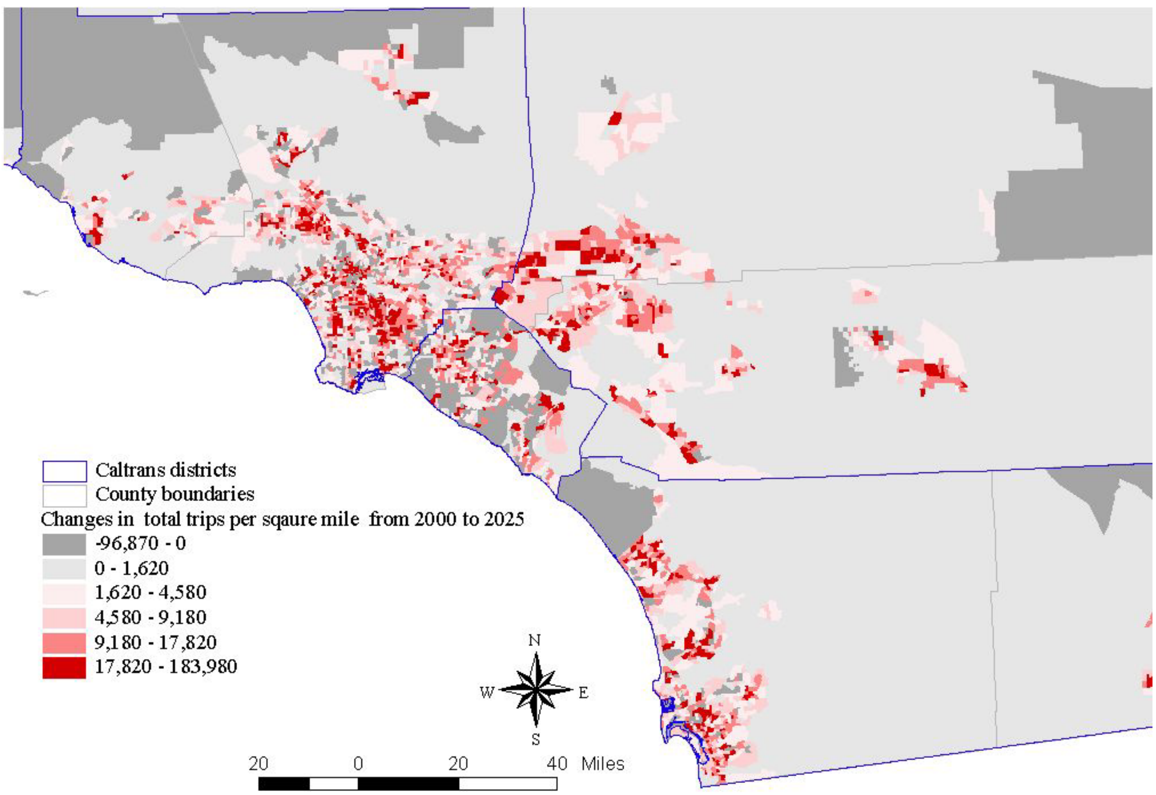
This is clearer when we focus on a particular metropolitan area. Southern California is shown in Map 3 (below). Trip growth relative to population growth is high in peripheral areas, such as in Ventura County, the Inland Empire, and San Diego County, but it is also high in some parts of the City of Los Angeles. On the other hand, many parts of Los Angeles are also projected to have falling per capita trip demand during this period.

Map 3. Changes from 2000 to 2025 in Southern California-Trips per Capita per Day



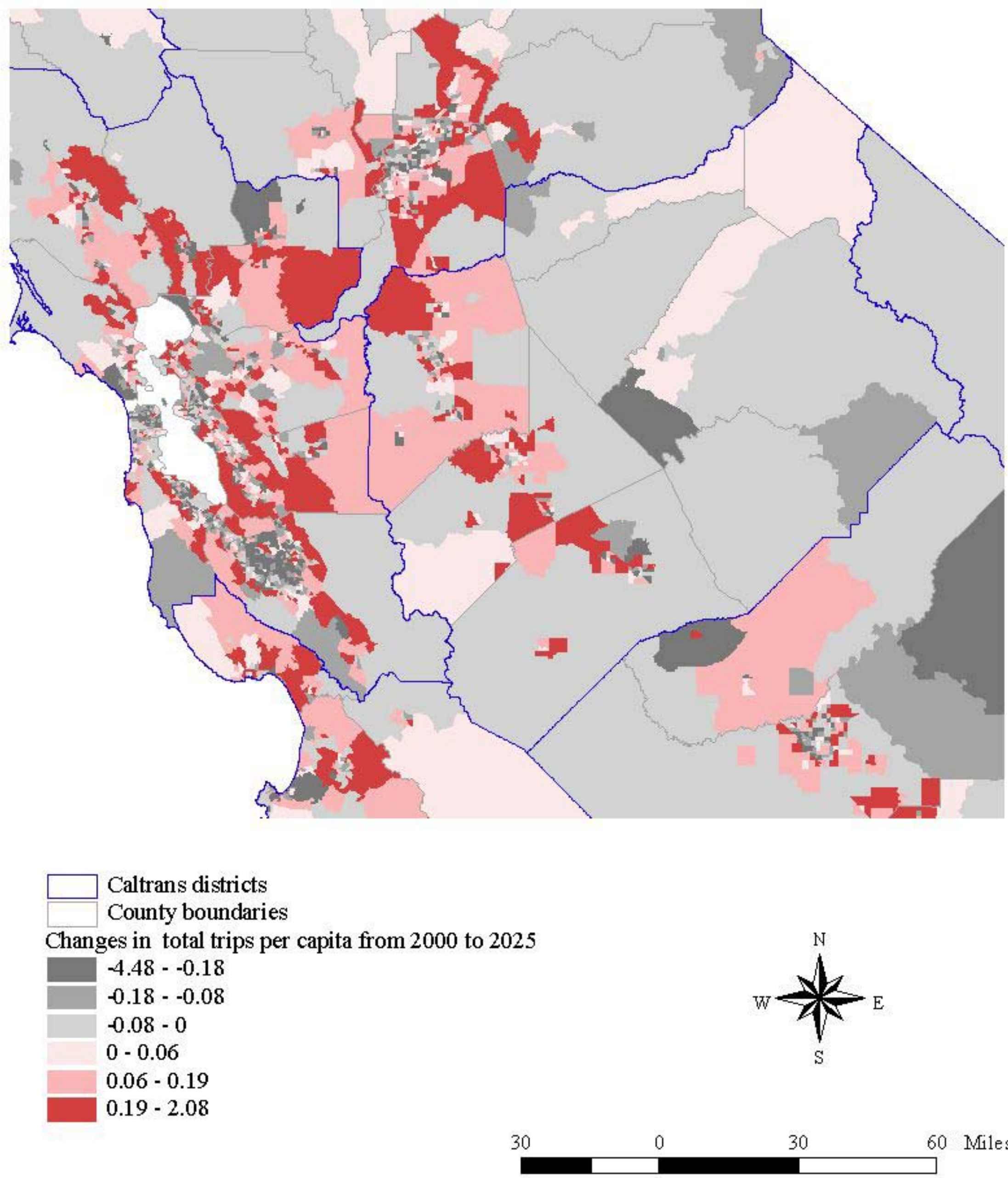
Finally, another perspective is provided by looking at the density of trips, which can be thought of as a crude measure of congestion. Map 4 shows the change in trips per square mile for southern California. The pattern here is less clear, with a mix of increased density in the older urban core of Los Angeles, Orange, and San Diego counties, and in the fast growing corridors of the Inland Empire and eastern Ventura County.

Map 4. Changes from 2000 to 2025 in Southern California-
Trips per Square Mile per Day

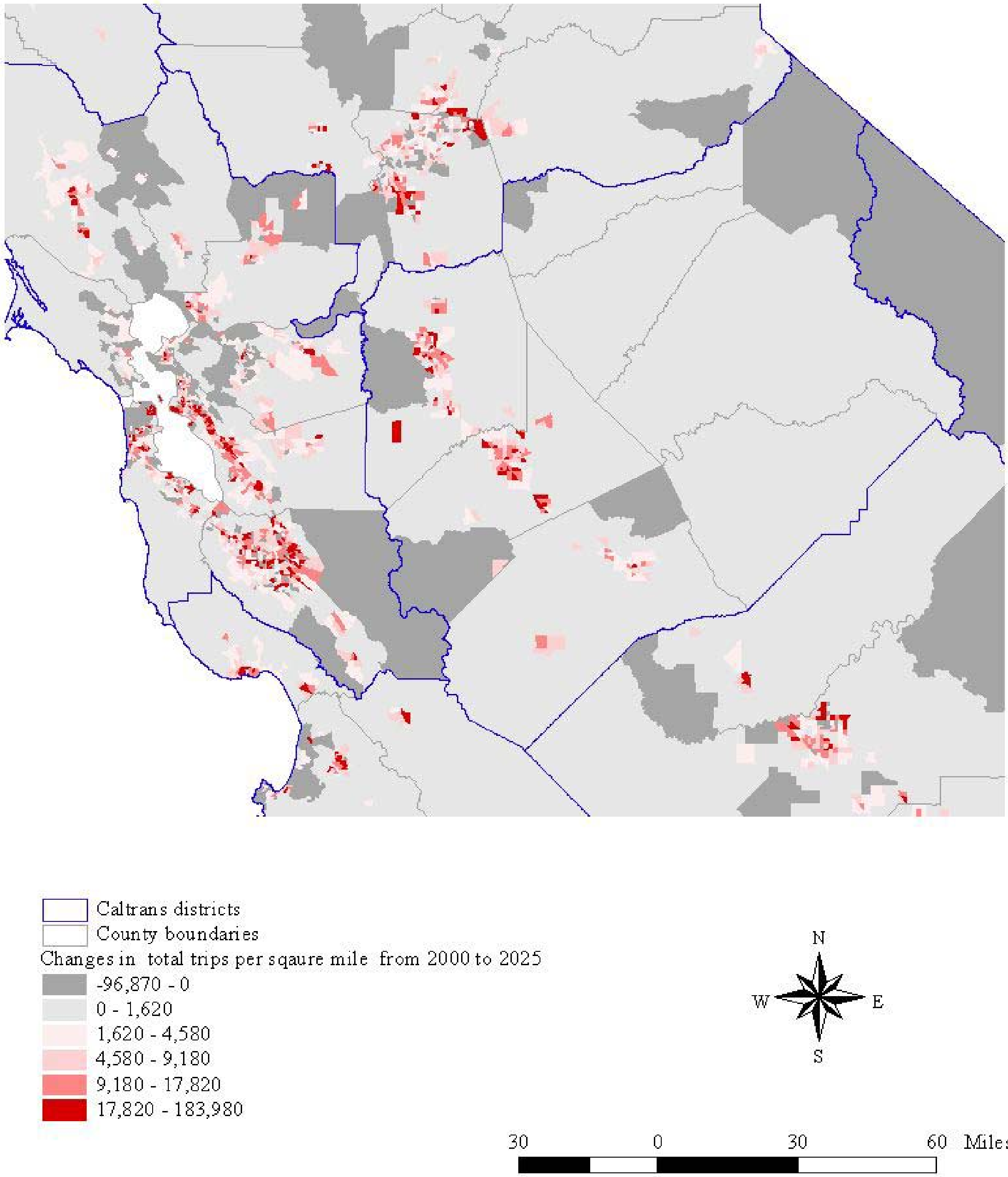


A similar pattern is visible in the metropolitan areas of northern California, as shown in Map 5 and Map 6 (below). Map 5 shows higher per capita trip demand in 2025 in many areas outside the San Francisco/Oakland/San Jose urban centers. However, in Map 6, the density of trip demand increases in the key employment areas, including areas near the urban core.

Map 5. Changes from 2000 to 2025 in Bay Area: Trips per Capita per Day

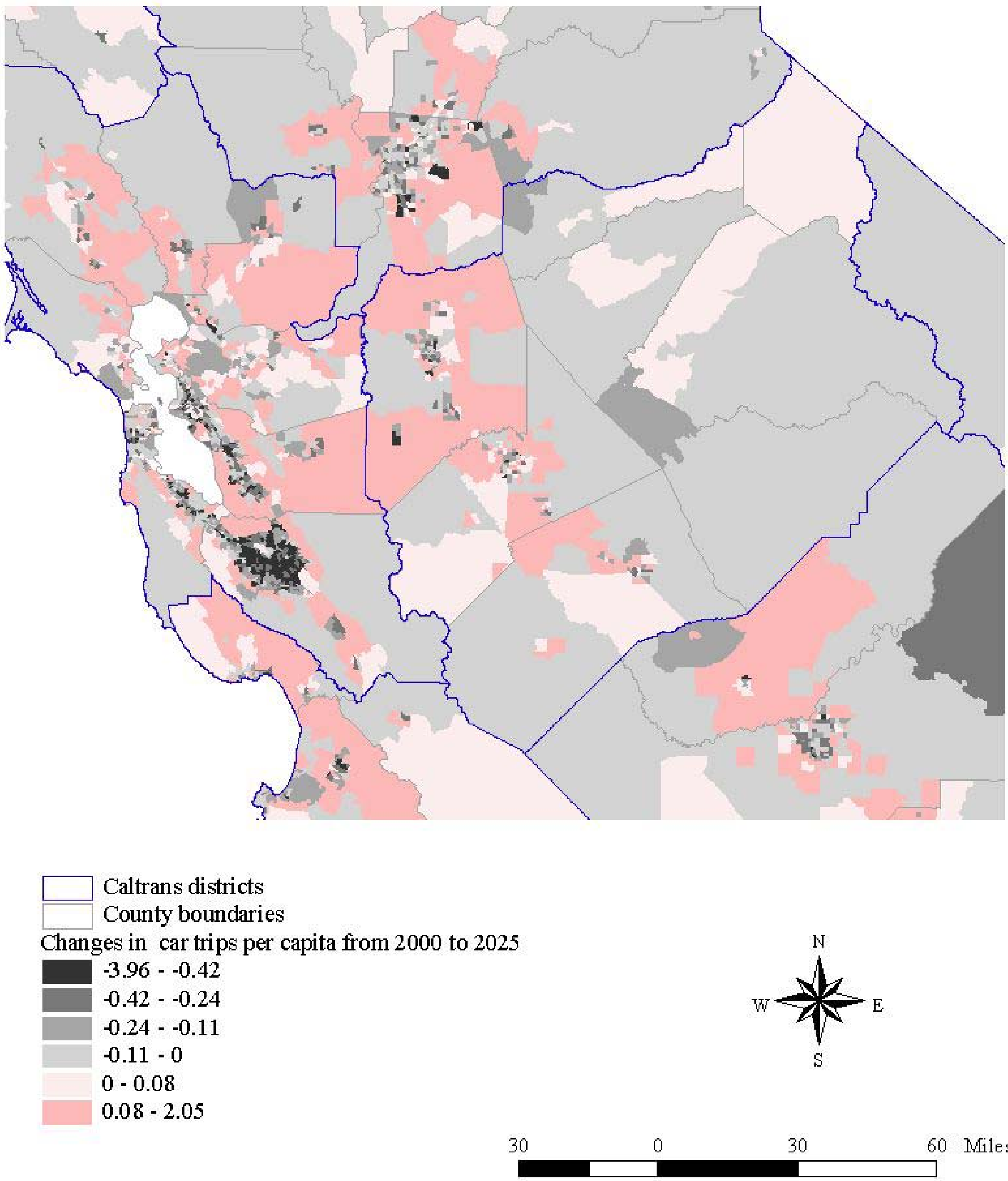


Map 6. Changes in Daily Trips per Square Mile, Bay Area/Sacramento, 2000 to 2025

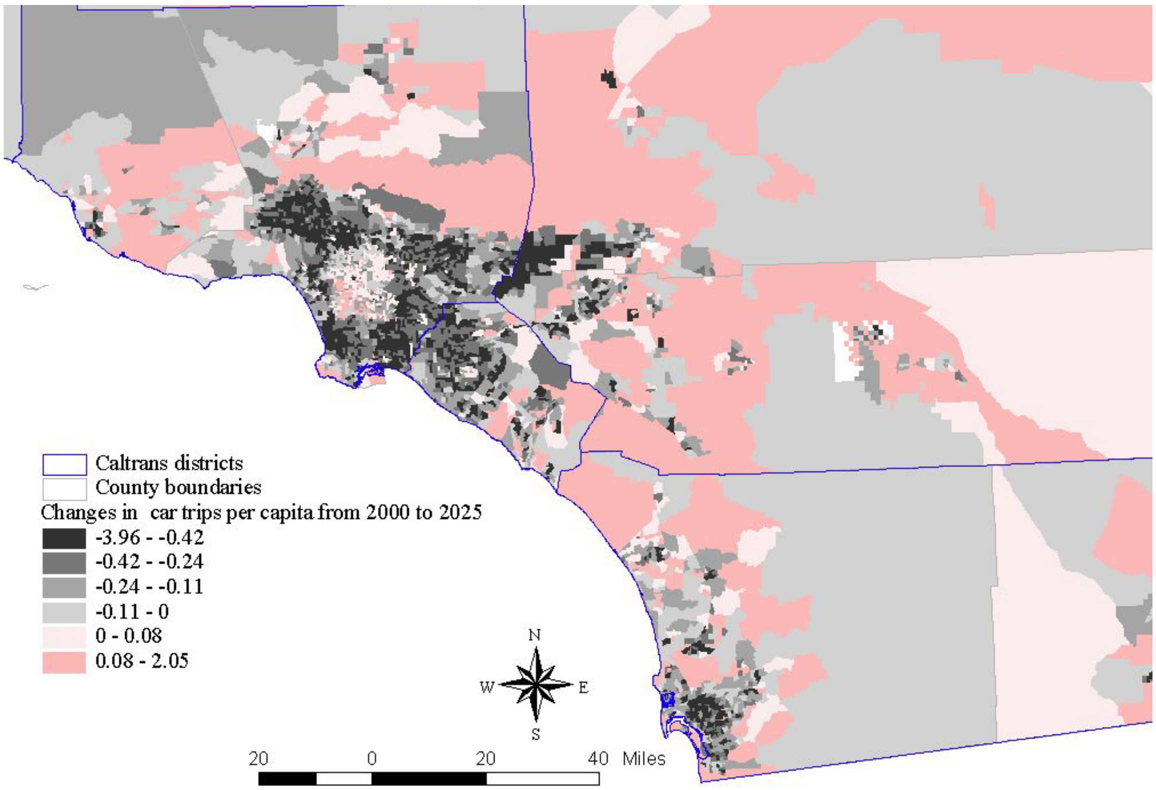


The maps above show total trips, but there are also differences by mode. Map 7 and Map 8 show the change in per capita car trips for these parts of northern and southern California, respectively. There are clear per capita car trip declines in the core urban areas in both regions. This pattern extends over a fairly wide area in Los Angeles.

Map 7. Changes in Daily Per Capita Auto/POV Trips, Bay Area/Sacramento, 2000 to 2025



Map 8. Changes in Car/POV Trips per Capita, Southern California, 2000 to 2025



6.3 Interpreting Travel Demand Trends

These estimated changes in demand are largely driven by several relationships found in the basic empirical model. Older individuals use transit at higher levels than younger people, particularly in the oldest cohorts, and the statewide population is aging over this period. Hispanics and other non-White racial/ethnic groups also are more frequent users of transit in the basic model, and individuals in these racial/ethnic categories are expected to increase as a percentage of the state population over this period. Finally, higher gross residential density is associated with higher transit and walk/bike use at particular threshold levels, and a number of tracts in the state are projected to exceed these thresholds over the 25-year period.

Those relationships may or not be robust over time, for a number of reasons as discussed previously, including whether the empirical model in either the basic or the more complex versions successfully accounted for most important co-correlates with age, sex, race/ethnicity, gross population density, and the 5-mile population accessibility measure, as well as the extent to which relationships between the included variables and omitted variables such as household income, family characteristics, and employment status can be expected to change over time.

Nevertheless, the broad trends are consistent with what we know about travel behavior based on the literature, and they provide a useful basis for planning and discussion.

The state's largest urban areas are in a process of change in terms of ethnic and age makeup of Census tracts and in terms of the loss or increase of population in the tract and surrounding ones. Regionally, the increased percentage of members of non-White racial/ethnic groups in the urban areas means that the per capita travel demand trends are projected to shift somewhat more strongly than the state average to the use of transit and walk/bike.

Meanwhile, some fringe areas are expected to have large per capita increases in travel. This is driven in some cases by an aging of the population located in these areas. In other cases, new development exceeds particular low-level density and population accessibility thresholds that are associated with increases in car trips for work and nonwork purposes.

It is important to note again that these results are predicated on two assumptions. First, we assume that transportation infrastructure (such as transit service and the amount of roads per capita) will be provided statewide at levels similar to the Bay Area counties in places where land use density and population accessibility are similar. Second, we assume that travel differences by age and race/ethnicity (controlling for the other factors in the model) will stay consistent over time. Given the inherent uncertainty associated with predicting future transportation infrastructure provision, household income distribution by age and race/ethnicity, and lifestyle/culture trends associated with particular age cohorts and particular racial/ethnic groups, the most reasonable course is to retain such assumptions.

6.4 Summary

Population and population densities are expected to increase substantially over the next two decades. Travel will rise more or less proportionately with population, implying a substantial increase in car traffic and higher demand for transit in major metropolitan areas. These changes will not occur uniformly, however.

Generally, traffic congestion is projected to increase in traditional urban areas and in suburban edge cities that will continue to be important employment centers. The aging of the population and the continued decentralization of employment combine to possibly reduce car use on a proportional basis.

We forecast an increase in transit trips on a per capita basis on the order of 20 percent, and an associated decrease in car trips per person of a few percent. This is a significant trend, indicating that traffic problems may not worsen in strict tandem with population growth.

7

CONCLUSIONS

What do the demographic and travel projections presented in this report imply for transportation planning and policy in the next 25 years? Summarizing the magnitude, distribution, and characteristics of travel demand statewide leads to several findings and recommendations for state transportation planning.

More concretely, the purpose of the travel demand projections is to assist the Department of Transportation in determining the future transportation infrastructure needs of the state. The Department could use the projections to compare estimated travel demand with the current and future supply of transportation infrastructure. Such a comparison was not possible to carry out within the scope of this project, but would greatly increase the value of the research presented here.

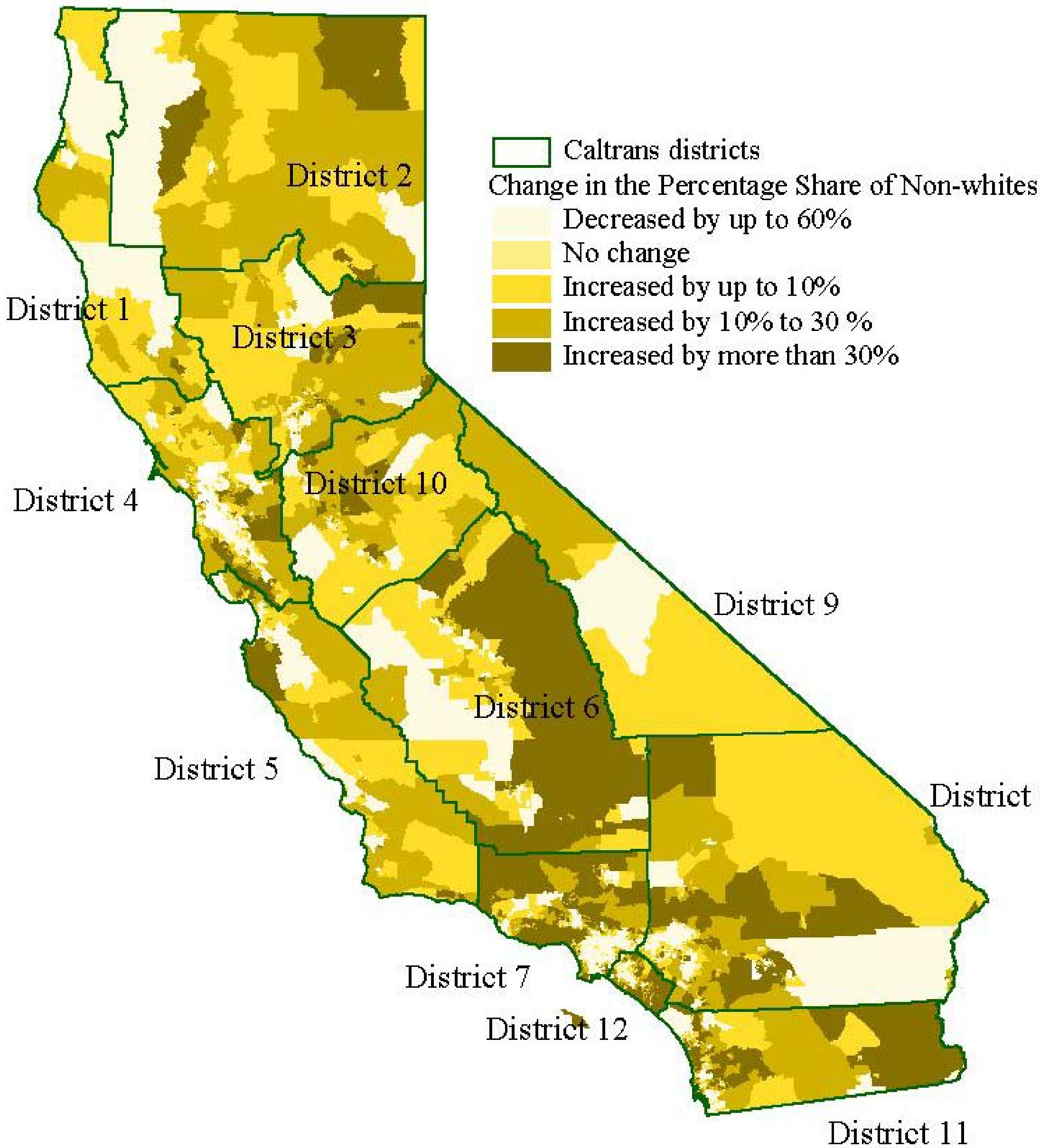
The State's potential role in influencing travel by individuals and households is multifaceted, but it has two particularly important parts. First, how at the margin can the statewide transportation system be appropriately managed to reduce the problems associated with travel? Second, how can the State serve its constituents, ensuring as much as possible that the system serves them equally? These issues are addressed in the sections below.

7.1 Racial/Ethnic Diversity

California's population, already diverse along racial/ethnic lines, is projected to become even more so (see Map 9, below). Although California's rural population has historically been quite diverse compared to other parts of the US, rural places in California are expected to see a comparatively large percentage increase in the nonwhite population, as people of color move to rural places and raise families there. But the map also shows that major metropolitan regions (particularly Southern California) will experience large increases in the nonwhite population, both as a percentage of the population and in absolute terms. These increases are expected to come both from immigration and natural increase.

Most rural portions of the state currently experience relatively little congestion. However, conflicts relating to shared use among personal vehicles and intra-state trucks have been documented on farm-to-market roads in parts of the Central Valley (Deakin 2000), and these conflicts are likely to intensify with further growth. Furthermore, many rural areas will not experience significant increases in projected demand for alternative modes despite in some cases experiencing significant demographic changes. This is partially because, based on patterns seen in the nine-county Bay Area, we would expect that expected marginal increases in density would not be sufficient to stimulate the provision of frequent and convenient transit service. Similarly,

Map 9. Projected Change in Percentage Share of Non-Whites, 2000 to 2025



in absolute terms, the projected increases in density and population accessibility are not enough to make non-motorized modes much more convenient. Therefore, in the most low-density rural areas, the future role of the state will likely continue to be limited to traditional management of state roads.

Nevertheless, there are substantial projected increases in minority populations in high-density parts of the urbanized portions of the state, areas that are relatively cost-efficient to serve with transit. Although both non-whites and low income people take the vast majority of their trips as passengers in personally operated vehicles, they also rely more on transit, walking and biking for work-related and household-serving trips. Transit affordability and service, which has been a contentious issue in Southern California for at least three decades, will be a pressing concern for regions. The state's role in transit provision could include providing subsidies for new transit infrastructure in areas with the highest projected levels of transit demand.

7.2 Transporting Seniors

Transit and mobility are also major concerns for seniors, who are a growing portion of the state's population. By the year 2025, the over-65 population in California will have increased by 52 percent, greater than the total population growth percentage. One of the fastest growing cohorts among the elderly is the "oldest old," those over 80 years of age—a category which is expected to increase by 62 percent. This means that there will be a larger-than-ever group of people who are dependent on family, friends, or public transportation services for mobility, and who will in some cases have seriously limited mobility and life activities as a result of this dependence.

Seniors make fewer work trips by car than the younger cohorts, mostly because many are retired, but they make more non-work trips by car. In fact, in the Bay Area, controlling for other factors, the number of non-work trips by car is consistently higher for older people, only declining after the age of 75. In addition, the transit share of non-work trips for seniors actually increases faster than car trips, which suggests that seniors are attracted by transit alternatives for non-work trips. However, even for seniors the share of non-work trips by transit is low.

In areas experiencing high percentages of growth of the eldest elderly, the market for transit will increase. At the same time, the percentage of drivers on the road who are elderly will be increasing as well, if past trends are any indication. This suggests that the state should both attempt to provide non-auto options, and be prepared to institute safety programs targeted at elderly drivers, in areas projected to experience large increases in the elderly population.

7.3 Managing a Changing Population Distribution

Given past trends in California, foreseeable changes in transportation and communication technology, and the future sociodemographic makeup of the population, reliance on the auto is unlikely to change dramatically over the next 25 years on a statewide basis. Therefore, the best evidence based on past trends is that new road capacity will be needed all over the state, but particularly in areas with the very highest projected growth, and areas that are already over capacity, such as the major urban areas.

Most population growth is expected to take place in the existing metropolitan regions, although large increases are also expected in some areas that are currently at lower density, such as the

Central Valley and along highway corridors connecting the Valley to major employment centers. Growth in existing metropolitan areas will undoubtedly increase crowding on roads and transit vehicles, while growth in currently low density areas may not overload the existing road network as much. We did not compare expected future road capacity with the travel demand estimates to obtain a more precise answer to this question, but our Census-tract level estimates of travel could be used to do so if appropriate data on transportation system capacity were compiled.

It seems sensible to target any transit development and "smart growth" funds toward those areas of the state where demand shares are predicted to be highest. These are places where the increase in the built environment density, the percentage of non-White race/ethnicity groups, and the percentage of the population that is in older cohorts is high. In areas where auto demand is expected to increase, it makes less sense to develop new transit infrastructure plans, or to attempt land use interventions that are transit-supportive.

That said, the state often has little opportunity for direct intervention in most of the urban regions where conditions seem most supportive for alternative modes. Given this constraint, the state's role could be to anticipate trends that the real estate market and local municipal agencies may be structurally unlikely to consider, given a somewhat more short-term focus, and to both make the information widely available and use any incentives at its disposal to encourage supportive planning in such areas.

This conclusion must be strongly tempered by the larger travel context. Although the demographic projections and the travel demand trends result in small projected increases in the demand for transit and walk/bike travel modes statewide, and larger increases in particular areas that newly exceed population density thresholds and experience aging and racial transition, if those trends are borne out they will still be a very small part of the travel demand story. Auto use will continue to be the predominant mode of travel, for all racial/ethnic groups, age categories, income levels, and for almost every travel purpose in every conceivable built environment, with some very localized and slowly expanding exceptions.

Preserving access and mobility for all segments of the travel demand market does not necessarily mean constructing new transit or highway systems. For example, there are alternative ways to enhance the ability of the transit dependent population in areas that are not supportive of transit. Policies to address transportation needs should be targeted to reflect the characteristics of the areas in which people live (Blumenberg and Ong 2001). In areas with low projected transit demand, the state should consider such programs as car ownership subsidies, car sharing programs, paratransit, and other non-traditional forms of assistance to people who do not have cars or who cannot drive. In transit-poor areas, employment accessibility is likely to be poor as well, so such targeting will assist not only with the general problem of access to travel but also with the more specific problem of unemployment due to the difficulty of accessing jobs.

7.4 Recommendations

In summary, we recommend that the state:

- Use the travel projections at the Census tract level statewide to compare expected future impacts on transportation infrastructure given Department of Transportation information on current and future state road capacity by region.
- Acknowledge and plan for inevitable large increases in traffic congestion. Road maintenance and building programs are important, but large scale road infrastructure is extremely costly, even in areas where additional right-of-way is available. Given likely constraints in funding, focus on strategies that manage congestion wisely, such as congestion pricing.
- Be sensitive to the needs of the carless and transit-dependent, particularly in areas that will experience high amounts of auto demand. Such areas may be the appropriate recipients of any funds for paratransit, auto ownership assistance, and van programs.
- Provide state support for walking and biking infrastructure, since these modes have substantially higher shares of travel than transit, and will experience greater increases in demand.
- Target "smart growth" and transit development planning or funding in areas that anticipate high demand for walk/bike and transit modes. Carefully identify areas that will exceed population accessibility thresholds (for example, areas with more than 200,000 population within a five mile radius—see Sections 4 and 7) as the best candidates.

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APPENDICES

A

DEMOGRAPHIC GIS FILE DOCUMENTATION

Demographic projections files were provided to the Department of Transportation on compact disc at an earlier stage of this project. The projection files are of three types:

- State elevation and landform images
- Reference features
- Population projections files

State Elevation and Landform Images

Both of these images are in Albers NAD27 projection: “av_image_flat.tiff” is for use at a full state level, and “av_image_clear.tiff” is for use at a higher resolution, for smaller geographic scales.

The remaining files were created in ArcView 3.2, and there are up to 5 file types sharing the same base name (i.e., .sbn, .sbx. shp, .shx, [nosuffix, which is the dbf file]).

Opening any of these shape files in ArcView 3.2 or 8.1 will automatically set the view into an Albers NAD27 projection. To use these files in conjunction with other GIS data, either convert the other files to Albers, convert these files to fit your other data projections, or unproject to latitude/longitude decimal degrees.

Reference Features

Reference feature GIS files include:

- “designated_places_00”: Census-designated places (Census 2000)
- “fullca_water”: lakes, rivers and ocean (TIGER 2000)
- “highways_00”: freeways and major highways (TIGER 2000)

Again, all are in Albers NAD27 projection.

Population Projections Files

- **tracts_nodata.** This file has 7115 polygons that consist of the 7,049 Census 2000 tracts plus 66 part tracts that are assigned a sequential suffix (_01.._0x) so that the SOLIMAR_JOIN field is unique for each record and part tracts. There are no data in this file, only geography.
- **tract_projections_final .** This file has 7115 records with projection data already joined into the file as attribute fields (see list of fields).
- **county_projections_final.** This file has 58 records with projection data already joined into the file as attribute fields (see list of fields).

Table 35. Fields for County_projections_final

COUNT	Number of tract records in the county
FIPSJOIN	FIPS county code (3-digit)
COUNTY_NAM	County name
Z990_CENSU	1990 Census unadjusted total population
ADJ_FACTOR	1990 Census adjustment total
CENSUS_200	Census 2000 total population
ADJ_FACTOR	Census 2000 adjustment (since rescinded by Census Bureau)
DOF_2000	DOF projection (1998 series)
DOF_2001	DOF projection (1998 series)
DOF_2011	DOF projection (1998 series)
DOF_2015	DOF projection (1998 series)
DOF_2025	DOF projection (1998 series)
AGS_2001	AGS (purchased) projection total population
AGS_2006	AGS (purchased) projection total population
AGS_2011	AGS (purchased) projection total population
DOF_CENSUS	DOF 2000 less Census 2000
CEN2000A	Census 2000 + Census 2000 adjustment
DOF_CENADJ	DOF 2000 less Census 2000 adjusted
DOFTOCENSU	Ratio DOF 2000 to Census 2000 adjusted

Table 36. Fields for Tract_projections_final

AREA	Calculated by GIS, do not use for density
PERIMETER	Calculated by GIS
TR06_D00_	Ignore
TR06_D00_I	Ignore
STATE	FIPS code (06)
COUNTY	3-digit FIPS code
NAME	Tract number as text, no '00' suffixes or leading '0s'
TGR_TRACT	concatenated st/cou/6-digit tract FIPS codes (will match to Census files)
SOLIMAR_JO	same as TGR-TRACT with addition of part suffix (_01, _02..) Set to _00 if no parts
PART	part suffix only (text)
STCOUTRACT	same as TGR_TRACT
PART	same as Part
SQ_MILES	Actual land area, from USGS, use this for density
C1980_TOT	1980 total population
C1990_TOT	1990 unadjusted population
C2000_TOT	2000 unadjusted population
GQ_POP	2000 group quarters population
TOT_UNITS	2000 total housing units
VACANTS	2000 total vacants (all types)
HHLDS	2000 total households (occupied units)
HH_POP	2000 total household population (i.e. without group quarters)
HHLD_SIZE	derived household size
SOL_2015	2015 total population
NH_W_15	Non-Hispanic White total 2015
NH_BL_15	Non-Hispanic Black total 2015
NH_AI_15	Non-Hispanic American Indians and Others total 2015
NH_API_15	Non-Hispanic Asian Pacific Islander total 2015
HISP_15	Hispanics 2015
M_15	Males 2015
F_15	Females 2015
UNDER5_15	Population under age 5, 2015
ZTO17_15	population age 5 to 17, 2015
Z8TO24_15	population age 18 to 24, 2015
Z5TO44_15	population age 25 to 44, 2015
Z5TO64_15	population age 45 to 64, 2015
Z5OLDER_15	population age 65 and older, 2015
SOL_2025	2025 total population
NH_W_25	Non-Hispanic White total 2025
NH_BL_25	Non-Hispanic Black total 2025
NH_AI_25	Non-Hispanic American Indians and Others total 2025
NH_API_25	Non-Hispanic Asian Pacific Islander total 2025
HISP_25	Hispanics 2025
M_25	Males 2025
F_25	Females 2025
UNDER5_25	Population under age 5, 2025
ZTO17_25	population age 5 to 17, 2025

Z8TO24_25	population age 18 to 24, 2025
Z5TO44_25	population age 25 to 44, 2025
Z5TO64_25	population age 45 to 64, 2025
Z5OLDER_25	population age 65 and older, 2025
ENVJUSTICE	Total Non-white population, 2015
PC25_64	Percent population age 25 to 64, 2015
ENVJUST_25	Total Non-white population, 2025
PC25TO64_2	Percent population age 25 to 64, 2025
Z5YRPOPCHG	Total population change 2000 to 2025
PC25YRCHG	Percent change 2000 to 2025
DEN2000	Pop per Sq Mile, 2000
DEN2025	Pop per Sq Mile, 2025
DENRATIO	Ratio of 2025 to 2000 densities

B

FUNCTIONAL FORMS FOR TRAVEL DEMAND MODELS

For social science purposes, functional form refers to the mathematical representation of the relationship between explanatory variables and the behavioral outcome that one is trying to explain. Deciding which functional form to use is sometimes dependent on one's *a priori* assumptions of how the theorized causal factors are expected to affect the behavior. More often, the unit of analysis is an important determinant of the choice of functional form. The unit of analysis is dependent on how the behavior is measured, how it is reported, and the nature of the behavior itself. The intention is to come up with a mathematical function that mimics the behavior being described as closely as possible.

We considered several functional forms for use in the trip models. The number of trips taken by an individual is discrete, meaning that it takes on only integer values. Also, the number of trips is not normally distributed (i.e., shaped like a bell curve). Instead, as shown previously, it is often heavily skewed with a high proportion of zeroes and small values, particularly for trip subcategories (e.g., work trips by transit).

Certain models are better suited to model such data than others. Ordinary least squares regression is typically used for continuous variables, and is not well-suited to discrete data, particularly when the distribution is skewed. The Tobit model is used when the distribution of an independent variable has a large number of zero values, such as trip data, but it also is better suited to continuous independent variables, and it presumes a latent tendency to make negative trips. A common model used for discrete variables taking on a limited number of values is the ordered logit model. However, the count data in this case takes on a fairly large number of values. Also, the ordered logit model is used primarily when the behavior to be modeled is thought to reflect a latent underlying tendency, which may not describe travel behavior appropriately.

The Poisson model is commonly used for count data. It is based on a discrete probability function (one that takes on only integer values) and is similar to an exponential decay function, with large amounts of small values rapidly declining to very small amounts of large values. In general, this kind of distribution resembles the trip counts we graphed previously. However, the Poisson model assumes that the conditional mean of the behavior (in this case, the average number of trips) is equivalent to the conditional variation of the behavior (that is, how much variance in tripmaking there is in the data). Investigations of the data show that this assumption does not hold.

The negative binomial model is based on the Poisson, but is more flexible. It allows the variance of the distribution to be a log-linear function of the mean if the data is over-dispersed or under-dispersed in comparison to a Poisson process. Estimating the model on data includes estimating the variance function for the data. Using this model corrects an important problem with the Poisson, which is that it typically underestimates variance, reporting higher levels of statistical significance than warranted, and sometimes leading to the belief that a causal relationship exists when in fact the data does not support that conclusion. Therefore we used the negative binomial regression for modeling trips.

The second unit of analysis is cumulative trip duration, including cumulative trip duration by mode. Because trip duration is a continuous variable, we restricted ourselves to using either an ordinary least squares (OLS) model or a Tobit model. The Tobit is often preferred for "censored" variables in which it is theorized that the behavior or tendency is only partly observed, in a truncated normal distribution with a portion of that distribution truncated at zero or some other threshold. A Tobit model would be appropriate if some people were not able to travel for a negative amount of time (either total or by mode), but would do so if they were able to (e.g., in order to save time for some other activity).

We extensively tested both the Tobit and ordinary least squares for individual cumulative travel duration variables. Because large percentages of the sample spend no time during the two-day period traveling by alternative modes, and because the models explain little of the variation in travel duration (consistent with the literature), the Tobit was intractable, predicting negative travel too frequently (all the time for transit, for example). The OLS model predicted positive travel duration too frequently, particularly for alternative modes (transit and walk/bike) but fit the data better than the Tobit. We therefore used OLS for the trip duration regressions, but the trip duration travel demand trend forecasts reflect this over-prediction of travel duration by all modes.

C

COMPLEX MODELS: DEMOGRAPHICS

The tables in this Appendix present the results of the complex empirical models focusing on demographic characteristics, as described in Section 4.

Table C1
Total Trips Regressed on Demographic Vars. (Land Use Vars. Included, Not Reported)
Negative Binomial Regression (Incidence Rate Ratios and Z-Statistics Reported)

	Base	Income	Emp/Prof	Children	HH Size	Licensing	Vehicles	Combined
HH Income (Thousands)		1.003						1.002
		(5.48***)						(5.00***)
HH Income Squared		1						1
		(3.11***)						(2.67***)
Work for Pay			1.078					1.087
			(5.25***)					(5.73***)
Professional Occupation			1.068					1.043
			(6.17***)					(3.86***)
Adult in HH With Kids				1.146				1.255
				(11.27***)				(12.53***)
Single Adult HOH With Kids				1.226				1.186
				(6.44***)				(5.06***)
Number in Household					1.009			0.956
					(1.83*)			(6.67***)
Licensed/Capable of Driving						1.638		
						(18.70***)		
Vehicles Per Driver in HH							0.975	
							(1.82*)	
Female	1.085	1.096	1.11	1.079	1.086	1.092	1.086	1.112
	(11.28***)	(12.42***)	(13.13***)	(10.53***)	(11.30***)	(12.11***)	(11.31***)	(13.14***)
Asian / Pacific Islander	0.871	0.868	0.868	0.865	0.87	0.886	0.871	0.859
	(7.85***)	(7.99***)	(8.32***)	(8.26***)	(7.92***)	(6.94***)	(7.84***)	(8.97***)
Hispanic	0.864	0.88	0.881	0.854	0.861	0.88	0.863	0.888
	(6.24***)	(5.41***)	(5.45***)	(6.69***)	(6.37***)	(5.48***)	(6.27***)	(5.07***)
African American	0.799	0.829	0.806	0.789	0.797	0.816	0.8	0.821
	(7.19***)	(6.03***)	(6.84***)	(7.58***)	(7.25***)	(6.59***)	(7.17***)	(6.20***)
Native American	0.767	0.773	0.795	0.76	0.766	0.78	0.766	0.793
	(3.79***)	(3.55***)	(3.25***)	(3.89***)	(3.80***)	(3.61***)	(3.80***)	(3.16***)
3+ Ethnicities	0.921	0.939	0.903	0.922	0.922	0.928	0.921	0.924
	(1.68*)	(1.27)	(1.80*)	(1.65*)	(1.63)	(1.52)	(1.67*)	(1.39)
Age 0 to 4	0.691	0.695		0.749	0.684	1.12	0.692	
	(14.34***)	(13.98***)	()	(10.46***)	(15.04***)	(3.09***)	(14.29***)	()
Age 5 to 9	0.716	0.72		0.776	0.708	1.161	0.716	
	(16.57***)	(16.18***)	()	(11.46***)	(17.20***)	(4.50***)	(16.54***)	()
Age 10 to 13	0.668	0.669	0.712	0.724	0.661	1.084	0.668	0.854
	(19.84***)	(19.59***)	(8.93***)	(14.46***)	(20.30***)	(2.42**)	(19.84***)	(3.77***)
Age 14 to 17	0.722	0.723	0.787	0.783	0.715	0.986	0.723	0.937
	(15.11***)	(14.98***)	(10.26***)	(10.49***)	(15.43***)	(0.53)	(15.04***)	(2.29**)
Age 18 to 20	0.827	0.84	0.865	0.862	0.821	0.863	0.828	0.962
	(6.05***)	(5.46***)	(4.56***)	(4.65***)	(6.23***)	(4.74***)	(5.99***)	(1.15)
Age 21 to 24	0.833	0.861	0.846	0.873	0.833	0.849	0.834	0.931
	(6.55***)	(5.25***)	(5.94***)	(4.83***)	(6.52***)	(5.86***)	(6.46***)	(2.46**)
Age 25 to 29	0.862	0.881	0.868	0.904	0.865	0.865	0.866	0.938
	(6.85***)	(5.80***)	(6.55***)	(4.62***)	(6.67***)	(6.69***)	(6.65***)	(2.89***)
Age 30 to 34	0.906	0.916	0.909	0.924	0.908	0.904	0.908	0.941
	(5.09***)	(4.47***)	(4.94***)	(4.12***)	(5.02***)	(5.22***)	(4.98***)	(3.14***)
Age 35 to 39	0.971	0.975	0.975	0.964	0.97	0.967	0.972	0.975
	(1.64)	(1.39)	(1.42)	(2.05**)	(1.72*)	(1.84*)	(1.58)	(1.42)
Age 40 to 44	1	1.004	1.003	0.988	0.998	0.996	0.999	0.998
	(0.02)	(0.23)	(0.18)	(0.67)	(0.12)	(0.23)	(0.03)	(0.09)
Age 50 to 54	0.919	0.925	0.922	0.951	0.923	0.919	0.919	0.958
	(4.70***)	(4.28***)	(4.53***)	(2.83***)	(4.46***)	(4.69***)	(4.70***)	(2.36**)
Age 55 to 59	0.875	0.881	0.887	0.93	0.881	0.874	0.875	0.949
	(6.52***)	(6.09***)	(5.81***)	(3.50***)	(6.13***)	(6.56***)	(6.54***)	(2.46**)
Age 60 to 64	0.834	0.853	0.868	0.894	0.84	0.836	0.833	0.948
	(7.70***)	(6.56***)	(5.92***)	(4.65***)	(7.27***)	(7.60***)	(7.71***)	(2.14**)
Age 65 to 69	0.786	0.814	0.842	0.846	0.792	0.793	0.786	0.931
	(9.16***)	(7.42***)	(6.30***)	(6.25***)	(8.71***)	(8.85***)	(9.14***)	(2.46**)
Age 70 to 74	0.727	0.754	0.791	0.784	0.734	0.738	0.728	0.872
	(10.58***)	(9.10***)	(7.48***)	(7.96***)	(10.13***)	(10.11***)	(10.53***)	(4.21***)
Age 75 to 79	0.645	0.666	0.705	0.694	0.651	0.667	0.646	0.772
	(12.72***)	(11.02***)	(9.63***)	(10.45***)	(12.33***)	(11.72***)	(12.66***)	(6.65***)
Age 80 to 84	0.558	0.594	0.615	0.6	0.563	0.59	0.559	0.696
	(11.74***)	(9.68***)	(9.55***)	(10.14***)	(11.48***)	(11.13***)	(11.67***)	(6.59***)
Age 85 and Up	0.39	0.408	0.431	0.419	0.393	0.467	0.391	0.484
	(11.05***)	(9.76***)	(9.82***)	(10.14***)	(10.93***)	(9.77***)	(11.03***)	(7.92***)
Observations	30375	29237	25621	30375	30375	30371	30375	24607

Robust z statistics in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%
NOTE: population accessibility index and gross residential category included in model; coefficients not shown.

Table C2
POV Trips to Work/School Regressed On Demographic Vars. (Land Use Vars. Included, Not Reported)
Negative Binomial Regression (Incidence Risk Ratios and Z-Statistics Reported)

	Base	Income	Emp/Prof	Children	HH Size	Licensing	Vehicles	Combined
HH Income (Thousands)		1.007						1.004
		(8.85***)						(5.10***)
HH Income Squared		1						1
		(6.44***)						(3.33***)
Work for Pay			4.08					3.981
			(44.48***)					(43.44***)
Professional Occupation			1.056					1.023
			(3.65***)					(1.44)
Adult in HH With Kids				0.992				1.103
				(0.48)				(3.93***)
Single Adult HOH With Kids				1.306				1.251
				(5.56***)				(4.42***)
Number in Household					0.966			0.962
					(5.55***)			(4.01***)
Licensed/Capable of Driving						2.246		
						(20.41***)		
Vehicles Per Driver in HH							0.879	
							(5.86***)	
Female	0.827	0.84	0.895	0.824	0.825	0.832	0.828	0.898
	(15.66***)	(14.30***)	(8.92***)	(16.01***)	(15.83***)	(15.20***)	(15.56***)	(8.52***)
Asian / Pacific Islander	0.979	0.971	0.999	0.98	0.985	1	0.982	0.994
	(0.95)	(1.29)	(0.02)	(0.88)	(0.69)	(0.01)	(0.83)	(0.26)
Hispanic	0.956	0.988	0.98	0.956	0.969	0.983	0.953	1.003
	(1.56)	(0.41)	(0.71)	(1.56)	(1.07)	(0.61)	(1.64)	(0.11)
African American	0.867	0.926	0.875	0.861	0.873	0.893	0.871	0.898
	(3.20***)	(1.76*)	(3.21***)	(3.34***)	(3.05***)	(2.58***)	(3.11***)	(2.58***)
Native American	0.76	0.75	0.789	0.758	0.765	0.781	0.755	0.762
	(3.07***)	(3.03***)	(2.84***)	(3.10***)	(3.05***)	(2.76***)	(3.14***)	(3.16***)
3+ Ethnicities	0.981	1.008	0.909	0.976	0.976	0.994	0.983	0.927
	(0.29)	(0.11)	(1.13)	(0.36)	(0.36)	(0.1)	(0.26)	(0.88)
Age 0 to 4	0.361	0.366	0	0.363	0.376	0.8	0.364	0
	(22.74***)	(22.34***)	(0)	(21.79***)	(21.95***)	(3.73***)	(22.61***)	(0)
Age 5 to 9	0.668	0.676	0	0.67	0.699	1.48	0.67	0
	(13.31***)	(12.88***)	(0)	(12.43***)	(11.77***)	(7.92***)	(13.21***)	(0)
Age 10 to 13	0.588	0.597	1.961	0.59	0.615	1.304	0.589	2.102
	(15.78***)	(15.23***)	(9.82***)	(14.87***)	(14.44***)	(5.18***)	(15.75***)	(10.28***)
Age 14 to 17	0.791	0.796	2.044	0.793	0.822	1.286	0.797	2.199
	(7.36***)	(7.15***)	(17.60***)	(6.87***)	(6.11***)	(6.88***)	(7.11***)	(17.47***)
Age 18 to 20	0.929	0.954	1.233	0.934	0.955	0.991	0.94	1.31
	(1.76*)	(1.11)	(4.78***)	(1.61)	(1.09)	(0.23)	(1.49)	(6.03***)
Age 21 to 24	0.93	0.992	1.006	0.935	0.929	0.957	0.941	1.08
	(1.87*)	(0.21)	(0.16)	(1.74*)	(1.91*)	(1.14)	(1.56)	(1.98**)
Age 25 to 29	0.844	0.877	0.901	0.846	0.833	0.851	0.86	0.942
	(5.33***)	(4.09***)	(3.40***)	(5.25***)	(5.72***)	(5.14***)	(4.75***)	(1.92*)
Age 30 to 34	0.889	0.906	0.926	0.891	0.885	0.888	0.899	0.946
	(4.24***)	(3.49***)	(2.90***)	(4.20***)	(4.44***)	(4.30***)	(3.86***)	(2.05**)
Age 35 to 39	0.92	0.929	0.946	0.919	0.925	0.917	0.925	0.954
	(3.20***)	(2.78***)	(2.23**)	(3.24***)	(3.01***)	(3.34***)	(3.00***)	(1.85*)
Age 40 to 44	0.961	0.969	0.979	0.96	0.968	0.958	0.961	0.983
	(1.58)	(1.25)	(0.89)	(1.63)	(1.32)	(1.73*)	(1.59)	(0.7)
Age 50 to 54	0.968	0.974	0.99	0.969	0.953	0.969	0.968	0.999
	(1.27)	(1)	(0.42)	(1.22)	(1.84*)	(1.24)	(1.26)	(0.03)
Age 55 to 59	0.846	0.858	0.941	0.849	0.825	0.846	0.844	0.962
	(5.26***)	(4.68***)	(2.03**)	(5.05***)	(5.91***)	(5.29***)	(5.34***)	(1.23)
Age 60 to 64	0.623	0.661	0.861	0.625	0.605	0.628	0.622	0.91
	(10.90***)	(9.48***)	(3.91***)	(10.66***)	(11.47***)	(10.80***)	(10.97***)	(2.40**)
Age 65 to 69	0.358	0.394	0.669	0.359	0.347	0.363	0.359	0.711
	(14.96***)	(13.24***)	(6.72***)	(14.81***)	(15.37***)	(14.78***)	(14.93***)	(5.51***)
Age 70 to 74	0.166	0.186	0.416	0.166	0.16	0.17	0.167	0.446
	(18.92***)	(17.14***)	(10.41***)	(18.84***)	(19.27***)	(18.72***)	(18.88***)	(9.25***)
Age 75 to 79	0.093	0.102	0.274	0.093	0.09	0.098	0.094	0.285
	(18.38***)	(16.98***)	(10.79***)	(18.33***)	(18.62***)	(18.02***)	(18.31***)	(10.07***)
Age 80 to 84	0.059	0.072	0.197	0.059	0.057	0.065	0.06	0.227
	(11.33***)	(10.27***)	(6.74***)	(11.31***)	(11.47***)	(11.02***)	(11.28***)	(6.01***)
Age 85 and Up	0.046	0.054	0.162	0.046	0.045	0.061	0.046	0.183
	(7.16***)	(6.79***)	(4.49***)	(7.16***)	(7.22***)	(6.52***)	(7.16***)	(4.23***)
Observations	30,375	29,237	25,621	30,375	30,375	30,371	30,375	24,607

Robust z statistics in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%
NOTE: population accessibility index and gross residential category included in model; coefficients not shown.

Table C3
Transit Trips to Work/School Regressed On Demographic Vars. (Land Use Vars. Included, Not Reported)
Negative Binomial Regression (Incidence Risk Ratios and Z-Statistics Reported)

	Base	Income	Emp/Prof	Children	HH Size	Licensing	Vehicles	Combined
HH Income (Thousands)		0.982						0.982
		(5.43***)						(4.86***)
HH Income Squared		1						1
		(4.62***)						(3.89***)
Work for Pay			1.659					1.633
			(4.02***)					(3.94***)
Professional Occupation			1.252					1.346
			(2.40**)					(3.05***)
Adult in HH With Kids				0.588				0.556
				(4.95***)				(4.00***)
Single Adult HOH With Kids				1.186				1.079
				(0.6)				(0.26)
Number in Household					0.926			1.083
					(2.30**)			(1.76*)
Licensed/Capable of Driving						0.293		
						(8.06***)		
Vehicles Per Driver in HH							0.966	
							(0.39)	
Female	0.883	0.879	0.927	0.885	0.885	0.852	0.884	0.919
	(1.89*)	(1.93*)	(1.03)	(1.86*)	(1.87*)	(2.41**)	(1.89*)	(1.12)
Asian / Pacific Islander	1.208	1.191	1.277	1.242	1.222	1.118	1.208	1.296
	(1.71*)	(1.54)	(2.06**)	(1.96**)	(1.81*)	(0.99)	(1.71*)	(2.14**)
Hispanic	1.698	1.503	1.634	1.77	1.76	1.573	1.699	1.41
	(3.89***)	(2.91***)	(3.50***)	(4.18***)	(4.10***)	(3.29***)	(3.89***)	(2.42**)
African American	2.832	2.258	2.725	2.972	2.967	2.595	2.838	2.291
	(5.44***)	(4.53***)	(5.74***)	(5.64***)	(5.58***)	(4.89***)	(5.44***)	(4.72***)
Native American	1.567	1.598	1.172	1.62	1.659	1.482	1.563	1.2
	(0.91)	(0.93)	(0.3)	(0.98)	(1)	(0.77)	(0.91)	(0.34)
3+ Ethnicities	1.404	1.354	1.521	1.385	1.397	1.422	1.404	1.373
	(1.45)	(1.26)	(1.48)	(1.41)	(1.43)	(1.44)	(1.45)	(1.12)
Age 0 to 4	0.449	0.424	0	0.354	0.499	0.142	0.449	0
	(2.46**)	(2.62***)	(0)	(3.20***)	(2.16**)	(5.39***)	(2.46**)	(0)
Age 5 to 9	2.844	2.659	0	2.226	3.173	0.883	2.839	0
	(6.23***)	(5.78***)	(0)	(4.60***)	(6.71***)	(0.57)	(6.23***)	(0)
Age 10 to 13	4.219	3.848	9.825	3.284	4.664	1.315	4.205	6.614
	(9.50***)	(8.74***)	(9.91***)	(7.48***)	(9.79***)	(1.31)	(9.50***)	(7.36***)
Age 14 to 17	3.504	3.369	5.955	2.739	3.836	1.466	3.503	4.015
	(7.77***)	(7.44***)	(9.88***)	(6.03***)	(8.11***)	(1.81*)	(7.77***)	(6.55***)
Age 18 to 20	1.516	1.425	1.917	1.346	1.602	1.191	1.515	1.485
	(1.61)	(1.36)	(2.48**)	(1.17)	(1.81*)	(0.68)	(1.61)	(1.47)
Age 21 to 24	1.977	1.67	2.255	1.781	1.985	1.774	1.98	1.679
	(3.71***)	(2.72***)	(4.41***)	(3.10***)	(3.72***)	(3.10***)	(3.71***)	(2.69***)
Age 25 to 29	1.444	1.356	1.483	1.271	1.421	1.383	1.455	1.218
	(2.25**)	(1.84*)	(2.40**)	(1.44)	(2.14**)	(1.97**)	(2.28**)	(1.17)
Age 30 to 34	1.545	1.451	1.552	1.446	1.531	1.533	1.548	1.35
	(2.75***)	(2.30**)	(2.74***)	(2.32**)	(2.69***)	(2.67***)	(2.76***)	(1.83*)
Age 35 to 39	1.197	1.162	1.192	1.191	1.195	1.207	1.196	1.15
	(1.15)	(0.94)	(1.13)	(1.11)	(1.14)	(1.19)	(1.15)	(0.89)
Age 40 to 44	1.042	0.958	1.073	1.074	1.056	1.034	1.039	1.009
	(0.26)	(0.26)	(0.43)	(0.43)	(0.34)	(0.21)	(0.24)	(0.06)
Age 50 to 54	0.973	0.91	0.989	0.882	0.947	0.964	0.972	0.853
	(0.15)	(0.52)	(0.06)	(0.69)	(0.3)	(0.2)	(0.16)	(0.86)
Age 55 to 59	0.931	0.89	0.989	0.787	0.884	0.956	0.929	0.823
	(0.36)	(0.57)	(0.05)	(1.18)	(0.62)	(0.22)	(0.37)	(0.94)
Age 60 to 64	0.854	0.794	1.01	0.692	0.798	0.832	0.853	0.793
	(0.67)	(0.96)	(0.04)	(1.56)	(0.96)	(0.78)	(0.68)	(0.97)
Age 65 to 69	0.182	0.164	0.256	0.149	0.171	0.158	0.182	0.194
	(3.61***)	(3.88***)	(2.89***)	(4.02***)	(3.75***)	(3.97***)	(3.62***)	(3.51***)
Age 70 to 74	0.213	0.187	0.341	0.172	0.199	0.184	0.213	0.254
	(2.67***)	(3.05***)	(1.82*)	(3.05***)	(2.79***)	(3.13***)	(2.69***)	(2.46**)
Age 75 to 79	0.13	0.115	0.222	0.105	0.122	0.102	0.13	0.166
	(2.71***)	(2.96***)	(2.00**)	(2.99***)	(2.79***)	(3.29***)	(2.72***)	(2.48**)
Age 80 to 84	0.111	0	0.19	0.091	0.104	0.082	0.112	0
	(2.18**)	(88.15***)	(1.68*)	(2.39**)	(2.26**)	(2.39**)	(2.18**)	(68.71***)
Age 85 and Up	0	0	0	0	0	0	0	0
	(75.53***)	(83.25***)	(66.94***)	(76.96***)	(76.04***)	(61.34***)	(75.34***)	(64.17***)
Observations	30,375	29,237	25,621	30,375	30,375	30,371	30,375	24,607

Robust z statistics in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%
NOTE: population accessibility index and gross residential category included in model; coefficients not shown.

Table C4
Walk/Bike Trips to Work/School Regressed On Demographic Vars (Land Use Vars Included, Not Reported)
Negative Binomial Regression (Incidence Risk Ratios and Z-Statistics Reported)

	Base	Income	Emp/Prof	Children	HH Size	Licensing	Vehicles	Combined
HH Income (Thousands)		0.997						0.996
		(1.70*)						(1.82*)
HH Income Squared		1						1
		(1.43)						(1.4)
Work for Pay			2.283					2.182
			(10.55***)					(9.76***)
Professional Occupation			1.42					1.418
			(6.99***)					(6.74***)
Adult in HH With Kids				0.624				0.815
				(8.63***)				(2.53**)
Single Adult HOH With Kids				0.871				0.739
				(0.63)				(1.3)
Number in Household					0.866			0.911
					(7.17***)			(3.21***)
Licensed/Capable of Driving						0.546		
						(7.00***)		
Vehicles Per Driver in HH							1.193	
							(3.94***)	
Female	0.771	0.771	0.82	0.767	0.764	0.764	0.773	0.806
	(7.11***)	(7.00***)	(4.88***)	(7.27***)	(7.40***)	(7.35***)	(7.05***)	(5.21***)
Asian / Pacific Islander	0.735	0.727	0.729	0.755	0.754	0.713	0.739	0.735
	(4.50***)	(4.62***)	(4.18***)	(4.10***)	(4.11***)	(4.99***)	(4.43***)	(4.03***)
Hispanic	0.744	0.747	0.621	0.776	0.797	0.716	0.751	0.673
	(2.83***)	(2.76***)	(4.47***)	(2.43**)	(2.15**)	(3.21***)	(2.74***)	(3.67***)
African American	1.021	1.021	1.01	1.064	1.091	0.997	1.022	1.067
	(0.2)	(0.2)	(0.08)	(0.61)	(0.8)	(0.03)	(0.21)	(0.54)
Native American	0.671	0.626	0.781	0.696	0.673	0.649	0.69	0.743
	(1.43)	(1.61)	(0.81)	(1.28)	(1.42)	(1.53)	(1.31)	(0.93)
3+ Ethnicities	1.101	1.075	1.178	1.096	1.057	1.095	1.104	1.098
	(0.54)	(0.4)	(0.79)	(0.52)	(0.32)	(0.51)	(0.55)	(0.47)
Age 0 to 4	0.258	0.258	0	0.205	0.307	0.145	0.256	0
	(7.14***)	(7.16***)	(0)	(8.26***)	(6.23***)	(9.48***)	(7.16***)	(0)
Age 5 to 9	1.333	1.298	0	1.048	1.654	0.746	1.333	0
	(3.11***)	(2.79***)	(0)	(0.48)	(5.36***)	(2.36**)	(3.11***)	(0)
Age 10 to 13	1.828	1.802	4.485	1.432	2.23	1.021	1.83	4.275
	(7.04***)	(6.81***)	(9.86***)	(3.99***)	(9.04***)	(0.17)	(7.06***)	(8.65***)
Age 14 to 17	1.468	1.424	3.373	1.154	1.752	0.948	1.465	3.146
	(4.07***)	(3.68***)	(11.10***)	(1.46)	(5.78***)	(0.46)	(4.03***)	(8.93***)
Age 18 to 20	1.219	1.178	1.913	1.082	1.343	1.11	1.213	1.807
	(1.47)	(1.19)	(4.26***)	(0.59)	(2.15**)	(0.76)	(1.46)	(3.74***)
Age 21 to 24	1.454	1.381	1.809	1.257	1.44	1.435	1.422	1.569
	(3.14***)	(2.66***)	(4.75***)	(1.93*)	(2.98***)	(2.98***)	(3.03***)	(3.53***)
Age 25 to 29	1.468	1.433	1.627	1.254	1.38	1.464	1.41	1.4
	(4.54***)	(4.21***)	(5.63***)	(2.66***)	(3.81***)	(4.50***)	(4.07***)	(3.82***)
Age 30 to 34	1.132	1.104	1.156	1.042	1.099	1.142	1.119	1.067
	(1.51)	(1.19)	(1.75*)	(0.5)	(1.14)	(1.62)	(1.37)	(0.77)
Age 35 to 39	1.005	0.976	1.03	0.995	1.006	1.005	0.996	0.997
	(0.06)	(0.29)	(0.35)	(0.06)	(0.07)	(0.06)	(0.05)	(0.04)
Age 40 to 44	0.887	0.87	0.911	0.905	0.902	0.892	0.892	0.909
	(1.4)	(1.6)	(1.08)	(1.16)	(1.19)	(1.34)	(1.33)	(1.08)
Age 50 to 54	0.926	0.927	0.948	0.829	0.865	0.929	0.926	0.86
	(0.9)	(0.88)	(0.62)	(2.17**)	(1.69*)	(0.86)	(0.89)	(1.73*)
Age 55 to 59	0.706	0.664	0.769	0.592	0.642	0.703	0.714	0.626
	(3.57***)	(4.08***)	(2.70***)	(5.30***)	(4.51***)	(3.62***)	(3.45***)	(4.60***)
Age 60 to 64	0.434	0.419	0.538	0.355	0.386	0.425	0.439	0.44
	(6.50***)	(6.52***)	(4.88***)	(7.92***)	(7.41***)	(6.63***)	(6.38***)	(6.20***)
Age 65 to 69	0.214	0.227	0.352	0.174	0.19	0.21	0.213	0.302
	(6.97***)	(6.71***)	(4.74***)	(7.71***)	(7.40***)	(7.14***)	(7.04***)	(5.32***)
Age 70 to 74	0.15	0.148	0.286	0.122	0.132	0.147	0.15	0.227
	(7.98***)	(7.57***)	(5.35***)	(8.74***)	(8.49***)	(8.01***)	(7.93***)	(5.97***)
Age 75 to 79	0.079	0.083	0.167	0.064	0.07	0.075	0.078	0.142
	(7.25***)	(7.10***)	(5.27***)	(7.77***)	(7.59***)	(7.28***)	(7.24***)	(5.74***)
Age 80 to 84	0.12	0.088	0.29	0.098	0.106	0.107	0.118	0.175
	(4.37***)	(3.82***)	(2.56**)	(4.81***)	(4.60***)	(4.63***)	(4.39***)	(2.73***)
Age 85 and Up	0	0	0	0	0	0	0	0
	(103.32***)	(100.24***)	(158.45***)	(121.32***)	(121.13***)	(108.74***)	(102.81***)	(155.04***)
Observations	30,375	29,237	25,621	30,375	30,375	30,371	30,375	24,607

Robust z statistics in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%
NOTE: population accessibility index and gross residential category included in model; coefficients not shown.

Table C5
Nonwork POV Trips Regressed On Demographic Vars (Land Use Vars Included, Not Reported)
Negative Binomial Regression (Incidence Risk Ratios and Z-Statistics Reported)

	Base	Income	Emp/Prof	Children	HH Size	Licensing	Vehicles	Combined
HH Income (Thousands)		1.005						1.006
		(6.39***)						(7.61***)
HH Income Squared		1						1
		(4.30***)						(5.22***)
Work for Pay			0.772					0.775
			(13.18***)					(12.71***)
Professional Occupation			1.091					1.047
			(5.19***)					(2.68***)
Adult in HH With Kids				1.033				1.172
				(1.77*)				(5.69***)
Single Adult HOH With Kids				1.049				1.024
				(0.91)				(0.44)
Number in Household					0.976			0.925
					(3.63***)			(7.66***)
Licensed/Capable of Driving						2.128		
						(18.59***)		
Vehicles Per Driver in HH							1.004	
							(0.16)	
Female	1.204	1.22	1.204	1.203	1.204	1.215	1.204	1.215
	(17.41***)	(18.20***)	(16.07***)	(17.28***)	(17.40***)	(18.27***)	(17.41***)	(16.50***)
Asian / Pacific Islander	0.801	0.799	0.79	0.8	0.804	0.82	0.801	0.791
	(7.62***)	(7.60***)	(8.44***)	(7.68***)	(7.49***)	(6.86***)	(7.62***)	(8.33***)
Hispanic	0.773	0.789	0.801	0.771	0.78	0.795	0.773	0.824
	(6.58***)	(6.14***)	(5.75***)	(6.63***)	(6.36***)	(5.91***)	(6.58***)	(5.05***)
African American	0.671	0.704	0.692	0.669	0.674	0.69	0.671	0.73
	(7.24***)	(6.39***)	(7.03***)	(7.29***)	(7.17***)	(6.80***)	(7.25***)	(6.05***)
Native American	0.657	0.675	0.696	0.656	0.659	0.667	0.657	0.722
	(3.97***)	(3.60***)	(3.47***)	(3.96***)	(4.00***)	(3.93***)	(3.97***)	(3.03***)
3+ Ethnicities	0.879	0.911	0.862	0.879	0.872	0.889	0.879	0.897
	(1.67*)	(1.19)	(1.69*)	(1.65*)	(1.77*)	(1.52)	(1.67*)	(1.25)
Age 0 to 4	0.847	0.851	0	0.863	0.871	1.778	0.847	0
	(4.60***)	(4.42***)	(0)	(3.75***)	(3.88***)	(10.63***)	(4.62***)	(0)
Age 5 to 9	0.737	0.743	0	0.751	0.761	1.548	0.737	0
	(9.41***)	(9.09***)	(0)	(8.05***)	(8.56***)	(8.46***)	(9.41***)	(0)
Age 10 to 13	0.631	0.633	0.501	0.643	0.651	1.325	0.631	0.596
	(12.81***)	(12.60***)	(10.67***)	(11.38***)	(12.07***)	(5.23***)	(12.81***)	(7.46***)
Age 14 to 17	0.627	0.624	0.554	0.639	0.644	1.001	0.627	0.644
	(12.69***)	(12.73***)	(15.23***)	(11.37***)	(11.96***)	(0.01)	(12.70***)	(9.53***)
Age 18 to 20	0.82	0.836	0.808	0.827	0.836	0.867	0.819	0.9
	(4.11***)	(3.64***)	(4.30***)	(3.89***)	(3.69***)	(2.98***)	(4.12***)	(2.03**)
Age 21 to 24	0.759	0.789	0.765	0.767	0.758	0.779	0.759	0.827
	(6.10***)	(5.15***)	(5.81***)	(5.85***)	(6.11***)	(5.57***)	(6.10***)	(4.04***)
Age 25 to 29	0.841	0.861	0.835	0.851	0.833	0.847	0.841	0.874
	(4.83***)	(4.15***)	(5.02***)	(4.48***)	(5.11***)	(4.65***)	(4.84***)	(3.70***)
Age 30 to 34	0.867	0.882	0.862	0.871	0.864	0.864	0.867	0.883
	(4.70***)	(4.11***)	(4.91***)	(4.56***)	(4.82***)	(4.82***)	(4.70***)	(4.04***)
Age 35 to 39	0.921	0.926	0.915	0.92	0.925	0.917	0.921	0.923
	(2.96***)	(2.76***)	(3.23***)	(3.03***)	(2.81***)	(3.14***)	(2.97***)	(2.87***)
Age 40 to 44	0.975	0.981	0.97	0.972	0.98	0.97	0.975	0.98
	(0.95)	(0.71)	(1.15)	(1.05)	(0.75)	(1.17)	(0.95)	(0.75)
Age 50 to 54	0.997	1.002	0.992	1.005	0.986	0.997	0.997	0.998
	(0.11)	(0.08)	(0.31)	(0.19)	(0.52)	(0.1)	(0.11)	(0.09)
Age 55 to 59	1.049	1.061	1.019	1.064	1.03	1.047	1.049	1.035
	(1.66*)	(2.00**)	(0.67)	(2.09**)	(0.99)	(1.6)	(1.66*)	(1.14)
Age 60 to 64	1.135	1.16	1.054	1.154	1.109	1.139	1.135	1.075
	(3.93***)	(4.48***)	(1.64)	(4.32***)	(3.18***)	(4.07***)	(3.93***)	(2.12**)
Age 65 to 69	1.233	1.289	1.104	1.255	1.204	1.249	1.233	1.151
	(6.45***)	(7.42***)	(2.91***)	(6.76***)	(5.59***)	(6.85***)	(6.45***)	(3.86***)
Age 70 to 74	1.226	1.294	1.059	1.248	1.194	1.251	1.226	1.104
	(5.65***)	(6.86***)	(1.53)	(5.96***)	(4.81***)	(6.23***)	(5.64***)	(2.48**)
Age 75 to 79	1.124	1.179	0.958	1.144	1.095	1.177	1.124	0.992
	(2.95***)	(3.86***)	(1.02)	(3.31***)	(2.24**)	(4.03***)	(2.93***)	(0.18)
Age 80 to 84	1	1.103	0.85	1.017	0.974	1.075	0.999	0.93
	(0)	(1.68*)	(2.90***)	(0.31)	(0.49)	(1.42)	(0.01)	(1.2)
Age 85 and Up	0.693	0.737	0.586	0.705	0.679	0.894	0.693	0.625
	(4.16***)	(3.19***)	(5.98***)	(3.95***)	(4.41***)	(1.4)	(4.16***)	(4.92***)
Observations	30,375	29,237	25,621	30,375	30,375	30,371	30,375	24,607

Robust z statistics in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%
NOTE: population accessibility index and gross residential category included in model; coefficients not shown.

Table C6
Nonwork Transit Trips Regressed On Demographic Vars (Land Use Vars Included, Not Reported)
Negative Binomial Regression (Incidence Risk Ratios and Z-Statistics Reported)

	Base	Income	Emp/Prof	Children	HH Size	Licensing	Vehicles	Combined
HH Income (Thousands)		0.976						0.977
		(5.53***)						(5.08***)
HH Income Squared		1						1
		(4.17***)						(4.01***)
Work for Pay			0.466					0.498
			(5.16***)					(4.71***)
Professional Occupation			1.096					1.156
			(0.69)					(1.04)
Adult in HH With Kids				0.436				0.519
				(5.24***)				(3.25***)
Single Adult HOH With Kids				2.299				1.408
				(2.32**)				(0.99)
Number in Household					0.789			0.961
					(4.68***)			(0.65)
Licensed/Capable of Driving						0.206		
						(9.23***)		
Vehicles Per Driver in HH							0.494	
							(5.20***)	
Female	0.888	0.908	0.877	0.889	0.872	0.829	0.875	0.919
	(1.22)	(0.98)	(1.34)	(1.21)	(1.41)	(1.90*)	(1.39)	(0.85)
Asian / Pacific Islander	1.075	1.141	0.944	1.135	1.142	0.916	1.078	1.045
	(0.4)	(0.7)	(0.33)	(0.7)	(0.74)	(0.48)	(0.43)	(0.24)
Hispanic	1.502	1.462	1.481	1.57	1.643	1.364	1.443	1.527
	(2.21**)	(2.03**)	(2.03**)	(2.49**)	(2.69***)	(1.63)	(1.99**)	(2.21**)
African American	2.222	1.668	2.074	2.307	2.419	1.906	1.986	1.759
	(3.61***)	(2.40**)	(3.21***)	(3.77***)	(3.85***)	(3.05***)	(3.22***)	(2.49**)
Native American	1.419	1.383	1.85	1.51	1.527	1.172	1.289	1.942
	(0.68)	(0.62)	(1.12)	(0.81)	(0.79)	(0.32)	(0.5)	(1.2)
3+ Ethnicities	2.584	2.526	3.018	2.581	2.584	2.895	2.562	2.968
	(2.57**)	(2.58***)	(2.84***)	(2.55**)	(2.49**)	(2.33**)	(2.61***)	(2.83***)
Age 0 to 4	0.434	0.409	0	0.321	0.595	0.101	0.448	0
	(1.97**)	(2.11**)	(0)	(2.69***)	(1.2)	(5.02***)	(1.91*)	(0)
Age 5 to 9	1.462	1.227	0	1.073	2.048	0.335	1.465	0
	(1.26)	(0.66)	(0)	(0.23)	(2.31**)	(3.27***)	(1.26)	(0)
Age 10 to 13	2.525	2.275	2.906	1.847	3.529	0.576	2.476	2.138
	(3.72***)	(3.26***)	(2.92***)	(2.40**)	(4.89***)	(1.92*)	(3.62***)	(1.92*)
Age 14 to 17	2.069	2.147	1.331	1.526	2.855	0.683	2.215	1.223
	(3.17***)	(3.24***)	(1.15)	(1.79*)	(4.32***)	(1.23)	(3.40***)	(0.71)
Age 18 to 20	1.182	0.942	1.064	1.04	1.412	0.925	1.198	0.823
	(0.5)	(0.17)	(0.18)	(0.12)	(0.99)	(0.22)	(0.52)	(0.5)
Age 21 to 24	1.708	1.342	1.704	1.456	1.709	1.643	1.734	1.188
	(1.87*)	(0.98)	(1.74*)	(1.3)	(1.84*)	(1.67*)	(1.95*)	(0.54)
Age 25 to 29	1.489	1.328	1.479	1.258	1.411	1.333	1.656	1.164
	(1.85*)	(1.3)	(1.82*)	(1.04)	(1.58)	(1.35)	(2.28**)	(0.67)
Age 30 to 34	1.073	1.055	1.084	0.977	1.05	1.096	1.094	0.993
	(0.33)	(0.24)	(0.38)	(0.11)	(0.23)	(0.41)	(0.4)	(0.03)
Age 35 to 39	0.959	0.978	0.977	0.967	0.957	0.993	0.983	1.015
	(0.19)	(0.1)	(0.1)	(0.15)	(0.2)	(0.03)	(0.08)	(0.07)
Age 40 to 44	1.019	0.857	1.023	1.062	1.04	1.045	0.972	0.913
	(0.08)	(0.68)	(0.1)	(0.26)	(0.17)	(0.19)	(0.12)	(0.4)
Age 50 to 54	1.562	1.479	1.512	1.382	1.421	1.534	1.462	1.303
	(2.11**)	(1.86*)	(1.96**)	(1.5)	(1.66*)	(2.00**)	(1.81*)	(1.23)
Age 55 to 59	1.059	1.026	0.992	0.851	0.936	1.084	1.039	0.806
	(0.24)	(0.1)	(0.03)	(0.66)	(0.27)	(0.33)	(0.16)	(0.85)
Age 60 to 64	1.656	1.412	1.355	1.282	1.413	1.653	1.606	0.953
	(2.07**)	(1.36)	(1.19)	(1)	(1.38)	(2.01**)	(1.89*)	(0.17)
Age 65 to 69	1.774	1.195	1.257	1.382	1.472	1.626	1.735	0.741
	(2.05**)	(0.6)	(0.79)	(1.16)	(1.39)	(1.68*)	(1.98**)	(0.98)
Age 70 to 74	2.08	1.446	1.322	1.594	1.702	1.795	1.989	0.8
	(2.83***)	(1.41)	(1.04)	(1.78*)	(2.04**)	(2.21**)	(2.69***)	(0.81)
Age 75 to 79	3.087	2.202	1.873	2.334	2.564	2.21	2.789	1.156
	(3.35***)	(2.29**)	(1.81*)	(2.51**)	(2.75***)	(2.14**)	(3.40***)	(0.4)
Age 80 to 84	3.895	1.591	2.29	2.948	3.036	1.86	3.255	0.81
	(2.96***)	(0.67)	(1.72*)	(2.37**)	(2.52**)	(1.58)	(2.88***)	(0.31)
Age 85 and Up	1.882	1.378	1.054	1.446	1.709	0.661	1.763	0.714
	(0.84)	(0.45)	(0.07)	(0.5)	(0.71)	(0.57)	(0.73)	(0.47)
Observations	30,375	29,237	25,621	30,375	30,375	30,371	30,375	24,607

Robust z statistics in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%
NOTE: population accessibility index and gross residential category included in model; coefficients not shown.

Table C7
Nonwork Walk/Bike Trips Regressed On Demographic Vars (Land Use Vars Included, Not Reported)
Negative Binomial Regression (Incidence Risk Ratios and Z-Statistics Reported)

	Base	Income	Emp/Prof	Children	HH Size	Licensing	Vehicles	Combined
HH Income (Thousands)		0.988						0.99
		(6.31***)						(5.03***)
HH Income Squared		1						1
		(5.41***)						(4.69***)
Work for Pay			0.625					0.614
			(7.86***)					(8.02***)
Professional Occupation			1.276					1.289
			(4.97***)					(5.05***)
Adult in HH With Kids				0.582				0.833
				(9.53***)				(2.20**)
Single Adult HOH With Kids				1.089				0.795
				(0.5)				(1.37)
Number in Household					0.819			0.845
					(9.61***)			(5.73***)
Licensed/Capable of Driving						0.506		
						(8.98***)		
Vehicles Per Driver in HH							1	
							(0)	
Female	1.011	1.002	0.994	1.013	1	1	1.011	0.983
	(0.34)	(0.07)	(0.17)	(0.39)	(0.01)	(0)	(0.34)	(0.49)
Asian / Pacific Islander	0.636	0.643	0.61	0.651	0.653	0.613	0.636	0.635
	(6.15***)	(5.93***)	(6.79***)	(5.85***)	(5.79***)	(6.59***)	(6.15***)	(6.20***)
Hispanic	0.597	0.579	0.61	0.608	0.627	0.57	0.597	0.632
	(5.15***)	(5.36***)	(4.56***)	(5.10***)	(4.81***)	(5.55***)	(5.15***)	(4.36***)
African American	0.691	0.644	0.617	0.717	0.739	0.655	0.691	0.626
	(2.88***)	(3.22***)	(3.88***)	(2.60***)	(2.17**)	(3.36***)	(2.89***)	(3.56***)
Native American	0.686	0.679	0.785	0.689	0.684	0.617	0.686	0.796
	(1.41)	(1.43)	(0.87)	(1.4)	(1.45)	(1.86*)	(1.41)	(0.82)
3+ Ethnicities	0.851	0.783	0.734	0.844	0.828	0.835	0.851	0.64
	(0.81)	(1.17)	(1.25)	(0.85)	(0.93)	(0.91)	(0.81)	(1.69*)
Age 0 to 4	0.961	0.972	0	0.76	1.243	0.505	0.961	0
	(0.39)	(0.27)	(0)	(2.52**)	(2.11**)	(5.43***)	(0.39)	(0)
Age 5 to 9	0.71	0.733	0	0.559	0.964	0.373	0.71	0
	(3.40***)	(3.06***)	(0)	(5.54***)	(0.36)	(7.87***)	(3.40***)	(0)
Age 10 to 13	1.002	0.984	0.998	0.785	1.354	0.525	1.002	1.141
	(0.02)	(0.16)	(0.01)	(2.39**)	(3.12***)	(5.38***)	(0.02)	(0.71)
Age 14 to 17	0.965	0.993	0.803	0.758	1.273	0.595	0.965	0.95
	(0.37)	(0.07)	(2.05**)	(2.72***)	(2.41**)	(4.59***)	(0.37)	(0.41)
Age 18 to 20	0.732	0.701	0.745	0.659	0.837	0.676	0.732	0.788
	(2.16**)	(2.38**)	(1.99**)	(2.89***)	(1.23)	(2.70***)	(2.16**)	(1.53)
Age 21 to 24	1.138	1.078	1.195	0.991	1.121	1.12	1.138	1.098
	(1.13)	(0.64)	(1.51)	(0.08)	(1)	(0.99)	(1.13)	(0.77)
Age 25 to 29	1.284	1.269	1.248	1.112	1.21	1.291	1.285	1.136
	(2.90***)	(2.74***)	(2.58***)	(1.23)	(2.22**)	(2.97***)	(2.91***)	(1.46)
Age 30 to 34	1.194	1.219	1.18	1.126	1.175	1.219	1.194	1.167
	(2.11**)	(2.33**)	(1.94*)	(1.41)	(1.91*)	(2.37**)	(2.11**)	(1.78*)
Age 35 to 39	1.001	1.013	0.987	1.028	1.027	1.022	1.002	1.032
	(0.02)	(0.16)	(0.16)	(0.33)	(0.32)	(0.26)	(0.02)	(0.37)
Age 40 to 44	0.899	0.909	0.904	0.936	0.927	0.913	0.899	0.954
	(1.31)	(1.16)	(1.24)	(0.81)	(0.93)	(1.12)	(1.31)	(0.57)
Age 50 to 54	0.908	0.933	0.888	0.818	0.838	0.91	0.908	0.827
	(1.12)	(0.8)	(1.37)	(2.34**)	(2.05**)	(1.1)	(1.12)	(2.21**)
Age 55 to 59	0.905	0.9	0.865	0.758	0.801	0.913	0.905	0.732
	(1.12)	(1.14)	(1.59)	(3.06***)	(2.43**)	(1.02)	(1.12)	(3.28***)
Age 60 to 64	0.959	0.915	0.858	0.781	0.821	0.94	0.959	0.672
	(0.39)	(0.79)	(1.41)	(2.23**)	(1.84*)	(0.58)	(0.39)	(3.40***)
Age 65 to 69	0.903	0.841	0.751	0.728	0.759	0.884	0.903	0.575
	(0.93)	(1.5)	(2.49**)	(2.85***)	(2.52**)	(1.12)	(0.93)	(4.61***)
Age 70 to 74	1.065	0.989	0.866	0.853	0.882	1.037	1.065	0.65
	(0.54)	(0.09)	(1.15)	(1.34)	(1.08)	(0.31)	(0.54)	(3.26***)
Age 75 to 79	0.811	0.767	0.635	0.658	0.685	0.765	0.811	0.496
	(1.56)	(1.85*)	(3.23***)	(3.09***)	(2.79***)	(1.97**)	(1.56)	(4.63***)
Age 80 to 84	0.811	0.803	0.635	0.652	0.682	0.742	0.811	0.525
	(0.85)	(0.86)	(1.82*)	(1.76*)	(1.56)	(1.16)	(0.85)	(2.53**)
Age 85 and Up	0.486	0.479	0.372	0.393	0.442	0.355	0.486	0.32
	(2.23**)	(2.12**)	(3.03***)	(2.93***)	(2.46**)	(3.15***)	(2.23**)	(3.26***)
Observations	30,375	29,237	25,621	30,375	30,375	30,371	30,375	24,607

Robust z statistics in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%
NOTE: population accessibility index and gross residential category included in model; coefficients not shown.

Table C8
Passenger-Serving POV Trips Regressed On Demographic Vars (Land Use Vars Included, Not Reported)
Negative Binomial Regression (Incidence Risk Ratios and Z-Statistics Reported)

	Base	Income	Emp/Prof	Children	HH Size	Licensing	Vehicles	Combined
HH Income (Thousands)		1.004						1.003
		(2.22**)						(1.6)
HH Income Squared		1						1
		(1.39)						(1.05)
Work for Pay			0.789					0.851
			(5.31***)					(3.49***)
Professional Occupation			0.955					0.96
			(1.26)					(1.08)
Adult in HH With Kids				3.909				3.116
				(35.90***)				(21.19***)
Single Adult HOH With Kids				1.584				1.918
				(7.47***)				(9.40***)
Number in Household					1.439			1.102
					(25.43***)			(5.14***)
Licensed/Capable of Driving						3.152		
						(12.31***)		
Vehicles Per Driver in HH							1.213	
							(4.17***)	
Female	1.521	1.54	1.559	1.413	1.497	1.533	1.521	1.476
	(16.09***)	(16.23***)	(15.00***)	(12.81***)	(15.20***)	(16.34***)	(16.11***)	(12.53***)
Asian / Pacific Islander	1.053	1.04	1.08	1	1.023	1.086	1.049	0.999
	(1.02)	(0.76)	(1.51)	(0)	(0.45)	(1.61)	(0.95)	(0.02)
Hispanic	1.117	1.154	1.194	1.016	1.002	1.151	1.123	1.069
	(1.66*)	(2.08**)	(2.52**)	(0.22)	(0.03)	(2.11**)	(1.75*)	(0.87)
African American	0.895	0.947	1.003	0.834	0.855	0.933	0.88	0.963
	(1.11)	(0.54)	(0.03)	(1.67*)	(1.47)	(0.69)	(1.32)	(0.33)
Native American	1.47	1.5	1.632	1.286	1.294	1.444	1.461	1.395
	(1.73*)	(1.76*)	(1.87*)	(1.22)	(1.17)	(1.69*)	(1.74*)	(1.31)
3+ Ethnicities	0.759	0.776	0.729	0.762	0.804	0.78	0.758	0.75
	(1.69*)	(1.55)	(1.68*)	(1.71*)	(1.35)	(1.47)	(1.67*)	(1.55)
Age 0 to 4	0.935	0.952	0	2.408	0.641	2.911	0.93	0
	(0.95)	(0.69)	(0)	(11.08***)	(6.75***)	(8.96***)	(1.03)	(0)
Age 5 to 9	0.56	0.566	0	1.462	0.389	1.742	0.559	0
	(9.10***)	(8.85***)	(0)	(5.16***)	(14.82***)	(4.86***)	(9.15***)	(0)
Age 10 to 13	0.463	0.458	0.338	1.218	0.326	1.444	0.464	0.763
	(11.48***)	(11.38***)	(8.29***)	(2.54**)	(16.06***)	(3.22***)	(11.48***)	(1.90*)
Age 14 to 17	0.513	0.513	0.431	1.351	0.389	1.068	0.508	0.963
	(8.85***)	(8.74***)	(10.52***)	(3.56***)	(11.84***)	(0.7)	(8.99***)	(0.38)
Age 18 to 20	0.499	0.507	0.476	0.899	0.428	0.536	0.491	0.775
	(6.73***)	(6.47***)	(7.00***)	(0.89)	(7.67***)	(6.15***)	(6.91***)	(2.05**)
Age 21 to 24	0.407	0.429	0.384	0.685	0.455	0.432	0.398	0.647
	(8.33***)	(7.65***)	(8.85***)	(3.36***)	(6.97***)	(7.55***)	(8.66***)	(3.70***)
Age 25 to 29	0.519	0.539	0.506	0.806	0.609	0.524	0.507	0.796
	(8.53***)	(7.94***)	(8.76***)	(2.70***)	(6.49***)	(8.44***)	(8.81***)	(2.79***)
Age 30 to 34	0.79	0.801	0.773	0.956	0.855	0.788	0.778	0.951
	(3.94***)	(3.65***)	(4.28***)	(0.71)	(2.63***)	(3.98***)	(4.19***)	(0.79)
Age 35 to 39	1.063	1.077	1.037	0.997	1.004	1.056	1.061	0.987
	(1.18)	(1.42)	(0.7)	(0.06)	(0.08)	(1.06)	(1.15)	(0.25)
Age 40 to 44	1.114	1.115	1.095	1.006	1.03	1.109	1.118	0.997
	(2.09**)	(2.08**)	(1.75*)	(0.1)	(0.59)	(2.01**)	(2.17**)	(0.06)
Age 50 to 54	0.585	0.598	0.579	0.804	0.698	0.587	0.583	0.814
	(8.80***)	(8.31***)	(8.97***)	(3.46***)	(6.06***)	(8.76***)	(8.91***)	(3.26***)
Age 55 to 59	0.417	0.409	0.403	0.797	0.573	0.419	0.418	0.755
	(11.59***)	(11.48***)	(11.92***)	(2.94***)	(7.55***)	(11.55***)	(11.57***)	(3.57***)
Age 60 to 64	0.406	0.428	0.365	0.896	0.632	0.408	0.407	0.868
	(8.90***)	(8.12***)	(10.10***)	(1.05)	(4.39***)	(8.90***)	(9.01***)	(1.32)
Age 65 to 69	0.392	0.419	0.341	0.927	0.636	0.4	0.392	0.895
	(9.89***)	(8.73***)	(10.87***)	(0.76)	(4.60***)	(9.75***)	(9.87***)	(1.01)
Age 70 to 74	0.385	0.387	0.319	0.96	0.652	0.398	0.383	0.84
	(8.58***)	(8.34***)	(10.00***)	(0.35)	(3.67***)	(8.32***)	(8.57***)	(1.4)
Age 75 to 79	0.341	0.375	0.277	0.804	0.57	0.369	0.337	0.748
	(8.36***)	(7.11***)	(9.67***)	(1.64)	(4.18***)	(7.72***)	(8.39***)	(1.98**)
Age 80 to 84	0.228	0.238	0.185	0.544	0.374	0.253	0.223	0.473
	(7.06***)	(6.32***)	(7.91***)	(2.76***)	(4.46***)	(6.79***)	(7.23***)	(3.09***)
Age 85 and Up	0.238	0.259	0.191	0.552	0.354	0.326	0.237	0.492
	(4.94***)	(4.40***)	(5.66***)	(1.93*)	(3.29***)	(4.11***)	(4.95***)	(2.14**)
Observations	30,375	29,237	25,621	30,375	30,375	30,371	30,375	24,607

Robust z statistics in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%
NOTE: population accessibility index and gross residential category included in model; coefficients not shown.

Table C9
Passenger-Serving Transit Trips Regressed On Demographic Vars (Land Use Vars Included, Not Reported)
Negative Binomial Regression (Incidence Risk Ratios and Z-Statistics Reported)

	Base	Income	Emp/Prof	Children	HH Size	Licensing	Vehicles	Combined
HH Income (Thousands)		0.989						0.983
		(1.12)						(1.46)
HH Income Squared		1						1
		(0.56)						(0.74)
Work for Pay			0.338					0.384
			(2.44**)					(2.12**)
Professional Occupation			1.629					1.714
			(1.15)					(1.19)
Adult in HH With Kids				3.602				3.653
				(3.15***)				(2.54**)
Single Adult HOH With Kids				2.19				1.649
				(1.31)				(0.65)
Number in Household					1.238			0.996
					(1.68*)			(0.02)
Licensed/Capable of Driving						0.091		
						(4.99***)		
Vehicles Per Driver in HH							1.61	
							(1.84*)	
Female	1.715	1.95	1.537	1.548	1.671	1.71	1.773	1.469
	(1.82*)	(2.20**)	(1.37)	(1.41)	(1.72*)	(1.86*)	(1.94*)	(1.11)
Asian / Pacific Islander	1.031	1.039	1.041	0.936	1.024	0.871	1.026	0.969
	(0.08)	(0.09)	(0.1)	(0.17)	(0.06)	(0.34)	(0.07)	(0.07)
Hispanic	0.456	0.143	0.775	0.432	0.436	0.417	0.501	0.218
	(0.99)	(2.76***)	(0.32)	(1.07)	(1.05)	(1.32)	(0.88)	(1.92*)
African American	6.879	5.217	8.881	4.592	5.519	5.586	7.125	3.401
	(4.98***)	(4.17***)	(4.94***)	(3.88***)	(4.52***)	(4.17***)	(5.15***)	(3.32***)
Native American	0	0	0	0	0	0	0	0
	(56.97***)	(50.51***)	(48.66***)	(43.52***)	(44.30***)	(49.18***)	(54.71***)	(48.12***)
3+ Ethnicities	4.967	5.936	7.341	4.913	5.115	4.618	5.337	7.082
	(1.93*)	(1.95*)	(1.83*)	(1.94*)	(1.94*)	(1.89*)	(2.01**)	(1.53)
Age 0 to 4	0.199	0.187	0	0.544	0.16	0.024	0.192	0
	(1.75*)	(1.78*)	(0)	(0.66)	(1.95*)	(3.68***)	(1.77*)	(0)
Age 5 to 9	0.883	0.56	0	2.237	0.699	0.1	0.879	0
	(0.17)	(0.73)	(0)	(1.13)	(0.45)	(2.85***)	(0.17)	(0)
Age 10 to 13	1.173	1.236	0.592	3.25	0.928	0.14	1.136	2.079
	(0.26)	(0.35)	(0.7)	(2.14**)	(0.12)	(2.88***)	(0.2)	(0.85)
Age 14 to 17	0	0	0	0	0	0	0	0
	(32.59***)	(29.75***)	(29.22***)	(32.02***)	(29.54***)	(30.14***)	(31.60***)	(26.21***)
Age 18 to 20	1.177	1.357	1.218	2.175	1.081	1.129	1.238	2.717
	(0.19)	(0.35)	(0.25)	(0.92)	(0.09)	(0.13)	(0.24)	(1.19)
Age 21 to 24	2.205	1.838	2.048	3.549	2.289	2.108	2.11	2.933
	(1.23)	(0.9)	(1.15)	(2.04**)	(1.32)	(1.11)	(1.17)	(1.59)
Age 25 to 29	0.722	0.619	0.763	1.426	0.836	0.838	0.614	1.24
	(0.41)	(0.58)	(0.35)	(0.51)	(0.24)	(0.22)	(0.63)	(0.3)
Age 30 to 34	1.806	1.722	1.741	2.083	1.841	1.513	1.776	1.935
	(1.05)	(0.93)	(1.01)	(1.38)	(1.09)	(0.75)	(1.01)	(1.25)
Age 35 to 39	0.774	0.76	0.725	0.762	0.758	0.97	0.712	0.713
	(0.36)	(0.39)	(0.49)	(0.4)	(0.4)	(0.04)	(0.48)	(0.56)
Age 40 to 44	0.919	0.887	1.073	0.969	0.884	1.113	0.874	1.106
	(0.12)	(0.17)	(0.11)	(0.05)	(0.17)	(0.15)	(0.19)	(0.14)
Age 50 to 54	0.494	0.475	0.526	0.658	0.552	0.557	0.488	0.689
	(0.92)	(0.97)	(0.85)	(0.61)	(0.8)	(0.74)	(0.93)	(0.57)
Age 55 to 59	0.129	0.104	0.103	0.15	0.17	0.176	0.153	0.114
	(2.69***)	(2.95***)	(3.14***)	(2.73***)	(2.42**)	(2.30**)	(2.41**)	(3.11***)
Age 60 to 64	0.333	0	0.263	0.72	0.417	0.313	0.334	0
	(0.91)	(26.17***)	(1.08)	(0.28)	(0.73)	(1.13)	(0.9)	(28.66***)
Age 65 to 69	0.858	0.79	0.624	1.96	1.041	0.704	0.745	1.269
	(0.17)	(0.26)	(0.53)	(0.78)	(0.05)	(0.39)	(0.34)	(0.28)
Age 70 to 74	0	0	0	0	0	0	0	0
	(29.54***)	(27.49***)	(28.13***)	(31.31***)	(30.68***)	(30.61***)	(28.86***)	(31.89***)
Age 75 to 79	0	0	0	0	0	0	0	0
	(30.82***)	(28.86***)	(28.08***)	(32.95***)	(30.74***)	(30.25***)	(29.73***)	(32.51***)
Age 80 to 84	0	0	0	0	0	0	0	0
	(31.06***)	(28.10***)	(28.12***)	(33.51***)	(32.35***)	(29.80***)	(29.82***)	(32.03***)
Age 85 and Up	0	0	0	0	0	0	0	0
	(30.87***)	(29.10***)	(27.40***)	(31.24***)	(31.52***)	(29.98***)	(28.92***)	(29.20***)
Observations	30,375	29,237	25,621	30,375	30,375	30,371	30,375	24,607

Robust z statistics in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%
NOTE: population accessibility index and gross residential category included in model; coefficients not shown.

Table C10
Passenger-Serving Walk/Bike Trips Regressed On Demographic Vars (Land Use Vars Included, Not Reported)
Negative Binomial Regression (Incidence Risk Ratios and Z-Statistics Reported)

	Base	Income	Emp/Prof	Children	HH Size	Licensing	Vehicles	Combined
HH Income (Thousands)		1.011						1.01
		(1.57)						(1.42)
HH Income Squared		1						1
		(2.42**)						(2.47**)
Work for Pay			0.293					0.326
			(6.13***)					(5.41***)
Professional Occupation			1.335					1.56
			(1.74*)					(2.59***)
Adult in HH With Kids				5.602				4.752
				(8.44***)				(5.81***)
Single Adult HOH With Kids				1.149				1.323
				(0.35)				(0.65)
Number in Household					1.642			1.097
					(8.94***)			(1.13)
Licensed/Capable of Driving						0.341		
						(3.46***)		
Vehicles Per Driver in HH							1.458	
							(2.38**)	
Female	1.835	1.794	1.69	1.716	1.815	1.802	1.831	1.602
	(5.27***)	(5.04***)	(4.06***)	(4.61***)	(5.07***)	(5.13***)	(5.25***)	(3.61***)
Asian / Pacific Islander	1.287	1.306	1.274	1.138	1.212	1.23	1.268	1.087
	(1.21)	(1.29)	(1.18)	(0.62)	(0.91)	(0.97)	(1.15)	(0.42)
Hispanic	0.843	0.839	0.853	0.758	0.669	0.812	0.866	0.679
	(0.56)	(0.58)	(0.52)	(0.91)	(1.28)	(0.66)	(0.47)	(1.25)
African American	0.93	0.827	1.323	0.83	0.689	0.888	0.807	1.02
	(0.19)	(0.45)	(0.78)	(0.43)	(0.98)	(0.31)	(0.59)	(0.05)
Native American	0.415	0.472	0.524	0.4	0.373	0.383	0.432	0.587
	(0.78)	(0.63)	(0.64)	(0.78)	(0.75)	(0.88)	(0.74)	(0.47)
3+ Ethnicities	1.204	1.212	2.938	1.172	1.409	1.147	1.269	2.945
	(0.28)	(0.3)	(1.25)	(0.23)	(0.5)	(0.22)	(0.35)	(1.24)
Age 0 to 4	3.252	3.316	0	10.506	1.908	1.151	3.174	0
	(3.91***)	(3.90***)	(0)	(6.14***)	(2.28**)	(0.33)	(3.81***)	(0)
Age 5 to 9	0.891	0.952	0	2.947	0.504	0.316	0.874	0
	(0.28)	(0.12)	(0)	(2.32**)	(1.79*)	(2.31**)	(0.33)	(0)
Age 10 to 13	1.272	1.411	1.036	4.274	0.774	0.452	1.276	3.502
	(0.73)	(1.04)	(0.07)	(3.60***)	(0.74)	(1.83*)	(0.73)	(2.24**)
Age 14 to 17	0.539	0.584	0.312	1.778	0.331	0.24	0.546	1.023
	(1.48)	(1.27)	(2.67***)	(1.21)	(2.57**)	(3.02***)	(1.41)	(0.04)
Age 18 to 20	0.21	0.223	0.172	0.316	0.144	0.166	0.203	0.281
	(2.33**)	(2.28**)	(2.75***)	(1.65*)	(2.91***)	(2.62***)	(2.44**)	(1.99**)
Age 21 to 24	0.701	0.73	0.762	1.117	0.735	0.591	0.706	1.181
	(0.8)	(0.7)	(0.62)	(0.25)	(0.73)	(1.27)	(0.78)	(0.37)
Age 25 to 29	0.466	0.47	0.477	0.803	0.614	0.465	0.448	0.778
	(1.91*)	(1.89*)	(1.79*)	(0.52)	(1.19)	(1.90*)	(1.98**)	(0.6)
Age 30 to 34	1.876	1.941	1.857	2.119	1.864	1.876	1.762	2.081
	(2.26**)	(2.43**)	(2.26**)	(2.45**)	(2.32**)	(2.25**)	(2.02**)	(2.68***)
Age 35 to 39	2.842	2.958	3.202	2.669	2.784	2.877	2.755	2.938
	(4.17***)	(4.42***)	(4.61***)	(3.54***)	(4.18***)	(4.20***)	(4.06***)	(4.26***)
Age 40 to 44	2.739	3.004	3.212	2.309	2.489	2.789	2.81	2.762
	(3.81***)	(4.18***)	(4.41***)	(3.01***)	(3.62***)	(3.87***)	(3.90***)	(3.92***)
Age 50 to 54	0.596	0.65	0.68	0.811	0.816	0.537	0.615	0.948
	(1.53)	(1.3)	(1.12)	(0.6)	(0.59)	(1.86*)	(1.41)	(0.16)
Age 55 to 59	0.295	0.318	0.283	0.597	0.46	0.266	0.301	0.615
	(2.52**)	(2.42**)	(2.70***)	(1.06)	(1.61)	(2.97***)	(2.47**)	(1.07)
Age 60 to 64	0.107	0.116	0.081	0.281	0.19	0.105	0.11	0.234
	(3.08***)	(2.98***)	(3.53***)	(1.64)	(2.22**)	(3.08***)	(3.02***)	(1.93*)
Age 65 to 69	0.207	0.224	0.134	0.516	0.345	0.187	0.21	0.379
	(2.52**)	(2.41**)	(3.18***)	(1.03)	(1.75*)	(2.74***)	(2.49**)	(1.54)
Age 70 to 74	0.16	0.174	0.089	0.425	0.281	0.15	0.157	0.269
	(2.52**)	(2.41**)	(3.31***)	(1.16)	(1.83*)	(2.55**)	(2.53**)	(1.85*)
Age 75 to 79	0.231	0.254	0.125	0.655	0.428	0.202	0.218	0.409
	(1.96**)	(1.83*)	(2.67***)	(0.53)	(1.09)	(2.04**)	(2.08**)	(1.1)
Age 80 to 84	0.281	0.319	0.136	0.732	0.477	0.221	0.274	0.427
	(1.22)	(1.1)	(2.01**)	(0.27)	(0.66)	(1.34)	(1.24)	(0.78)
Age 85 and Up	0	0	0	0	0	0	0	0
	(50.16***)	(53.52***)	(47.31***)	(36.28***)	(46.73***)	(37.83***)	(50.04***)	(35.55***)
Observations	30375	29237	25621	30375	30375	30371	30375	24607

Robust z statistics in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%
NOTE: population accessibility index and gross residential category included in model; coefficients not shown.

Table C11
Total Travel Time Regressed on Demographic Vars. (Land Use Vars. Included, Not Reported)
Ordinary Least Squares Regression (Simple Coefficients and T-Statistics Reported)

	Base	Income	Emp/Prof	Children	HH Size	Licensing	Vehicles	Combined
HH Income (Thousands)		0.327						0.31
		3.50***						2.99***
HH Income Squared		-0.001						-0.001
		1.78*						1.32
Work for Pay			25.889					26.02
			8.50***					8.33***
Professional Occupation			10.846					6.864
			4.43***					2.69***
Adult in HH With Kids				2.867				11.815
				1.1				3.13***
Single Adult HOH With Kids				24.312				22.768
				2.70***				2.44**
Number in Household					-1.476			-4.532
					1.74*			3.49***
Licensed/Capable of Driving						40.718		
						9.33***		
Vehicles Per Driver in HH							-3.405	
							1.19	
Female	-11.373	-9.835	-9.887	-11.679	-11.44	-10.666	-11.363	-9.058
	7.04***	5.93***	5.35***	7.23***	7.08***	6.60***	7.03***	4.77***
Asian / Pacific Islander	-2.977	-4.16	0.577	-3.026	-2.691	-1.224	-2.913	-0.599
	0.92	1.27	0.16	0.93	0.83	0.38	0.9	0.17
Hispanic	-7.946	-5.671	-3.679	-8.287	-7.323	-6.148	-8.045	-1.258
	1.85*	1.3	0.75	1.92*	1.70*	1.43	1.87*	0.25
African American	2.571	6.435	1.695	1.813	2.982	4.337	2.68	4.047
	0.47	1.16	0.29	0.33	0.55	0.8	0.49	0.68
Native American	-32.805	-36.119	-27.943	-33.084	-32.507	-30.378	-33.035	-32.431
	3.13***	3.55***	2.42**	3.14***	3.13***	2.93***	3.15***	2.91***
3+ Ethnicities	5.212	7.298	4.567	5.015	5.085	5.957	5.283	6.558
	0.55	0.76	0.39	0.53	0.54	0.63	0.56	0.54
Age 0 to 4	-86.388	-84.568	0	-84.332	-84.605	-46.804	-86.195	0
	19.71***	19.10***	.	18.04***	19.16***	7.74***	19.65***	.
Age 5 to 9	-85.127	-83.704	0	-83.054	-83.141	-45.516	-85.075	0
	22.12***	21.61***	.	20.04***	21.34***	7.99***	22.10***	.
Age 10 to 13	-78.63	-77.67	-49.55	-76.546	-76.639	-38.929	-78.609	-38.972
	19.97***	19.51***	7.30***	18.20***	19.31***	6.82***	19.97***	5.25***
Age 14 to 17	-62.655	-63.053	-39.45	-60.584	-60.939	-35.833	-62.452	-29.833
	14.06***	14.14***	8.04***	12.83***	13.54***	6.60***	14.01***	5.17***
Age 18 to 20	-21.14	-19.807	-9.702	-19.903	-19.955	-16.813	-20.84	-3.135
	2.93***	2.75***	1.33	2.75***	2.76***	2.33**	2.89***	0.42
Age 21 to 24	-7.404	-3.918	-1.998	-6.131	-7.396	-5.298	-7.113	4.536
	1.16	0.61	0.31	0.96	1.16	0.84	1.12	0.7
Age 25 to 29	-5.131	-1.978	-2.37	-3.993	-5.635	-4.962	-4.569	2.926
	1.05	0.4	0.48	0.81	1.15	1.01	0.93	0.58
Age 30 to 34	-8.244	-6.251	-6.786	-7.75	-8.403	-8.457	-7.943	-3.75
	1.95*	1.46	1.6	1.83*	1.99**	2.00**	1.88*	0.87
Age 35 to 39	-8.246	-6.785	-7.453	-8.523	-8.032	-8.591	-8.09	-5.922
	2.04**	1.66*	1.84*	2.11**	1.98**	2.13**	2.00**	1.45
Age 40 to 44	1.035	2.613	1.898	0.657	1.311	0.79	1.015	3.236
	0.25	0.62	0.46	0.16	0.31	0.19	0.24	0.77
Age 50 to 54	-9.862	-8.315	-8.847	-8.971	-10.509	-9.843	-9.878	-6.593
	2.39**	1.98**	2.14**	2.16**	2.54**	2.39**	2.39**	1.56
Age 55 to 59	-14.802	-13.555	-10.806	-13.203	-15.837	-14.739	-14.865	-7.977
	3.30***	2.96***	2.41**	2.90***	3.50***	3.29***	3.32***	1.71*
Age 60 to 64	-17.17	-13.442	-5.513	-15.363	-18.42	-16.456	-17.219	-0.65
	3.15***	2.38**	1	2.79***	3.36***	3.02***	3.16***	0.11
Age 65 to 69	-34.174	-28.501	-14.279	-32.275	-35.552	-32.934	-34.169	-8.15
	6.02***	4.73***	2.43**	5.57***	6.19***	5.81***	6.01***	1.29
Age 70 to 74	-46.368	-41.228	-22.007	-44.451	-47.832	-44.499	-46.19	-16.934
	7.58***	6.75***	3.42***	7.15***	7.75***	7.28***	7.55***	2.59***
Age 75 to 79	-61.153	-56.352	-34.566	-59.252	-62.609	-57.298	-60.903	-29.991
	9.08***	7.83***	4.86***	8.70***	9.23***	8.55***	9.04***	3.93***
Age 80 to 84	-68.674	-60.12	-40.893	-66.845	-69.967	-61.547	-68.33	-32.266
	8.13***	6.48***	4.67***	7.87***	8.29***	7.41***	8.07***	3.37***
Age 85 and Up	-114.773	-106.792	-86.523	-112.979	-115.583	-96.108	-114.614	-77.272
	11.13***	9.62***	8.22***	10.91***	11.22***	9.35***	11.11***	6.85***
Constant	205.69	182.798	177.101	203.763	210.2	164.844	208.762	163.273
	44.46***	29.51***	31.81***	42.58***	39.66***	25.81***	38.79***	22.08***
Observations	27363	26334	22938	27363	27363	27359	27363	22019
R-squared	0.05	0.06	0.04	0.05	0.05	0.06	0.05	0.04

Robust t statistics in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%
NOTE: population accessibility index and gross residential category included in model; coefficients not shown.

Table C12
POV Travel Duration Regressed On Demographic Vars (Land Use Vars Included, Not Reported)
Ordinary Least Squares Regression (Coefficients and T-Statistics Reported)

	Base	Income	Emp/Prof	Children	HH Size	Licensing	Vehicles	Combined
HH Income (Thousands)		0.64						0.628
		(7.47***)						(6.67***)
HH Income Squared		-0.002						-0.002
		(4.92***)						(4.20***)
Work for Pay			30.956					31.237
			(11.16***)					(11.07***)
Professional Occupation			4.567					-0.574
			(1.97**)					(0.24)
Adult in HH With Kids				12.93				19.823
				(5.29***)				(5.70***)
Single Adult HOH With Kids				29.04				31.282
				(3.16***)				(3.33***)
Number in Household					0.759			-4.137
					(0.94)			(3.40***)
Licensed/Capable of Driving						76.792		
						(24.38***)		
Vehicles Per Driver in HH							-2.696	
							(0.99)	
Female	-8.413	-6.729	-6.231	-8.85	-8.379	-7.081	-8.405	-5.441
	(5.61***)	(4.38***)	(3.66***)	(5.91***)	(5.59***)	(4.75***)	(5.60***)	(3.13***)
Asian / Pacific Islander	-3.14	-4.26	-0.113	-3.727	-3.287	0.155	-3.09	-1.792
	(1.08)	(1.47)	(0.04)	(1.28)	(1.13)	(0.05)	(1.07)	(0.57)
Hispanic	-4.926	-0.854	0.936	-6.091	-5.246	-1.292	-5.005	3.707
	(1.25)	(0.21)	(0.21)	(1.55)	(1.33)	(0.33)	(1.27)	(0.82)
African American	-6.458	0.045	-4.088	-7.916	-6.669	-3.125	-6.372	-0.634
	(1.2)	(0.01)	(0.73)	(1.48)	(1.24)	(0.59)	(1.18)	(0.11)
Native American	-34.409	-37.545	-31.062	-35.083	-34.562	-29.844	-34.592	-36.234
	(3.71***)	(4.32***)	(2.93***)	(3.74***)	(3.71***)	(3.32***)	(3.73***)	(3.71***)
3+ Ethnicities	2.52	5.345	-1.405	2.48	2.585	3.924	2.576	1.255
	(0.28)	(0.6)	(0.13)	(0.28)	(0.29)	(0.45)	(0.29)	(0.11)
Age 0 to 4	-76.069	-73.965	0	-68.761	-76.986	-1.423	-75.916	0
	(18.19***)	(17.53***)	(.)	(15.45***)	(18.29***)	(0.28)	(18.15***)	(.)
Age 5 to 9	-79.176	-76.944	0	-71.816	-80.197	-4.485	-79.135	0
	(21.28***)	(20.55***)	(.)	(18.01***)	(21.37***)	(0.95)	(21.26***)	(.)
Age 10 to 13	-90.245	-88.39	-68.505	-82.833	-91.269	-15.386	-90.228	-53.549
	(24.65***)	(23.92***)	(12.04***)	(21.13***)	(24.69***)	(3.29***)	(24.65***)	(8.46***)
Age 14 to 17	-77.873	-77.668	-54.96	-70.502	-78.756	-27.007	-77.712	-41.301
	(19.78***)	(19.78***)	(12.62***)	(16.91***)	(19.63***)	(5.95***)	(19.75***)	(7.98***)
Age 18 to 20	-22.084	-19.953	-12.661	-18.517	-22.693	-13.933	-21.847	-3.896
	(3.20***)	(2.92***)	(1.83*)	(2.68***)	(3.28***)	(2.03**)	(3.17***)	(0.56)
Age 21 to 24	-22.812	-17.332	-18.877	-18.754	-22.815	-18.841	-22.581	-8.184
	(4.01***)	(3.05***)	(3.31***)	(3.29***)	(4.01***)	(3.34***)	(3.97***)	(1.43)
Age 25 to 29	-15.557	-11.531	-12.703	-11.425	-15.298	-15.074	-15.112	-3.89
	(3.35***)	(2.49**)	(2.74***)	(2.45**)	(3.29***)	(3.27***)	(3.26***)	(0.83)
Age 30 to 34	-14.91	-12.419	-13.197	-13.304	-14.828	-15.305	-14.672	-8.792
	(3.77***)	(3.11***)	(3.33***)	(3.37***)	(3.74***)	(3.89***)	(3.71***)	(2.20**)
Age 35 to 39	-13.142	-11.138	-12.4	-13.945	-13.252	-13.793	-13.019	-10.814
	(3.47***)	(2.92***)	(3.28***)	(3.70***)	(3.50***)	(3.66***)	(3.44***)	(2.85***)
Age 40 to 44	1.937	3.747	2.553	0.759	1.794	1.475	1.921	3.383
	(0.49)	(0.95)	(0.65)	(0.19)	(0.46)	(0.38)	(0.49)	(0.85)
Age 50 to 54	-7.686	-6.262	-6.843	-4.445	-7.354	-7.651	-7.699	-2.642
	(1.96*)	(1.57)	(1.74*)	(1.13)	(1.87*)	(1.96*)	(1.96**)	(0.66)
Age 55 to 59	-16.407	-14.883	-12.376	-10.873	-15.874	-16.283	-16.456	-5.816
	(3.98***)	(3.56***)	(2.99***)	(2.59***)	(3.81***)	(3.98***)	(3.99***)	(1.36)
Age 60 to 64	-17.317	-12.934	-5.713	-10.972	-16.674	-16.094	-17.357	3.684
	(3.37***)	(2.43**)	(1.1)	(2.11**)	(3.22***)	(3.15***)	(3.37***)	(0.68)
Age 65 to 69	-31.08	-22.997	-11.083	-24.453	-30.372	-28.74	-31.076	1.431
	(5.74***)	(4.02***)	(1.98**)	(4.43***)	(5.54***)	(5.35***)	(5.73***)	(0.24)
Age 70 to 74	-43.736	-35.687	-18.761	-37.023	-42.983	-40.205	-43.594	-6.769
	(7.60***)	(6.18***)	(3.10***)	(6.33***)	(7.39***)	(7.02***)	(7.57***)	(1.1)
Age 75 to 79	-57.001	-49.02	-29.804	-50.378	-56.252	-49.723	-56.802	-18.152
	(9.18***)	(7.41***)	(4.54***)	(8.02***)	(8.99***)	(8.12***)	(9.15***)	(2.60***)
Age 80 to 84	-62.244	-49.422	-33.758	-55.973	-61.579	-48.798	-61.971	-17.382
	(8.00***)	(5.74***)	(4.18***)	(7.12***)	(7.89***)	(6.51***)	(7.95***)	(1.95*)
Age 85 and Up	-96.122	-85.594	-66.897	-90.012	-95.706	-60.905	-95.997	-51.796
	(9.43***)	(7.76***)	(6.46***)	(8.79***)	(9.37***)	(6.01***)	(9.41***)	(4.64***)
Constant	190.095	151.494	162.217	182.856	187.775	113.057	192.527	127.467
	(43.30***)	(26.23***)	(30.93***)	(40.16***)	(37.34***)	(20.94***)	(37.84***)	(18.93***)
Observations	27,363	26,334	22,938	27,363	27,363	27,359	27,363	22,019
R-squared	0.06	0.07	0.05	0.06	0.06	0.07	0.06	0.06

Robust t statistics in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%
NOTE: population accessibility index and gross residential category included in model; coefficients not shown.

Table C13
Transit Travel Duration Regressed On Demographic Vars (Land Use Vars Included, Not Reported)2
Ordinary Least Squares Regression (Coefficients and T-Statistics Reported)

	Base	Income	Emp/Prof	Children	HH Size	Licensing	Vehicles	Combined
HH Income (Thousands)		-0.156						-0.141
		(5.32***)						(4.90***)
HH Income Squared		0.001						0.001
		(4.66***)						(4.11***)
Work for Pay			-0.887					-0.982
			(1.3)					(1.39)
Professional Occupation			0.863					1.654
			(1.70*)					(3.09***)
Adult in HH With Kids				-2.419				-2.962
				(4.66***)				(3.50***)
Single Adult HOH With Kids				0.953				0.151
				(0.58)				(0.09)
Number in Household					-0.385			0.535
					(1.75*)			(1.6)
Licensed/Capable of Driving						-12.464		
						(7.09***)		
Vehicles Per Driver in HH							-3.419	
							(3.15***)	
Female	0.075	-0.006	0.06	0.082	0.057	-0.143	0.085	0.027
	(0.2)	(0.02)	(0.14)	(0.21)	(0.15)	(0.38)	(0.22)	(0.06)
Asian / Pacific Islander	3.263	3.305	3.432	3.402	3.338	2.725	3.327	3.557
	(3.40***)	(3.41***)	(3.17***)	(3.55***)	(3.46***)	(2.84***)	(3.46***)	(3.23***)
Hispanic	3.223	2.517	3.074	3.411	3.385	2.613	3.123	2.366
	(2.82***)	(2.14**)	(2.52**)	(2.99***)	(2.97***)	(2.31**)	(2.72***)	(1.90*)
African American	10.216	8.647	8.756	10.333	10.323	9.672	10.324	7.533
	(3.70***)	(3.24***)	(3.95***)	(3.75***)	(3.76***)	(3.53***)	(3.73***)	(3.50***)
Native American	3.688	3.484	3.199	3.768	3.766	2.944	3.457	3.168
	(1.02)	(0.91)	(0.82)	(1.04)	(1.04)	(0.82)	(0.96)	(0.78)
3+ Ethnicities	6.36	6.016	8.799	6.3	6.327	6.127	6.431	8.553
	(2.35**)	(2.19**)	(2.48**)	(2.32**)	(2.33**)	(2.25**)	(2.34**)	(2.35**)
Age 0 to 4	-2.813	-3.009	0	-4.025	-2.349	-14.928	-2.62	0
	(3.72***)	(3.91***)	(.)	(5.02***)	(3.09***)	(7.71***)	(3.45***)	(.)
Age 5 to 9	1.165	0.775	0	-0.055	1.682	-10.957	1.217	0
	(1.37)	(0.92)	(.)	(0.06)	(1.90*)	(5.53***)	(1.43)	(.)
Age 10 to 13	6.864	6.226	9.625	5.634	7.383	-5.285	6.885	6.411
	(5.84***)	(5.39***)	(3.84***)	(4.62***)	(6.25***)	(2.50**)	(5.85***)	(2.64***)
Age 14 to 17	6.881	6.839	6.794	5.658	7.328	-1.393	7.085	4.948
	(5.41***)	(5.32***)	(5.02***)	(4.36***)	(5.65***)	(0.85)	(5.54***)	(3.16***)
Age 18 to 20	1.614	1.179	1.831	1.106	1.923	0.292	1.915	0.628
	(1.09)	(0.76)	(1.21)	(0.75)	(1.26)	(0.2)	(1.28)	(0.38)
Age 21 to 24	4.388	3.281	4.563	3.763	4.39	3.744	4.68	2.902
	(2.44**)	(1.76*)	(2.53**)	(2.09**)	(2.44**)	(2.08**)	(2.59***)	(1.52)
Age 25 to 29	0.895	0.374	0.736	0.201	0.764	0.834	1.459	-0.439
	(0.83)	(0.34)	(0.68)	(0.19)	(0.71)	(0.78)	(1.35)	(0.4)
Age 30 to 34	1.259	1.044	1.16	1.009	1.218	1.323	1.562	0.687
	(1.21)	(0.99)	(1.11)	(0.98)	(1.18)	(1.28)	(1.49)	(0.65)
Age 35 to 39	0.097	-0.211	0.061	0.211	0.153	0.203	0.253	-0.166
	(0.12)	(0.25)	(0.07)	(0.25)	(0.18)	(0.24)	(0.3)	(0.19)
Age 40 to 44	0.151	-0.077	0.147	0.33	0.223	0.227	0.131	0.059
	(0.18)	(0.09)	(0.17)	(0.39)	(0.27)	(0.27)	(0.16)	(0.07)
Age 50 to 54	-0.467	-0.561	-0.434	-1.012	-0.636	-0.472	-0.483	-0.947
	(0.62)	(0.73)	(0.58)	(1.34)	(0.85)	(0.63)	(0.64)	(1.22)
Age 55 to 59	-0.201	-0.225	-0.211	-1.103	-0.471	-0.221	-0.264	-0.94
	(0.22)	(0.24)	(0.23)	(1.2)	(0.51)	(0.24)	(0.29)	(0.97)
Age 60 to 64	0.395	-0.02	0.368	-0.65	0.069	0.221	0.345	-0.749
	(0.41)	(0.02)	(0.38)	(0.66)	(0.07)	(0.23)	(0.36)	(0.71)
Age 65 to 69	-1.319	-2.566	-1.437	-2.405	-1.678	-1.699	-1.314	-3.277
	(1.67*)	(3.05***)	(1.63)	(2.94***)	(2.11**)	(2.16**)	(1.67*)	(3.37***)
Age 70 to 74	-0.558	-1.906	-0.759	-1.661	-0.939	-1.132	-0.379	-2.608
	(0.53)	(1.68*)	(0.64)	(1.54)	(0.89)	(1.08)	(0.36)	(2.01**)
Age 75 to 79	-0.679	-2.469	-0.913	-1.764	-1.058	-1.862	-0.428	-3.138
	(0.64)	(2.07**)	(0.79)	(1.64)	(0.99)	(1.75*)	(0.4)	(2.40**)
Age 80 to 84	0.643	-2.014	0.389	-0.373	0.306	-1.54	0.989	-2.644
	(0.22)	(0.6)	(0.13)	(0.13)	(0.1)	(0.54)	(0.34)	(0.79)
Age 85 and Up	-2.732	-4.219	-3.09	-3.718	-2.943	-8.449	-2.573	-5.105
	(2.16**)	(3.13***)	(2.23**)	(2.92***)	(2.32**)	(5.42***)	(2.02**)	(3.41***)
Constant	2.945	10.91	2.457	4.184	4.121	15.448	6.03	9.367
	(3.59***)	(7.00***)	(2.46**)	(4.86***)	(3.88***)	(7.56***)	(4.72***)	(5.63***)
Observations	27,363	26,334	22,938	27,363	27,363	27,359	27,363	22,019
R-squared	0.03	0.03	0.03	0.03	0.03	0.04	0.03	0.03

Robust t statistics in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%
NOTE: population accessibility index and gross residential category included in model; coefficients not shown.

Table C14
Walk/Bike Travel Duration Regressed On Demographic Vars (Land Use Vars Included, Not Reported)
Ordinary Least Squares Regression (Coefficients and T-Statistics Reported)

	Base	Income	Emp/Prof	Children	HH Size	Licensing	Vehicles	Combined
HH Income (Thousands)		-0.148						-0.156
		(3.37***)						(3.16***)
HH Income Squared		0.001						0.001
		(2.90***)						(2.72***)
Work for Pay			-3.52					-3.567
			(2.53**)					(2.46**)
Professional Occupation			5.286					5.455
			(4.96***)					(4.96***)
Adult in HH With Kids				-6.615				-4.076
				(6.36***)				(2.59***)
Single Adult HOH With Kids				-5.038				-7.67
				(2.48**)				(3.36***)
Number in Household					-1.62			-0.967
					(4.89***)			(1.85*)
Licensed/Capable of Driving						-21.909		
						(7.38***)		
Vehicles Per Driver in HH							-0.742	
							(0.47)	
Female	-0.01	-0.096	-0.153	0.099	-0.083	-0.41	-0.007	-0.11
	(0.01)	(0.13)	(0.18)	(0.13)	(0.11)	(0.56)	(0.01)	(0.12)
Asian / Pacific Islander	-1.121	-1.316	-0.447	-0.776	-0.808	-2.053	-1.108	-0.236
	(0.68)	(0.79)	(0.24)	(0.47)	(0.49)	(1.28)	(0.67)	(0.12)
Hispanic	-3.222	-4.181	-4.113	-2.671	-2.537	-4.384	-3.243	-3.706
	(2.03**)	(2.66***)	(2.31**)	(1.68*)	(1.59)	(2.75***)	(2.05**)	(2.03**)
African American	0.54	-0.428	-0.44	1.047	0.991	-0.42	0.564	-0.275
	(0.28)	(0.22)	(0.2)	(0.54)	(0.51)	(0.22)	(0.29)	(0.12)
Native American	-3.471	-3.737	-2.277	-3.198	-3.144	-4.781	-3.521	-2.027
	(0.92)	(0.95)	(0.49)	(0.85)	(0.83)	(1.25)	(0.93)	(0.42)
3+ Ethnicities	-1.152	-1.506	0.548	-1.235	-1.291	-1.562	-1.136	0.231
	(0.34)	(0.43)	(0.12)	(0.36)	(0.38)	(0.46)	(0.33)	(0.05)
Age 0 to 4	-5.744	-5.796	0	-9.244	-3.787	-27.04	-5.702	0
	(3.40***)	(3.37***)	(.)	(5.04***)	(2.25**)	(8.03***)	(3.37***)	(.)
Age 5 to 9	-6.443	-6.868	0	-9.966	-4.262	-27.748	-6.431	0
	(4.80***)	(5.10***)	(.)	(6.63***)	(3.23***)	(8.56***)	(4.79***)	(.)
Age 10 to 13	2.727	2.457	7.134	-0.823	4.913	-18.626	2.731	6.367
	(1.62)	(1.43)	(1.90*)	(0.46)	(2.89***)	(5.53***)	(1.62)	(1.55)
Age 14 to 17	4.39	4.318	5.045	0.859	6.274	-10.254	4.434	3.804
	(2.15**)	(2.08**)	(2.16**)	(0.39)	(3.11***)	(3.54***)	(2.16**)	(1.42)
Age 18 to 20	-0.665	-1.049	1.15	-2.245	0.635	-2.987	-0.6	0.359
	(0.29)	(0.44)	(0.49)	(0.97)	(0.27)	(1.28)	(0.26)	(0.14)
Age 21 to 24	9.402	8.771	10.672	7.531	9.41	8.272	9.465	8.736
	(2.62***)	(2.37**)	(2.95***)	(2.11**)	(2.62***)	(2.33**)	(2.64***)	(2.37**)
Age 25 to 29	7.164	6.962	7.206	5.171	6.611	7.108	7.286	5.324
	(3.16***)	(3.01***)	(3.17***)	(2.28**)	(2.92***)	(3.14***)	(3.23***)	(2.28**)
Age 30 to 34	4.221	3.911	4.04	3.475	4.047	4.333	4.286	3.224
	(2.23**)	(2.02**)	(2.14**)	(1.84*)	(2.14**)	(2.30**)	(2.26**)	(1.67*)
Age 35 to 39	3.216	3.055	3.277	3.572	3.451	3.401	3.25	3.473
	(1.73*)	(1.61)	(1.76*)	(1.92*)	(1.86*)	(1.84*)	(1.76*)	(1.83*)
Age 40 to 44	-1.456	-1.531	-1.244	-0.918	-1.152	-1.324	-1.46	-0.802
	(0.9)	(0.92)	(0.76)	(0.56)	(0.71)	(0.82)	(0.9)	(0.48)
Age 50 to 54	-0.816	-0.578	-0.704	-2.379	-1.526	-0.826	-0.819	-1.913
	(0.51)	(0.35)	(0.44)	(1.45)	(0.95)	(0.52)	(0.51)	(1.13)
Age 55 to 59	2.544	2.489	2.578	-0.082	1.408	2.507	2.53	0.123
	(1.25)	(1.18)	(1.27)	(0.04)	(0.69)	(1.24)	(1.25)	(0.06)
Age 60 to 64	1.128	1.03	1.347	-1.899	-0.245	0.816	1.117	-1.521
	(0.56)	(0.48)	(0.64)	(0.9)	(0.12)	(0.41)	(0.55)	(0.66)
Age 65 to 69	-0.276	-1.288	0.017	-3.43	-1.788	-0.946	-0.275	-3.95
	(0.15)	(0.67)	(0.01)	(1.80*)	(0.97)	(0.52)	(0.15)	(1.82*)
Age 70 to 74	-1.069	-2.431	-1.093	-4.267	-2.676	-2.078	-1.03	-5.519
	(0.56)	(1.22)	(0.52)	(2.16**)	(1.39)	(1.09)	(0.54)	(2.39**)
Age 75 to 79	-0.935	-1.931	-0.879	-4.086	-2.534	-3.016	-0.881	-4.893
	(0.34)	(0.65)	(0.3)	(1.45)	(0.91)	(1.08)	(0.32)	(1.5)
Age 80 to 84	-4.698	-6.143	-4.697	-7.665	-6.118	-8.538	-4.623	-8.846
	(2.06**)	(2.45**)	(1.86*)	(3.29***)	(2.67***)	(3.53***)	(2.02**)	(3.14***)
Age 85 and Up	-13.372	-14.171	-13.584	-16.256	-14.261	-23.421	-13.338	-16.764
	(7.27***)	(7.20***)	(6.31***)	(8.61***)	(7.73***)	(9.32***)	(7.23***)	(7.11***)
Constant	8.51	15.332	7.867	12.037	13.462	30.5	9.179	20.087
	(5.85***)	(6.14***)	(3.99***)	(7.72***)	(7.49***)	(9.16***)	(4.50***)	(6.32***)
Observations	27,363	26,334	22,938	27,363	27,363	27,359	27,363	22,019
R-squared	0.04	0.05	0.05	0.05	0.05	0.05	0.04	0.05

Robust t statistics in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%
NOTE: population accessibility index and gross residential category included in model; coefficients not shown.

D

COMPLEX MODELS: LAND USE

The tables in this Appendix present the results of the complex empirical models focusing on land use characteristics, as described in Section 4.

Table D1
Total Trips Regressed On Land Use Variables (Basic Demographic Vars. Included, Not Reported)
Negative Binomial Regression (Incidence Risk Ratios and Z-Statistics Reported)

Model Type	Base	Street Density	% Dev-eloped	Res/Com Density	Combined Density	Emp. Access Index	Ret/Serv Access Indexes	County Effects	Combined w/ Gross Density	Combined w/ Pop Access
Street Density in TAZ		1.407							1.297	1.256
		(2.69***)							(1.83*)	(1.68*)
Percent of Zone Developed			1.056						0.995	0.981
			(1.36)						(0.1)	(0.55)
Res. Land Density (Logged)				0.931					0.914	0.909
				(5.28***)					(3.75***)	(4.21***)
Comm. Land Density (Logged)				1.015					1.003	1.004
				(2.30**)					(0.33)	(0.48)
Dev. Density (Logged)					0.929				1.062	1.072
					(2.45**)				(1.13)	(1.32)
Employment Access Index (000s)						1			0.997	0.997
						(0.72)			(3.06***)	(3.00***)
Retail Access Index (000s)							0.992		1.004	1.001
							(1.51)		(0.63)	(0.24)
Serv Emp Access Index (000s)							1.004		1.007	1.008
							(2.48**)		(3.35***)	(3.49***)
San Mateo County								1.013	1.065	1.006
								(0.27)	(1.81*)	(0.12)
Santa Clara County								1.026	1.067	1.012
								(0.54)	(1.94*)	(0.26)
Alameda County								1.029	1.06	1.008
								(0.6)	(1.84*)	(0.17)
Contra Costa County								1.025	1.041	0.995
								(0.49)	(1.11)	(0.1)
Solano County								0.96	0.991	0.966
								(0.73)	(0.21)	(0.63)
Napa County								1.008	1.012	0.977
								(0.14)	(0.26)	(0.4)
Sonoma County								1.003	1.002	0.958
								(0.06)	(0.04)	(0.8)
Marin County								1.054	1.05	1.014
								(0.95)	(1.16)	(0.24)
TAZ Res Density > 2/Ac.	1.02	1.015	1.009	1.036	1.032	1.02	1.021	1.021	1.039	
	(0.9)	(0.68)	(0.39)	(1.6)	(1.4)	(0.9)	(0.96)	(0.91)	(1.58)	
TAZ Res Density > 4/Ac.	1.021	1.013	1.01	1.018	1.025	1.021	1.023	1.027	1.017	
	(0.83)	(0.53)	(0.39)	(0.73)	(0.99)	(0.82)	(0.91)	(1.03)	(0.65)	
TAZ Res Density > 6/Ac.	0.939	0.931	0.929	0.952	0.943	0.938	0.939	0.939	0.957	
	(2.92***)	(3.27***)	(3.22***)	(2.26**)	(2.72***)	(2.93***)	(2.90***)	(2.89***)	(1.89*)	
TAZ Res Density > 10/Ac.	0.996	0.984	0.994	1.009	1.001	0.996	1.001	1.002	1.011	
	(0.21)	(0.82)	(0.34)	(0.49)	(0.06)	(0.2)	(0.05)	(0.11)	(0.56)	
TAZ Res Density > 15/Ac.	0.983	0.977	0.982	1.007	0.99	0.983	0.982	0.984	1.001	
	(0.92)	(1.26)	(0.97)	(0.34)	(0.52)	(0.94)	(1.01)	(0.87)	(0.07)	
TAZ Res Density > 25/Ac.	0.996	0.981	0.995	1.019	1.004	0.996	0.992	0.999	0.999	
	(0.12)	(0.61)	(0.15)	(0.6)	(0.12)	(0.13)	(0.26)	(0.03)	(0.02)	
TAZ Res Density > 45/Ac.	1.043	1.036	1.041	1.062	1.05	1.038	1.017	1.042	1.033	
	(1.01)	(0.85)	(0.96)	(1.45)	(1.17)	(0.9)	(0.4)	(1)	(0.77)	
TAZ Res Density > 65/Ac.	0.994	0.982	0.993	1.01	0.998	0.984	0.975	0.993	0.99	
	(0.1)	(0.28)	(0.11)	(0.15)	(0.03)	(0.24)	(0.38)	(0.11)	(0.14)	
TAZ Res Density > 100/Ac.	0.94	0.926	0.941	0.982	0.95	0.913	0.852	0.941	0.934	
	(0.63)	(0.78)	(0.62)	(0.18)	(0.52)	(0.86)	(1.53)	(0.63)	(0.64)	
Pop Acc Index > 20,000	1.038	1.037	1.035	1.053	1.045	1.037	1.038	1.03		1.057
	(1.4)	(1.39)	(1.29)	(1.94*)	(1.65*)	(1.37)	(1.43)	(1.08)		(2.04**)
Pop Acc Index > 30,000	1.032	1.03	1.027	1.021	1.032	1.031	1.031	1.022		1.014
	(1.46)	(1.34)	(1.22)	(0.96)	(1.45)	(1.41)	(1.41)	(0.96)		(0.59)
Pop Acc Index > 40,000	0.963	0.965	0.963	0.966	0.964	0.962	0.962	0.965		0.967
	(1.68*)	(1.59)	(1.68*)	(1.56)	(1.67*)	(1.73*)	(1.73*)	(1.52)		(1.48)
Pop Acc Index > 50,000	1.04	1.037	1.038	1.033	1.039	1.039	1.034	1.033		1.018
	(1.62)	(1.5)	(1.54)	(1.36)	(1.6)	(1.57)	(1.38)	(1.33)		(0.71)
Pop Acc Index > 60,000	1.042	1.039	1.041	1.054	1.044	1.041	1.041	1.038		1.039
	(1.56)	(1.45)	(1.51)	(1.97**)	(1.63)	(1.5)	(1.5)	(1.39)		(1.43)
Pop Acc Index > 70,000	1.015	1.014	1.014	1.015	1.015	1.014	1.016	1.012		1.007
	(0.56)	(0.54)	(0.55)	(0.59)	(0.59)	(0.54)	(0.61)	(0.46)		(0.28)
Pop Acc Index > 80,000	0.958	0.962	0.958	0.961	0.96	0.958	0.957	0.954		0.967
	(1.63)	(1.49)	(1.63)	(1.51)	(1.57)	(1.66*)	(1.70*)	(1.75*)		(1.28)
Pop Acc Index > 90,000	1.003	1.003	1.003	1.002	1.003	1.002	1.002	1.004		0.998
	(0.12)	(0.09)	(0.1)	(0.07)	(0.1)	(0.07)	(0.08)	(0.12)		(0.06)
Pop Acc Index > 100,000	1.031	1.027	1.031	1.035	1.031	1.03	1.02	1.031		1.009
	(1.13)	(1.01)	(1.15)	(1.29)	(1.16)	(1.11)	(0.72)	(1.15)		(0.33)
Pop Acc Index > 125,000	0.993	0.983	0.995	0.995	0.996	0.992	0.983	0.994		0.997
	(0.2)	(0.48)	(0.14)	(0.13)	(0.12)	(0.22)	(0.46)	(0.15)		(0.08)
Pop Acc Index > 150,000	0.956	0.949	0.957	0.96	0.958	0.952	0.935	0.977		0.935
	(1.11)	(1.29)	(1.11)	(1.01)	(1.07)	(1.22)	(1.64)	(0.44)		(1.23)
Pop Acc Index > 200,000	1.08	1.076	1.078	1.093	1.082	1.069	1.038	1.079		1.045
	(1.85*)	(1.77*)	(1.82*)	(2.13**)	(1.91*)	(1.5)	(0.81)	(1.84*)		(0.95)
Observations	30,375	30,375	30,375	30,342	30,375	30,375	30,375	30,375	30,342	30,342

Robust z statistics in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

Table D2
POV Trips to Work Regressed On Land Use Variables (Basic Demographic Variables Included, Not Reported)
Negative Binomial Regression (Incidence Risk Ratios and Z-Statistics Reported)

Model Type	Base	Street Density	% Dev-eloped	Res/Com Density	Combined Density	Emp. Access Index	Ret/Serv Access Indexes	County Effects	Combined w/ Gross Density	Combined w/ Pop Access
Street Density in TAZ		0.356							0.513	0.512
		(5.54***)							(3.22***)	(3.37***)
Percent of Zone Developed			0.967						1.021	1.065
			(0.62)						(0.33)	(1.35)
Res. Land Density (Logged)				0.964					0.909	0.897
				(1.89*)					(2.92***)	(3.47***)
Comm. Land Density (Logged)				1.008					0.995	0.994
				(0.84)					(0.46)	(0.48)
Dev. Density (Logged)					1.04				1.217	1.258
					(0.94)				(2.63***)	(3.09***)
Employment Access Index (000s)						0.999			1.005	1.005
						(1.29)			(3.73***)	(3.65***)
Retail Access Index (000s)							1.022		1.003	1.001
							(2.87***)		(0.33)	(0.1)
Serv Emp Access Index (000s)							0.99		0.984	0.983
							(4.35***)		(5.06***)	(4.96***)
San Mateo County								1.026	1.05	1.055
								(0.3)	(0.86)	(0.64)
Santa Clara County								1.096	1.064	1.06
								(1.11)	(1.12)	(0.7)
Alameda County								0.925	0.94	0.939
								(0.94)	(1.12)	(0.76)
Contra Costa County								0.934	0.938	0.938
								(0.8)	(1.07)	(0.74)
Solano County								0.954	0.938	0.962
								(0.51)	(0.97)	(0.43)
Napa County								1.111	1.094	1.116
								(1.11)	(1.31)	(1.17)
Sonoma County								1.07	1.054	1.061
								(0.76)	(0.83)	(0.66)
Marin County								0.945	0.952	0.97
								(0.61)	(0.72)	(0.32)
TAZ Res Density > 2/Ac.	1.006	1.021	1.013	1.013	1.001	1.006	1.003	1.019	1.035	
	(0.21)	(0.66)	(0.41)	(0.42)	(0.02)	(0.21)	(0.1)	(0.57)	(1)	
TAZ Res Density > 4/Ac.	1.063	1.087	1.07	1.062	1.061	1.063	1.056	1.072	1.067	
	(1.84*)	(2.48**)	(1.90*)	(1.80*)	(1.77*)	(1.84*)	(1.64)	(2.01**)	(1.77*)	
TAZ Res Density > 6/Ac.	0.937	0.96	0.943	0.943	0.935	0.937	0.936	0.926	0.954	
	(2.11**)	(1.31)	(1.84*)	(1.87*)	(2.17**)	(2.09**)	(2.14**)	(2.44**)	(1.41)	
TAZ Res Density > 10/Ac.	1.027	1.064	1.028	1.033	1.024	1.026	1.013	1.021	1.039	
	(1.02)	(2.33**)	(1.08)	(1.25)	(0.92)	(1)	(0.51)	(0.79)	(1.44)	
TAZ Res Density > 15/Ac.	0.987	1.003	0.987	0.999	0.983	0.988	0.991	1.007	1.023	
	(0.53)	(0.11)	(0.5)	(0.06)	(0.67)	(0.49)	(0.37)	(0.29)	(0.88)	
TAZ Res Density > 25/Ac.	0.873	0.915	0.874	0.883	0.87	0.874	0.882	0.888	0.933	
	(2.93***)	(1.87*)	(2.92***)	(2.66***)	(3.00***)	(2.90***)	(2.71***)	(2.52**)	(1.5)	
TAZ Res Density > 45/Ac.	0.822	0.838	0.823	0.829	0.819	0.833	0.877	0.827	0.915	
	(2.20**)	(1.98**)	(2.19**)	(2.09**)	(2.24**)	(2.03**)	(1.45)	(2.12**)	(1.01)	
TAZ Res Density > 65/Ac.	0.738	0.764	0.738	0.744	0.736	0.759	0.774	0.737	0.771	
	(2.05**)	(1.81*)	(2.04**)	(1.99**)	(2.06**)	(1.84*)	(1.72*)	(2.06**)	(1.75*)	
TAZ Res Density > 100/Ac.	1.138	1.192	1.138	1.162	1.132	1.242	1.469	1.133	1.461	
	(0.52)	(0.71)	(0.52)	(0.61)	(0.5)	(0.85)	(1.51)	(0.51)	(1.48)	
Pop Acc Index > 20,000	1.071	1.072	1.073	1.08	1.067	1.074	1.068	1.093		1.106
	(1.91*)	(1.94*)	(1.95*)	(2.12**)	(1.80*)	(1.97**)	(1.83*)	(2.40**)		(2.74***)
Pop Acc Index > 30,000	0.932	0.939	0.935	0.927	0.932	0.935	0.934	0.95		0.954
	(2.31**)	(2.08**)	(2.20**)	(2.48**)	(2.31**)	(2.20**)	(2.23**)	(1.63)		(1.47)
Pop Acc Index > 40,000	0.996	0.99	0.996	0.998	0.996	1	0.999	1.016		1.03
	(0.12)	(0.32)	(0.12)	(0.07)	(0.13)	(0)	(0.04)	(0.49)		(0.93)
Pop Acc Index > 50,000	1.012	1.021	1.013	1.01	1.012	1.016	1.028	0.978		0.99
	(0.35)	(0.62)	(0.39)	(0.29)	(0.36)	(0.47)	(0.81)	(0.64)		(0.28)
Pop Acc Index > 60,000	1.031	1.039	1.032	1.035	1.03	1.035	1.033	1.031		1.045
	(0.81)	(1.02)	(0.83)	(0.91)	(0.78)	(0.92)	(0.87)	(0.81)		(1.15)
Pop Acc Index > 70,000	0.991	0.993	0.991	0.992	0.991	0.992	0.986	0.974		0.999
	(0.25)	(0.19)	(0.25)	(0.21)	(0.26)	(0.21)	(0.39)	(0.73)		(0.03)
Pop Acc Index > 80,000	1.015	1.004	1.015	1.016	1.014	1.017	1.021	1.012		1.024
	(0.42)	(0.12)	(0.42)	(0.45)	(0.4)	(0.48)	(0.57)	(0.34)		(0.66)
Pop Acc Index > 90,000	1.009	1.012	1.01	1.009	1.01	1.013	1.011	0.976		0.984
	(0.23)	(0.3)	(0.24)	(0.21)	(0.23)	(0.33)	(0.28)	(0.59)		(0.39)
Pop Acc Index > 100,000	0.929	0.936	0.929	0.931	0.929	0.93	0.953	0.935		0.99
	(1.88*)	(1.68*)	(1.89*)	(1.83*)	(1.88*)	(1.84*)	(1.22)	(1.73*)		(0.26)
Pop Acc Index > 125,000	0.937	0.968	0.936	0.939	0.935	0.938	0.964	0.983		0.99
	(1.07)	(0.52)	(1.09)	(1.03)	(1.1)	(1.05)	(0.6)	(0.28)		(0.18)
Pop Acc Index > 150,000	0.908	0.929	0.908	0.912	0.908	0.921	0.962	0.885		0.966
	(1.29)	(0.97)	(1.29)	(1.23)	(1.3)	(1.08)	(0.5)	(1.21)		(0.34)
Pop Acc Index > 200,000	0.88	0.889	0.88	0.884	0.879	0.906	0.973	0.875		0.969
	(1.5)	(1.37)	(1.49)	(1.44)	(1.52)	(1.12)	(0.3)	(1.57)		(0.36)
Observations	30,375	30,375	30,375	30,342	30,375	30,375	30,375	30,375	30,342	30,342

Robust z statistics in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

Table D3
Transit Trips to Work Regressed On Land Use Variables (Basic Demographic Variables Included, Not Reported)
Negative Binomial Regression (Incidence Risk Ratios and Z-Statistics Reported)

Model Type	Base	Street Density	% Dev-eloped	Res/Com Density	Combined Density	Emp. Access Index	Ret/Serv Access Indexes	County Effects	Combined w/ Gross Density	Combined w/ Pop Access
Street Density in TAZ		4.89							2.305	1.63
		(1.98**)							(0.95)	(0.6)
Percent of Zone Developed			0.635						0.897	0.688
			(1.6)						(0.38)	(1.64)
Res. Land Density (Logged)				1.399					1.754	1.779
				(3.52***)					(4.16***)	(4.29***)
Comm. Land Density (Logged)				0.972					1.037	1.026
				(0.62)					(0.67)	(0.47)
Dev. Density (Logged)					1.145				0.469	0.444
					(0.6)				(2.25**)	(2.53**)
Employment Access Index (000s)						1.002			0.99	0.99
						(1.28)			(1.48)	(1.58)
Retail Access Index (000s)							0.881		0.922	0.9
							(3.50***)		(2.16**)	(2.62***)
Serv Emp Access Index (000s)							1.043		1.048	1.057
							(4.06***)		(3.26***)	(3.74***)
San Mateo County								0.347	0.477	0.333
								(3.85***)	(3.42***)	(4.22***)
Santa Clara County								0.233	0.373	0.266
								(5.51***)	(4.71***)	(5.24***)
Alameda County								0.402	0.549	0.392
								(3.55***)	(3.17***)	(3.93***)
Contra Costa County								0.364	0.5	0.396
								(3.54***)	(3.02***)	(3.45***)
Solano County								0.302	0.367	0.306
								(3.74***)	(3.79***)	(3.97***)
Napa County								0.148	0.183	0.166
								(4.89***)	(5.16***)	(4.81***)
Sonoma County								0.3	0.43	0.369
								(3.78***)	(3.23***)	(3.30***)
Marin County								0.421	0.551	0.478
								(2.51**)	(2.05**)	(2.24**)
TAZ Res Density > 2/Ac.	0.911	0.895	0.989	0.833	0.889	0.911	0.923	0.968	1.008	
	(0.6)	(0.72)	(0.06)	(1.17)	(0.75)	(0.6)	(0.52)	(0.2)	(0.05)	
TAZ Res Density > 4/Ac.	0.701	0.681	0.758	0.704	0.696	0.701	0.728	0.657	0.79	
	(1.92*)	(2.06**)	(1.43)	(1.89*)	(1.95*)	(1.92*)	(1.70*)	(2.23**)	(1.23)	
TAZ Res Density > 6/Ac.	1.232	1.184	1.346	1.157	1.224	1.229	1.253	1.29	1.285	
	(1.22)	(0.98)	(1.64)	(0.85)	(1.18)	(1.2)	(1.31)	(1.49)	(1.43)	
TAZ Res Density > 10/Ac.	0.724	0.681	0.746	0.691	0.718	0.725	0.765	0.773	0.78	
	(1.97**)	(2.27**)	(1.85*)	(2.26**)	(1.99**)	(1.96**)	(1.64)	(1.72*)	(1.66*)	
TAZ Res Density > 15/Ac.	1.543	1.499	1.556	1.372	1.523	1.54	1.52	1.445	1.284	
	(3.36***)	(3.13***)	(3.42***)	(2.41**)	(3.22***)	(3.35***)	(3.26***)	(2.79***)	(1.90*)	
TAZ Res Density > 25/Ac.	1.251	1.149	1.279	1.12	1.239	1.246	1.248	1.029	0.939	
	(1.29)	(0.78)	(1.42)	(0.65)	(1.24)	(1.27)	(1.32)	(0.16)	(0.36)	
TAZ Res Density > 45/Ac.	1.29	1.269	1.31	1.133	1.273	1.218	1.074	1.24	0.872	
	(1.23)	(1.14)	(1.3)	(0.58)	(1.16)	(0.92)	(0.3)	(1.11)	(0.59)	
TAZ Res Density > 65/Ac.	1.024	0.974	1.03	0.966	1.018	0.963	1.065	1.078	1.04	
	(0.09)	(0.1)	(0.11)	(0.13)	(0.07)	(0.14)	(0.22)	(0.28)	(0.14)	
TAZ Res Density > 100/Ac.	1.256	1.155	1.246	0.923	1.23	0.942	0.774	1.251	0.695	
	(0.71)	(0.44)	(0.69)	(0.25)	(0.64)	(0.15)	(0.65)	(0.7)	(0.96)	
Pop Acc Index > 20,000	1.065	1.06	1.097	0.945	1.042	1.056	1.104	0.935		0.936
	(0.33)	(0.3)	(0.48)	(0.3)	(0.22)	(0.28)	(0.51)	(0.35)		(0.34)
Pop Acc Index > 30,000	1.109	1.1	1.153	1.193	1.111	1.098	1.139	1.069		1.193
	(0.64)	(0.58)	(0.86)	(1.09)	(0.65)	(0.57)	(0.8)	(0.39)		(1.05)
Pop Acc Index > 40,000	1.159	1.165	1.164	1.104	1.158	1.146	1.173	1.124		1.085
	(0.87)	(0.9)	(0.89)	(0.58)	(0.86)	(0.81)	(0.94)	(0.67)		(0.48)
Pop Acc Index > 50,000	1.235	1.21	1.25	1.273	1.233	1.216	1.204	1.26		1.304
	(1.17)	(1.06)	(1.23)	(1.34)	(1.16)	(1.08)	(1.02)	(1.25)		(1.43)
Pop Acc Index > 60,000	0.845	0.841	0.857	0.823	0.845	0.837	0.868	0.819		0.832
	(0.87)	(0.89)	(0.8)	(1.01)	(0.87)	(0.92)	(0.72)	(1.03)		(0.95)
Pop Acc Index > 70,000	1.301	1.298	1.286	1.253	1.297	1.295	1.351	1.322		1.29
	(1.43)	(1.41)	(1.38)	(1.24)	(1.42)	(1.4)	(1.62)	(1.52)		(1.37)
Pop Acc Index > 80,000	0.729	0.746	0.735	0.724	0.727	0.722	0.728	0.732		0.745
	(1.61)	(1.49)	(1.57)	(1.67*)	(1.63)	(1.66*)	(1.62)	(1.58)		(1.51)
Pop Acc Index > 90,000	1.148	1.128	1.142	1.164	1.148	1.136	1.142	1.194		1.208
	(0.56)	(0.49)	(0.54)	(0.62)	(0.56)	(0.51)	(0.54)	(0.77)		(0.83)
Pop Acc Index > 100,000	1.167	1.151	1.164	1.141	1.164	1.157	1.051	1.164		0.996
	(0.67)	(0.61)	(0.67)	(0.58)	(0.66)	(0.63)	(0.22)	(0.73)		(0.02)
Pop Acc Index > 125,000	1.848	1.797	1.795	1.812	1.837	1.843	1.707	1.365		1.258
	(2.97***)	(2.83***)	(2.82***)	(2.83***)	(2.93***)	(2.96***)	(2.56**)	(1.48)		(1.14)
Pop Acc Index > 150,000	1.085	1.059	1.088	1.087	1.08	1.039	0.933	0.541		0.468
	(0.41)	(0.28)	(0.42)	(0.42)	(0.39)	(0.19)	(0.33)	(2.42**)		(2.96***)
Pop Acc Index > 200,000	1.4	1.346	1.404	1.279	1.395	1.246	1.158	1.465		1.106
	(1.76*)	(1.54)	(1.77*)	(1.27)	(1.74*)	(1.05)	(0.66)	(2.02**)		(0.46)
Observations	30,375	30,375	30,375	30,342	30,375	30,375	30,375	30,375	30,342	30,342

Robust z statistics in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

Table D4
Walk/Bike Trips to Work Regressed On Land Use Variables (Basic Demographic Variables Included, Not Reported)
Negative Binomial Regression (Incidence Risk Ratios and Z-Statistics Reported)

Model Type	Base	Street Density	% Dev-eloped	Res/Com Density	Combined Density	Emp. Access Index	Ret/Serv Access Indexes	County Effects	Combined w/ Gross Density	Combined w/ Pop Access
Street Density in TAZ		75.839							10.104	7.571
		(9.54***)							(4.47***)	(4.07***)
Percent of Zone Developed			1.386						1.523	0.93
			(1.98**)						(2.37**)	(0.52)
Res. Land Density (Logged)				1.207					1.126	1.056
				(3.46***)					(1.35)	(0.62)
Comm. Land Density (Logged)				1.063					1.003	0.995
				(2.29**)					(0.1)	(0.17)
Dev. Density (Logged)					1.475				1.244	1.167
					(2.69***)				(0.97)	(0.69)
Employment Access Index (000s)						1.005			0.986	0.984
						(5.77***)			(4.25***)	(4.56***)
Retail Access Index (000s)							0.926		0.998	0.984
							(3.98***)		(0.11)	(0.73)
Serv Emp Access Index (000s)							1.04		1.045	1.052
							(7.22***)		(6.34***)	(6.88***)
San Mateo County								0.816	0.98	0.726
								(1.18)	(0.17)	(1.87*)
Santa Clara County								0.506	0.699	0.527
								(4.17***)	(3.23***)	(3.91***)
Alameda County								1.105	1.251	0.956
								(0.64)	(2.36**)	(0.29)
Contra Costa County								0.955	1.032	0.859
								(0.27)	(0.27)	(0.88)
Solano County								0.944	0.929	0.84
								(0.29)	(0.51)	(0.9)
Napa County								0.92	0.79	0.754
								(0.38)	(1.42)	(1.29)
Sonoma County								0.769	0.748	0.674
								(1.3)	(1.93*)	(1.96**)
Marin County								1.644	1.507	1.423
								(2.55**)	(2.86***)	(1.78*)
TAZ Res Density > 2/Ac.	1.237	1.172	1.163	1.18	1.168	1.24	1.26	1.152	1.036	
	(2.07**)	(1.56)	(1.4)	(1.61)	(1.52)	(2.09**)	(2.24**)	(1.31)	(0.33)	
TAZ Res Density > 4/Ac.	1.027	0.933	0.962	1.02	1.007	1.025	1.05	0.908	0.858	
	(0.26)	(0.66)	(0.36)	(0.19)	(0.07)	(0.24)	(0.46)	(0.89)	(1.4)	
TAZ Res Density > 6/Ac.	0.943	0.858	0.895	0.903	0.918	0.94	0.942	0.994	0.896	
	(0.64)	(1.63)	(1.13)	(1.09)	(0.92)	(0.67)	(0.65)	(0.07)	(1.08)	
TAZ Res Density > 10/Ac.	0.902	0.765	0.891	0.875	0.883	0.908	0.96	0.954	0.912	
	(1.36)	(3.42***)	(1.53)	(1.75*)	(1.64)	(1.28)	(0.54)	(0.62)	(1.2)	
TAZ Res Density > 15/Ac.	1.274	1.147	1.266	1.202	1.23	1.275	1.255	1.126	1.011	
	(3.43***)	(1.95*)	(3.34***)	(2.55**)	(2.90***)	(3.45***)	(3.25***)	(1.67*)	(0.16)	
TAZ Res Density > 25/Ac.	1.445	1.194	1.434	1.365	1.398	1.431	1.368	1.311	1.041	
	(4.08***)	(1.93*)	(3.98***)	(3.37***)	(3.68***)	(3.95***)	(3.45***)	(2.94***)	(0.42)	
TAZ Res Density > 45/Ac.	1.197	1.096	1.188	1.086	1.152	1.057	0.883	1.185	0.787	
	(1.64)	(0.8)	(1.56)	(0.73)	(1.28)	(0.5)	(1.08)	(1.57)	(2.09**)	
TAZ Res Density > 65/Ac.	1.319	1.122	1.308	1.262	1.284	1.072	1.051	1.294	1.031	
	(1.74*)	(0.7)	(1.69*)	(1.47)	(1.59)	(0.42)	(0.3)	(1.66*)	(0.19)	
TAZ Res Density > 100/Ac.	0.902	0.777	0.908	0.723	0.856	0.442	0.276	0.93	0.428	
	(0.46)	(1.07)	(0.43)	(1.44)	(0.7)	(3.17***)	(4.72***)	(0.33)	(3.23***)	
Pop Acc Index > 20,000	1.234	1.223	1.212	1.166	1.193	1.208	1.232	1.268		1.228
	(1.61)	(1.56)	(1.48)	(1.18)	(1.35)	(1.45)	(1.59)	(1.74*)		(1.54)
Pop Acc Index > 30,000	1.127	1.096	1.094	1.128	1.128	1.096	1.105	1.082		1.025
	(1.23)	(0.94)	(0.91)	(1.22)	(1.24)	(0.94)	(1.02)	(0.78)		(0.24)
Pop Acc Index > 40,000	0.957	0.98	0.954	0.94	0.954	0.93	0.937	1.044		1.003
	(0.45)	(0.2)	(0.47)	(0.62)	(0.47)	(0.74)	(0.66)	(0.42)		(0.03)
Pop Acc Index > 50,000	1.28	1.226	1.266	1.281	1.276	1.238	1.198	1.471		1.36
	(2.47**)	(2.03**)	(2.35**)	(2.47**)	(2.44**)	(2.14**)	(1.80*)	(3.75***)		(2.95***)
Pop Acc Index > 60,000	1.015	0.978	1.004	1.005	1.013	0.981	0.992	1.023		0.955
	(0.14)	(0.21)	(0.03)	(0.05)	(0.12)	(0.18)	(0.07)	(0.21)		(0.43)
Pop Acc Index > 70,000	1.154	1.135	1.157	1.122	1.14	1.136	1.143	1.226		1.112
	(1.39)	(1.24)	(1.41)	(1.12)	(1.28)	(1.25)	(1.31)	(1.93*)		(1.03)
Pop Acc Index > 80,000	0.959	1.017	0.954	0.949	0.953	0.944	0.953	0.951		0.991
	(0.41)	(0.17)	(0.45)	(0.51)	(0.47)	(0.56)	(0.47)	(0.48)		(0.09)
Pop Acc Index > 90,000	0.825	0.81	0.823	0.839	0.828	0.799	0.788	0.948		0.881
	(1.72*)	(1.90*)	(1.74*)	(1.57)	(1.69*)	(2.00**)	(2.13**)	(0.48)		(1.14)
Pop Acc Index > 100,000	1.341	1.277	1.346	1.302	1.326	1.314	1.165	1.257		1.043
	(2.82***)	(2.38**)	(2.86***)	(2.55**)	(2.72***)	(2.63***)	(1.46)	(2.21**)		(0.39)
Pop Acc Index > 125,000	1.139	1.075	1.159	1.082	1.12	1.125	1.089	0.964		1
	(1.11)	(0.6)	(1.26)	(0.67)	(0.97)	(1.01)	(0.71)	(0.31)		(0)
Pop Acc Index > 150,000	1.149	1.038	1.148	1.116	1.14	1.007	0.863	1.137		0.781
	(1.12)	(0.29)	(1.11)	(0.89)	(1.07)	(0.05)	(1.14)	(0.74)		(1.4)
Pop Acc Index > 200,000	1.318	1.282	1.311	1.28	1.305	1.063	0.877	1.359		0.903
	(2.54**)	(2.22**)	(2.48**)	(2.24**)	(2.45**)	(0.53)	(1.07)	(2.84***)		(0.86)
Observations	30,375	30,375	30,375	30,342	30,375	30,375	30,375	30,375	30,342	30,342

Robust z statistics in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

Table D5
Non-Work Trips by POV Regressed On Land Use Variables (Basic Demographic Variables Included, Not Reported)
Negative Binomial Regression (Incidence Risk Ratios and Z-Statistics Reported)

Model Type	Base	Street Density	% Dev-eloped	Res/Com Density	Combined Density	Emp. Access Index	Ret/Serv Access Indexes	County Effects	Combined w/ Gross Density	Combined w/ Pop Access
Street Density in TAZ		0.9							1.264	1.128
		(0.52)							(1.04)	(0.56)
Percent of Zone Developed			1.1						0.964	1.005
			(1.59)						(0.51)	(0.1)
Res. Land Density (Logged)				0.85					0.825	0.818
				(7.96***)					(5.11***)	(5.63***)
Comm. Land Density (Logged)				1.005					0.997	0.999
				(0.56)					(0.25)	(0.06)
Dev. Density (Logged)					0.806				1.103	1.136
					(4.87***)				(1.21)	(1.59)
Employment Access Index (000s)						0.999			0.999	0.999
						(2.72***)			(0.61)	(0.38)
Retail Access Index (000s)							1.003		1.009	1.008
							(0.35)		(1.02)	(0.84)
Serv Emp Access Index (000s)							0.996		0.998	0.997
							(1.57)		(0.65)	(0.86)
San Mateo County								1.172	1.102	1.182
								(1.78*)	(1.63)	(1.92*)
Santa Clara County								1.256	1.141	1.221
								(2.62***)	(2.26**)	(2.32**)
Alameda County								1.164	1.064	1.15
								(1.76*)	(1.11)	(1.65*)
Contra Costa County								1.213	1.067	1.16
								(2.14**)	(1.04)	(1.68*)
Solano County								1.083	0.979	1.09
								(0.83)	(0.3)	(0.91)
Napa County								1.098	0.977	1.068
								(0.95)	(0.32)	(0.68)
Sonoma County								1.15	0.985	1.067
								(1.49)	(0.22)	(0.69)
Marin County								1.191	1.032	1.134
								(1.81*)	(0.45)	(1.31)
TAZ Res Density > 2/Ac.	0.997	0.999	0.979	1.042	1.033	0.998	0.997	1.007	1.049	
	(0.08)	(0.03)	(0.64)	(1.28)	(1)	(0.08)	(0.09)	(0.21)	(1.33)	
TAZ Res Density > 4/Ac.	1.038	1.04	1.019	1.039	1.051	1.038	1.038	1.06	1.053	
	(1)	(1.06)	(0.49)	(1.04)	(1.34)	(1.02)	(1)	(1.54)	(1.32)	
TAZ Res Density > 6/Ac.	0.921	0.924	0.906	0.95	0.932	0.923	0.922	0.92	0.966	
	(2.48**)	(2.38**)	(2.87***)	(1.57)	(2.12**)	(2.44**)	(2.46**)	(2.52**)	(0.98)	
TAZ Res Density > 10/Ac.	0.981	0.984	0.977	1.011	0.996	0.979	0.977	0.986	1.008	
	(0.69)	(0.54)	(0.83)	(0.36)	(0.15)	(0.73)	(0.83)	(0.48)	(0.26)	
TAZ Res Density > 15/Ac.	0.921	0.923	0.919	0.974	0.941	0.923	0.923	0.934	0.988	
	(2.97***)	(2.88***)	(3.03***)	(0.91)	(2.17**)	(2.87***)	(2.90***)	(2.45**)	(0.43)	
TAZ Res Density > 25/Ac.	0.907	0.911	0.906	0.958	0.927	0.911	0.914	0.933	0.988	
	(1.75*)	(1.63)	(1.77*)	(0.77)	(1.36)	(1.67*)	(1.62)	(1.23)	(0.21)	
TAZ Res Density > 45/Ac.	0.955	0.957	0.952	1.009	0.975	0.983	0.991	0.958	1.04	
	(0.55)	(0.52)	(0.59)	(0.11)	(0.31)	(0.2)	(0.1)	(0.52)	(0.46)	
TAZ Res Density > 65/Ac.	0.892	0.895	0.891	0.93	0.902	0.956	0.943	0.886	0.957	
	(0.94)	(0.91)	(0.95)	(0.6)	(0.85)	(0.36)	(0.48)	(0.99)	(0.36)	
TAZ Res Density > 100/Ac.	0.888	0.893	0.889	0.99	0.915	1.08	1.069	0.889	1.118	
	(0.56)	(0.53)	(0.55)	(0.05)	(0.42)	(0.35)	(0.3)	(0.56)	(0.51)	
Pop Acc Index > 20,000	1.025	1.025	1.02	1.064	1.046	1.031	1.029	0.997		1.049
	(0.67)	(0.67)	(0.53)	(1.65*)	(1.21)	(0.82)	(0.76)	(0.07)		(1.26)
Pop Acc Index > 30,000	1.04	1.041	1.031	1.021	1.039	1.047	1.045	1.021		1.01
	(1.22)	(1.24)	(0.93)	(0.66)	(1.18)	(1.43)	(1.37)	(0.64)		(0.28)
Pop Acc Index > 40,000	0.949	0.948	0.949	0.955	0.95	0.956	0.954	0.938		0.951
	(1.62)	(1.64)	(1.61)	(1.43)	(1.59)	(1.36)	(1.43)	(1.88*)		(1.49)
Pop Acc Index > 50,000	1.09	1.091	1.086	1.078	1.088	1.1	1.1	1.067		1.054
	(2.45**)	(2.47**)	(2.34**)	(2.14**)	(2.40**)	(2.69***)	(2.68***)	(1.80*)		(1.44)
Pop Acc Index > 60,000	1.027	1.028	1.025	1.051	1.033	1.038	1.035	1.027		1.04
	(0.69)	(0.71)	(0.63)	(1.27)	(0.83)	(0.95)	(0.88)	(0.67)		(0.99)
Pop Acc Index > 70,000	0.987	0.988	0.986	0.991	0.989	0.991	0.99	0.977		0.978
	(0.33)	(0.32)	(0.36)	(0.24)	(0.29)	(0.24)	(0.25)	(0.6)		(0.57)
Pop Acc Index > 80,000	0.949	0.948	0.95	0.959	0.954	0.953	0.952	0.945		0.96
	(1.3)	(1.32)	(1.29)	(1.05)	(1.18)	(1.2)	(1.22)	(1.4)		(1.02)
Pop Acc Index > 90,000	1.043	1.043	1.042	1.037	1.042	1.053	1.049	1.025		1.024
	(0.94)	(0.95)	(0.92)	(0.82)	(0.93)	(1.15)	(1.07)	(0.55)		(0.53)
Pop Acc Index > 100,000	1.006	1.007	1.007	1.017	1.008	1.009	1.02	1.017		1.031
	(0.14)	(0.16)	(0.17)	(0.39)	(0.18)	(0.22)	(0.46)	(0.4)		(0.71)
Pop Acc Index > 125,000	0.943	0.947	0.947	0.958	0.952	0.945	0.951	0.981		0.986
	(0.9)	(0.85)	(0.84)	(0.66)	(0.77)	(0.87)	(0.78)	(0.3)		(0.22)
Pop Acc Index > 150,000	0.948	0.95	0.949	0.961	0.952	0.978	0.985	1.079		1.107
	(0.72)	(0.68)	(0.71)	(0.53)	(0.66)	(0.29)	(0.2)	(0.74)		(0.99)
Pop Acc Index > 200,000	0.921	0.921	0.919	0.943	0.928	0.981	0.991	0.915		1.006
	(1.02)	(1.01)	(1.04)	(0.72)	(0.93)	(0.22)	(0.11)	(1.09)		(0.07)
Observations	30,375	30,375	30,375	30,342	30,375	30,375	30,375	30,375	30,342	30,342

Robust z statistics in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

Table D6
Non-Work Trips on Transit Regressed On Land Use Variables (Basic Demographic Variables Included, Not Reported)
Negative Binomial Regression (Incidence Risk Ratios and Z-Statistics Reported)

Model Type	Base	Street Density	% Dev-eloped	Res/Com Density	Combined Density	Emp. Access Index	Ret/Serv Access Indexes	County Effects	Combined w/ Gross Density	Combined w/ Pop Access
Street Density in TAZ		204.225							32.854	12.09
		(5.24***)							(3.18***)	(2.35**)
Percent of Zone Developed			1.534						1.368	1.2
			(1.05)						(0.71)	(0.54)
Res. Land Density (Logged)				1.38					2.046	1.657
				(2.33**)					(3.94***)	(2.86***)
Comm. Land Density (Logged)				1.031					1.099	1.078
				(0.44)					(1.16)	(0.95)
Dev. Density (Logged)					1.103				0.335	0.408
					(0.27)				(2.29**)	(2.13**)
Employment Access Index (000s)						1.003			0.972	0.979
						(1.70*)			(3.60***)	(2.64***)
Retail Access Index (000s)							0.923		1.01	0.973
							(1.61)		(0.17)	(0.52)
Serv Emp Access Index (000s)							1.034		1.064	1.059
							(2.43**)		(3.43***)	(3.01***)
San Mateo County								0.48	0.535	0.458
								(2.19**)	(2.29**)	(2.41**)
Santa Clara County								0.187	0.307	0.232
								(4.81***)	(4.05***)	(4.32***)
Alameda County								0.522	0.612	0.489
								(2.14**)	(2.21**)	(2.51**)
Contra Costa County								0.519	0.515	0.475
								(1.84*)	(2.32**)	(2.16**)
Solano County								0.237	0.255	0.22
								(3.11***)	(3.37***)	(3.45***)
Napa County								0.321	0.349	0.297
								(2.30**)	(2.55**)	(2.55**)
Sonoma County								0.52	0.631	0.541
								(1.61)	(1.4)	(1.57)
Marin County								0.633	0.649	0.625
								(1.1)	(1.25)	(1.15)
TAZ Res Density > 2/Ac.	0.839	0.781	0.775	0.77	0.823	0.837	0.847	0.91	0.754	
	(0.71)	(1.01)	(0.99)	(1.07)	(0.79)	(0.73)	(0.68)	(0.37)	(1.11)	
TAZ Res Density > 4/Ac.	1.601	1.426	1.48	1.625	1.593	1.599	1.643	1.505	1.432	
	(1.65*)	(1.24)	(1.31)	(1.70*)	(1.62)	(1.65*)	(1.72*)	(1.44)	(1.24)	
TAZ Res Density > 6/Ac.	0.84	0.739	0.778	0.799	0.836	0.842	0.847	0.91	0.761	
	(0.72)	(1.23)	(0.98)	(0.92)	(0.74)	(0.71)	(0.68)	(0.38)	(1.06)	
TAZ Res Density > 10/Ac.	0.778	0.642	0.758	0.745	0.773	0.777	0.8	0.809	0.777	
	(1.24)	(2.10**)	(1.38)	(1.44)	(1.26)	(1.24)	(1.08)	(1.03)	(1.24)	
TAZ Res Density > 15/Ac.	1.33	1.155	1.327	1.212	1.318	1.336	1.327	1.087	0.983	
	(1.52)	(0.78)	(1.51)	(1.01)	(1.46)	(1.55)	(1.51)	(0.45)	(0.09)	
TAZ Res Density > 25/Ac.	1.604	1.3	1.575	1.48	1.59	1.593	1.54	1.35	1.199	
	(2.02**)	(1.09)	(1.95*)	(1.67*)	(1.98**)	(2.01**)	(1.96*)	(1.27)	(0.77)	
TAZ Res Density > 45/Ac.	1.264	1.226	1.246	1.101	1.253	1.201	1.047	1.258	0.761	
	(1.12)	(0.96)	(1.05)	(0.44)	(1.06)	(0.87)	(0.21)	(1.08)	(1.19)	
TAZ Res Density > 65/Ac.	0.605	0.526	0.602	0.588	0.603	0.565	0.577	0.612	0.596	
	(1.47)	(1.84*)	(1.48)	(1.54)	(1.47)	(1.53)	(1.52)	(1.44)	(1.57)	
TAZ Res Density > 100/Ac.	2.484	1.955	2.509	1.686	2.441	1.598	1.146	2.457	1.482	
	(1.91*)	(1.35)	(1.93*)	(1.09)	(1.86*)	(0.93)	(0.27)	(1.90*)	(0.83)	
Pop Acc Index > 20,000	0.778	0.764	0.755	0.696	0.769	0.769	0.786	0.697		0.658
	(0.85)	(0.92)	(0.95)	(1.24)	(0.91)	(0.89)	(0.8)	(1.22)		(1.46)
Pop Acc Index > 30,000	1.165	1.134	1.116	1.19	1.168	1.149	1.17	1.122		1.176
	(0.62)	(0.51)	(0.44)	(0.7)	(0.63)	(0.56)	(0.64)	(0.45)		(0.65)
Pop Acc Index > 40,000	1.162	1.2	1.165	1.125	1.162	1.143	1.15	1.219		1.244
	(0.64)	(0.78)	(0.65)	(0.5)	(0.64)	(0.57)	(0.59)	(0.81)		(0.89)
Pop Acc Index > 50,000	0.596	0.569	0.586	0.609	0.596	0.585	0.572	0.661		0.612
	(1.68*)	(1.83*)	(1.75*)	(1.6)	(1.68*)	(1.74*)	(1.81*)	(1.28)		(1.55)
Pop Acc Index > 60,000	1.322	1.252	1.313	1.261	1.32	1.3	1.331	1.194		1.045
	(0.85)	(0.67)	(0.83)	(0.7)	(0.84)	(0.8)	(0.86)	(0.53)		(0.13)
Pop Acc Index > 70,000	2.141	2.124	2.149	2.056	2.134	2.119	2.211	2.429		2.096
	(2.82***)	(2.72***)	(2.82***)	(2.66***)	(2.81***)	(2.77***)	(2.92***)	(3.29***)		(2.71***)
Pop Acc Index > 80,000	0.569	0.583	0.566	0.561	0.569	0.564	0.557	0.616		0.564
	(1.96*)	(1.85*)	(1.98**)	(2.01**)	(1.96*)	(1.99**)	(2.03**)	(1.63)		(1.94*)
Pop Acc Index > 90,000	0.775	0.773	0.775	0.785	0.774	0.761	0.765	0.948		0.895
	(0.73)	(0.74)	(0.73)	(0.7)	(0.74)	(0.78)	(0.76)	(0.15)		(0.3)
Pop Acc Index > 100,000	2.671	2.459	2.679	2.544	2.666	2.629	2.371	2.285		1.823
	(3.20***)	(2.99***)	(3.20***)	(3.05***)	(3.19***)	(3.16***)	(2.84***)	(2.70***)		(1.97**)
Pop Acc Index > 125,000	1.576	1.453	1.619	1.481	1.57	1.548	1.471	1.225		1.21
	(1.62)	(1.31)	(1.70*)	(1.39)	(1.6)	(1.56)	(1.4)	(0.69)		(0.67)
Pop Acc Index > 150,000	1.275	1.168	1.274	1.222	1.273	1.219	1.118	0.72		0.557
	(1.01)	(0.63)	(1.01)	(0.83)	(1.01)	(0.82)	(0.46)	(1.09)		(1.92*)
Pop Acc Index > 200,000	1.506	1.286	1.488	1.377	1.498	1.253	1.055	1.543		1.043
	(1.93*)	(1.15)	(1.88*)	(1.46)	(1.90*)	(0.92)	(0.21)	(2.06**)		(0.17)
Observations	30,375	30,375	30,375	30,342	30,375	30,375	30,375	30,375	30,342	30,342

Robust z statistics in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

Table D7
Non-Work Walk/Bike Trips Regressed On Land Use Variables (Basic Demographic Variables Included, Not Reported)
Negative Binomial Regression (Incidence Risk Ratios and Z-Statistics Reported)

Model Type	Base	Street Density	% Dev-eloped	Res/Com Density	Combined Density	Emp. Access Index	Ret/Serv Access Indexes	County Effects	Combined w/ Gross Density	Combined w/ Pop Access
Street Density in TAZ		230.482							30.275	21.249
		(12.23***)							(6.98***)	(6.54***)
Percent of Zone Developed			1.726						1.426	0.978
			(3.27***)						(1.93*)	(0.16)
Res. Land Density (Logged)				1.14					1.217	1.128
				(2.32**)					(2.18**)	(1.31)
Comm. Land Density (Logged)				1.139					1.062	1.072
				(4.67***)					(1.88*)	(2.18**)
Dev. Density (Logged)					1.34				0.84	0.838
					(1.80*)				(0.75)	(0.72)
Employment Access Index (000s)						1.007			0.984	0.985
						(7.92***)			(5.06***)	(4.51***)
Retail Access Index (000s)							0.931		0.99	0.962
							(3.81***)		(0.49)	(1.82*)
Serv Emp Access Index (000s)							1.045		1.055	1.057
							(8.37***)		(7.80***)	(7.66***)
San Mateo County								0.748	1.007	0.702
								(1.83*)	(0.06)	(2.35**)
Santa Clara County								0.56	0.905	0.596
								(3.88***)	(0.94)	(3.61***)
Alameda County								1.032	1.307	0.9
								(0.22)	(2.93***)	(0.78)
Contra Costa County								0.907	1.098	0.827
								(0.61)	(0.81)	(1.23)
Solano County								0.645	0.807	0.607
								(2.22**)	(1.36)	(2.63***)
Napa County								0.914	0.987	0.747
								(0.43)	(0.08)	(1.44)
Sonoma County								0.846	0.976	0.752
								(0.89)	(0.17)	(1.58)
Marin County								1.582	1.707	1.388
								(2.45**)	(3.77***)	(1.80*)
TAZ Res Density > 2/Ac.	1.112	1.023	0.993	1.047	1.059	1.106	1.118	1.074	0.874	
	(1.02)	(0.22)	(0.07)	(0.44)	(0.56)	(0.97)	(1.08)	(0.68)	(1.29)	
TAZ Res Density > 4/Ac.	1.142	1.023	1.033	1.118	1.126	1.143	1.166	1.045	0.989	
	(1.23)	(0.21)	(0.29)	(1.03)	(1.09)	(1.25)	(1.43)	(0.4)	(0.1)	
TAZ Res Density > 6/Ac.	0.919	0.807	0.84	0.898	0.902	0.913	0.911	0.955	0.841	
	(0.92)	(2.30**)	(1.79*)	(1.15)	(1.11)	(0.99)	(1.02)	(0.49)	(1.72*)	
TAZ Res Density > 10/Ac.	0.864	0.705	0.848	0.84	0.847	0.871	0.927	0.929	0.885	
	(1.90*)	(4.43***)	(2.14**)	(2.25**)	(2.14**)	(1.80*)	(0.99)	(0.94)	(1.6)	
TAZ Res Density > 15/Ac.	1.402	1.206	1.384	1.337	1.364	1.393	1.352	1.255	1.106	
	(4.75***)	(2.68***)	(4.58***)	(3.98***)	(4.30***)	(4.69***)	(4.30***)	(3.08***)	(1.41)	
TAZ Res Density > 25/Ac.	1.415	1.13	1.39	1.355	1.382	1.371	1.303	1.323	1.032	
	(3.93***)	(1.3)	(3.72***)	(3.42***)	(3.63***)	(3.58***)	(2.97***)	(3.06***)	(0.33)	
TAZ Res Density > 45/Ac.	1.295	1.195	1.278	1.18	1.262	1.169	0.993	1.274	0.805	
	(2.47**)	(1.62)	(2.35**)	(1.54)	(2.21**)	(1.44)	(0.06)	(2.35**)	(1.94*)	
TAZ Res Density > 65/Ac.	1.196	0.975	1.178	1.16	1.174	0.846	0.831	1.194	0.873	
	(1.32)	(0.18)	(1.22)	(1.1)	(1.19)	(1.08)	(1.11)	(1.32)	(0.86)	
TAZ Res Density > 100/Ac.	0.723	0.579	0.732	0.565	0.694	0.235	0.147	0.733	0.216	
	(1.62)	(2.53**)	(1.56)	(2.82***)	(1.83*)	(5.72***)	(6.99***)	(1.55)	(6.03***)	
Pop Acc Index > 20,000	0.846	0.845	0.82	0.8	0.825	0.819	0.841	0.867		0.827
	(1.36)	(1.38)	(1.61)	(1.79*)	(1.55)	(1.62)	(1.4)	(1.14)		(1.55)
Pop Acc Index > 30,000	1.201	1.152	1.136	1.184	1.203	1.154	1.163	1.122		1.062
	(1.87*)	(1.44)	(1.29)	(1.70*)	(1.88*)	(1.46)	(1.54)	(1.15)		(0.58)
Pop Acc Index > 40,000	1.059	1.089	1.063	1.036	1.054	1.009	1.018	1.203		1.154
	(0.56)	(0.84)	(0.61)	(0.34)	(0.52)	(0.09)	(0.18)	(1.78*)		(1.39)
Pop Acc Index > 50,000	1.002	0.954	0.982	0.989	1.001	0.947	0.912	1.11		0.965
	(0.02)	(0.44)	(0.17)	(0.1)	(0.01)	(0.52)	(0.88)	(0.96)		(0.34)
Pop Acc Index > 60,000	1.338	1.258	1.313	1.339	1.333	1.276	1.299	1.332		1.224
	(2.59***)	(2.09**)	(2.42**)	(2.62***)	(2.56**)	(2.19**)	(2.36**)	(2.45**)		(1.86*)
Pop Acc Index > 70,000	1.027	1.03	1.029	1	1.02	0.999	1.006	1.06		0.987
	(0.26)	(0.29)	(0.27)	(0)	(0.19)	(0.01)	(0.06)	(0.53)		(0.12)
Pop Acc Index > 80,000	0.947	1.01	0.94	0.935	0.941	0.926	0.935	0.93		0.973
	(0.53)	(0.09)	(0.6)	(0.66)	(0.59)	(0.75)	(0.67)	(0.67)		(0.25)
Pop Acc Index > 90,000	1.04	1.016	1.035	1.065	1.046	0.99	0.975	1.124		1.06
	(0.35)	(0.14)	(0.31)	(0.55)	(0.39)	(0.09)	(0.22)	(1.02)		(0.5)
Pop Acc Index > 100,000	1.53	1.415	1.542	1.472	1.514	1.482	1.291	1.427		1.154
	(4.07***)	(3.43***)	(4.16***)	(3.70***)	(3.97***)	(3.78***)	(2.46**)	(3.54***)		(1.41)
Pop Acc Index > 125,000	0.973	0.887	1.002	0.906	0.961	0.929	0.897	0.862		0.824
	(0.23)	(1.01)	(0.01)	(0.85)	(0.34)	(0.63)	(0.94)	(1.27)		(1.63)
Pop Acc Index > 150,000	1.143	1.081	1.147	1.098	1.134	0.974	0.83	1.091		0.752
	(1.07)	(0.58)	(1.1)	(0.77)	(1.01)	(0.2)	(1.45)	(0.56)		(1.86*)
Pop Acc Index > 200,000	1.485	1.348	1.469	1.447	1.472	1.032	0.857	1.524		0.962
	(3.67***)	(2.62***)	(3.57***)	(3.46***)	(3.61***)	(0.26)	(1.2)	(3.96***)		(0.33)
Observations	30,375	30,375	30,375	30,342	30,375	30,375	30,375	30,375	30,342	30,342

Robust z statistics in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

Table D8
Passenger-Serving POV Trips Regressed On Land Use Variables (Basic Demographic Variables Included, Not Reported)
Negative Binomial Regression (Incidence Risk Ratios and Z-Statistics Reported)

Model Type	Base	Street Density	% Dev-eloped	Res/Com Density	Combined Density	Emp. Access Index	Ret/Serv Access Indexes	County Effects	Combined w/ Gross Density	Combined w/ Pop Access
Street Density in TAZ		0.938							1.535	1.708
		(0.15)							(0.91)	(1.17)
Percent of Zone Developed			0.893						0.949	0.891
			(0.95)						(0.36)	(1.13)
Res. Land Density (Logged)				0.915					0.878	0.879
				(2.04**)					(1.79*)	(1.93*)
Comm. Land Density (Logged)				0.985					1	0.99
				(0.73)					(0.01)	(0.38)
Dev. Density (Logged)					0.911				1.187	1.156
					(1.05)				(1.17)	(1)
Employment Access Index (000s)						0.996			0.997	0.996
						(3.31***)			(0.99)	(1.09)
Retail Access Index (000s)							0.991		1.014	1.017
							(0.53)		(0.7)	(0.85)
Serv Emp Access Index (000s)							0.993		0.994	0.996
							(1.27)		(0.84)	(0.56)
San Mateo County								1.099	1.075	1.135
								(0.56)	(0.57)	(0.74)
Santa Clara County								1.089	1.04	1.143
								(0.52)	(0.32)	(0.8)
Alameda County								1.133	1.109	1.163
								(0.77)	(0.89)	(0.93)
Contra Costa County								1.16	1.102	1.166
								(0.87)	(0.76)	(0.9)
Solano County								1.135	1.049	1.148
								(0.69)	(0.33)	(0.75)
Napa County								1.059	0.953	1.052
								(0.3)	(0.31)	(0.26)
Sonoma County								0.988	0.893	0.968
								(0.07)	(0.82)	(0.18)
Marin County								1.062	1.007	1.05
								(0.32)	(0.05)	(0.26)
TAZ Res Density > 2/Ac.	1.057	1.058	1.082	1.081	1.071	1.058	1.06	1.039	1.091	
	(0.85)	(0.86)	(1.14)	(1.17)	(1.03)	(0.87)	(0.9)	(0.57)	(1.12)	
TAZ Res Density > 4/Ac.	0.859	0.86	0.878	0.861	0.863	0.86	0.863	0.872	0.884	
	(1.94*)	(1.91*)	(1.61)	(1.90*)	(1.87*)	(1.91*)	(1.86*)	(1.69*)	(1.53)	
TAZ Res Density > 6/Ac.	1.008	1.01	1.029	1.025	1.014	1.013	1.013	1.008	1.023	
	(0.12)	(0.14)	(0.4)	(0.35)	(0.2)	(0.19)	(0.19)	(0.12)	(0.3)	
TAZ Res Density > 10/Ac.	1.127	1.13	1.133	1.151	1.135	1.123	1.122	1.131	1.133	
	(2.09**)	(2.07**)	(2.16**)	(2.42**)	(2.19**)	(2.03**)	(1.99**)	(2.13**)	(2.12**)	
TAZ Res Density > 15/Ac.	0.93	0.931	0.931	0.957	0.939	0.936	0.933	0.925	0.942	
	(1.22)	(1.19)	(1.19)	(0.71)	(1.05)	(1.11)	(1.16)	(1.3)	(1)	
TAZ Res Density > 25/Ac.	0.874	0.876	0.876	0.9	0.882	0.873	0.88	0.883	0.934	
	(1.29)	(1.25)	(1.28)	(1)	(1.2)	(1.29)	(1.21)	(1.18)	(0.65)	
TAZ Res Density > 45/Ac.	1.011	1.012	1.015	1.052	1.02	1.124	1.138	1.01	1.152	
	(0.06)	(0.07)	(0.09)	(0.3)	(0.12)	(0.7)	(0.77)	(0.06)	(0.84)	
TAZ Res Density > 65/Ac.	1.129	1.132	1.131	1.15	1.135	1.419	1.372	1.126	1.357	
	(0.46)	(0.47)	(0.46)	(0.53)	(0.48)	(1.23)	(1.12)	(0.45)	(1.08)	
TAZ Res Density > 100/Ac.	0.347	0.348	0.346	0.377	0.351	0.653	0.611	0.347	0.699	
	(1.96*)	(1.95*)	(1.96*)	(1.80*)	(1.93*)	(0.75)	(0.87)	(1.95*)	(0.63)	
Pop Acc Index > 20,000	1.09	1.09	1.097	1.12	1.1	1.11	1.108	1.071		1.113
	(1.07)	(1.07)	(1.15)	(1.39)	(1.17)	(1.29)	(1.28)	(0.82)		(1.25)
Pop Acc Index > 30,000	1.164	1.164	1.174	1.158	1.164	1.188	1.188	1.142		1.141
	(2.29**)	(2.29**)	(2.38**)	(2.18**)	(2.29**)	(2.59***)	(2.58***)	(1.96**)		(1.89*)
Pop Acc Index > 40,000	0.937	0.937	0.937	0.944	0.937	0.963	0.96	0.914		0.915
	(0.96)	(0.96)	(0.95)	(0.84)	(0.95)	(0.54)	(0.59)	(1.27)		(1.27)
Pop Acc Index > 50,000	0.847	0.847	0.851	0.84	0.846	0.872	0.868	0.852		0.866
	(2.21**)	(2.20**)	(2.14**)	(2.31**)	(2.22**)	(1.81*)	(1.87*)	(2.06**)		(1.82*)
Pop Acc Index > 60,000	1.126	1.127	1.129	1.141	1.129	1.165	1.162	1.129		1.18
	(1.44)	(1.46)	(1.47)	(1.6)	(1.48)	(1.84*)	(1.80*)	(1.47)		(2.00**)
Pop Acc Index > 70,000	1.066	1.065	1.066	1.066	1.065	1.07	1.078	1.07		1.09
	(0.81)	(0.81)	(0.82)	(0.81)	(0.81)	(0.86)	(0.96)	(0.85)		(1.08)
Pop Acc Index > 80,000	0.915	0.914	0.914	0.92	0.917	0.927	0.921	0.917		0.944
	(1.13)	(1.14)	(1.15)	(1.05)	(1.1)	(0.97)	(1.05)	(1.09)		(0.74)
Pop Acc Index > 90,000	0.864	0.864	0.865	0.859	0.863	0.895	0.891	0.87		0.884
	(1.58)	(1.57)	(1.56)	(1.63)	(1.59)	(1.18)	(1.23)	(1.49)		(1.31)
Pop Acc Index > 100,000	1.012	1.013	1.011	1.019	1.013	1.026	1.049	1.015		1.02
	(0.14)	(0.14)	(0.12)	(0.21)	(0.15)	(0.28)	(0.52)	(0.17)		(0.21)
Pop Acc Index > 125,000	1.211	1.213	1.208	1.229	1.215	1.228	1.227	1.22		1.186
	(1.61)	(1.62)	(1.59)	(1.73*)	(1.64)	(1.69*)	(1.67*)	(1.66*)		(1.49)
Pop Acc Index > 150,000	0.759	0.76	0.758	0.771	0.761	0.826	0.839	0.824		0.927
	(1.80*)	(1.79*)	(1.81*)	(1.70*)	(1.79*)	(1.22)	(1.11)	(0.97)		(0.36)
Pop Acc Index > 200,000	0.717	0.718	0.719	0.728	0.719	0.908	0.923	0.716		0.955
	(1.82*)	(1.81*)	(1.80*)	(1.73*)	(1.80*)	(0.51)	(0.42)	(1.82*)		(0.24)
Observations	30,375	30,375	30,375	30,342	30,375	30,375	30,375	30,375	30,342	30,342

Robust z statistics in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

Table D9
Passenger-Serving Transit Trips Regressed On Land Use Variables (Basic Demographic Variables Included, Not Reported)
Negative Binomial Regression (Incidence Risk Ratios and Z-Statistics Reported)

Model Type	Base	Street Density	% Dev-eloped	Res/Com Density	Combined Density	Emp. Access Index	Ret/Serv Access Indexes	County Effects	Combined w/ Gross Density	Combined w/ Pop Access
Street Density in TAZ		50.295							92.946	72.975
		(0.98)							(1.11)	(1.13)
Percent of Zone Developed			0.381						1.074	0.465
			(0.92)						(0.06)	(0.74)
Res. Land Density (Logged)				1.093					1.645	1.196
				(0.21)					(0.94)	(0.37)
Comm. Land Density (Logged)				0.884					1.107	0.976
				(0.65)					(0.45)	(0.1)
Dev. Density (Logged)					0.654				0.36	0.705
					(0.51)				(1.01)	(0.35)
Employment Access Index (000s)						0.975			1.023	1.047
						(2.13**)			(0.93)	(1.69*)
Retail Access Index (000s)							0.745		0.793	0.66
							(1.86*)		(1.28)	(2.32**)
Serv Emp Access Index (000s)							1.01		0.951	0.942
							(0.2)		(0.69)	(0.61)
San Mateo County								0.527	0.124	1.044
								(0.63)	(2.26**)	(0.04)
Santa Clara County								0.195	0.073	0.34
								(1.98**)	(3.36***)	(1.25)
Alameda County								0.325	0.098	0.639
								(1.35)	(3.42***)	(0.57)
Contra Costa County								0.705	0.139	1.207
								(0.36)	(2.40**)	(0.19)
Solano County								0.111	0.011	0.14
								(2.08**)	(4.89***)	(1.77*)
Napa County								3.578	0.259	8.14
								(1.02)	(1.29)	(1.6)
Sonoma County								0	0	0
								(15.07***)	(20.24***)	(14.01***)
Marin County								1.19	0.16	3.595
								(0.14)	(1.76*)	(1)
TAZ Res Density > 2/Ac.	1.268	1.221	1.475	1.43	1.372	1.273	1.247	0.833	1.827	
	(0.38)	(0.31)	(0.61)	(0.54)	(0.49)	(0.38)	(0.34)	(0.29)	(0.83)	
TAZ Res Density > 4/Ac.	1.162	1.048	1.47	1.215	1.187	1.238	1.463	0.944	1.31	
	(0.23)	(0.07)	(0.6)	(0.3)	(0.26)	(0.33)	(0.58)	(0.09)	(0.44)	
TAZ Res Density > 6/Ac.	0.7	0.644	0.821	0.686	0.713	0.733	0.727	0.679	0.698	
	(0.6)	(0.73)	(0.32)	(0.64)	(0.56)	(0.52)	(0.52)	(0.66)	(0.55)	
TAZ Res Density > 10/Ac.	0.589	0.496	0.654	0.63	0.599	0.539	0.583	0.892	1.225	
	(0.88)	(1.19)	(0.69)	(0.77)	(0.85)	(1.05)	(0.91)	(0.2)	(0.33)	
TAZ Res Density > 15/Ac.	1.773	1.685	1.815	1.816	1.856	1.911	1.831	1.729	2.26	
	(1.11)	(0.97)	(1.15)	(1.24)	(1.24)	(1.26)	(1.17)	(1.04)	(1.48)	
TAZ Res Density > 25/Ac.	0.576	0.461	0.591	0.651	0.596	0.581	0.617	0.498	0.378	
	(1.02)	(1.54)	(0.98)	(0.74)	(0.94)	(1.02)	(0.89)	(1.24)	(1.65*)	
TAZ Res Density > 45/Ac.	0	0	0	0	0	0	0	0	0	
	(33.73***)	(30.63***)	(30.12***)	(28.61***)	(32.94***)	(34.00***)	(34.39***)	(31.68***)	(28.66***)	
TAZ Res Density > 65/Ac.	12629731	3558706	4425243	5048827	11866477	87865701	2.36E+08	7788530	17901392	
	(17.87***)	(15.78***)	(16.66***)	(16.78***)	(17.66***)	(15.19***)	(18.08***)	(17.34***)	(16.26***)	
TAZ Res Density > 100/Ac.	0.276	0.249	0.191	0.38	0.314	14.139	30.616	0.401	0	
	(1.79*)	(1.77*)	(2.32**)	(1.18)	(1.6)	(1.21)	(1.48)	(1.3)	(6.22***)	
Pop Acc Index > 20,000	9263592	3507026	5238717	2863919	7429104	5898034	7611151	6948066		7564110
	(35.81***)	(33.60***)	(33.86***)	(30.05***)	(34.94***)	(34.08***)	(34.31***)	(23.89***)		(23.78***)
Pop Acc Index > 30,000	0.529	0.516	0.57	0.528	0.526	0.593	0.648	0.537		0.687
	(0.95)	(0.99)	(0.85)	(0.94)	(0.96)	(0.78)	(0.63)	(0.88)		(0.5)
Pop Acc Index > 40,000	1.903	1.912	1.978	1.797	1.897	2.169	2.313	3.173		4.402
	(0.97)	(0.97)	(1.01)	(0.88)	(0.96)	(1.16)	(1.25)	(1.73*)		(2.23**)
Pop Acc Index > 50,000	0.37	0.367	0.378	0.397	0.37	0.506	0.503	0.426		0.531
	(1.25)	(1.25)	(1.22)	(1.18)	(1.25)	(0.85)	(0.87)	(1.06)		(0.78)
Pop Acc Index > 60,000	0.547	0.53	0.509	0.483	0.553	0.501	0.592	0.454		0.411
	(0.66)	(0.7)	(0.75)	(0.8)	(0.65)	(0.74)	(0.57)	(0.84)		(0.88)
Pop Acc Index > 70,000	7.668	7.328	8.001	7.913	7.786	9.794	10.195	8.185		9.357
	(2.51**)	(2.56**)	(2.55**)	(2.58***)	(2.53**)	(2.74***)	(2.85***)	(2.70***)		(3.00***)
Pop Acc Index > 80,000	1.377	1.514	1.352	1.387	1.411	1.39	1.433	1.606		2.274
	(0.44)	(0.6)	(0.42)	(0.44)	(0.47)	(0.45)	(0.51)	(0.7)		(1.33)
Pop Acc Index > 90,000	0.711	0.675	0.679	0.703	0.714	0.909	0.934	0.646		0.707
	(0.5)	(0.57)	(0.56)	(0.51)	(0.5)	(0.14)	(0.1)	(0.59)		(0.47)
Pop Acc Index > 100,000	0.774	0.809	0.772	0.757	0.772	0.732	0.877	0.79		1.175
	(0.31)	(0.24)	(0.32)	(0.33)	(0.31)	(0.39)	(0.15)	(0.31)		(0.2)
Pop Acc Index > 125,000	0.656	0.488	0.655	0.602	0.663	0.762	0.615	0.507		0.217
	(0.35)	(0.76)	(0.35)	(0.43)	(0.34)	(0.23)	(0.42)	(0.54)		(1.66*)
Pop Acc Index > 150,000	16.757	17.919	16.708	15.553	16.909	26.624	34.209	6.904		33.737
	(2.32**)	(2.72***)	(2.31**)	(2.32**)	(2.32**)	(2.58***)	(2.82***)	(1.65*)		(3.17***)
Pop Acc Index > 200,000	0	0	0	0	0	0	0	0		0
	(42.99***)	(40.60***)	(39.93***)	(39.02***)	(42.52***)	(33.42***)	(36.03***)	(41.39***)		(22.02***)
Observations	30,375	30,375	30,375	30,342	30,375	30,375	30,375	30,375	30,342	30,342

Robust z statistics in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

Table D10
Passenger-Serving Walk/Bike Trips Regressed On Land Use Variables (Basic Demographic Variables Included, Not Reported)
Negative Binomial Regression (Incidence Risk Ratios and Z-Statistics Reported)

Model Type	Base	Street Density	% Dev-eloped	Res/Com Density	Combined Density	Emp. Access Index	Ret/Serv Access Indexes	County Effects	Combined w/ Gross Density	Combined w/ Pop Access
Street Density in TAZ		9.784							1.564	2.961
		(1.35)							(0.23)	(0.63)
Percent of Zone Developed			1.272						0.897	1.931
			(0.41)						(0.17)	(1.41)
Res. Land Density (Logged)				1.085					1.602	1.648
				(0.38)					(1.70*)	(2.00**)
Comm. Land Density (Logged)				0.908					1.028	0.984
				(1.2)					(0.25)	(0.16)
Dev. Density (Logged)					0.499				0.207	0.34
					(1.69*)				(2.70***)	(2.01**)
Employment Access Index (000s)						1.001			0.97	0.965
						(0.41)			(2.64***)	(3.14***)
Retail Access Index (000s)							0.944		1.045	1.117
							(0.82)		(0.57)	(1.48)
Serv Emp Access Index (000s)							1.03		1.053	1.059
							(1.44)		(2.00**)	(2.21**)
San Mateo County								0.609	0.985	0.678
								(0.88)	(0.04)	(0.72)
Santa Clara County								0.545	0.811	0.649
								(1.1)	(0.51)	(0.82)
Alameda County								1.215	1.589	1.232
								(0.37)	(1.27)	(0.43)
Contra Costa County								0.537	0.825	0.523
								(1.1)	(0.44)	(1.18)
Solano County								0.45	0.84	0.567
								(1.15)	(0.3)	(0.76)
Napa County								1.444	2.395	1.486
								(0.53)	(1.69*)	(0.58)
Sonoma County								0.233	0.417	0.247
								(2.09**)	(1.51)	(2.02**)
Marin County								0.845	1.014	0.731
								(0.26)	(0.03)	(0.5)
TAZ Res Density > 2/Ac.	1.818	1.762	1.732	1.882	2.184	1.819	1.857	1.374	1.695	
	(1.76*)	(1.67*)	(1.49)	(1.85*)	(2.29**)	(1.76*)	(1.82*)	(0.92)	(1.36)	
TAZ Res Density > 4/Ac.	1.487	1.414	1.411	1.534	1.517	1.483	1.504	1.457	1.409	
	(1.18)	(1.04)	(0.95)	(1.27)	(1.24)	(1.17)	(1.2)	(1.17)	(0.98)	
TAZ Res Density > 6/Ac.	0.754	0.716	0.725	0.746	0.785	0.755	0.759	0.715	0.702	
	(0.86)	(1.01)	(0.98)	(0.88)	(0.74)	(0.86)	(0.83)	(1.08)	(1.13)	
TAZ Res Density > 10/Ac.	1.293	1.202	1.284	1.301	1.363	1.298	1.341	1.487	1.238	
	(0.97)	(0.66)	(0.93)	(0.99)	(1.16)	(0.99)	(1.11)	(1.54)	(0.79)	
TAZ Res Density > 15/Ac.	1.423	1.331	1.408	1.418	1.53	1.417	1.386	1.348	1.167	
	(1.47)	(1.14)	(1.44)	(1.41)	(1.73*)	(1.46)	(1.36)	(1.19)	(0.6)	
TAZ Res Density > 25/Ac.	0.999	0.874	0.997	1.019	1.061	0.992	0.954	0.929	0.846	
	(0)	(0.37)	(0.01)	(0.05)	(0.15)	(0.02)	(0.12)	(0.19)	(0.44)	
TAZ Res Density > 45/Ac.	0.958	0.916	0.946	1.001	1.033	0.904	0.692	0.921	0.684	
	(0.08)	(0.15)	(0.1)	(0)	(0.06)	(0.19)	(0.65)	(0.14)	(0.66)	
TAZ Res Density > 65/Ac.	3.426	3.105	3.404	3.486	3.597	3.27	3.109	3.452	4.37	
	(1.70*)	(1.54)	(1.68*)	(1.74*)	(1.75*)	(1.55)	(1.55)	(1.72*)	(2.08**)	
TAZ Res Density > 100/Ac.	0.403	0.384	0.404	0.399	0.454	0.328	0.153	0.412	0.482	
	(1.04)	(1.08)	(1.04)	(1)	(0.89)	(1.12)	(1.90*)	(1.03)	(0.73)	
Pop Acc Index > 20,000	0.916	0.91	0.901	0.915	0.931	0.91	0.923	1.095		1.147
	(0.22)	(0.24)	(0.26)	(0.22)	(0.18)	(0.23)	(0.2)	(0.22)		(0.34)
Pop Acc Index > 30,000	0.501	0.497	0.491	0.509	0.501	0.497	0.495	0.471		0.489
	(2.13**)	(2.17**)	(2.18**)	(2.08**)	(2.14**)	(2.14**)	(2.13**)	(2.29**)		(2.17**)
Pop Acc Index > 40,000	1.518	1.551	1.524	1.529	1.545	1.506	1.496	1.829		1.768
	(1.09)	(1.15)	(1.11)	(1.1)	(1.15)	(1.07)	(1.06)	(1.72*)		(1.61)
Pop Acc Index > 50,000	0.878	0.86	0.872	0.883	0.865	0.869	0.831	0.746		0.757
	(0.38)	(0.43)	(0.39)	(0.35)	(0.42)	(0.4)	(0.53)	(0.88)		(0.84)
Pop Acc Index > 60,000	0.546	0.523	0.542	0.534	0.556	0.541	0.535	0.533		0.51
	(1.66*)	(1.76*)	(1.68*)	(1.71*)	(1.62)	(1.69*)	(1.70*)	(1.80*)		(1.89*)
Pop Acc Index > 70,000	2.683	2.724	2.701	2.669	2.735	2.667	2.628	2.618		2.373
	(2.94***)	(2.95***)	(2.96***)	(2.94***)	(2.99***)	(2.93***)	(2.89***)	(2.92***)		(2.61***)
Pop Acc Index > 80,000	0.451	0.466	0.445	0.45	0.458	0.447	0.454	0.411		0.453
	(2.23**)	(2.11**)	(2.28**)	(2.24**)	(2.14**)	(2.26**)	(2.24**)	(2.43**)		(2.18**)
Pop Acc Index > 90,000	0.719	0.693	0.717	0.712	0.699	0.717	0.724	0.806		0.749
	(0.83)	(0.92)	(0.84)	(0.87)	(0.89)	(0.84)	(0.81)	(0.51)		(0.71)
Pop Acc Index > 100,000	1.244	1.23	1.254	1.208	1.256	1.24	1.128	1.122		0.926
	(0.65)	(0.61)	(0.67)	(0.56)	(0.68)	(0.63)	(0.35)	(0.34)		(0.22)
Pop Acc Index > 125,000	1.58	1.575	1.593	1.592	1.634	1.58	1.531	1.441		1.418
	(1.02)	(1.03)	(1.04)	(1.08)	(1.1)	(1.02)	(0.96)	(0.81)		(0.78)
Pop Acc Index > 150,000	0.898	0.838	0.902	0.809	0.911	0.868	0.748	0.829		0.767
	(0.23)	(0.38)	(0.22)	(0.46)	(0.2)	(0.3)	(0.58)	(0.33)		(0.44)
Pop Acc Index > 200,000	0.579	0.581	0.576	0.61	0.589	0.531	0.368	0.607		0.356
	(1.08)	(1.05)	(1.09)	(0.97)	(1.05)	(1.27)	(1.82*)	(1)		(1.98**)
Observations	30,375	30,375	30,375	30,342	30,375	30,375	30,375	30,375	30,342	30,342

Robust z statistics in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

Table D11
Total Travel Time for Individuals, Regressed On Land Use Variables (Basic Demographic Variables Included, Not Reported)
Ordinary Least Squares Regression (Coefficients and T-Statistics Reported)

	Base	Street Density	% Dev-eloped	Res/Com Density	Combined Density	Emp. Access Index	Ret/Serv Access Indexes	County Effects	Combined w/ Gross Density	Combined w/ Pop Access
Street Density in TAZ		7.645							-10.602	-6.519
		(0.32)							(0.4)	(0.25)
Percent of Zone Developed			-16.722						-9.103	-14.585
			(2.30**)						(1.09)	(2.35**)
Res. Land Density (Logged)				0.617					1.463	2.337
				(0.24)					(0.35)	(0.6)
Comm. Land Density (Logged)				1.404					2.264	2.858
				(1.18)					(1.49)	(1.88*)
Dev. Density (Logged)					2.147				0.234	-0.533
					(0.38)				(0.03)	(0.06)
Employment Access Index (000s)						-0.166			-0.527	-0.476
						(3.21***)			(2.82***)	(2.44**)
Retail Access Index (000s)							-3.176		-0.995	-1.388
							(3.35***)		(0.96)	(1.25)
Serv Emp Access Index (000s)							0.67		1.31	1.332
							(2.44**)		(3.15***)	(3.07***)
San Mateo County								-22.548	-11.905	-25.63
								(2.34**)	(1.79*)	(2.71***)
Santa Clara County								-29.258	-16.383	-30.29
								(3.14***)	(2.55**)	(3.30***)
Alameda County								-15.64	-6.255	-18.639
								(1.69*)	(1.01)	(2.06**)
Contra Costa County								-15.054	-4.876	-16.377
								(1.54)	(0.71)	(1.71*)
Solano County								-25.689	-14.717	-24.629
								(2.46**)	(1.89*)	(2.41**)
Napa County								-36.537	-26.656	-39.226
								(3.35***)	(3.28***)	(3.64***)
Sonoma County								-30.327	-18.241	-30.238
								(2.92***)	(2.40**)	(2.93***)
Marin County								-13.758	-1.919	-11.876
								(1.24)	(0.23)	(1.08)
TAZ Res Density > 2/Ac.	1.095	0.991	4.445	0.554	0.763	1.071	1.66	0.945	2.197	
	(0.26)	(0.23)	(1.01)	(0.13)	(0.17)	(0.25)	(0.39)	(0.22)	(0.46)	
TAZ Res Density > 4/Ac.	3.546	3.382	6.711	3.272	3.434	3.582	4.581	3.68	4.687	
	(0.72)	(0.68)	(1.29)	(0.66)	(0.69)	(0.72)	(0.93)	(0.73)	(0.9)	
TAZ Res Density > 6/Ac.	-15.607	-15.787	-12.599	-15.693	-15.727	-15.414	-15.096	-14.242	-10.778	
	(3.63***)	(3.65***)	(2.85***)	(3.62***)	(3.64***)	(3.58***)	(3.51***)	(3.27***)	(2.37**)	
TAZ Res Density > 10/Ac.	-0.513	-0.786	0.307	-0.727	-0.66	-0.666	0.617	0.517	2.436	
	(0.15)	(0.22)	(0.09)	(0.21)	(0.19)	(0.19)	(0.18)	(0.15)	(0.69)	
TAZ Res Density > 15/Ac.	5.273	5.13	5.588	5.021	5.062	5.545	5.018	3.306	3.175	
	(1.59)	(1.54)	(1.69*)	(1.46)	(1.51)	(1.67*)	(1.52)	(0.99)	(0.94)	
TAZ Res Density > 25/Ac.	12.217	11.859	12.556	12.03	12.013	12.665	12.302	7.893	6.396	
	(2.17**)	(2.05**)	(2.22**)	(2.11**)	(2.12**)	(2.24**)	(2.18**)	(1.38)	(1.16)	
TAZ Res Density > 45/Ac.	5.489	5.336	6.125	4.565	5.283	9.587	6.067	4.757	5.578	
	(0.56)	(0.54)	(0.62)	(0.46)	(0.53)	(0.96)	(0.61)	(0.48)	(0.57)	
TAZ Res Density > 65/Ac.	1.329	1.063	1.47	1.162	1.207	9.481	8.627	2.208	11.673	
	(0.08)	(0.07)	(0.09)	(0.07)	(0.08)	(0.59)	(0.54)	(0.14)	(0.73)	
TAZ Res Density > 100/Ac.	-7.146	-7.463	-7.278	-9.068	-7.439	17.941	3.962	-7.2	10.169	
	(0.29)	(0.3)	(0.3)	(0.37)	(0.3)	(0.7)	(0.16)	(0.29)	(0.4)	
Pop Acc Index > 20,000	2.126	2.117	3.122	1.798	1.914	2.866	3.659	-1.883		0.46
	(0.43)	(0.43)	(0.63)	(0.36)	(0.39)	(0.58)	(0.74)	(0.38)		(0.09)
Pop Acc Index > 30,000	2.731	2.679	4.098	2.495	2.721	3.635	4.149	-0.233		2.551
	(0.65)	(0.64)	(0.96)	(0.59)	(0.65)	(0.86)	(0.98)	(0.05)		(0.57)
Pop Acc Index > 40,000	-4.162	-4.119	-4.101	-4.393	-4.175	-3.079	-2.649	-6.298		-4.717
	(0.97)	(0.96)	(0.96)	(1.02)	(0.97)	(0.72)	(0.61)	(1.44)		(1.07)
Pop Acc Index > 50,000	1.81	1.743	2.502	1.876	1.83	2.956	1.722	3.448		4.195
	(0.4)	(0.38)	(0.55)	(0.41)	(0.4)	(0.65)	(0.38)	(0.74)		(0.89)
Pop Acc Index > 60,000	2.928	2.876	3.253	2.999	2.878	4.164	4.666	2.275		3.609
	(0.59)	(0.58)	(0.66)	(0.61)	(0.58)	(0.84)	(0.94)	(0.46)		(0.73)
Pop Acc Index > 70,000	-0.898	-0.923	-0.852	-1.145	-0.922	-0.461	0.889	0.513		0.329
	(0.18)	(0.19)	(0.17)	(0.23)	(0.19)	(0.09)	(0.18)	(0.1)		(0.07)
Pop Acc Index > 80,000	-6.347	-6.256	-6.331	-6.49	-6.383	-5.826	-6.293	-6.41		-5.23
	(1.3)	(1.28)	(1.3)	(1.33)	(1.31)	(1.2)	(1.29)	(1.3)		(1.07)
Pop Acc Index > 90,000	-0.224	-0.241	-0.064	-0.025	-0.214	1.029	1.519	2.78		4.38
	(0.04)	(0.05)	(0.01)	(0)	(0.04)	(0.2)	(0.29)	(0.53)		(0.82)
Pop Acc Index > 100,000	3.103	3.037	2.87	2.939	3.083	3.534	2.449	1.869		-0.821
	(0.62)	(0.61)	(0.58)	(0.59)	(0.62)	(0.71)	(0.49)	(0.38)		(0.16)
Pop Acc Index > 125,000	3.45	3.275	2.649	2.768	3.359	3.652	0.931	-2.158		-0.213
	(0.48)	(0.46)	(0.37)	(0.39)	(0.47)	(0.51)	(0.13)	(0.3)		(0.03)
Pop Acc Index > 150,000	-0.783	-0.991	-0.756	-1.268	-0.834	3.43	1.158	-15.29		-17.765
	(0.1)	(0.12)	(0.09)	(0.16)	(0.1)	(0.42)	(0.14)	(1.43)		(1.65*)
Pop Acc Index > 200,000	15.397	15.327	15.683	15.315	15.324	24.408	20.613	16.36		21.402
	(1.54)	(1.53)	(1.56)	(1.53)	(1.53)	(2.35**)	(1.99**)	(1.63)		(2.12**)
Constant	205.69	205.634	207.313	201.703	204.448	206.65	206.804	233.297	216.018	226.642
	(44.46***)	(44.46***)	(44.33***)	(28.18***)	(37.21***)	(44.56***)	(44.58***)	(22.03***)	(20.68***)	(18.43***)
Observations	27,363	27,363	27,363	27,332	27,363	27,363	27,363	27,363	27,332	27,332
R-squared	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.06	0.06	0.06

Robust t statistics in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

Table D12
POV Travel Time Regressed On Land Use Variables (Basic Demographic Variables Included, Not Reported)
Ordinary Least Squares Regression (Coefficients and T-Statistics Reported)

	Base	Street Density	% Dev-eloped	Res/Com Density	Combined Density	Emp. Access Index	Ret/Serv Access Indexes	County Effects	Combined w/ Gross Density	Combined w/ Pop Access
Street Density in TAZ		-112.8							-72.697	-65.993
		(4.97***)							(2.87***)	(2.70***)
Percent of Zone Developed			-18.453						-8.861	-6.707
			(2.63***)						(1.11)	(1.15)
Res. Land Density (Logged)				-6.834					-7.935	-7.325
				(2.85***)					(2.00**)	(1.96**)
Comm. Land Density (Logged)				-0.496					1.239	1.657
				(0.45)					(0.87)	(1.16)
Dev. Density (Logged)					-7.468				8.155	9.046
					(1.39)				(0.9)	(1.02)
Employment Access Index (000s)						-0.373			-0.041	0.055
						(7.71***)			(0.23)	(0.3)
Retail Access Index (000s)							-1.826		-1.428	-1.364
							(2.06**)		(1.48)	(1.33)
Serv Emp Access Index (000s)							-0.439		-0.219	-0.469
							(1.68*)		(0.56)	(1.16)
San Mateo County								0.897	-3.493	3.448
								(0.1)	(0.55)	(0.38)
Santa Clara County								3.702	-3.348	2.688
								(0.42)	(0.55)	(0.31)
Alameda County								1.438	-4.631	2.44
								(0.16)	(0.79)	(0.28)
Contra Costa County								6.227	-0.434	7.015
								(0.67)	(0.07)	(0.77)
Solano County								-0.884	-7.267	2.266
								(0.09)	(0.99)	(0.23)
Napa County								-12.711	-17.884	-11.579
								(1.23)	(2.35**)	(1.14)
Sonoma County								-6.257	-11.791	-4.617
								(0.63)	(1.63)	(0.47)
Marin County								-3.359	-6.498	1.426
								(0.32)	(0.8)	(0.14)
TAZ Res Density > 2/Ac.	-2.456	-0.923	1.241	-0.763	-1.3	-2.508	-2.122	-2.133	1.585	
	(0.61)	(0.23)	(0.3)	(0.19)	(0.31)	(0.63)	(0.53)	(0.52)	(0.36)	
TAZ Res Density > 4/Ac.	3.983	6.411	7.475	4.119	4.373	4.063	4.793	6.404	8.008	
	(0.86)	(1.38)	(1.53)	(0.89)	(0.95)	(0.88)	(1.04)	(1.35)	(1.62)	
TAZ Res Density > 6/Ac.	-15.354	-12.692	-12.035	-14.106	-14.938	-14.922	-14.716	-15.012	-8.863	
	(3.81***)	(3.14***)	(2.90***)	(3.48***)	(3.70***)	(3.72***)	(3.67***)	(3.69***)	(2.08**)	
TAZ Res Density > 10/Ac.	3.355	7.377	4.26	4.604	3.865	3.012	3.133	3.43	7.77	
	(1.04)	(2.23**)	(1.32)	(1.42)	(1.19)	(0.94)	(0.97)	(1.06)	(2.37**)	
TAZ Res Density > 15/Ac.	-1.255	0.841	-0.908	1.122	-0.523	-0.644	-0.926	-0.895	2.593	
	(0.4)	(0.27)	(0.29)	(0.35)	(0.17)	(0.21)	(0.3)	(0.28)	(0.81)	
TAZ Res Density > 25/Ac.	-11.5	-6.223	-11.125	-9.146	-10.791	-10.494	-9.587	-11.025	-3.715	
	(2.18**)	(1.16)	(2.10**)	(1.71*)	(2.03**)	(1.98**)	(1.81*)	(2.03**)	(0.7)	
TAZ Res Density > 45/Ac.	-11.821	-9.568	-11.119	-8.94	-11.103	-2.619	-0.889	-11.786	3.472	
	(1.32)	(1.06)	(1.24)	(0.99)	(1.23)	(0.29)	(0.1)	(1.31)	(0.39)	
TAZ Res Density > 65/Ac.	-11.092	-7.158	-10.936	-9.61	-10.666	7.212	7.806	-11.15	8.893	
	(0.92)	(0.59)	(0.91)	(0.8)	(0.89)	(0.58)	(0.62)	(0.93)	(0.72)	
TAZ Res Density > 100/Ac.	-22.256	-17.583	-22.401	-16.616	-21.238	34.072	34.702	-22.24	30.83	
	(1.39)	(1.09)	(1.4)	(1.03)	(1.33)	(1.97**)	(2.02**)	(1.39)	(1.80*)	
Pop Acc Index > 20,000	2.901	3.043	4	4.748	3.639	4.563	5.014	-1.066		2.415
	(0.62)	(0.65)	(0.86)	(1.01)	(0.78)	(0.98)	(1.07)	(0.23)		(0.52)
Pop Acc Index > 30,000	-0.522	0.242	0.987	-1.014	-0.489	1.509	2.032	-2.617		0.64
	(0.13)	(0.06)	(0.25)	(0.25)	(0.12)	(0.38)	(0.51)	(0.64)		(0.15)
Pop Acc Index > 40,000	-4.523	-5.146	-4.457	-4.197	-4.476	-2.092	-1.741	-7.86		-4.609
	(1.12)	(1.27)	(1.1)	(1.04)	(1.11)	(0.52)	(0.43)	(1.91*)		(1.11)
Pop Acc Index > 50,000	1.43	2.418	2.193	1.054	1.361	4.002	3.608	0.531		2.497
	(0.34)	(0.57)	(0.52)	(0.25)	(0.32)	(0.94)	(0.85)	(0.12)		(0.57)
Pop Acc Index > 60,000	2.841	3.608	3.199	3.73	3.016	5.616	6.13	2.91		7.139
	(0.62)	(0.79)	(0.7)	(0.82)	(0.66)	(1.23)	(1.34)	(0.63)		(1.56)
Pop Acc Index > 70,000	-7.452	-7.085	-7.402	-7.164	-7.367	-6.471	-5.246	-7.462		-4.46
	(1.66*)	(1.59)	(1.65*)	(1.6)	(1.64)	(1.44)	(1.16)	(1.66*)		(0.99)
Pop Acc Index > 80,000	-0.556	-1.908	-0.538	-0.246	-0.432	0.614	0.21	-0.736		1.295
	(0.12)	(0.42)	(0.12)	(0.06)	(0.1)	(0.14)	(0.05)	(0.16)		(0.29)
Pop Acc Index > 90,000	0.215	0.465	0.391	-0.063	0.18	3.027	3.323	-0.148		2.666
	(0.04)	(0.1)	(0.08)	(0.01)	(0.04)	(0.62)	(0.68)	(0.03)		(0.54)
Pop Acc Index > 100,000	-4.658	-3.685	-4.916	-4.184	-4.589	-3.691	-1.582	-4.45		-1.523
	(1)	(0.79)	(1.06)	(0.9)	(0.99)	(0.8)	(0.34)	(0.95)		(0.32)
Pop Acc Index > 125,000	0.982	3.559	0.099	1.885	1.299	1.437	0.275	1.874		0.384
	(0.14)	(0.51)	(0.01)	(0.27)	(0.19)	(0.21)	(0.04)	(0.27)		(0.06)
Pop Acc Index > 150,000	-9.483	-6.411	-9.453	-9.051	-9.304	-0.024	2.705	-8.138		3.755
	(1.23)	(0.83)	(1.23)	(1.18)	(1.21)	(0)	(0.34)	(0.81)		(0.37)
Pop Acc Index > 200,000	-9.242	-8.211	-8.927	-7.696	-8.99	10.992	15.352	-9.403		14.896
	(1.06)	(0.94)	(1.02)	(0.88)	(1.03)	(1.2)	(1.65*)	(1.08)		(1.63)
Constant	190.095	190.916	191.886	203.901	194.414	192.25	192.604	194.594	211.864	200.938
	(43.30***)	(43.51***)	(43.27***)	(30.08***)	(36.66***)	(43.73***)	(43.81***)	(19.19***)	(21.17***)	(17.00***)
Observations	27,363	27,363	27,363	27,332	27,363	27,363	27,363	27,363	27,332	27,332
R-squared	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06

Robust t statistics in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

Table D13
Transit Travel Time Regressed On Land Use Variables (Basic Demographic Variables Included, Not Reported)
Ordinary Least Squares Regression (Coefficients and T-Statistics Reported)

	Base	Street Density	% Dev-eloped	Res/Com Density	Combined Density	Emp. Access Index	Ret/Serv Access Indexes	County Effects	Combined w/ Gross Density	Combined w/ Pop Access
Street Density in TAZ		20.024							13.718	9.202
		(3.46***)							(2.09**)	(1.47)
Percent of Zone Developed			-1.87						-1.445	-2.067
			(0.99)						(0.68)	(1.64)
Res. Land Density (Logged)				2.113					2.743	2.453
				(3.22***)					(2.37**)	(2.49**)
Comm. Land Density (Logged)				-0.19					-0.095	-0.116
				(0.65)					(0.28)	(0.36)
Dev. Density (Logged)					1.089				-3.725	-3.573
					(0.86)				(1.62)	(1.56)
Employment Access Index (000s)						0.037			0.028	0.02
						(1.82*)			(0.47)	(0.3)
Retail Access Index (000s)							-0.586		-0.524	-0.638
							(2.43**)		(2.01**)	(2.07**)
Serv Emp Access Index (000s)							0.271		0.161	0.264
							(3.13***)		(1.24)	(1.99**)
San Mateo County								-16.869	-8.914	-17.201
								(2.70***)	(2.75***)	(2.79***)
Santa Clara County								-19.473	-10.523	-18.929
								(3.06***)	(3.27***)	(3.02***)
Alameda County								-16.63	-8.193	-16.605
								(2.64***)	(2.57**)	(2.70***)
Contra Costa County								-17.214	-8.742	-16.674
								(2.70***)	(2.60***)	(2.70***)
Solano County								-18.408	-10.261	-18.051
								(2.87***)	(2.90***)	(2.91***)
Napa County								-19.229	-10.47	-18.202
								(2.99***)	(3.05***)	(2.97***)
Sonoma County								-17.444	-8.424	-16.299
								(2.75***)	(2.49**)	(2.65***)
Marin County								-17.588	-8.867	-16.63
								(2.75***)	(2.67***)	(2.73***)
TAZ Res Density > 2/Ac.	-0.218	-0.49	0.157	-0.77	-0.386	-0.213	-0.115	0.16	0.01	
	(0.29)	(0.64)	(0.18)	(0.98)	(0.52)	(0.28)	(0.15)	(0.21)	(0.01)	
TAZ Res Density > 4/Ac.	-0.417	-0.848	-0.063	-0.423	-0.474	-0.425	-0.265	-0.613	-0.024	
	(0.5)	(1.01)	(0.07)	(0.51)	(0.57)	(0.51)	(0.32)	(0.72)	(0.03)	
TAZ Res Density > 6/Ac.	0.366	-0.106	0.703	-0.054	0.306	0.324	0.399	0.569	0.184	
	(0.44)	(0.13)	(0.78)	(0.07)	(0.37)	(0.39)	(0.48)	(0.7)	(0.19)	
TAZ Res Density > 10/Ac.	-1.277	-1.991	-1.186	-1.697	-1.352	-1.244	-0.913	-1.193	-1.391	
	(1.42)	(2.13**)	(1.36)	(1.80*)	(1.47)	(1.38)	(1.02)	(1.4)	(1.75*)	
TAZ Res Density > 15/Ac.	1.165	0.793	1.2	0.427	1.058	1.105	1.033	0.592	0.031	
	(1.69*)	(1.13)	(1.74*)	(0.56)	(1.48)	(1.6)	(1.5)	(0.84)	(0.04)	
TAZ Res Density > 25/Ac.	2.781	1.845	2.819	1.987	2.678	2.682	2.463	0.276	0.121	
	(1.32)	(0.86)	(1.34)	(0.91)	(1.26)	(1.26)	(1.16)	(0.13)	(0.06)	
TAZ Res Density > 45/Ac.	5.831	5.431	5.902	5.084	5.727	4.925	4.038	5.522	3.18	
	(1.55)	(1.44)	(1.56)	(1.34)	(1.52)	(1.3)	(1.08)	(1.46)	(0.85)	
TAZ Res Density > 65/Ac.	-0.486	-1.185	-0.471	-0.961	-0.548	-2.289	-1.776	0.236	-3.285	
	(0.09)	(0.21)	(0.08)	(0.17)	(0.1)	(0.39)	(0.3)	(0.04)	(0.57)	
TAZ Res Density > 100/Ac.	15.855	15.025	15.84	14.469	15.706	10.307	8.84	15.615	9.216	
	(1.03)	(0.97)	(1.03)	(0.94)	(1.02)	(0.68)	(0.58)	(1.01)	(0.6)	
Pop Acc Index > 20,000	-0.965	-0.99	-0.853	-1.433	-1.072	-1.128	-0.903	-1.44		-1.122
	(1.07)	(1.1)	(0.96)	(1.57)	(1.17)	(1.25)	(1)	(1.6)		(1.3)
Pop Acc Index > 30,000	0.554	0.419	0.707	0.858	0.549	0.354	0.504	0.387		0.83
	(0.89)	(0.67)	(1.11)	(1.36)	(0.88)	(0.56)	(0.79)	(0.6)		(1.21)
Pop Acc Index > 40,000	0.638	0.749	0.645	0.536	0.631	0.398	0.574	0.436		0.503
	(0.86)	(1.01)	(0.87)	(0.72)	(0.85)	(0.53)	(0.76)	(0.55)		(0.68)
Pop Acc Index > 50,000	-0.249	-0.425	-0.172	-0.05	-0.239	-0.503	-0.665	-0.015		-0.233
	(0.29)	(0.49)	(0.19)	(0.06)	(0.28)	(0.58)	(0.76)	(0.02)		(0.26)
Pop Acc Index > 60,000	0.615	0.479	0.651	0.354	0.59	0.342	0.525	0.387		-0.128
	(0.55)	(0.43)	(0.58)	(0.32)	(0.53)	(0.3)	(0.46)	(0.33)		(0.11)
Pop Acc Index > 70,000	-0.18	-0.245	-0.175	-0.253	-0.193	-0.277	-0.062	0.175		-0.034
	(0.17)	(0.23)	(0.17)	(0.24)	(0.19)	(0.27)	(0.06)	(0.17)		(0.03)
Pop Acc Index > 80,000	-0.483	-0.243	-0.481	-0.545	-0.501	-0.598	-0.605	-0.332		-0.853
	(0.53)	(0.26)	(0.53)	(0.6)	(0.55)	(0.66)	(0.66)	(0.37)		(0.98)
Pop Acc Index > 90,000	0.839	0.794	0.856	0.892	0.844	0.562	0.782	1.474		1.362
	(0.58)	(0.55)	(0.59)	(0.61)	(0.58)	(0.39)	(0.53)	(1.03)		(0.92)
Pop Acc Index > 100,000	0.656	0.483	0.63	0.537	0.646	0.561	-0.083	-0.026		-1.089
	(0.42)	(0.31)	(0.4)	(0.34)	(0.41)	(0.36)	(0.05)	(0.02)		(0.65)
Pop Acc Index > 125,000	7.268	6.81	7.178	7.178	7.222	7.223	6.67	4.6		3.544
	(2.35**)	(2.20**)	(2.33**)	(2.32**)	(2.34**)	(2.34**)	(2.13**)	(1.46)		(1.19)
Pop Acc Index > 150,000	-1.48	-2.025	-1.477	-1.404	-1.506	-2.411	-3.106	-14.591		-16.479
	(0.45)	(0.62)	(0.45)	(0.43)	(0.46)	(0.73)	(0.93)	(2.44**)		(2.78***)
Pop Acc Index > 200,000	6.304	6.121	6.336	5.754	6.267	4.311	3.395	6.798		3.817
	(1.95*)	(1.89*)	(1.96*)	(1.78*)	(1.94*)	(1.32)	(1.01)	(2.10**)		(1.12)
Constant	2.945	2.799	3.126	-0.591	2.315	2.733	2.816	20.908	8.793	17.834
	(3.59***)	(3.41***)	(3.76***)	(0.33)	(1.99**)	(3.27***)	(3.37***)	(3.31***)	(2.42**)	(2.81***)
Observations	27,363	27,363	27,363	27,332	27,363	27,363	27,363	27,363	27,332	27,332
R-squared	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03

Robust t statistics in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

Table D14
Walk/Bike Duration Regressed On Land Use Variables (Basic Demographic Variables Included, Not Reported)
Ordinary Least Squares Regression (Coefficients and T-Statistics Reported)

	Base	Street Density	% Dev-eloped	Res/Com Density	Combined Density	Emp. Access Index	Ret/Serv Access Indexes	County Effects	Combined w/ Gross Density	Combined w/ Pop Access
Street Density in TAZ		82.725							33.26	34.534
		(7.39***)							(2.64***)	(2.89***)
Percent of Zone Developed			4.083						2.822	-3.996
			(1.59)						(0.87)	(1.72*)
Res. Land Density (Logged)				4.229					6.309	6.552
				(3.78***)					(3.56***)	(4.12***)
Comm. Land Density (Logged)				1.902					1.364	1.521
				(4.17***)					(2.43**)	(2.72***)
Dev. Density (Logged)					6.02				-5.442	-7.363
					(2.96***)				(1.69*)	(2.23**)
Employment Access Index (000s)						0.14			-0.456	-0.472
						(3.90***)			(5.03***)	(4.99***)
Retail Access Index (000s)							-0.595		0.88	0.515
							(1.38)		(1.93*)	(1.03)
Serv Emp Access Index (000s)							0.692		1.188	1.361
							(5.06***)		(5.88***)	(6.25***)
San Mateo County								-8.385	-2.216	-12.599
								(1.43)	(0.6)	(2.11**)
Santa Clara County								-16.339	-6.735	-16.838
								(2.87***)	(1.94*)	(2.88***)
Alameda County								-4.998	1.279	-8.329
								(0.88)	(0.36)	(1.43)
Contra Costa County								-6.042	1.101	-8.228
								(1.05)	(0.3)	(1.39)
Solano County								-9.53	-1.467	-11.213
								(1.62)	(0.37)	(1.86*)
Napa County								-8.592	-3.294	-12.598
								(1.43)	(0.8)	(2.03**)
Sonoma County								-9.065	-1.798	-11.3
								(1.55)	(0.48)	(1.89*)
Marin County								1.988	7.345	-1.409
								(0.32)	(1.76*)	(0.22)
TAZ Res Density > 2/Ac.	2.314	1.19	1.496	0.896	1.383	2.334	2.414	1.965	-0.201	
	(1.74*)	(0.89)	(1.03)	(0.63)	(0.98)	(1.75*)	(1.80*)	(1.4)	(0.12)	
TAZ Res Density > 4/Ac.	0.347	-1.434	-0.426	-0.022	0.032	0.317	0.392	-1.552	-2.722	
	(0.18)	(0.76)	(0.23)	(0.01)	(0.02)	(0.17)	(0.21)	(0.82)	(1.55)	
TAZ Res Density > 6/Ac.	-0.631	-2.584	-1.366	-1.346	-0.967	-0.793	-0.773	0.129	-2.002	
	(0.37)	(1.51)	(0.78)	(0.79)	(0.57)	(0.47)	(0.46)	(0.07)	(1.09)	
TAZ Res Density > 10/Ac.	-2.451	-5.4	-2.651	-3.294	-2.862	-2.322	-1.639	-1.813	-3.181	
	(1.67*)	(3.53***)	(1.77*)	(2.22**)	(1.95*)	(1.58)	(1.12)	(1.21)	(2.08**)	
TAZ Res Density > 15/Ac.	4.602	3.065	4.526	3.09	4.012	4.374	4.227	2.909	0.589	
	(3.17***)	(2.10**)	(3.12***)	(2.03**)	(2.73***)	(3.01***)	(2.93***)	(2.03**)	(0.39)	
TAZ Res Density > 25/Ac.	17.096	13.225	17.013	15.695	16.524	16.719	15.829	14.469	7.313	
	(5.09***)	(3.88***)	(5.06***)	(4.63***)	(4.91***)	(4.99***)	(4.74***)	(4.40***)	(2.48**)	
TAZ Res Density > 45/Ac.	12.746	11.094	12.591	10.197	12.168	9.3	5.558	12.372	1.581	
	(2.00**)	(1.75*)	(1.98**)	(1.59)	(1.91*)	(1.45)	(0.87)	(1.95*)	(0.25)	
TAZ Res Density > 65/Ac.	9.437	6.552	9.403	8.504	9.094	2.583	0.682	9.787	3.969	
	(0.86)	(0.6)	(0.85)	(0.77)	(0.83)	(0.23)	(0.06)	(0.89)	(0.35)	
TAZ Res Density > 100/Ac.	10.525	7.097	10.557	5.381	9.704	-10.567	-22.21	10.581	-14.595	
	(0.59)	(0.4)	(0.59)	(0.3)	(0.54)	(0.55)	(1.16)	(0.59)	(0.76)	
Pop Acc Index > 20,000	1.649	1.545	1.406	0.274	1.054	1.027	1.088	1.522		0.11
	(1.24)	(1.16)	(1.06)	(0.21)	(0.79)	(0.77)	(0.81)	(1.07)		(0.08)
Pop Acc Index > 30,000	1.953	1.393	1.619	1.889	1.927	1.193	1.022	1.418		0.522
	(1.28)	(0.91)	(1.04)	(1.22)	(1.26)	(0.78)	(0.66)	(0.93)		(0.33)
Pop Acc Index > 40,000	0.36	0.817	0.346	-0.052	0.322	-0.55	-0.673	1.379		-0.335
	(0.24)	(0.54)	(0.23)	(0.03)	(0.21)	(0.36)	(0.44)	(0.9)		(0.22)
Pop Acc Index > 50,000	-0.563	-1.288	-0.732	-0.379	-0.508	-1.526	-2.114	1.537		0.576
	(0.35)	(0.8)	(0.45)	(0.23)	(0.31)	(0.93)	(1.29)	(0.92)		(0.34)
Pop Acc Index > 60,000	0.121	-0.442	0.041	-0.304	-0.021	-0.918	-1.131	-0.248		-2.315
	(0.06)	(0.24)	(0.02)	(0.16)	(0.01)	(0.48)	(0.59)	(0.13)		(1.26)
Pop Acc Index > 70,000	5.436	5.167	5.425	5.049	5.367	5.069	4.959	6.762		4.212
	(2.36**)	(2.25**)	(2.35**)	(2.19**)	(2.33**)	(2.20**)	(2.13**)	(2.94***)		(1.80*)
Pop Acc Index > 80,000	-3.285	-2.294	-3.289	-3.613	-3.386	-3.724	-3.781	-2.81		-3.202
	(1.4)	(0.98)	(1.4)	(1.55)	(1.45)	(1.59)	(1.62)	(1.19)		(1.38)
Pop Acc Index > 90,000	-2.254	-2.437	-2.293	-1.888	-2.226	-3.307	-3.378	0.197		-0.713
	(1.07)	(1.16)	(1.08)	(0.89)	(1.05)	(1.55)	(1.59)	(0.09)		(0.33)
Pop Acc Index > 100,000	6.255	5.542	6.312	5.827	6.199	5.893	3.757	5.441		1.235
	(2.94***)	(2.63***)	(2.97***)	(2.75***)	(2.92***)	(2.77***)	(1.76*)	(2.60***)		(0.57)
Pop Acc Index > 125,000	-3.657	-5.547	-3.462	-4.935	-3.912	-3.828	-4.639	-7.439		-3.823
	(0.9)	(1.36)	(0.85)	(1.22)	(0.96)	(0.95)	(1.15)	(1.79*)		(1.03)
Pop Acc Index > 150,000	11.772	9.519	11.765	10.948	11.628	8.23	4.513	6.032		-4.906
	(2.42**)	(1.95*)	(2.42**)	(2.24**)	(2.39**)	(1.68*)	(0.91)	(0.89)		(0.72)
Pop Acc Index > 200,000	14.883	14.127	14.813	14.002	14.68	7.307	0.993	15.519		1.8
	(2.30**)	(2.18**)	(2.29**)	(2.16**)	(2.27**)	(1.11)	(0.15)	(2.40**)		(0.26)
Constant	8.51	7.908	8.114	-3.289	5.029	7.703	7.433	16.785	-3.056	7.761
	(5.85***)	(5.42***)	(5.44***)	(1.14)	(2.75***)	(5.20***)	(5.00***)	(2.81***)	(0.62)	(1.19)
Observations	27,363	27,363	27,363	27,332	27,363	27,363	27,363	27,363	27,332	27,332
R-squared	0.04	0.05	0.04	0.05	0.04	0.05	0.05	0.05	0.06	0.05

Robust t statistics in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

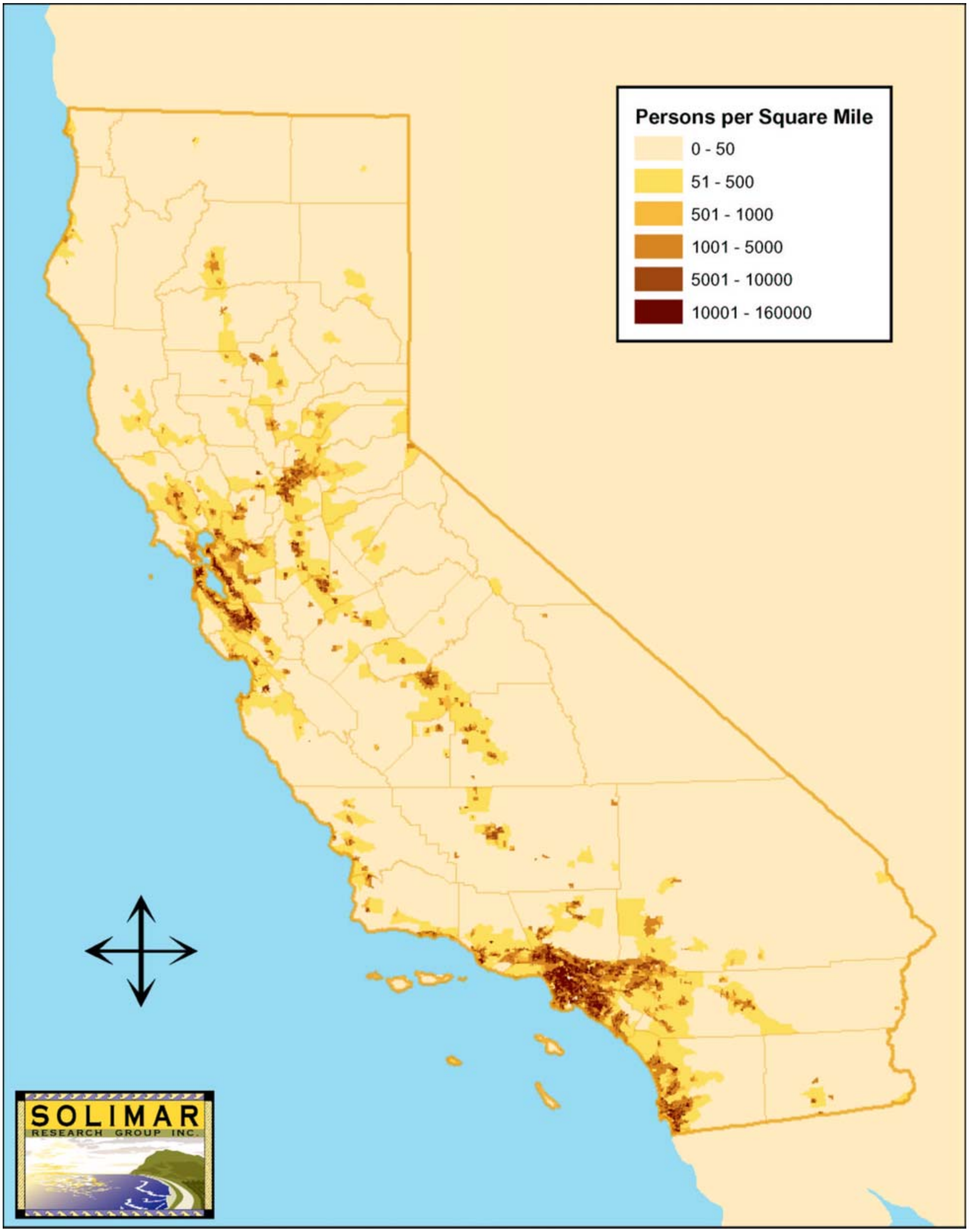
E

DEMOGRAPHIC PROJECTION MAPS

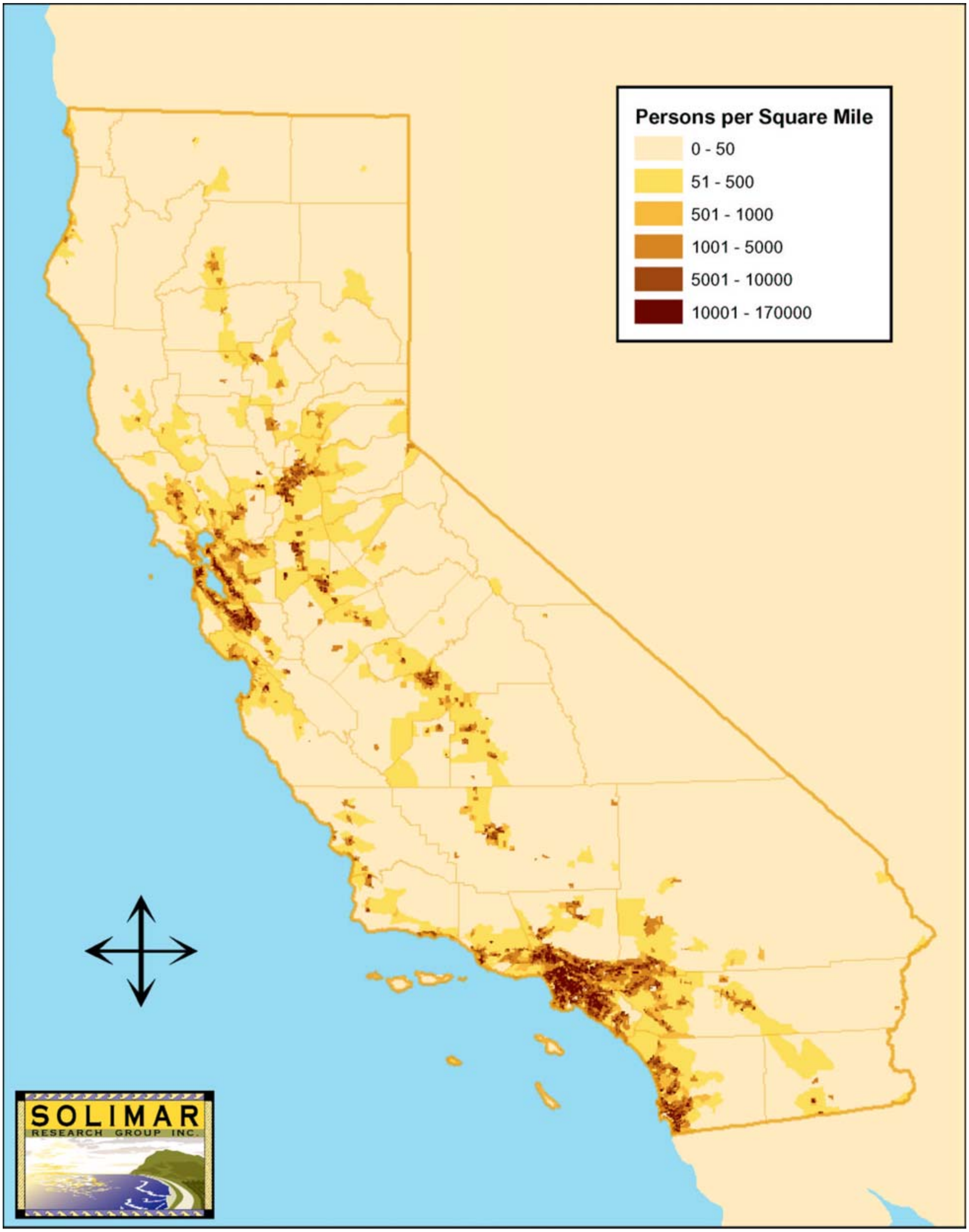
This Appendix contains maps showing population density by Census tract for the State of California, the San Francisco Bay Area, Southern California, and the southern Central Valley for years 2000, 2015, and 2025.

Sources: Year 2000 maps are based on 2000 Census data. Year 2015 and year 2025 maps are based on Census-tract-level demographic projections prepared by Solimar Research Group, Inc. For an explanation of methodology and data sources drawn upon, see Section 5.

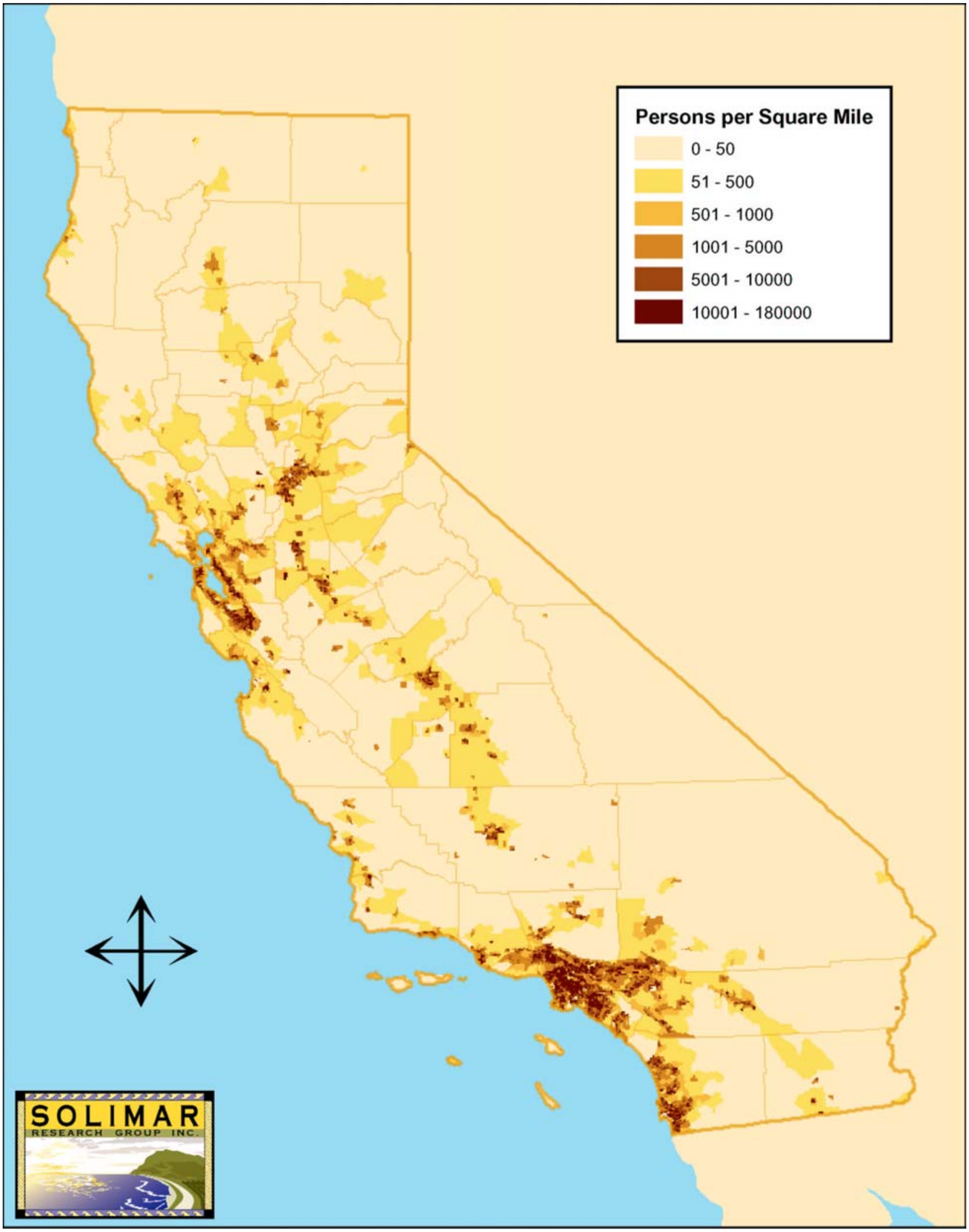
Map 10: Census 2000 Population Density, State of California



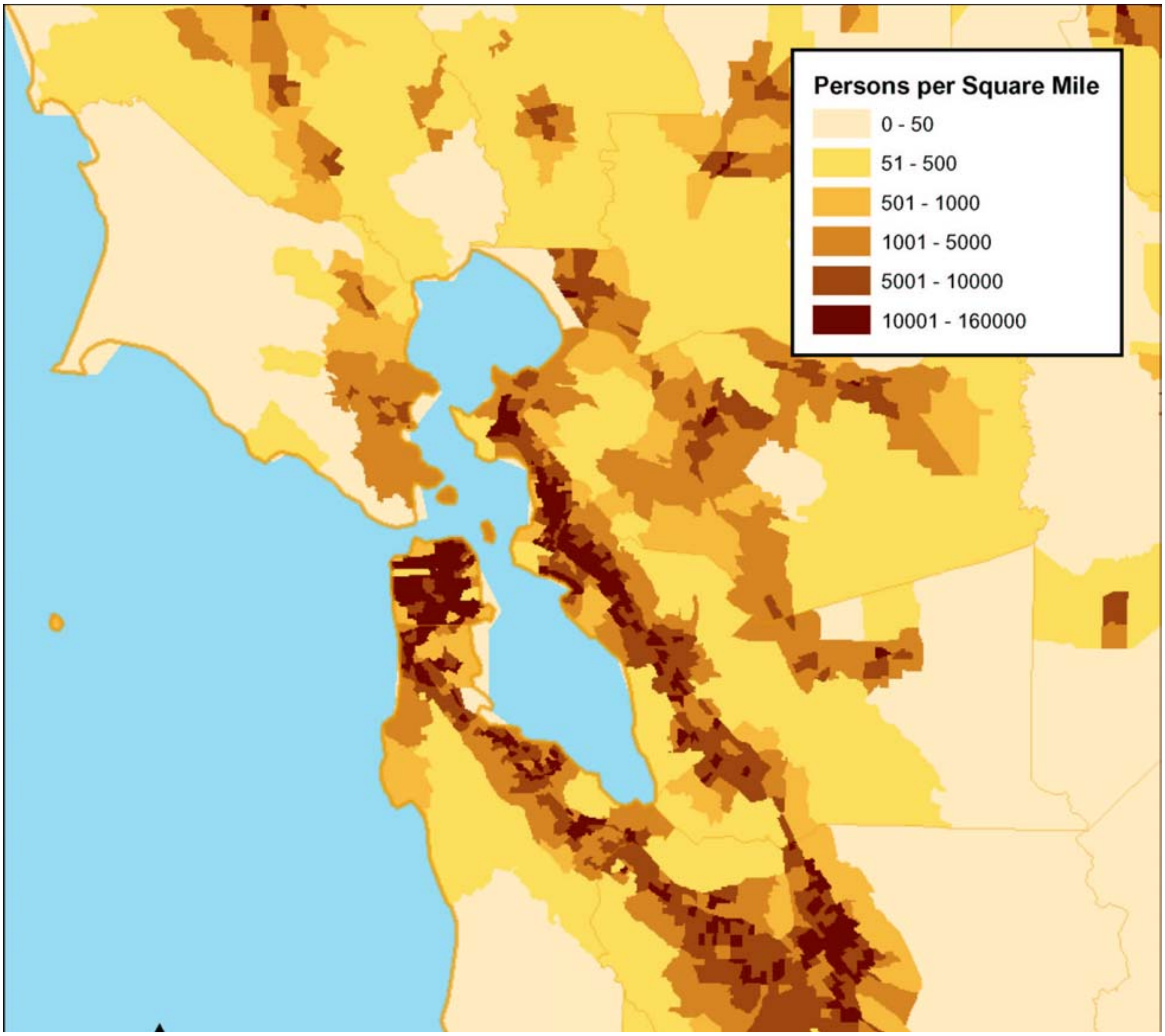
Map 11: 2015 Projected Population Density, State of California



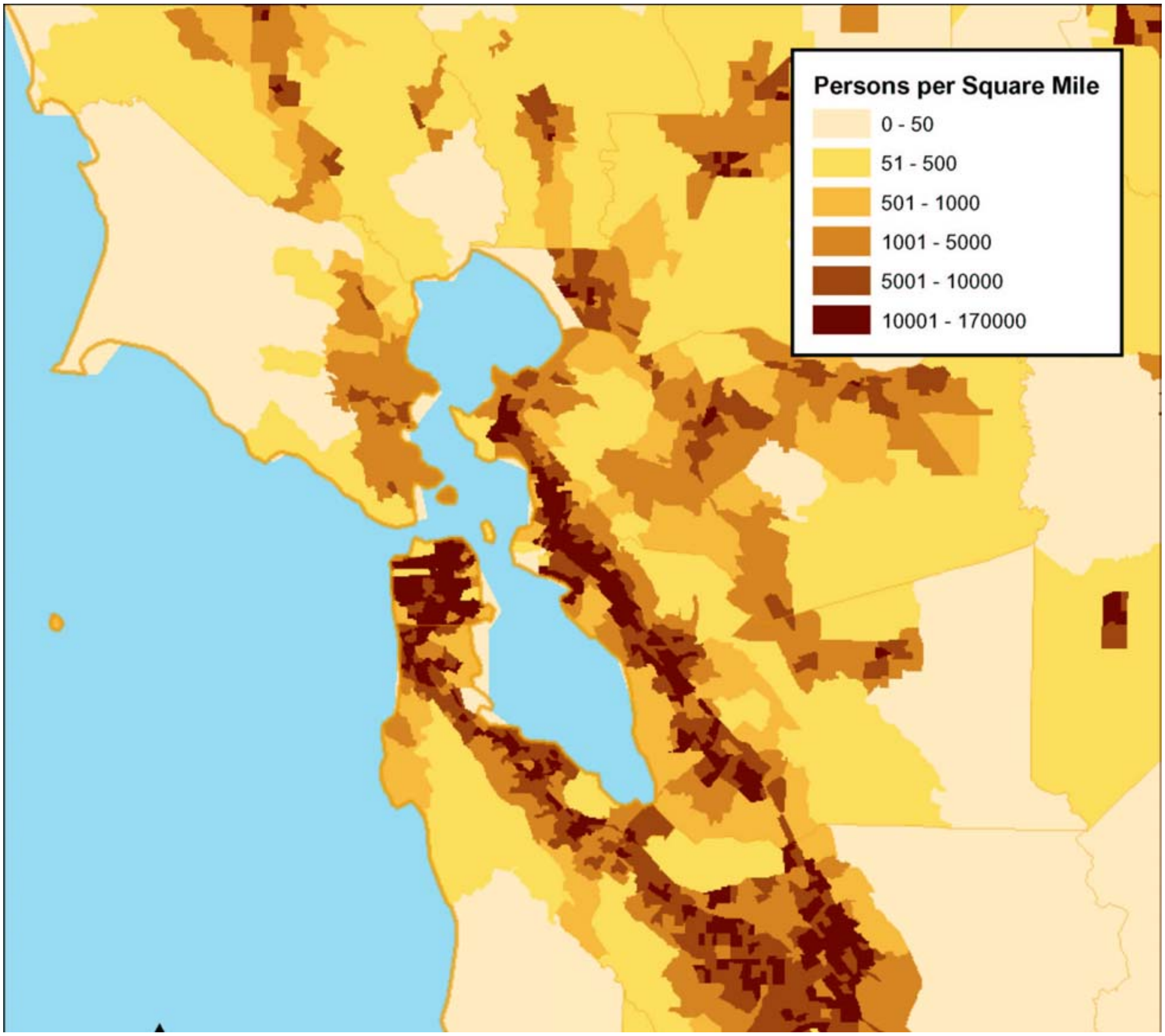
Map 12: 2025 Projected Population Density, State of California



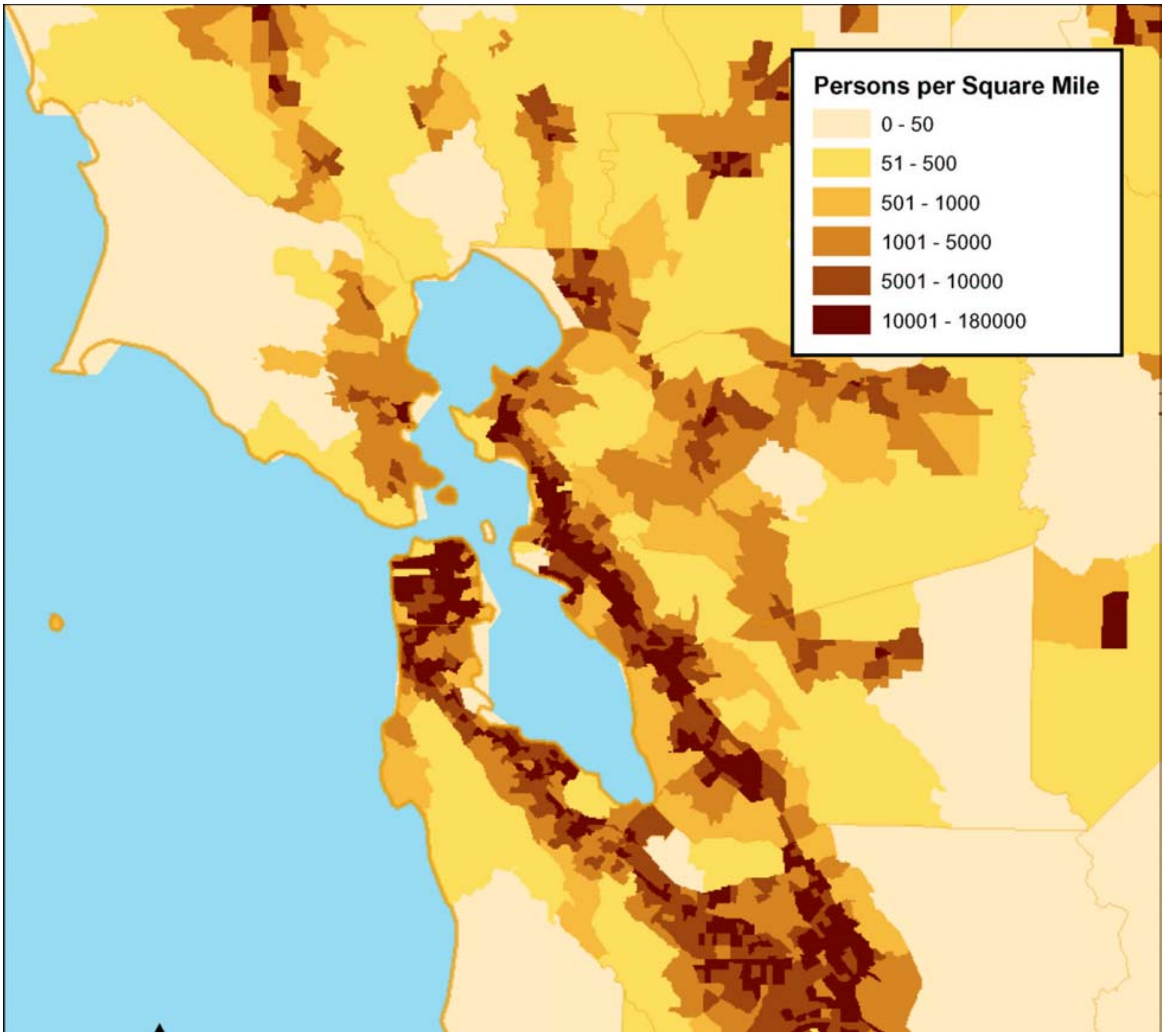
Map 13: Census 2000 Population Density, Bay Area



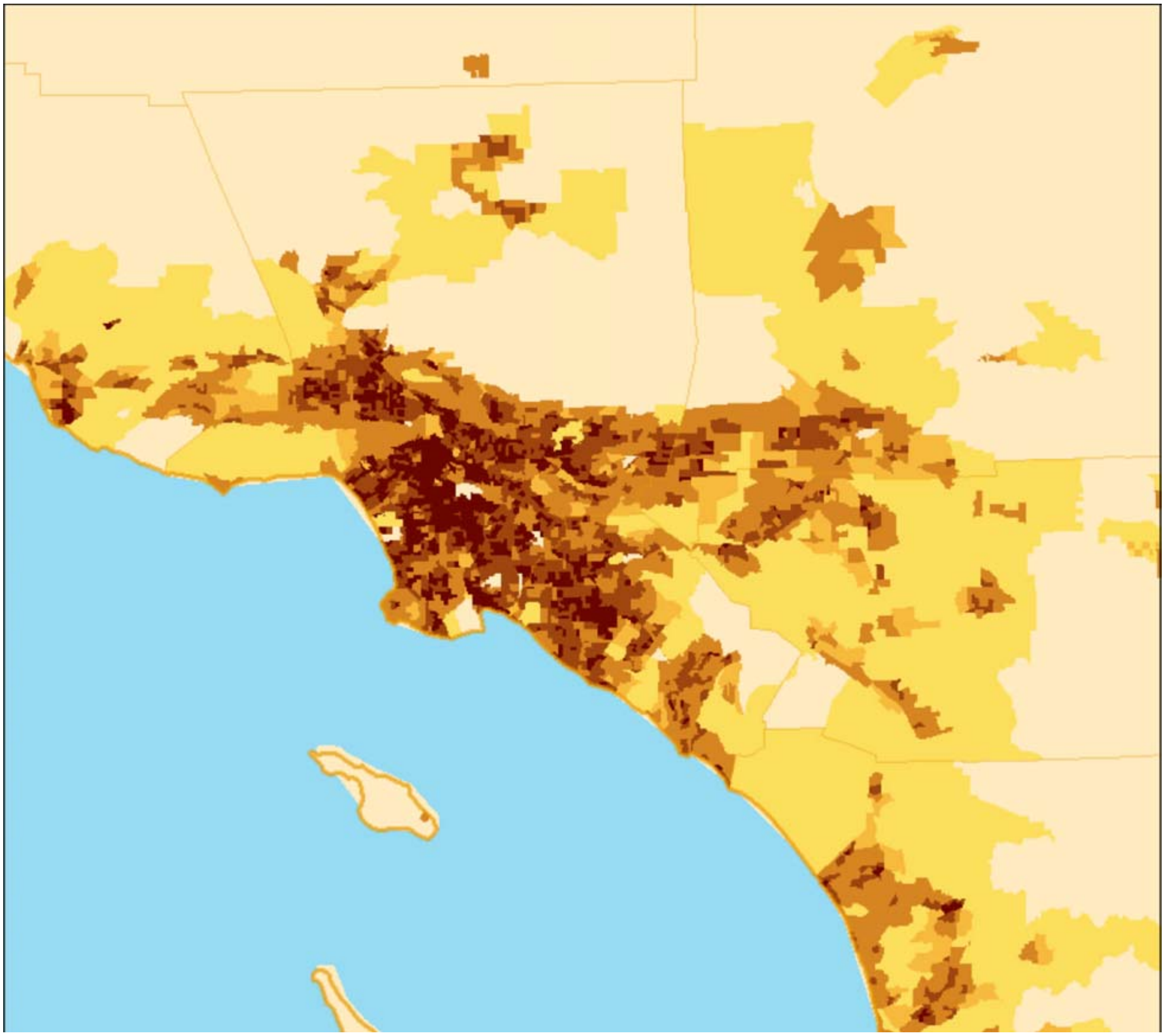
Map 14: 2015 Projected Population Density, Bay Area



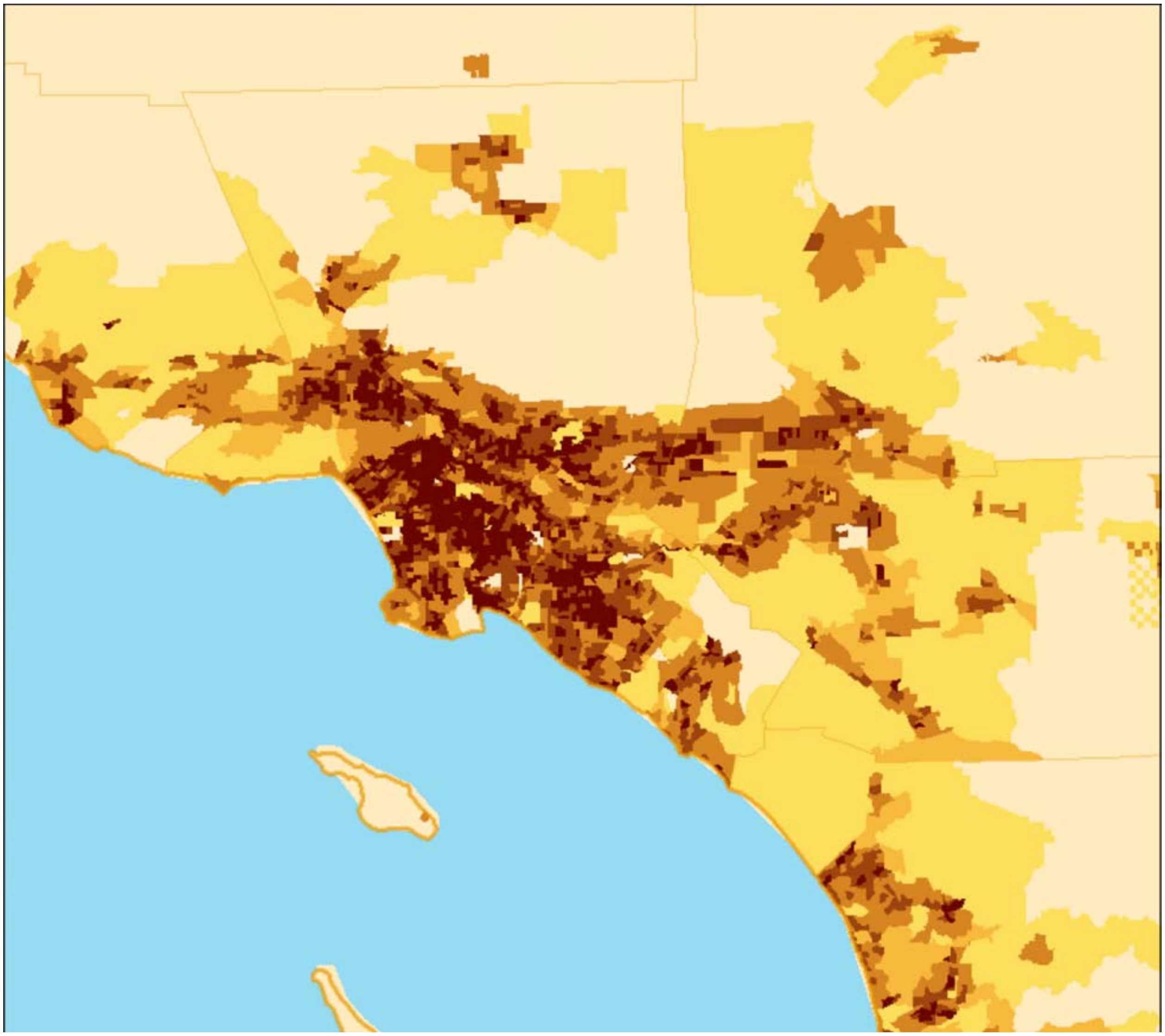
Map 15: 2025 Projected Population Density, Bay Area



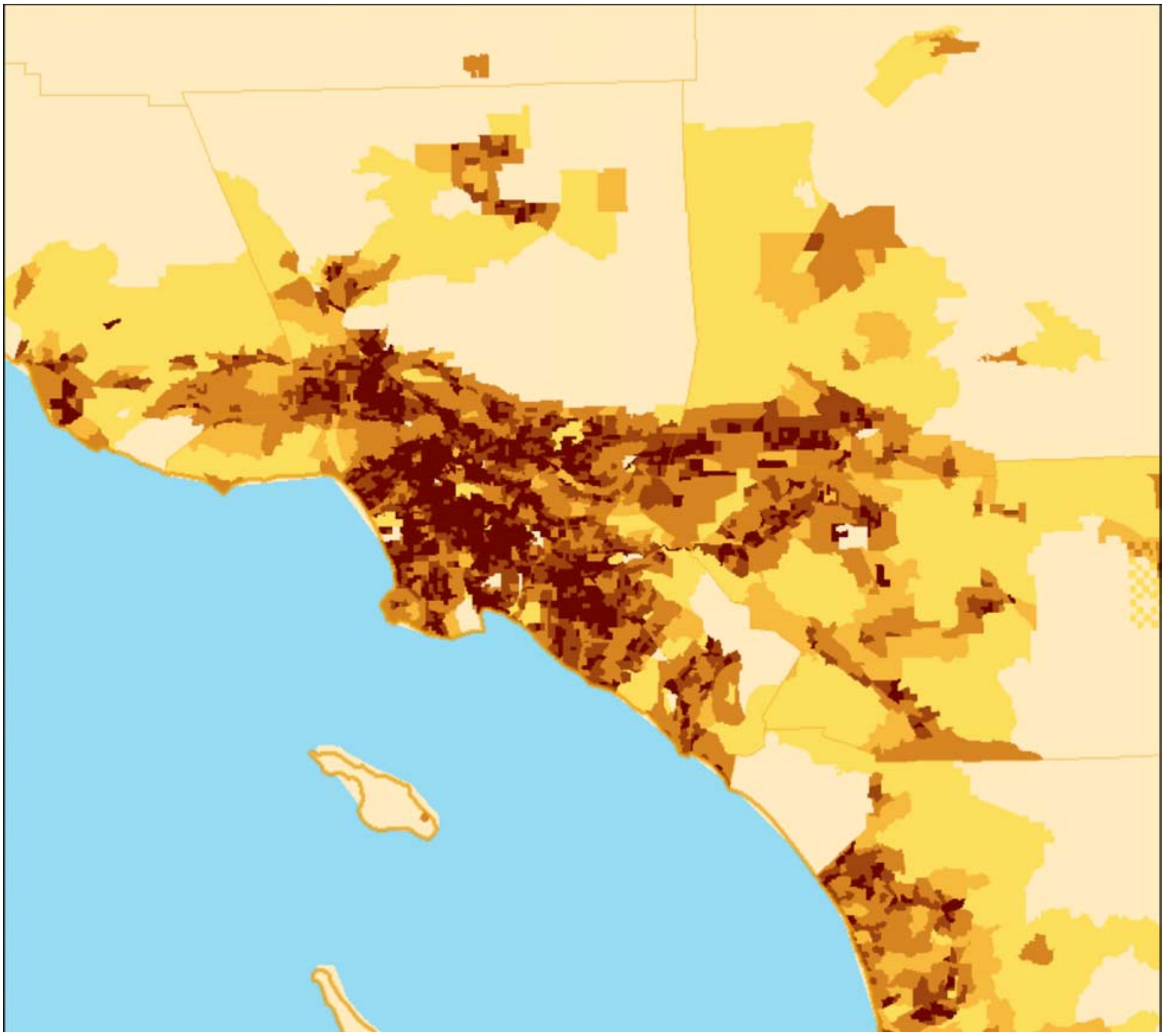
Map 16: Census 2000 Population Density, Southern California



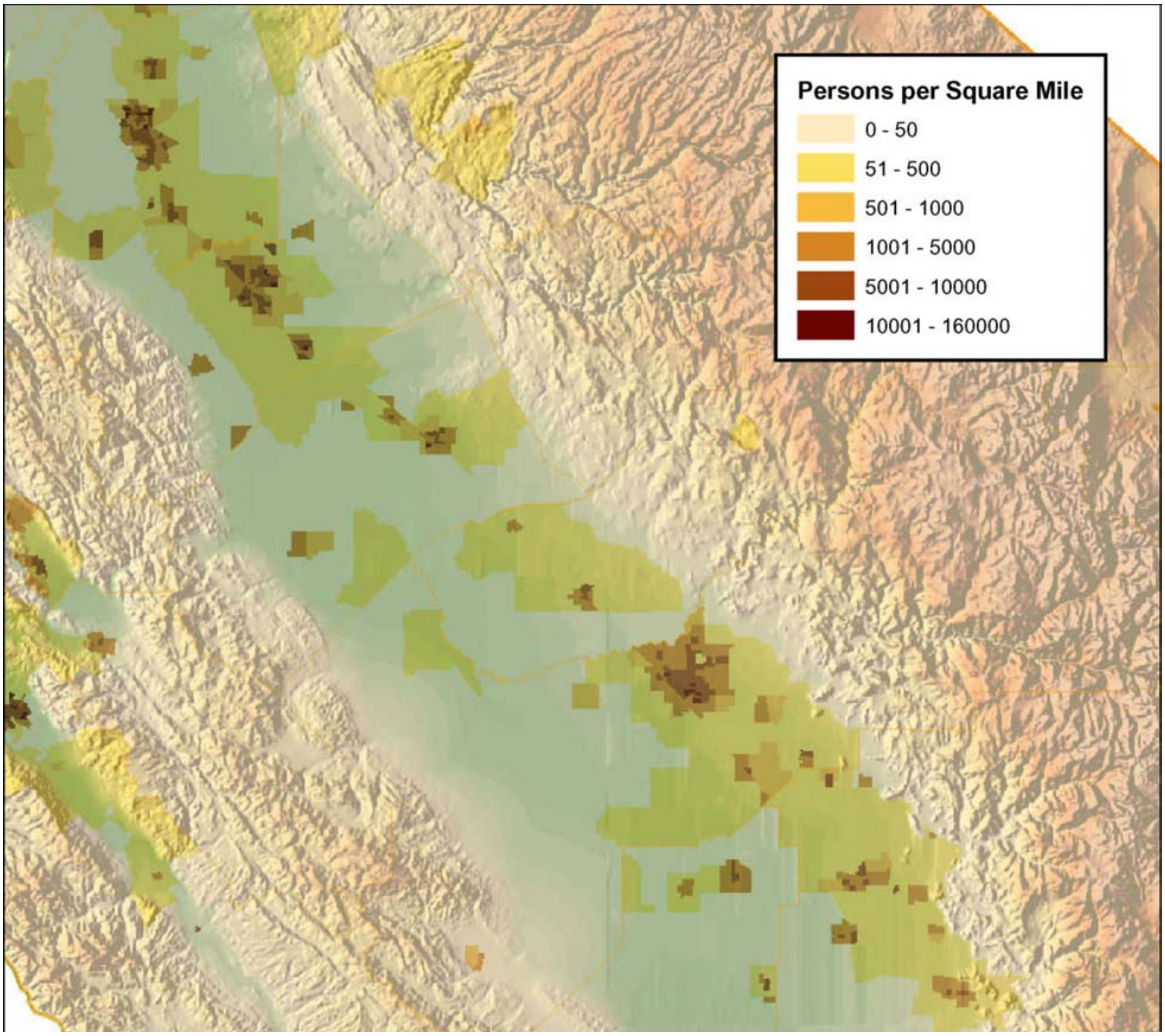
Map 17: 2015 Projected Population Density, Southern California



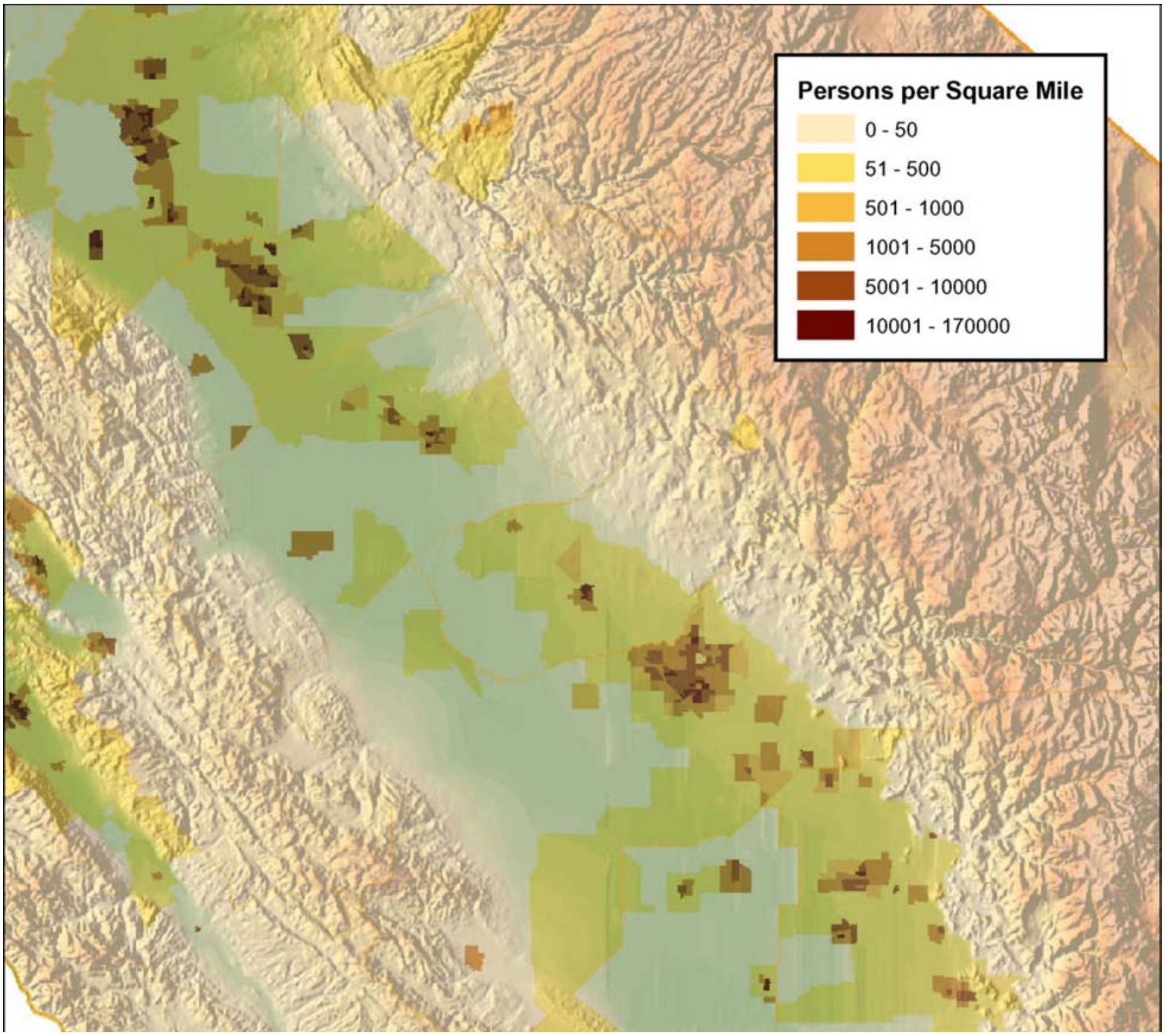
Map 18: 2025 Projected Population Density, Southern California



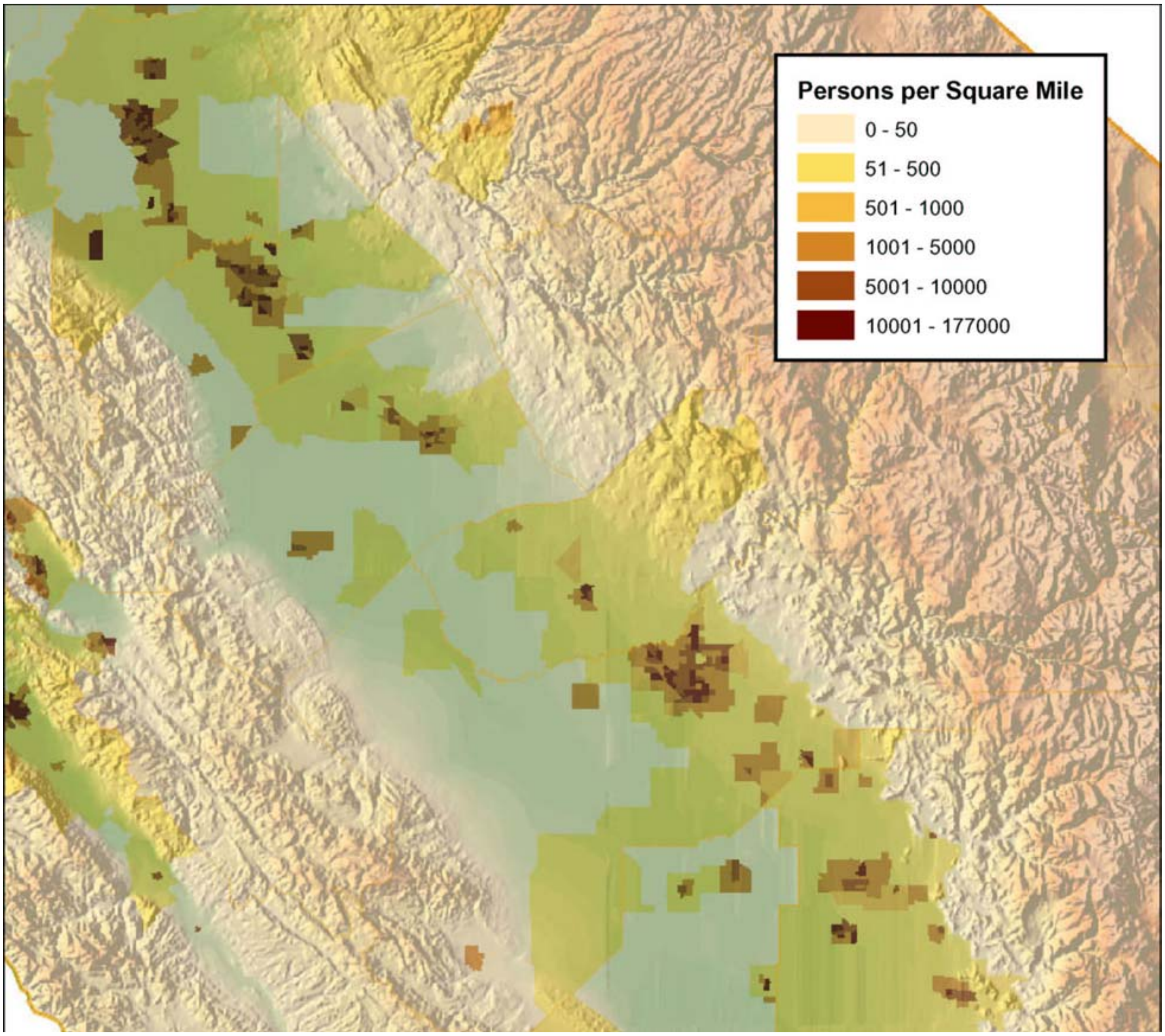
Map 19: Census 2000 Population Density, Southern Central Valley



Map 20: 2015 Projected Population Density, Southern Central Valley



Map 21: 2025 Projected Population Density, Southern Central Valley



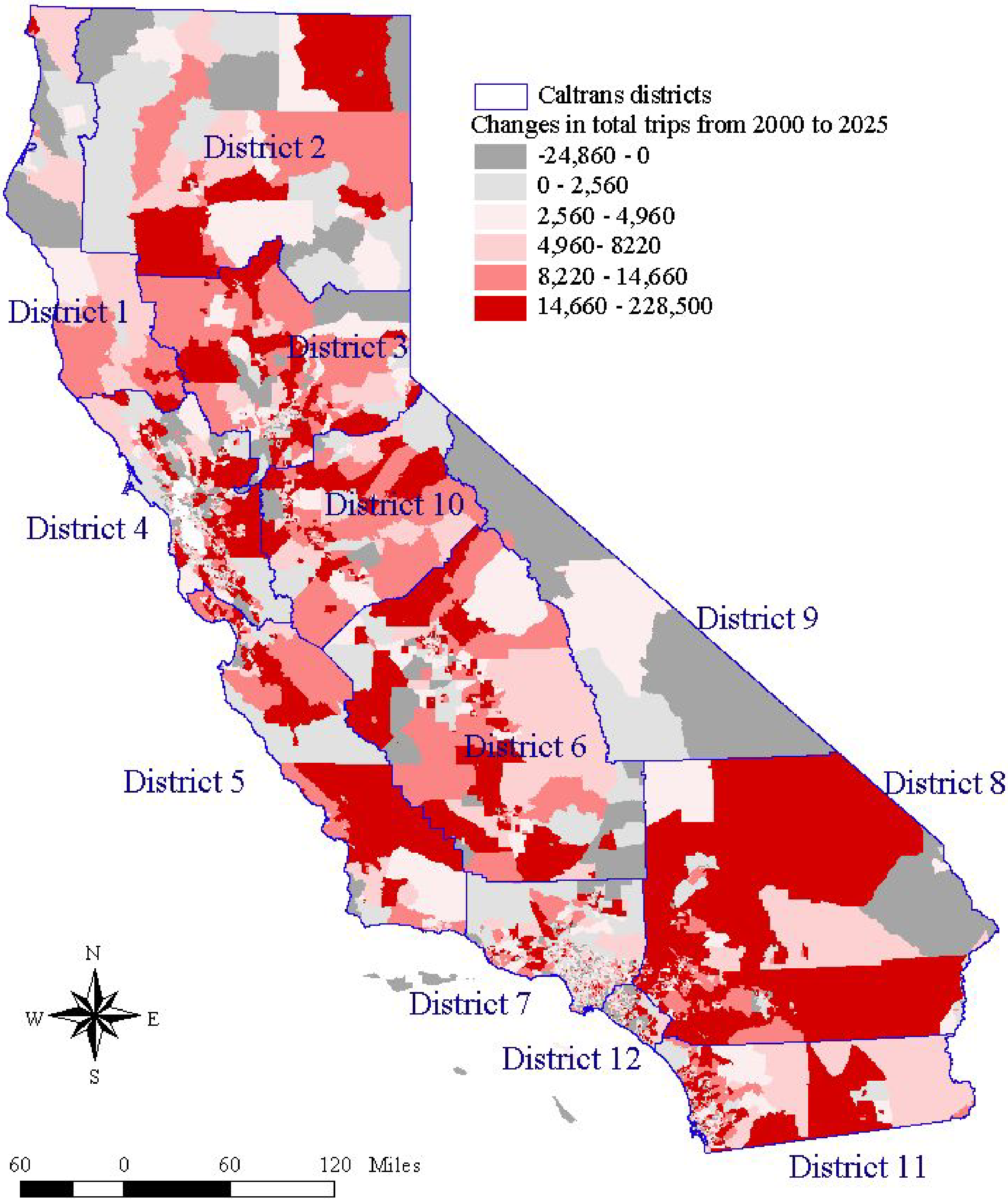
F

TRAVEL TREND MAPS: STATEWIDE

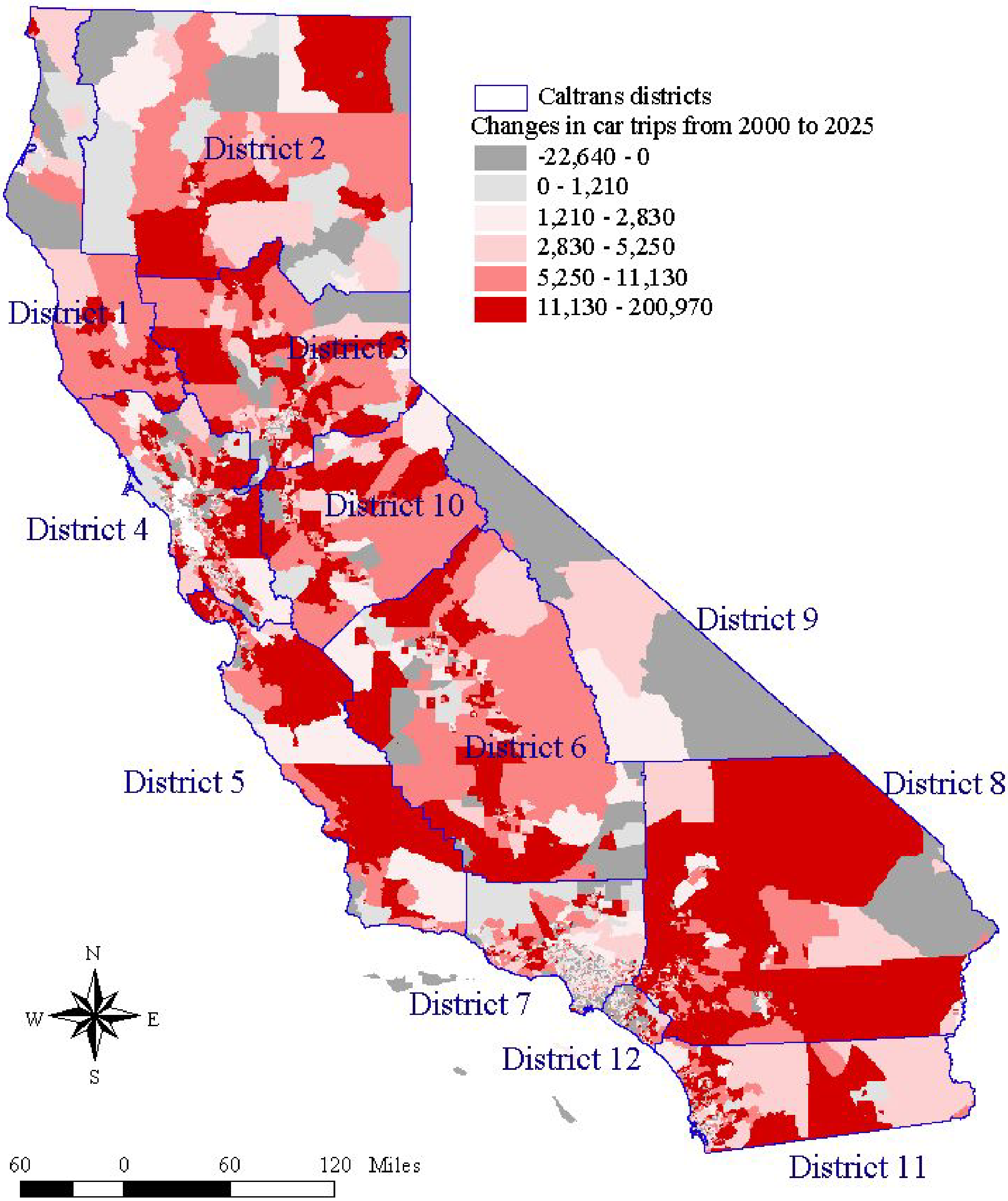
This Appendix contains selected maps showing California travel demand trends from 2000 to 2025.

Sources: Census-tract-level travel demand projections developed by UCLA, based on an empirical model applied to 2000 Census data and population projections for 2025 prepared by Solimar Research Group. For an explanation of methodology and data sources drawn upon, see Sections 4 and 6.

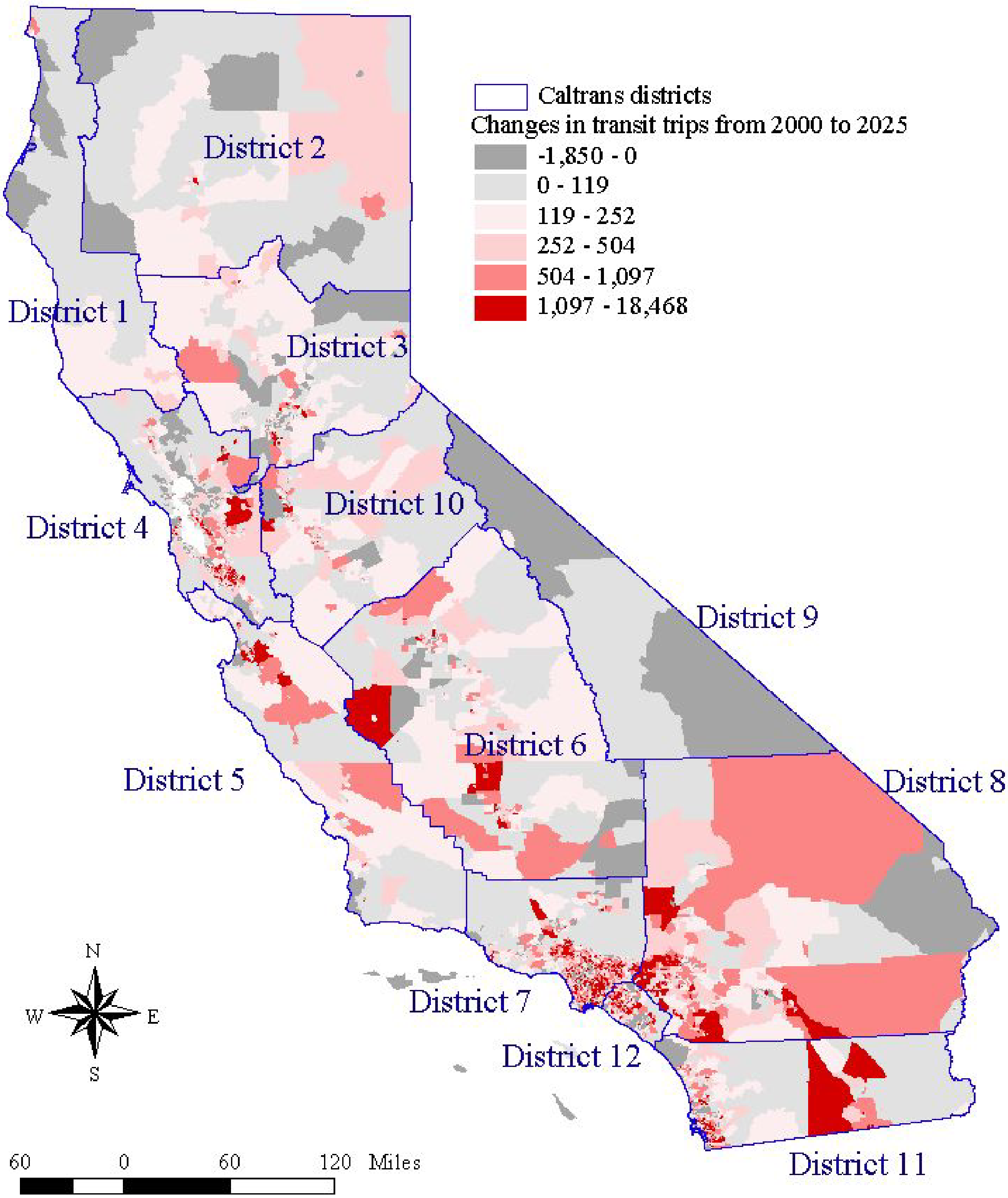
Map 22: Changes in Daily Total Trips, 2000 to 2025



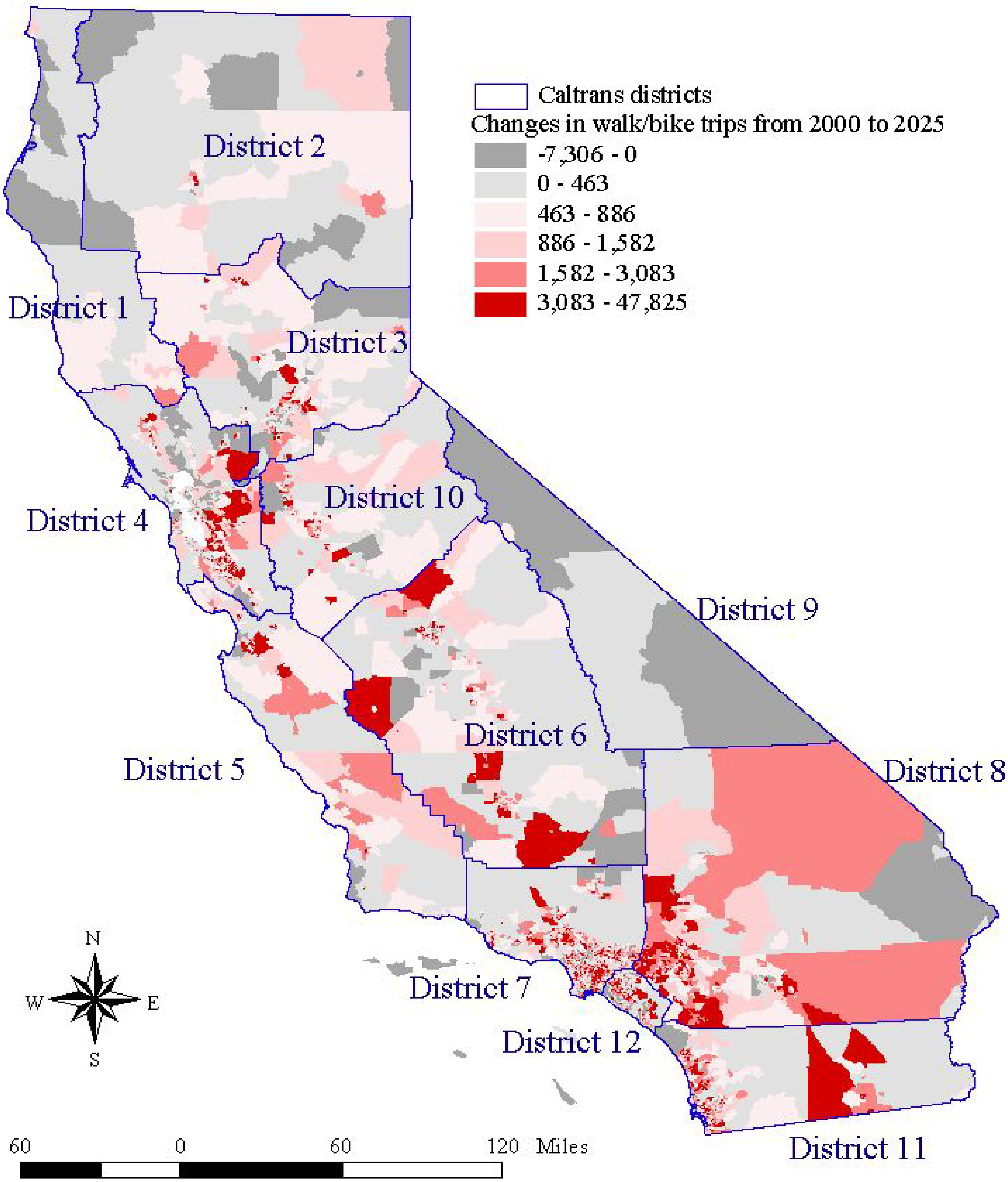
Map 23: Changes in Daily Car Trips, 2000 to 2025



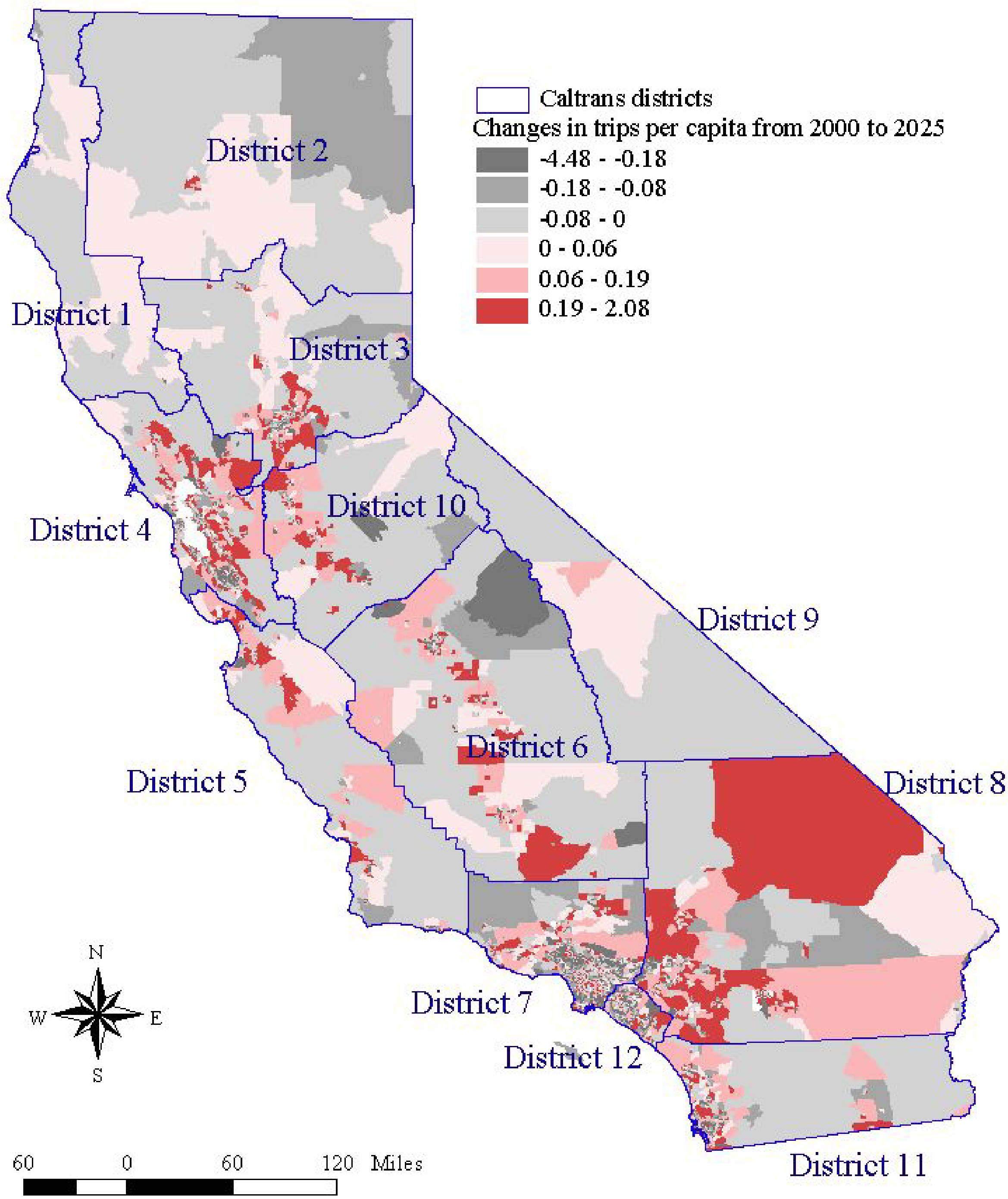
Map 24: Changes in Daily Transit Trips, 2000 to 2025



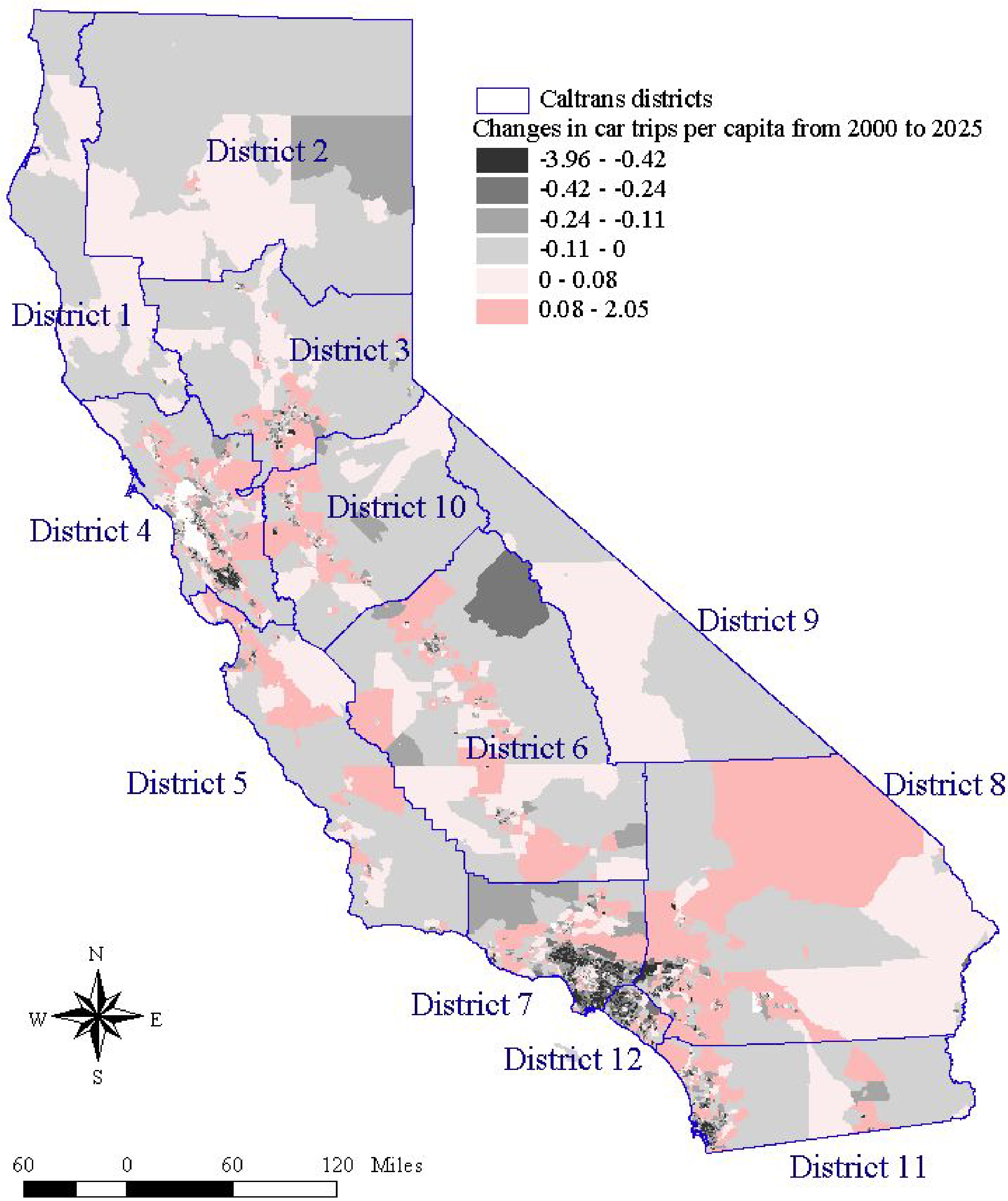
Map 25: Changes in Daily Walk/Bike Trips, 2000 to 2025



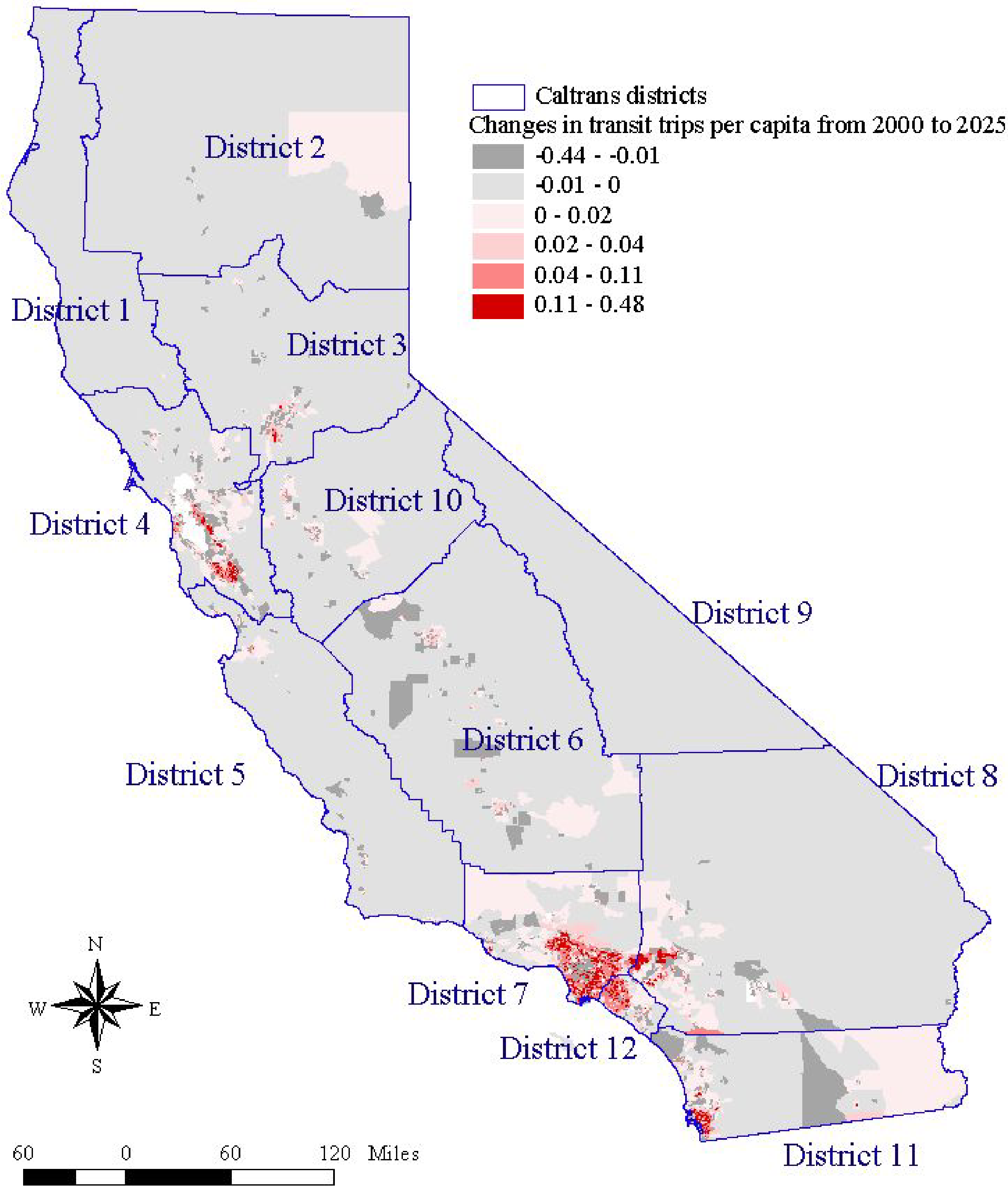
Map 26: Changes in Daily Trips Per Capita, 2000 to 2025



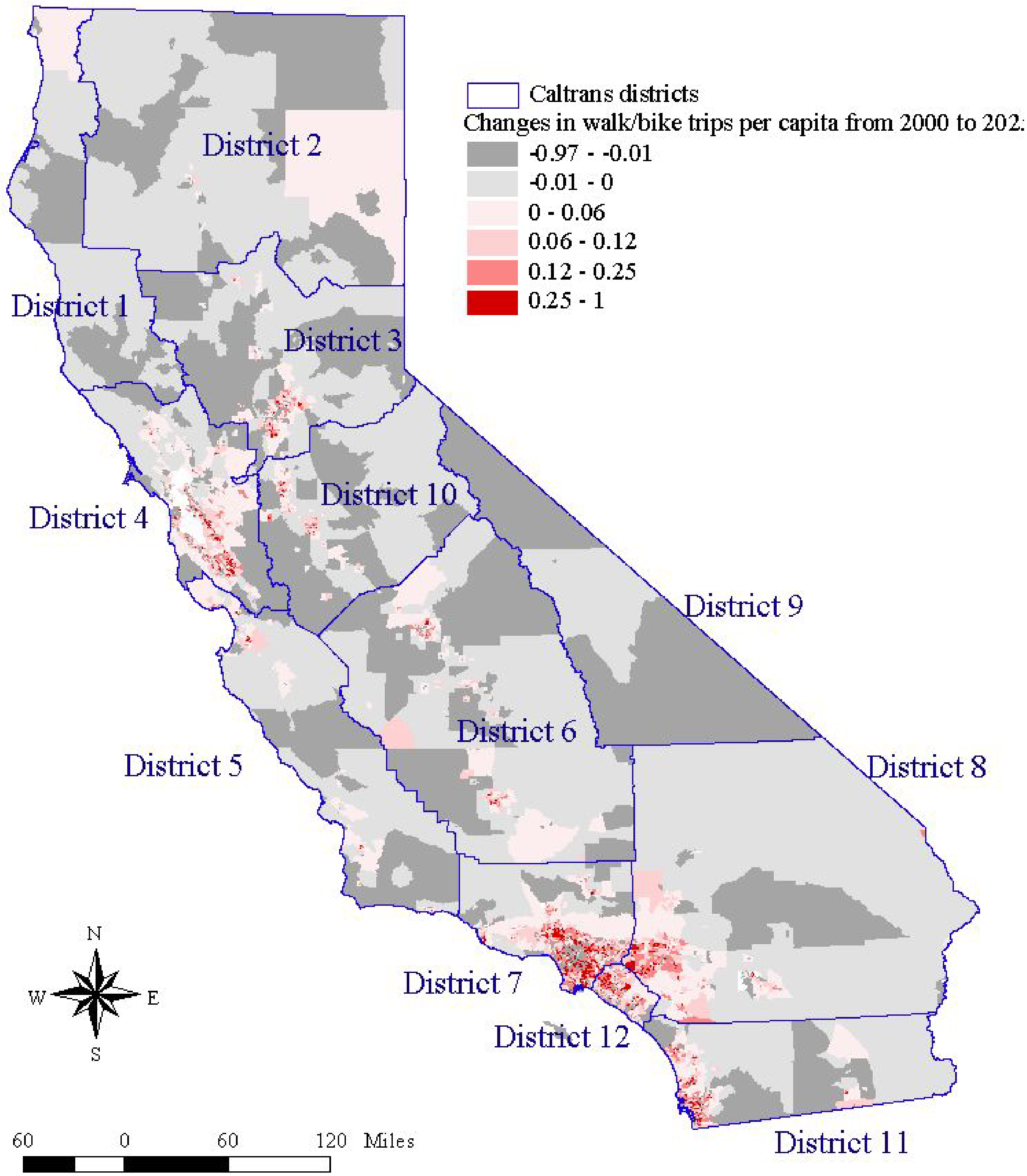
Map 27: Changes in Daily Car Trips Per Capita, 2000 to 2025



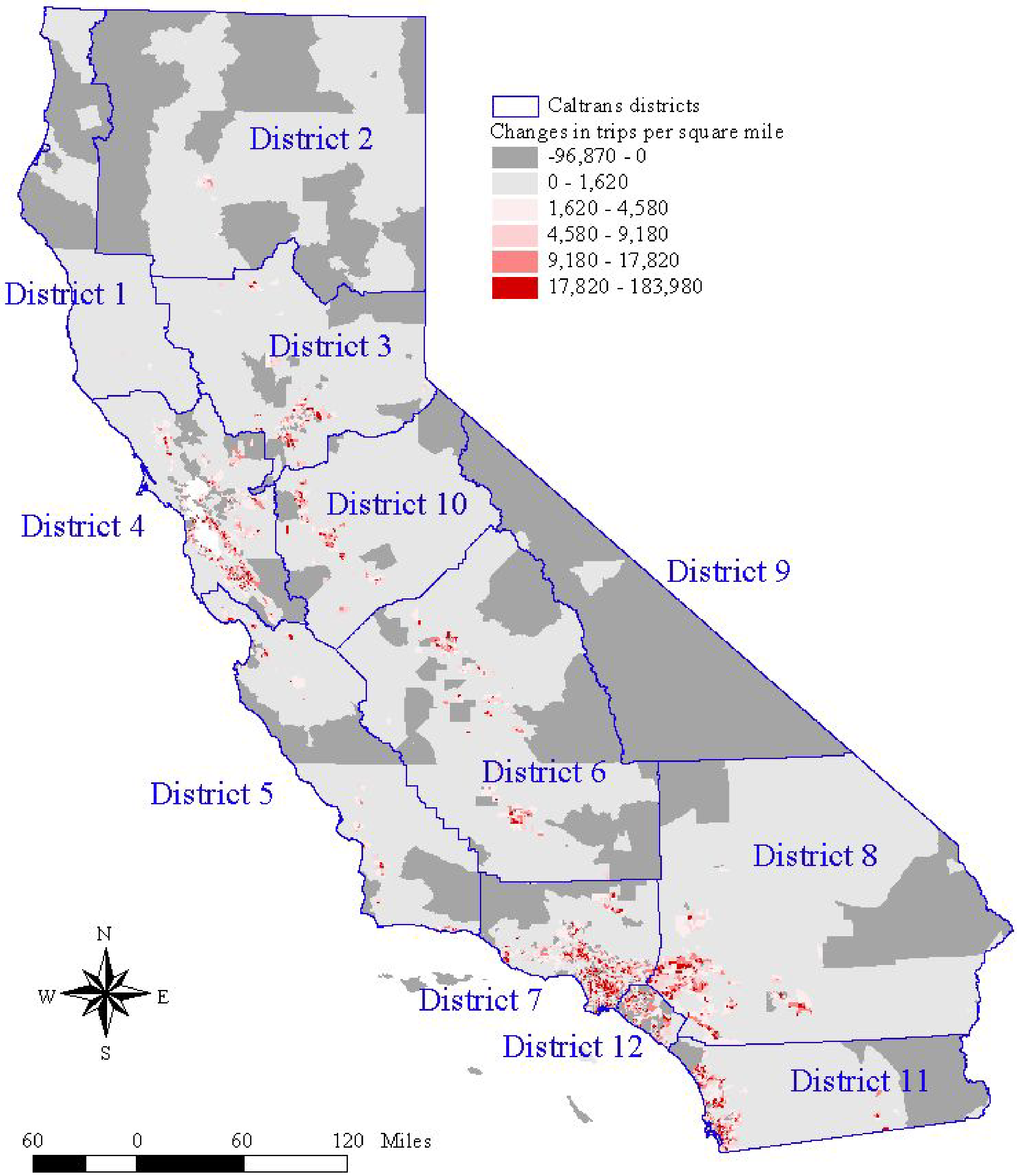
Map 28: Changes in Daily Transit Trips Per Capita, 2000 to 2025



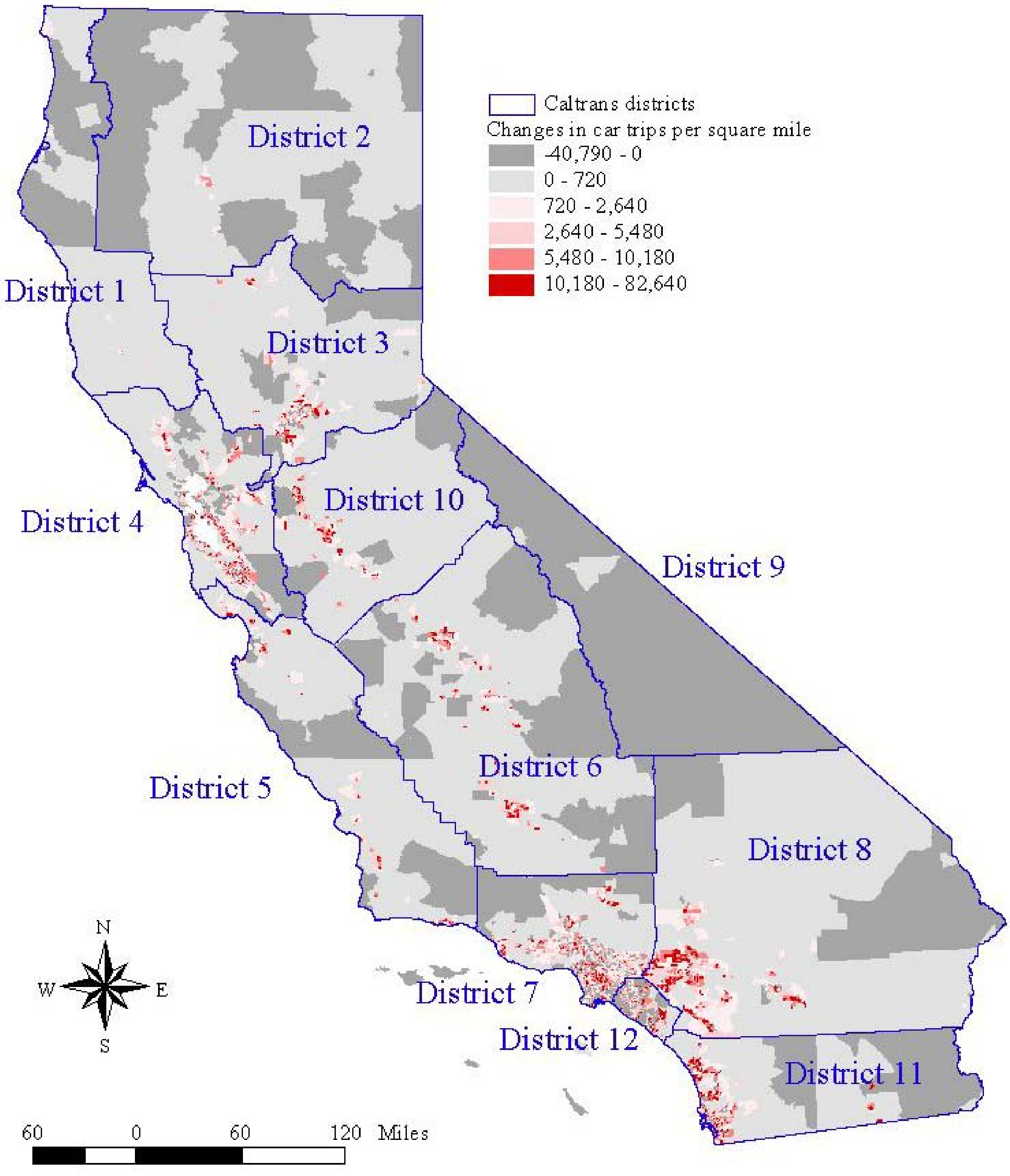
Map 29: Changes in Daily Walk/Bike Trips Per Capita, 2000 to 2025



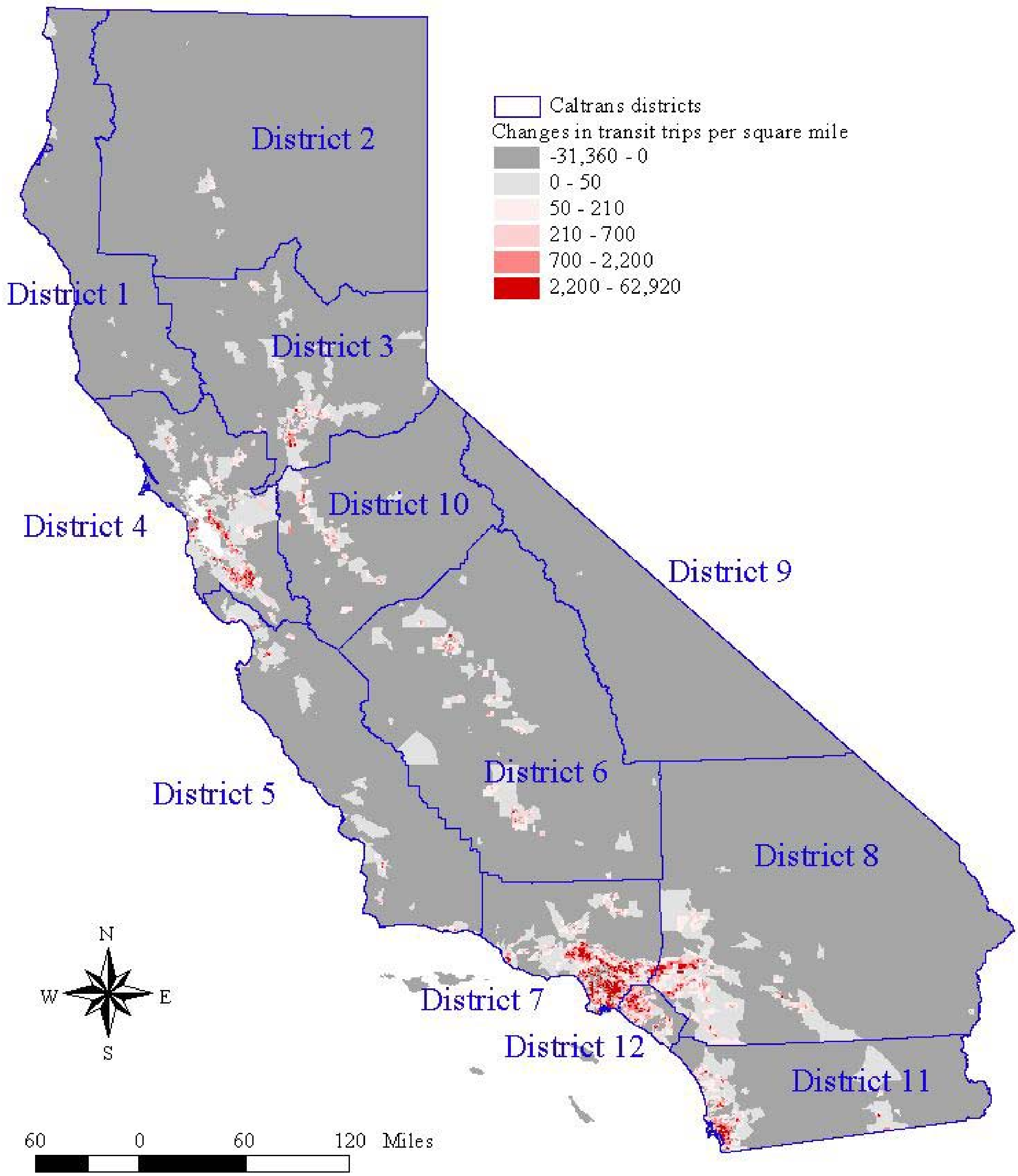
Map 30: Changes in Daily Trip Density, 2000 to 2025



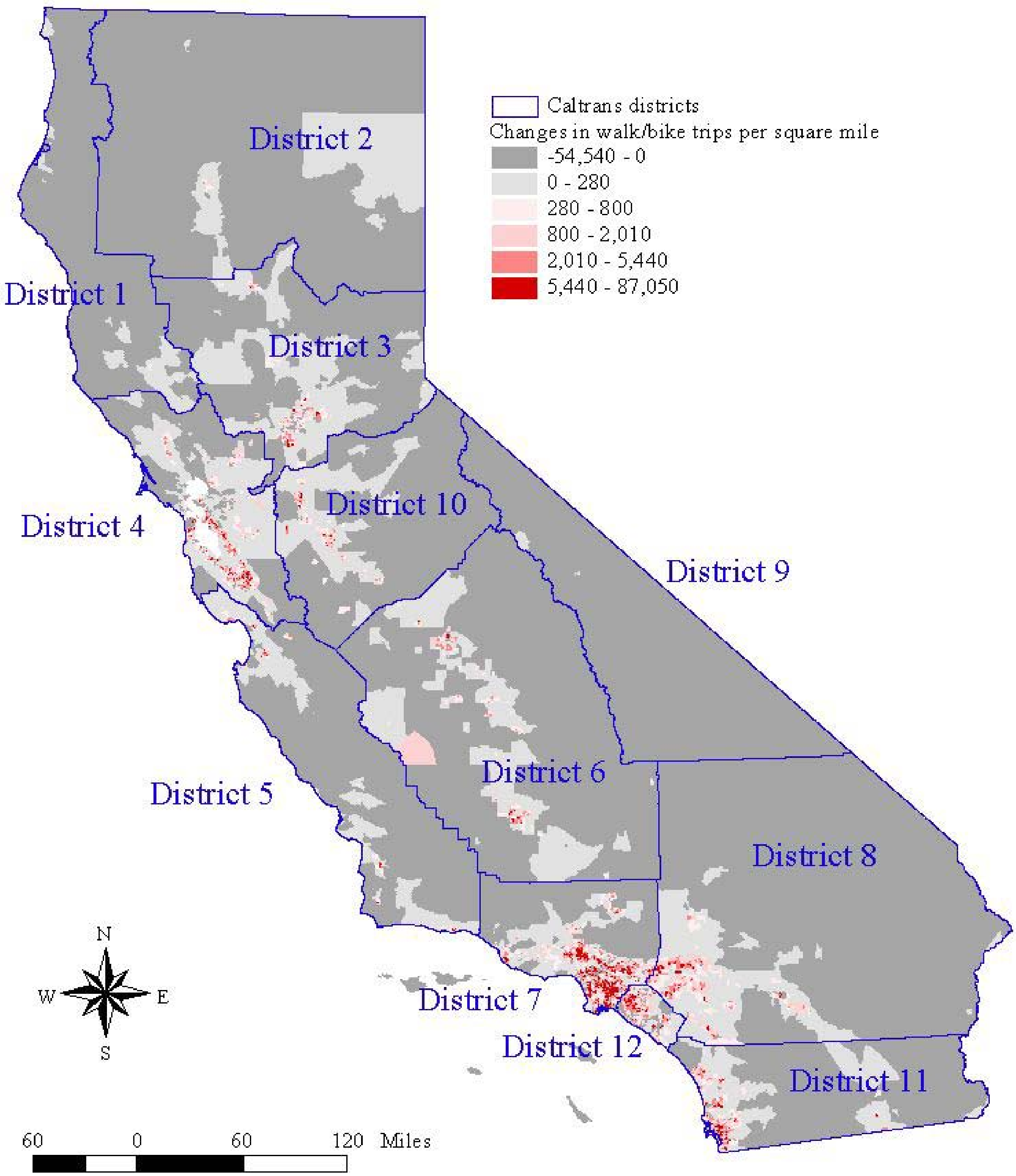
Map 31: Changes in Daily Auto Trip Density, 2000 to 2025



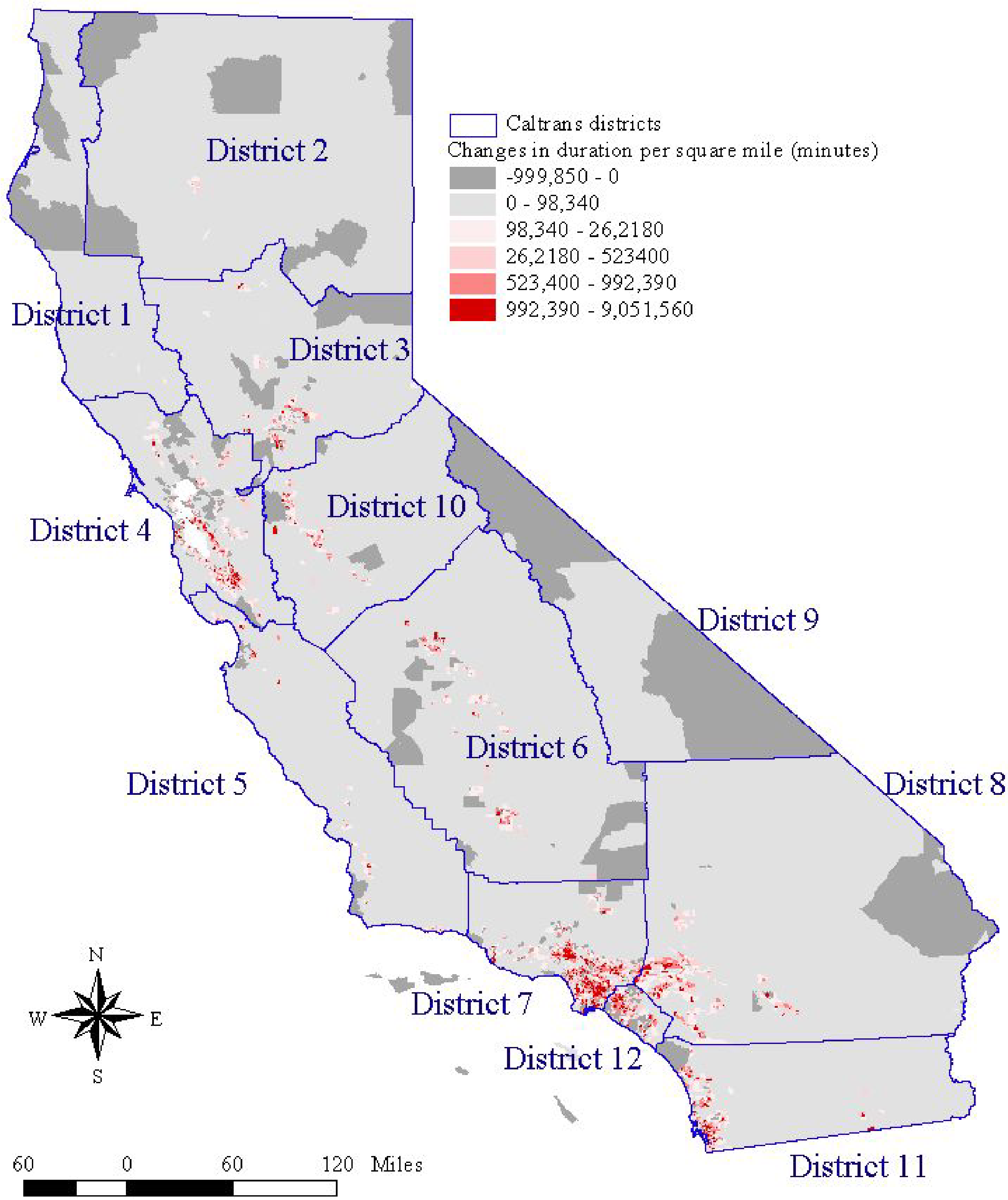
Map 32: Changes in Daily Transit Trip Density, 2000 to 2025



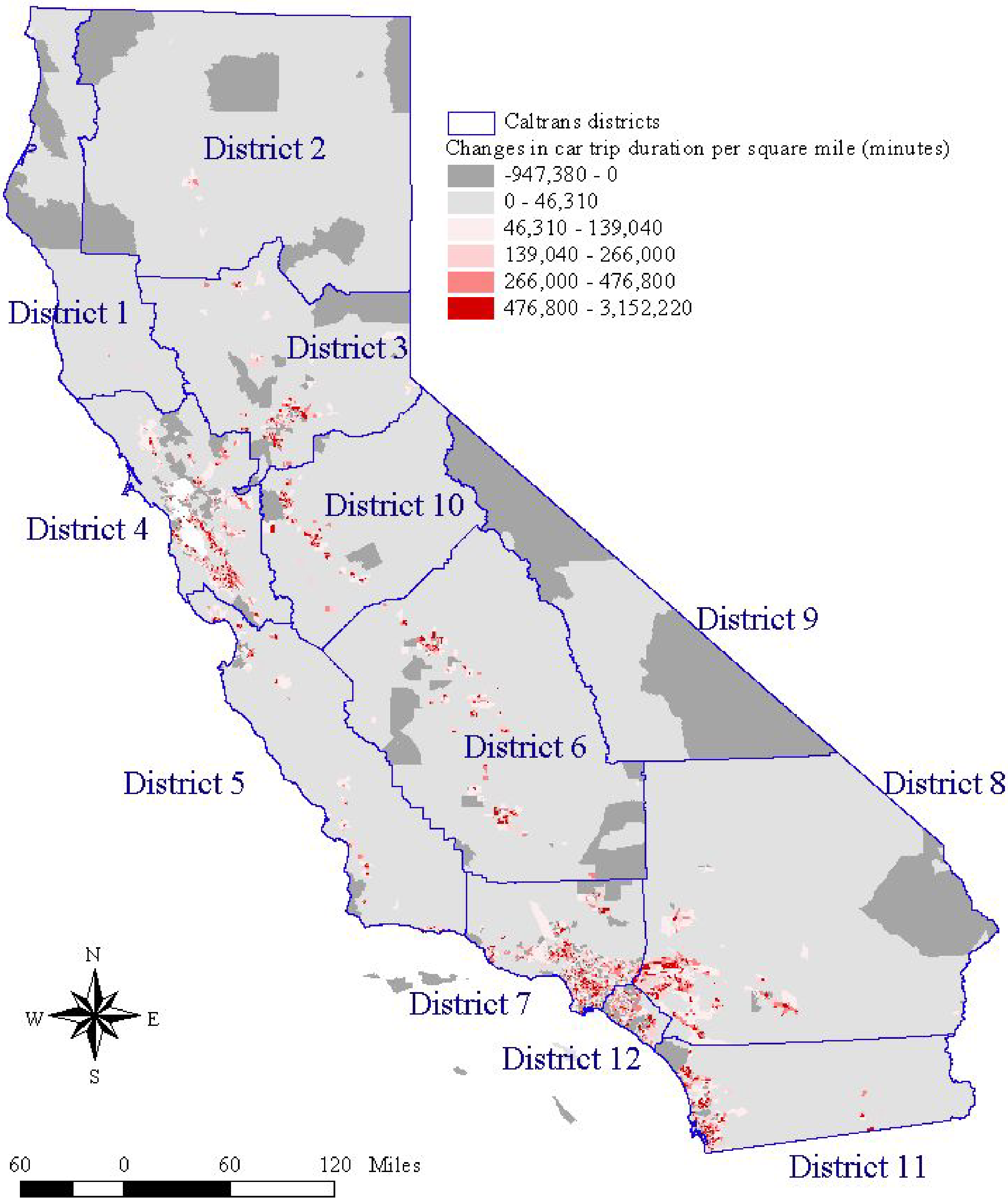
Map 33: Changes in Daily Walk/Bike Trip Density, 2000 to 2025



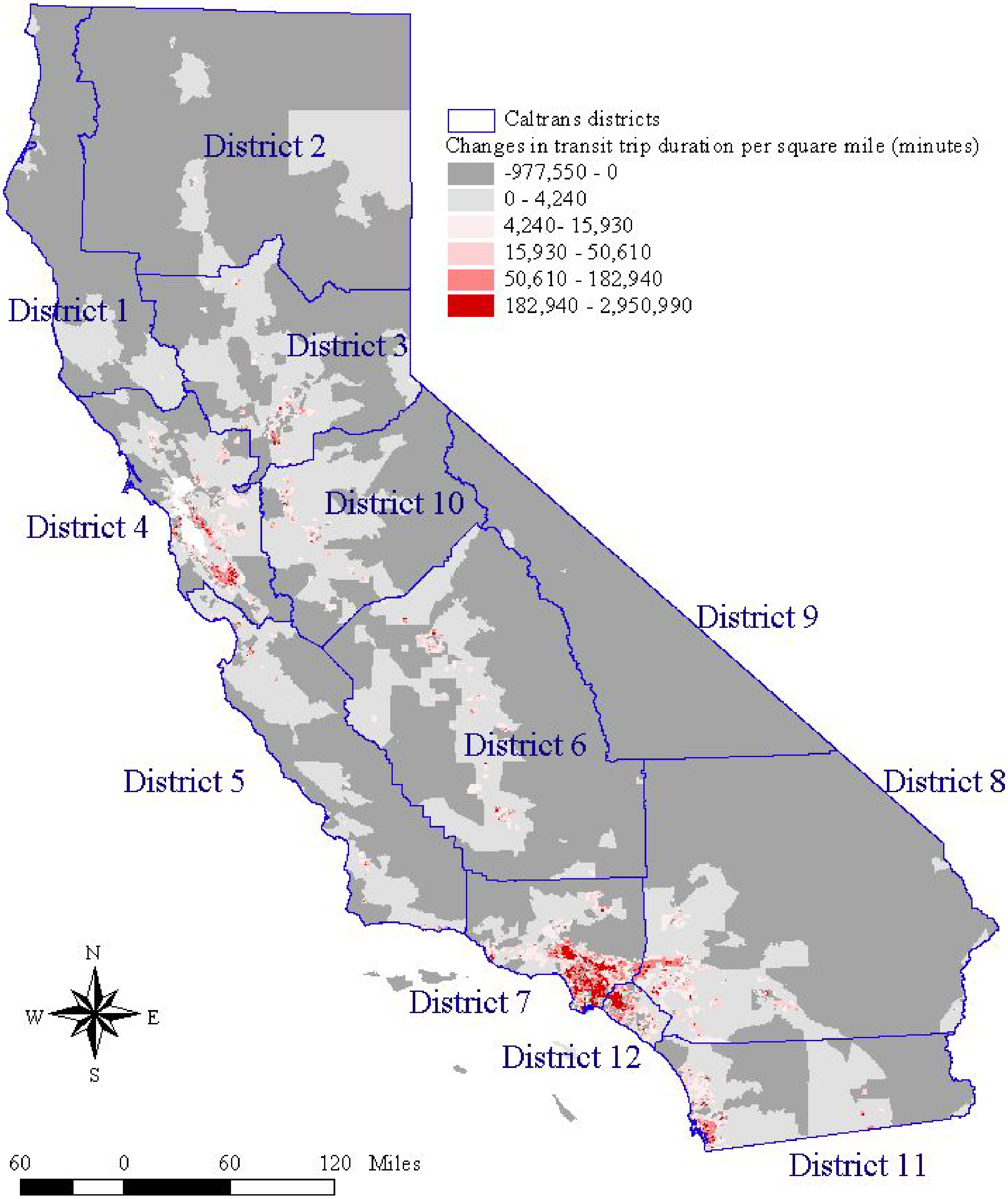
Map 34: Changes in Daily Trip Duration Density, 2000 to 2025



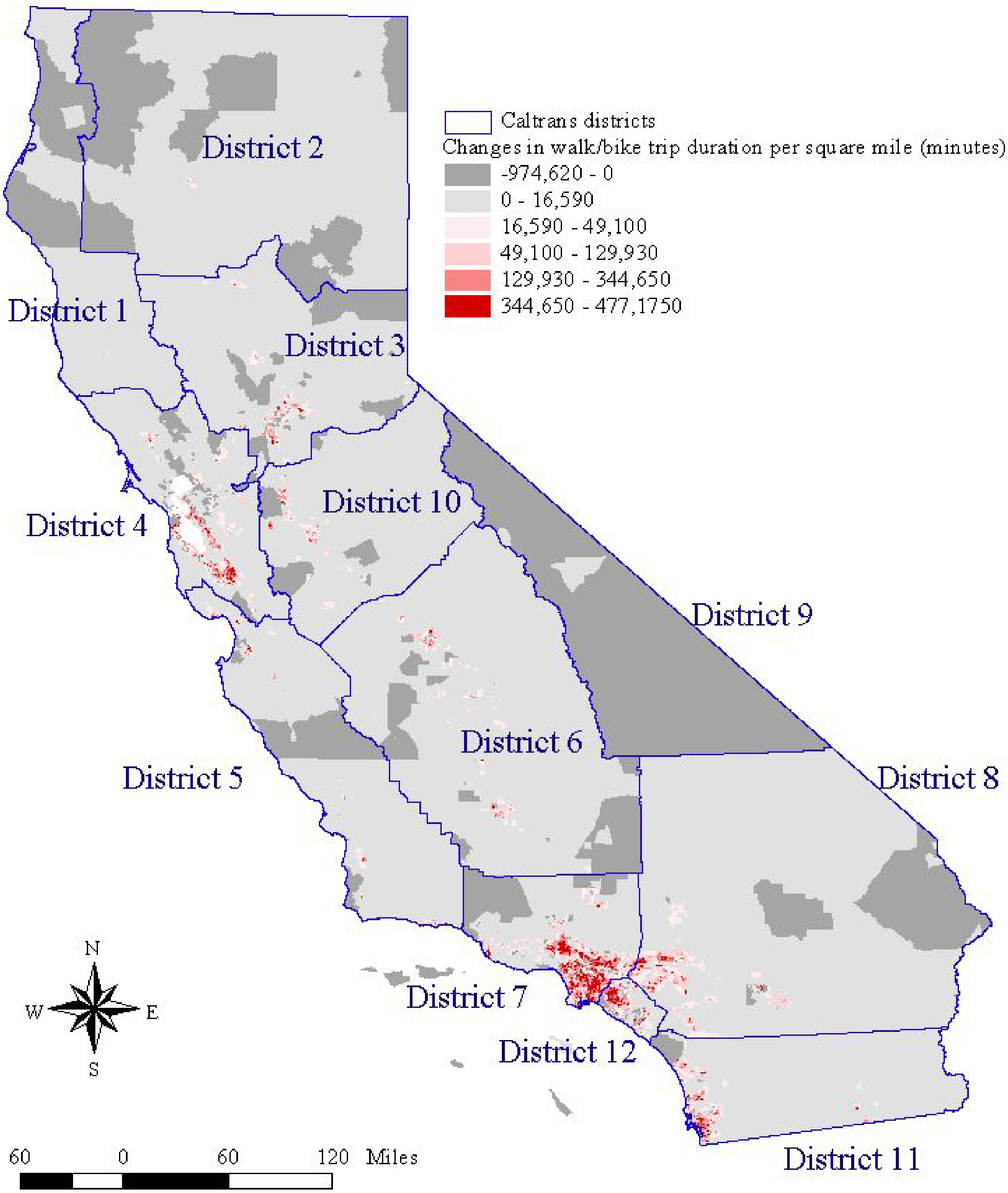
Map 35: Changes in Daily Auto Trip Duration Density, 2000 to 2025



Map 36: Changes in Daily Transit Trip Duration Density, 2000 to 2025



Map 37: Changes in Daily Walk/Bike Trip Duration Density, 2000 to 2025



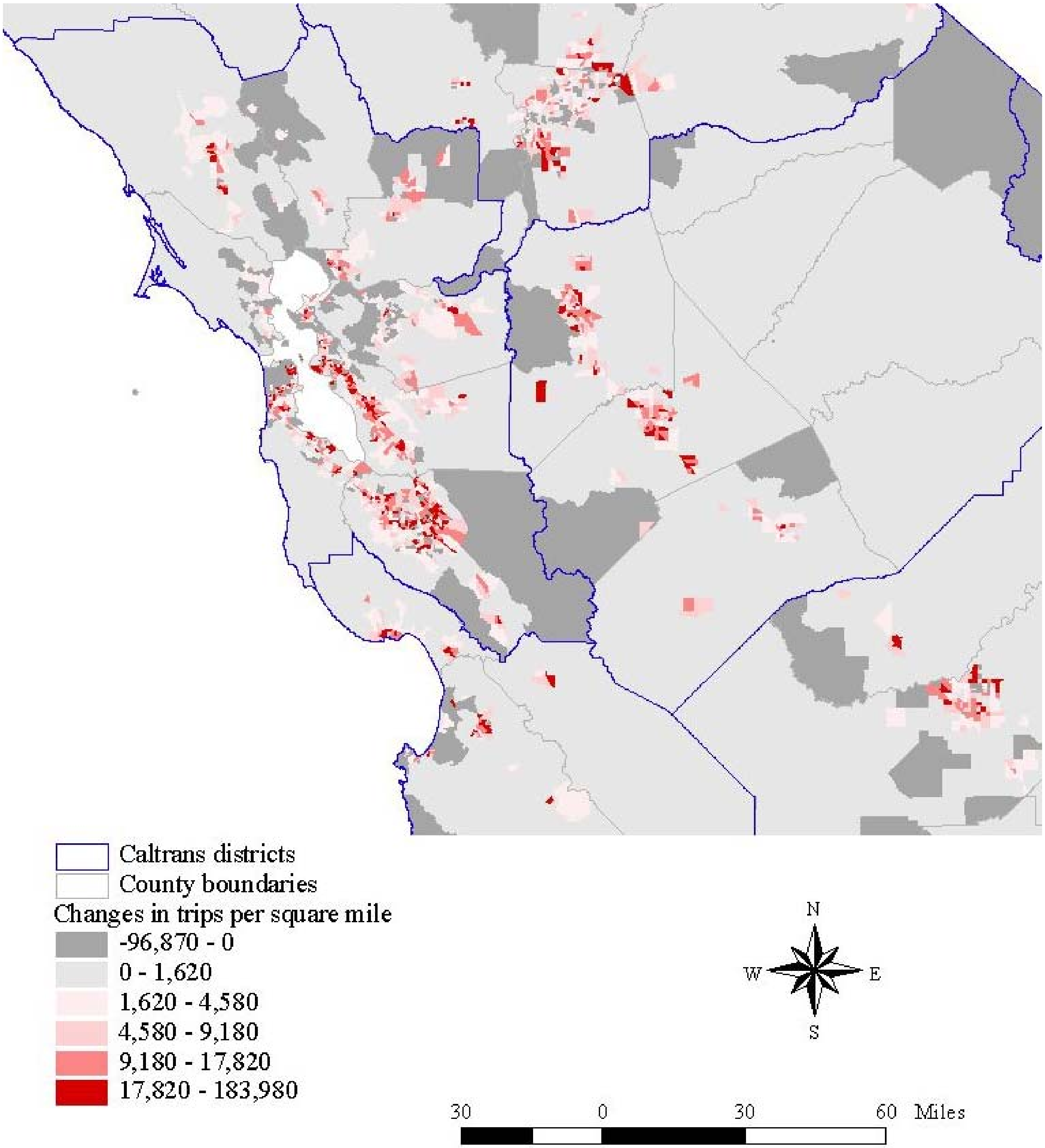
G

TRAVEL TREND MAPS: BAY AREA AND SACRAMENTO REGION

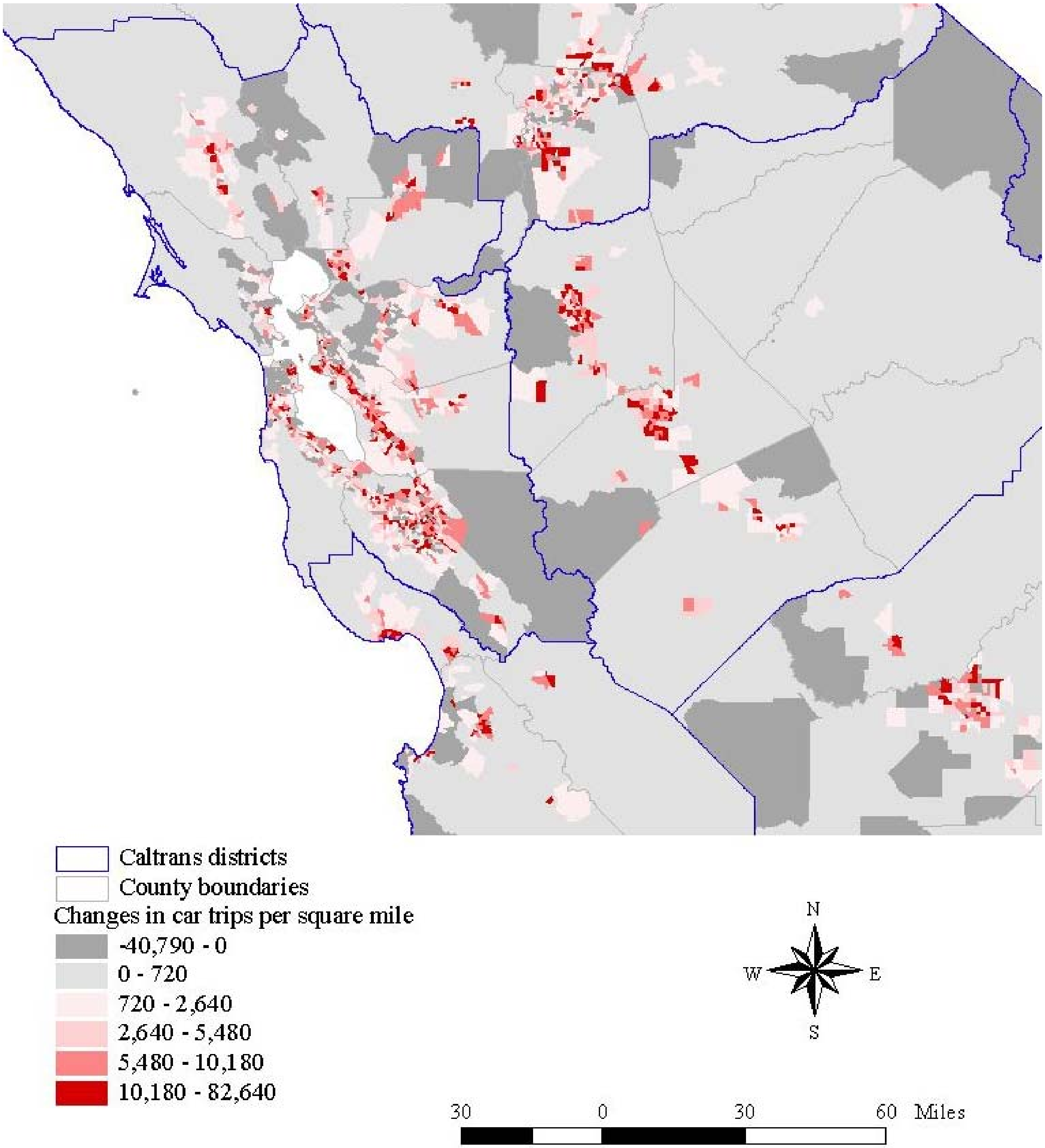
This Appendix contains selected maps developed by UCLA to show travel demand trends from 2000 to 2025 in the San Francisco Bay Area and the Sacramento region.

Sources: Census-tract-level travel demand projections developed by UCLA, based on an empirical model applied to 2000 Census data and population projections for 2025 prepared by Solimar Research Group. For an explanation of methodology and data sources drawn upon, see Sections 4 and 6.

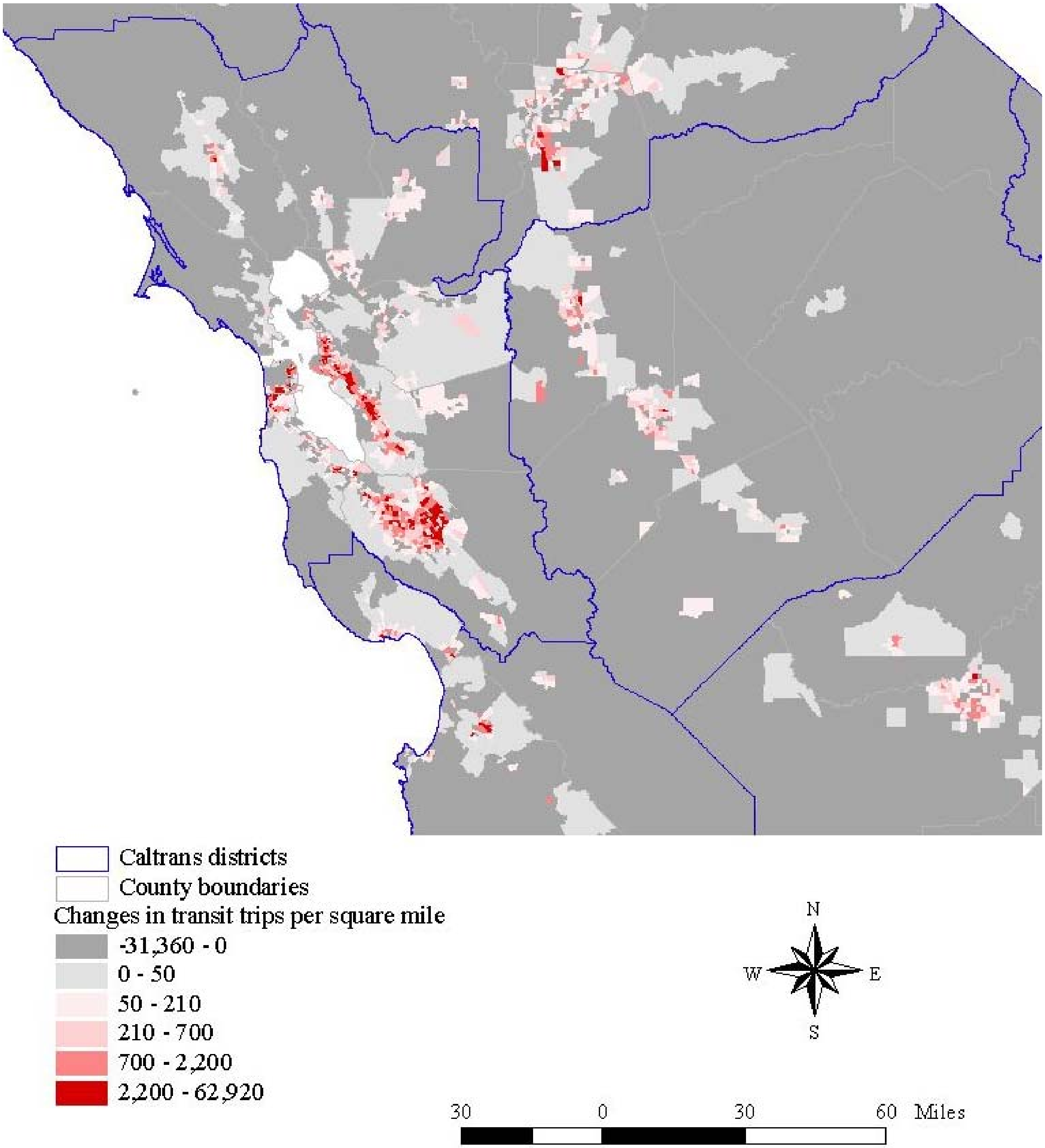
Map 38: Changes in Daily Trip Density, Bay Area/Sacramento, 2000 to 2025



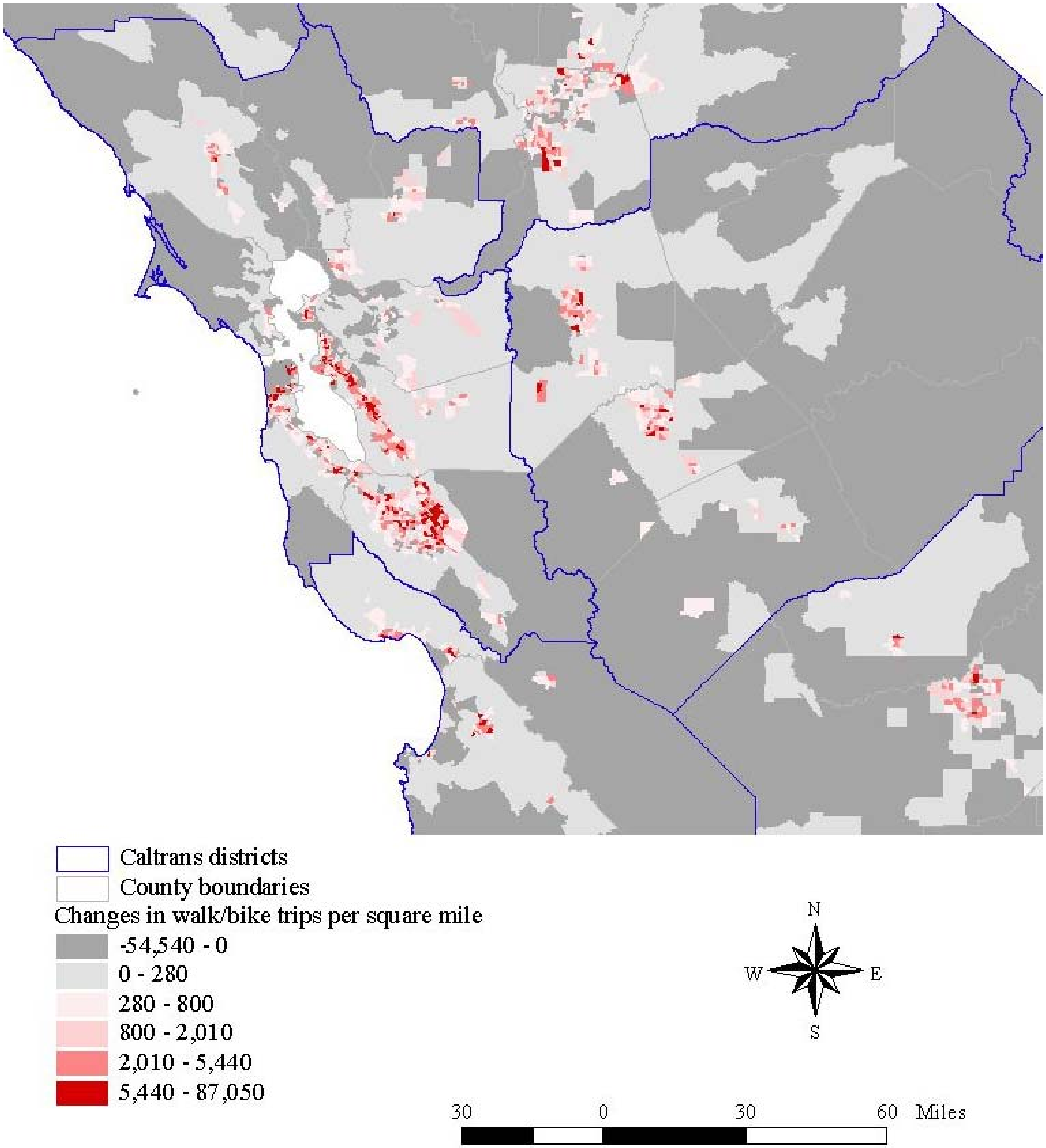
Map 39: Changes in Daily Auto Trip Density, Bay Area/Sacramento, 2000 to 2025



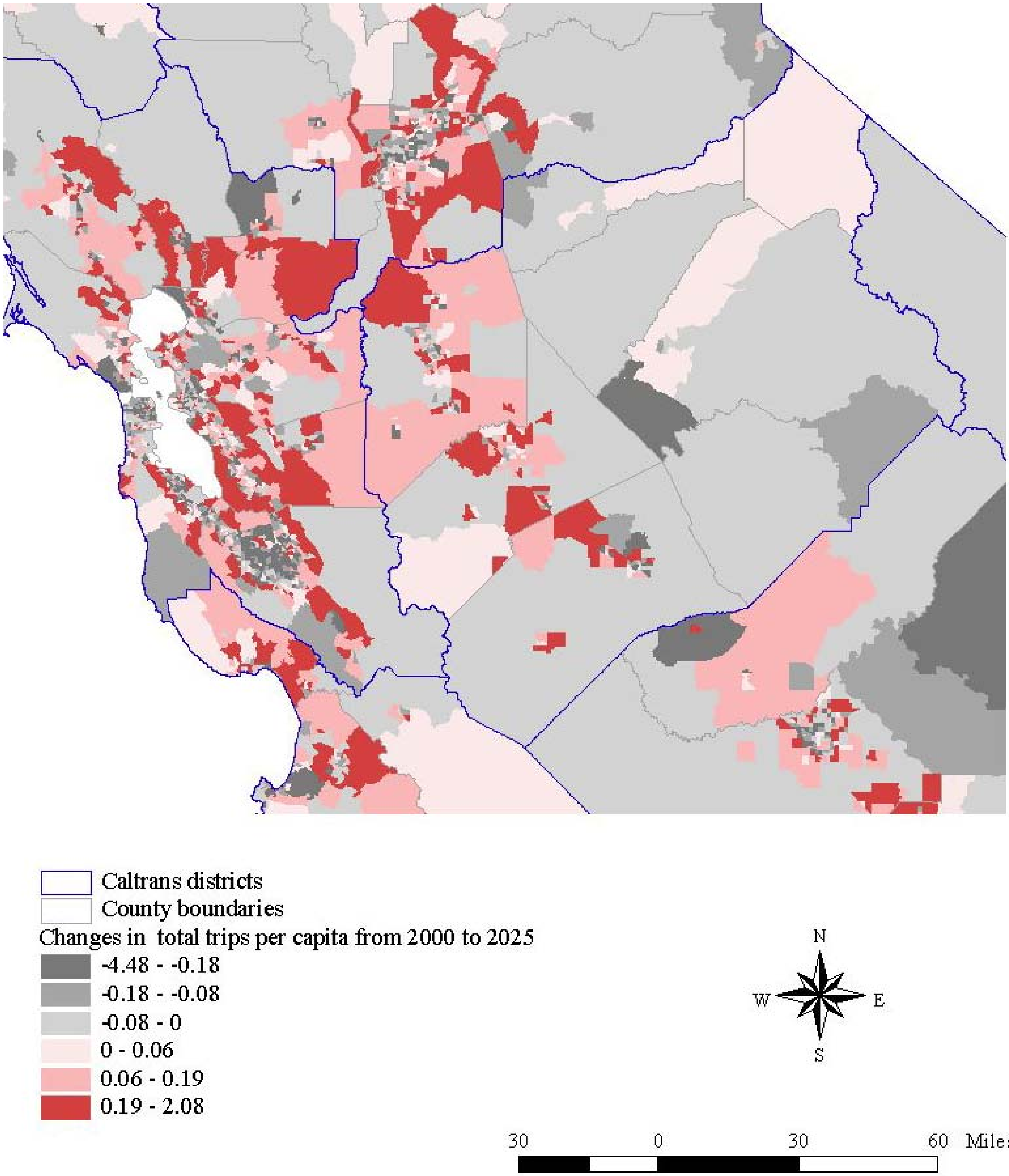
Map 40: Changes in Daily Transit Trip Density, Bay Area/Sacramento, 2000 to 2025



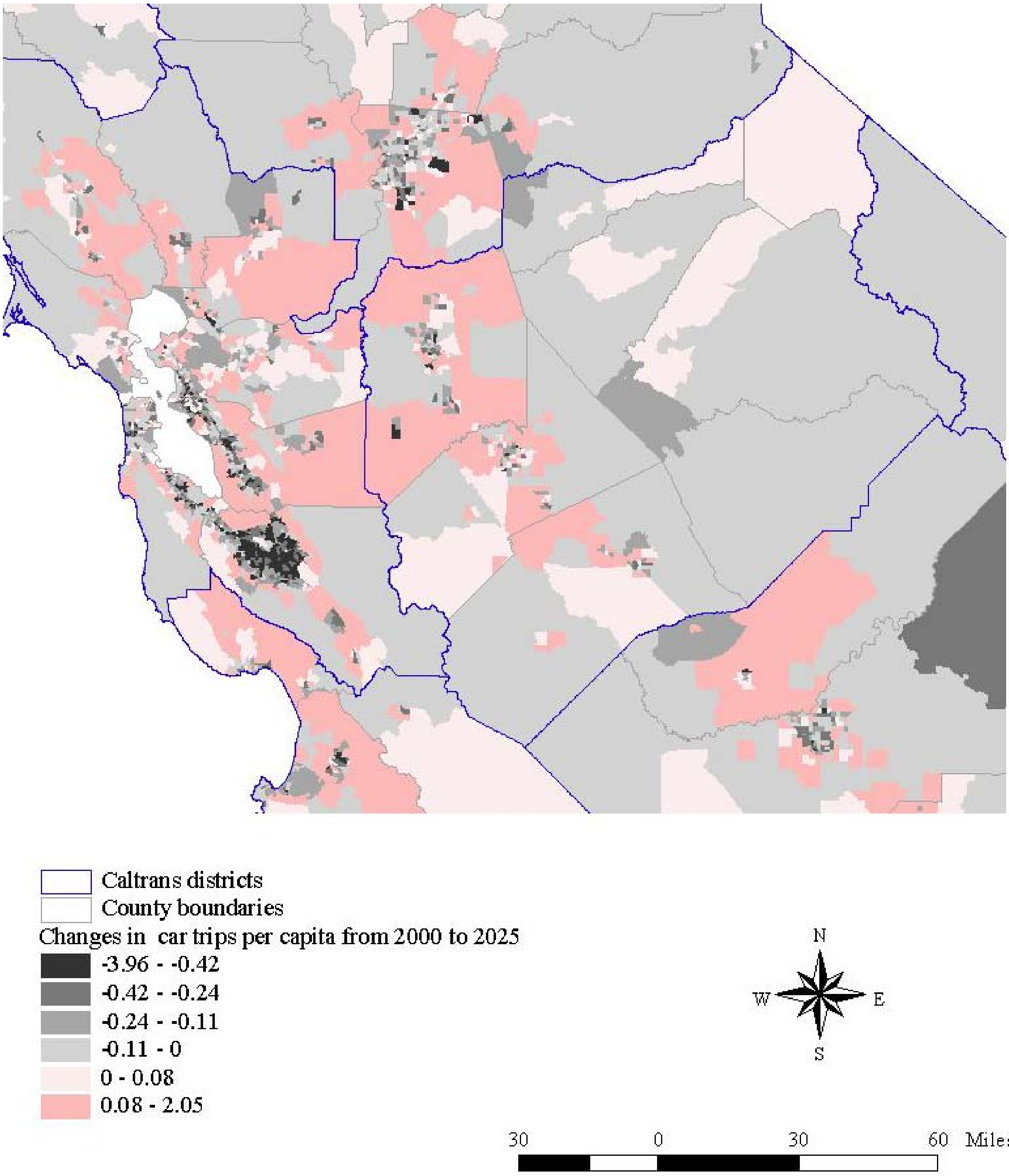
Map 41: Changes in Daily Walk/Bike Trip Density, Bay Area/Sacramento, 2000 to 2025



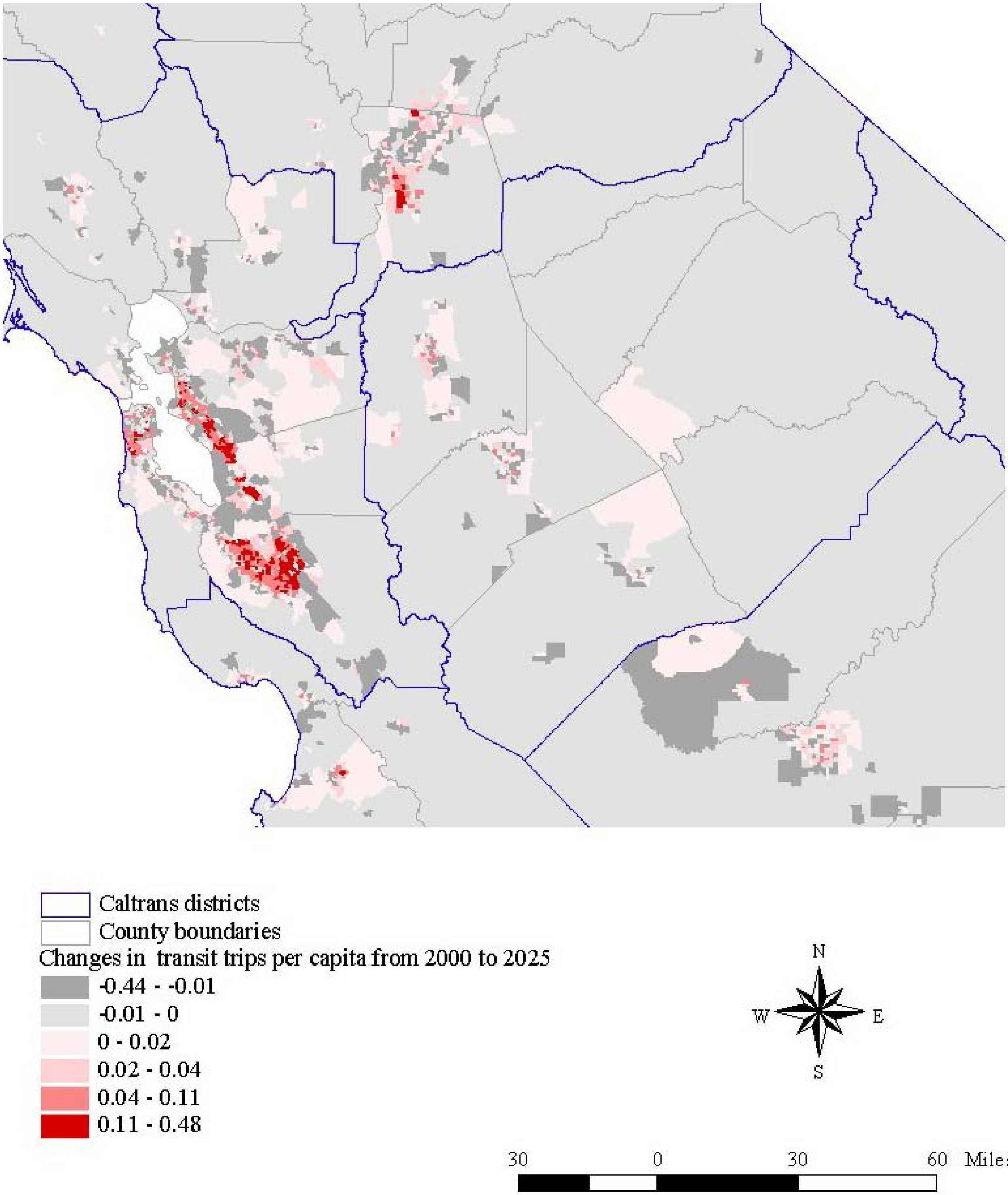
Map 42: Changes in Daily Trips Per Capita, Bay Area/Sacramento, 2000 to 2025



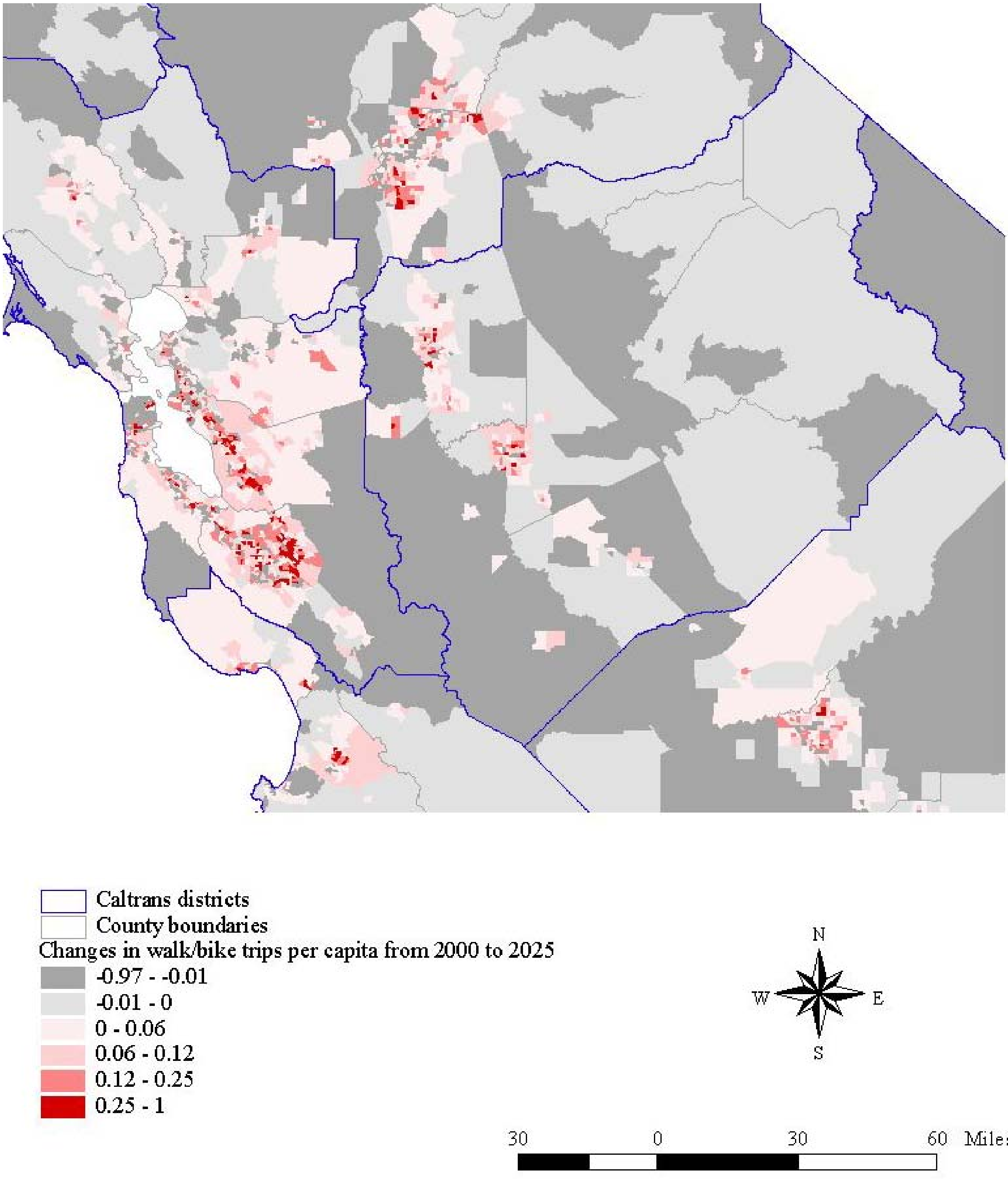
Map 43: Changes in Daily Auto Trips Per Capita, Bay Area/Sacramento, 2000 to 2025



Map 44: Changes in Daily Transit Trips Per Capita, Bay Area/Sacramento, 2000 to 2025



Map 45: Changes in Daily Walk/Bike Trips Per Capita, Bay Area/Sacramento, 2000 to 2025



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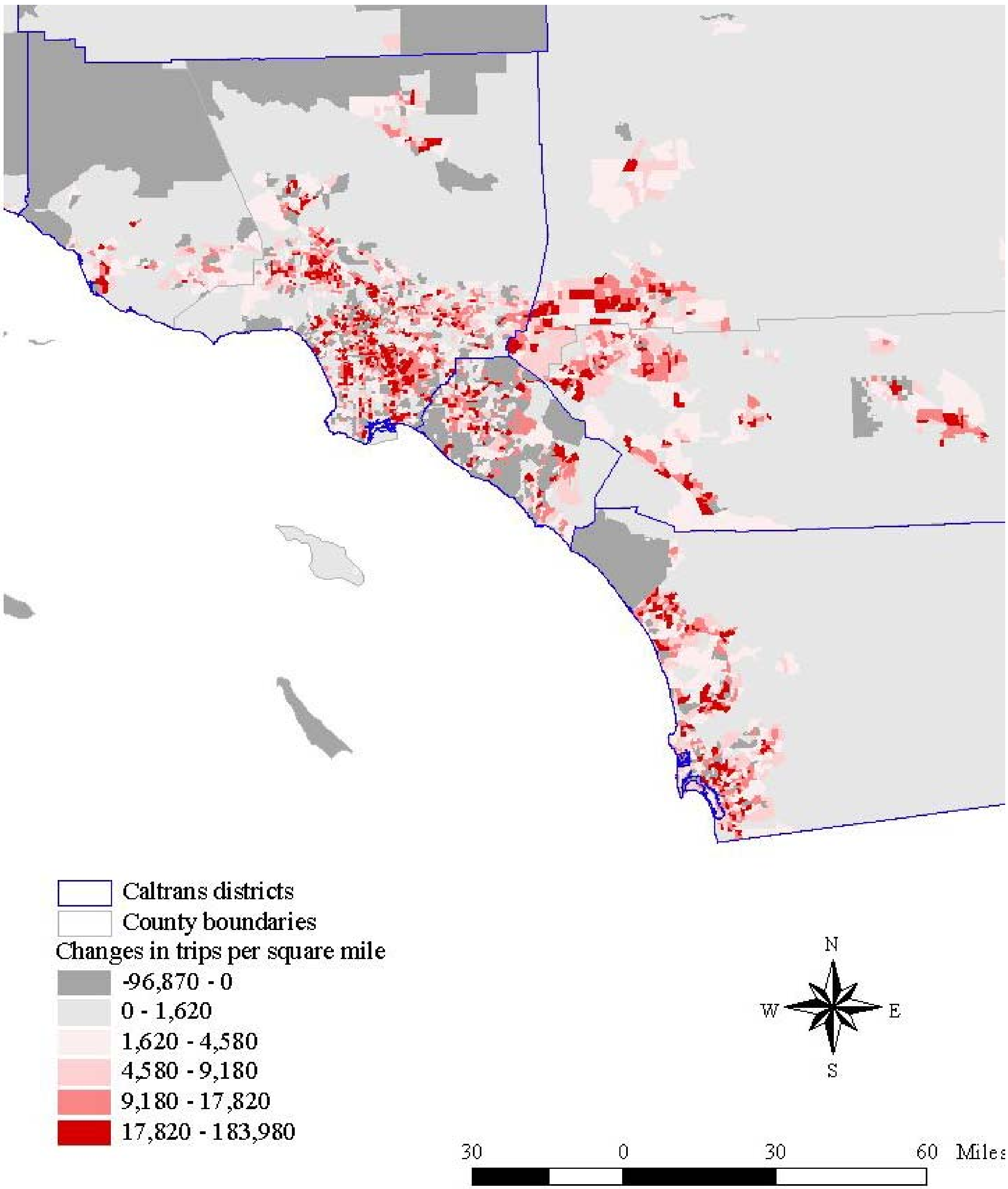
TRAVEL TREND MAPS: SOUTHERN CALIFORNIA

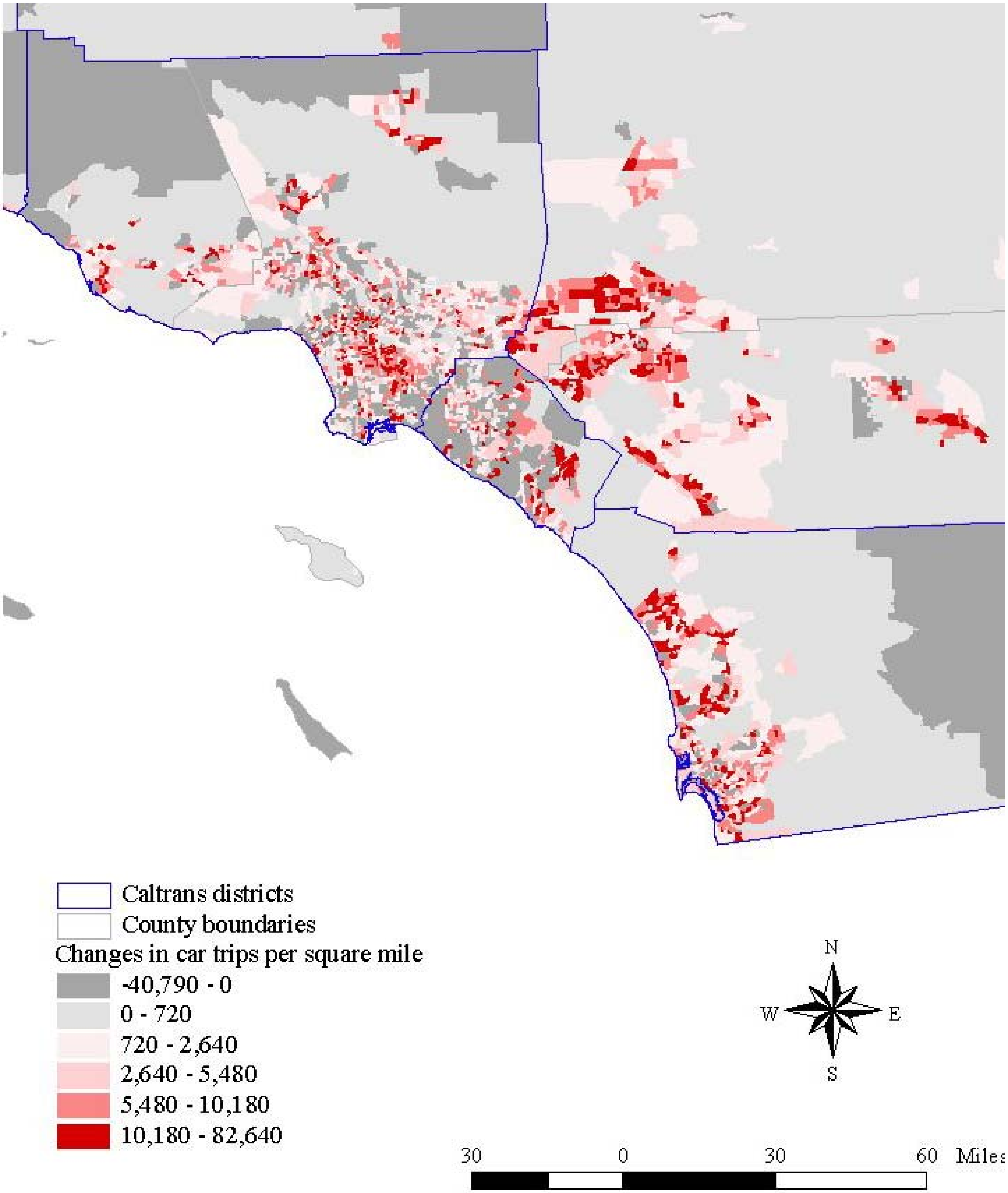
This Appendix contains selected maps developed by UCLA to show travel demand trends from 2000 to 2025 in Southern California.

Sources: Census-tract-level travel demand projections developed by UCLA, based on an empirical model applied to 2000 Census data and population projections for 2025 prepared by Solimar Research Group. For an explanation of methodology and data sources drawn upon, see Sections 4 and 6.

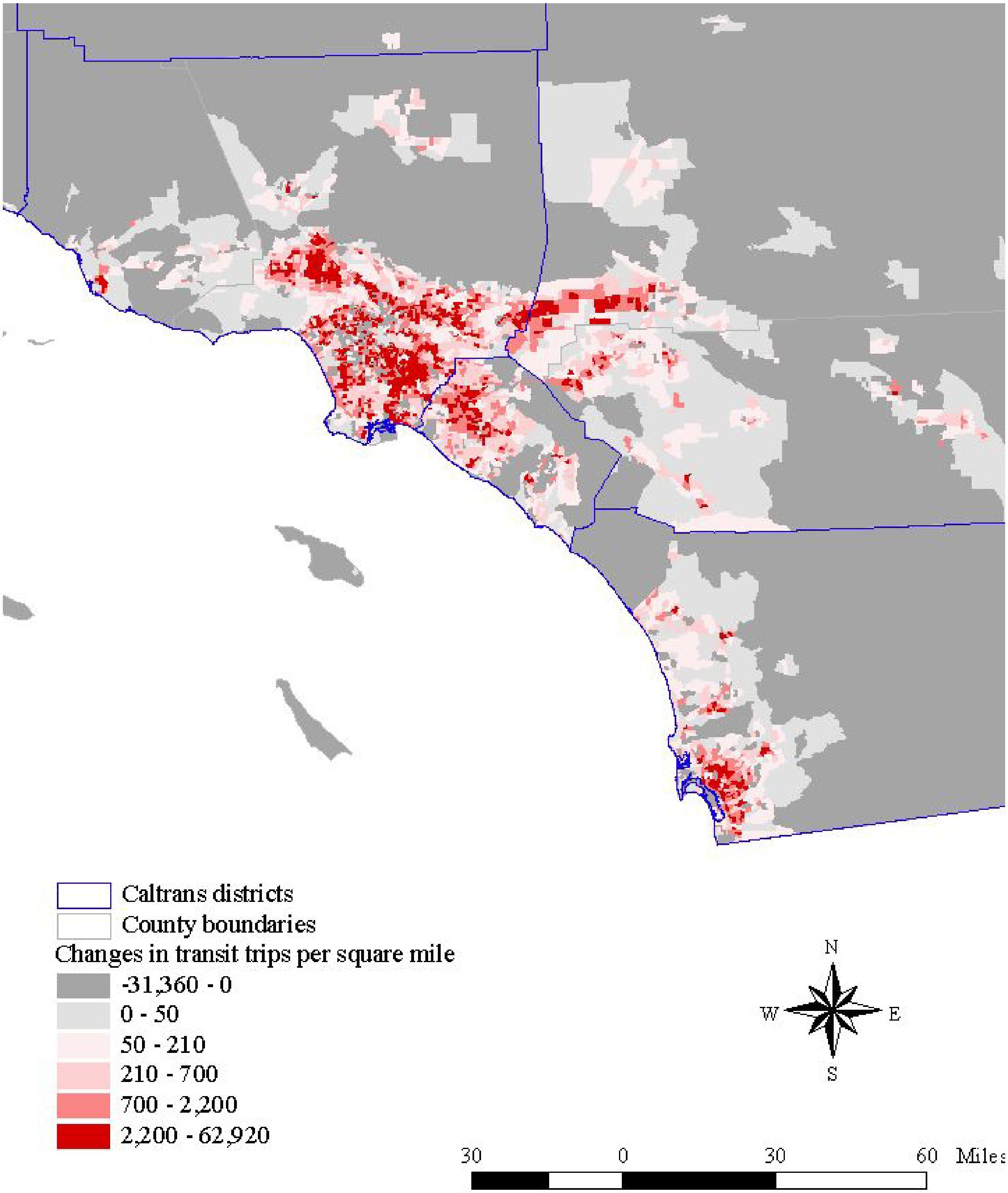
Map 46: Changes in Southern California Daily Trip Density, 2000 to 2025



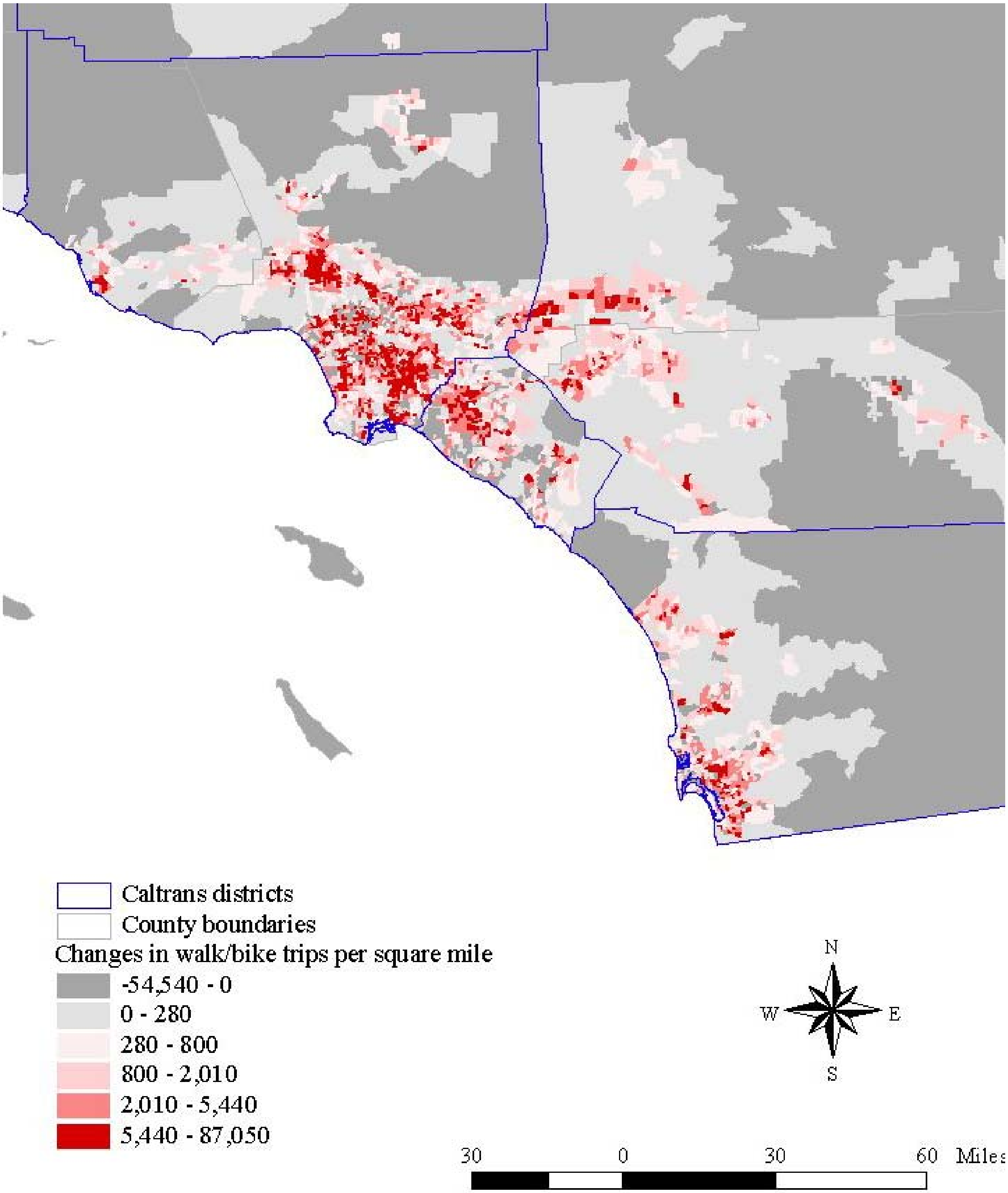
Map 47: Changes in Southern California Daily Auto Trip Density, 2000 to 2025



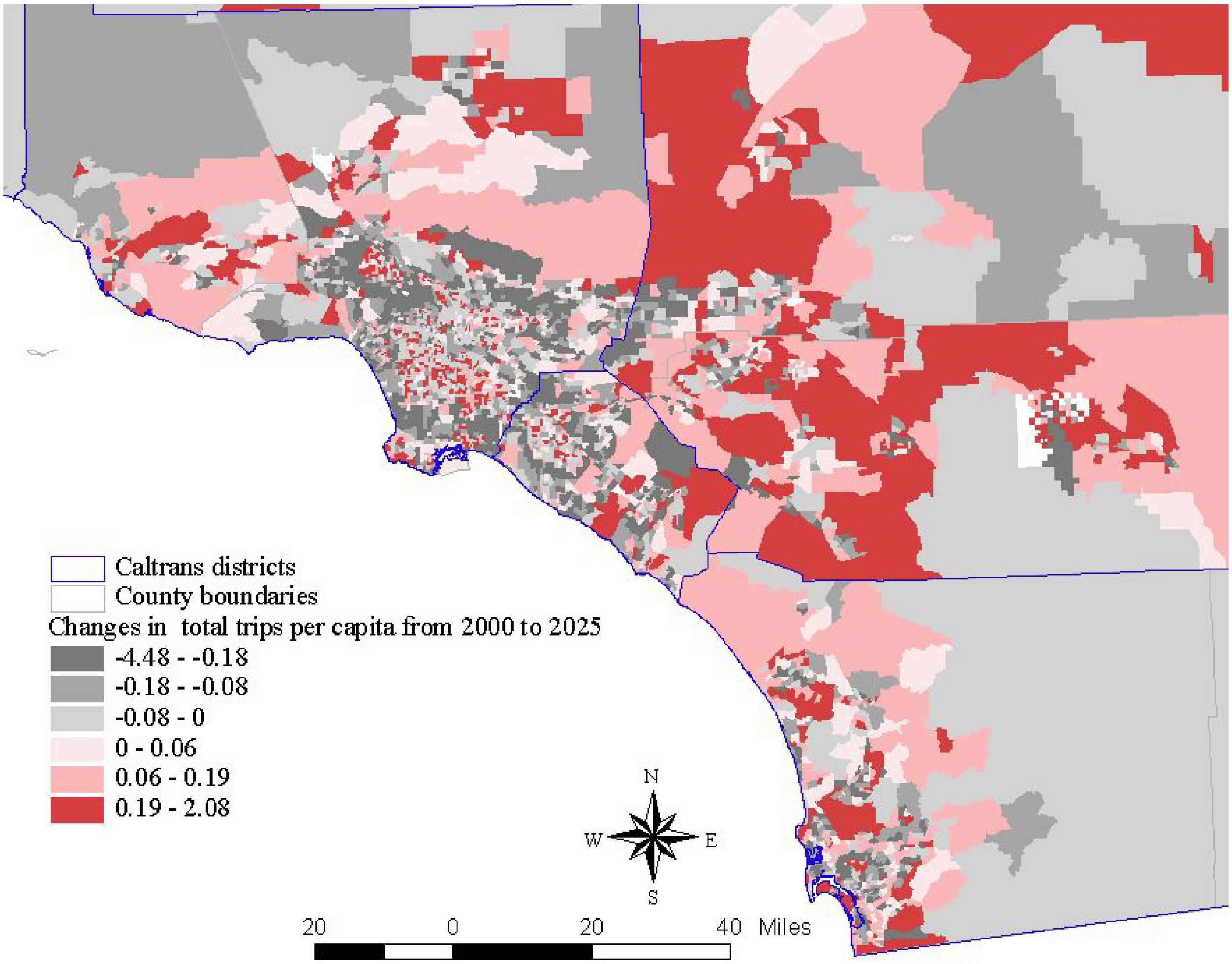
Map 48: Changes in Southern California Daily Transit Trip Density, 2000 to 2025



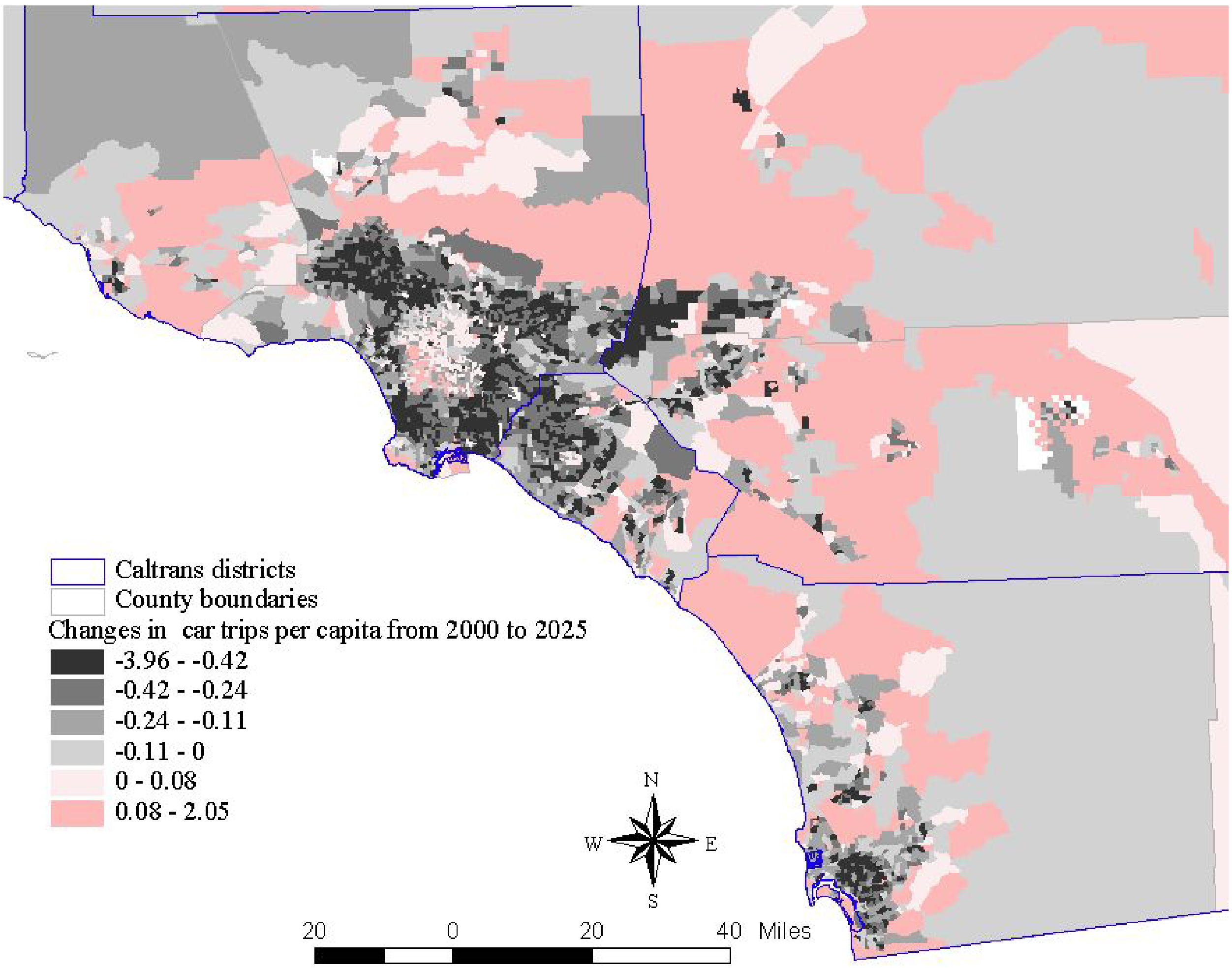
Map 49: Changes in Southern California Daily Walk/Bike Trip Density, 2000 to 2025



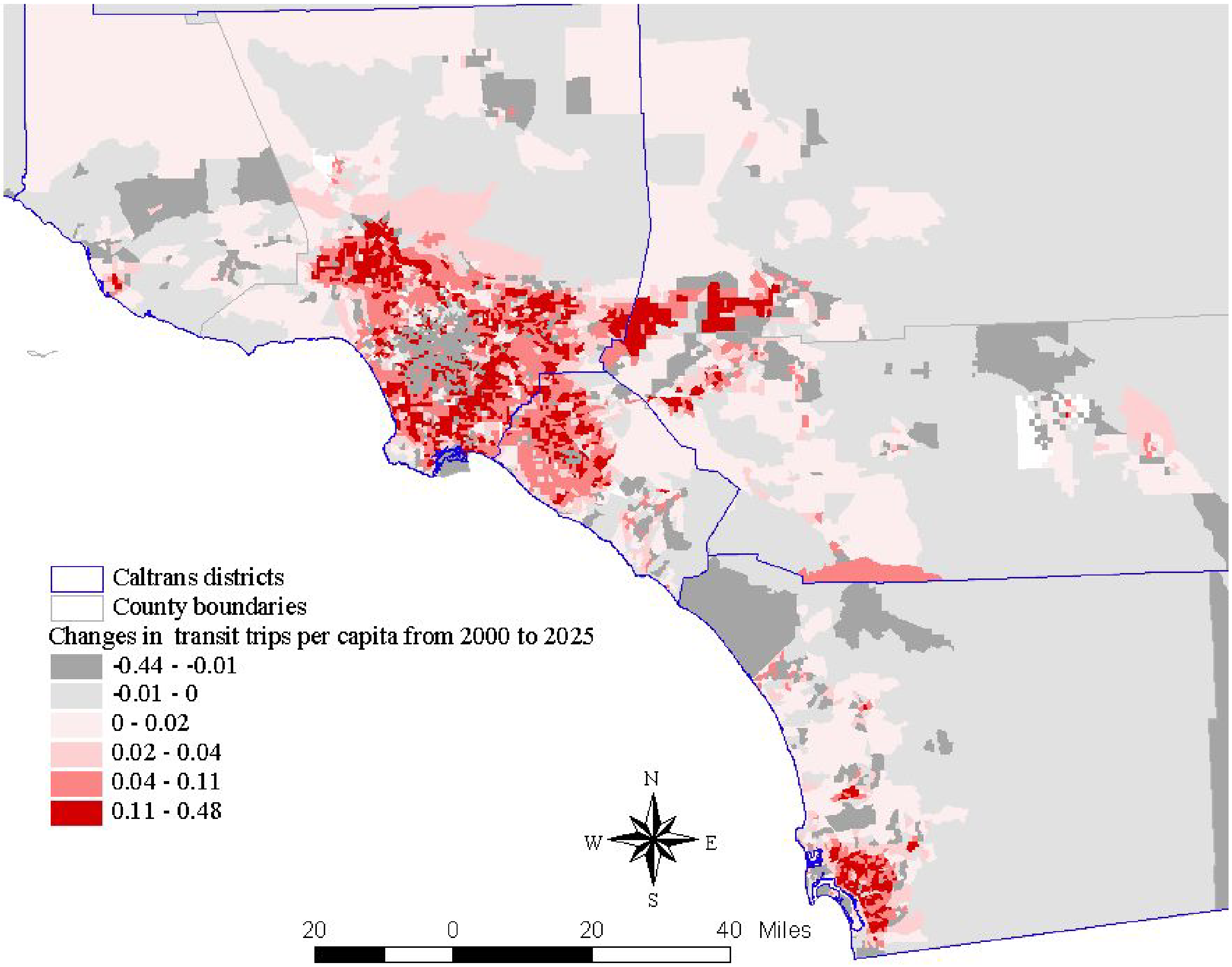
Map 50: Changes in Southern California Daily Trips Per Capita, 2000 to 2025



Map 51: Changes in Southern California Daily Auto Trips Per Capita, 2000 to 2025



Map 52: Changes in Southern California Daily Transit Trips Per Capita, 2000 to 2025



Map 53: Changes in Southern California Daily Walk/Bike Trips Per Capita, 2000 to 2025