

THE TRAVEL BEHAVIOR OF MINORITY
COHORTS IN TEXAS

by

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Presented to the Faculty of the Graduate School of
The University of Texas at Arlington in Partial Fulfillment
of the Requirements
for the Degree of

MASTER OF SCIENCE IN CIVIL ENGINEERING

THE UNIVERSITY OF TEXAS AT ARLINGTON

August 2007

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ACKNOWLEDGEMENTS

I would like to thank all the faculty members of the Civil & Environmental Engineering Department at UT Arlington, for their dedication to teaching and their passion for the Civil & Environmental Engineering profession, a profession that touches so many people on the daily basis. More importantly, I would like to thank my advisor, Dr. Stephen Mattingly, for encouraging me to do whatever I found interesting in the transportation engineering field, and for his guidance and advice while writing this thesis. Furthermore, I would like to thank Dr. Siamak Ardekani, for his advice on pursuing graduate school at my Alma Mater. Also, I would like to thank Dr. Melanie Sattler and Dr. Mattingly for allowing me to participate in research activities as an undergraduate; these experiences helped me discover the world of engineering research. I would also like to thank Dr. Jim Williams for his dedication to the Transportation Engineering field, and his encouragement throughout the years.

Moreover, I would like to thank all the Civil Engineering Staff that helped me through my undergraduate and master's years in filling all the paperwork needed for enrollment, graduation, and research. I would like to thank especially Diane Copeman, Ava Chapman, Ginny Bowers, and Barbara Wallace, for their cheerful and prompt assistance. Moreover, I would like to thank Nancy Rowe, the SAS consultant at UT Arlington, for helping me make the large amounts of data used for this research manageable through SAS.

July 23, 2007

ABSTRACT

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Publication No. _____

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The University of Texas at Arlington, 2007

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Texas is changing dramatically; the most conservative population forecast indicates that Hispanics will account for 50% of the Texas population before 2035. Not only is the number of Hispanics on the rise in Texas, but also the foreign-born share has increased dramatically over the last 15 years. The State of Texas is now a majority minority state, and minority cohorts are expected to grow and become more than 65% of the Texas population before 2035. Transportation professionals in the State of Texas are wondering how these demographic changes will affect the transportation system. To gain an understanding of this, one must consider the prevalent travel behavior and attitudes of these minority groups, their cultural preferences, and their traveling mode preferences. This research provides an understanding of the travel behavior of Texas'

burgeoning minority cohorts, and assists in identifying potential transportation policy concerns. For this analysis the National Household Travel Survey (NHTS) Add-On for the State of Texas is used, because it allows us to examine respondents by race/ethnicity and immigrant status. This study also helps determine how the travel behavior of minority cohorts may impact the state's transportation system in the near future, and possible implications to travel demand models are offered. In addition, this research attempts to foster further research on the travel behavior of burgeoning minority populations within the State of Texas. This study provides descriptive statistics, and multivariate models that examine the travel behavior of minority cohorts.

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CHAPTER 1

INTRODUCTION

Texas is changing dramatically; the most conservative population forecast indicates that Hispanics will account for 50% of the Texas population before 2035. Not only is the number of Hispanics on the rise in Texas, but also the foreign-born share has increased dramatically over the last decade. The State of Texas is now a majority minority state. Transportation professionals in the State of Texas need to consider the travel behavior and attitudes of these minority groups, their cultural preferences, their traveling mode preferences, amongst other relevant factors. This thesis will attempt to answer some of these questions by providing descriptive statistics, and building multivariate models that examine the travel behavior of minority cohorts in Texas. For this analysis the National Household Travel Survey (NHTS) Add On for the State of Texas will be used, because it allows us to examine respondents by race/ethnicity and immigrant status.

There are three main objectives for this research. (1) Understand the travel behavior of rapidly-growing minority cohorts, so as to provide information that will allow transportation professionals to examine environmental justice issues within the state. (2) Determine how the travel behavior of minority cohorts may impact the state's transportation system in the near future. (3) Foster further research on the travel behavior of burgeoning minority populations.

1.1 Motivation for this Research: The Changing Face of Texas

First, it is crucial to understand the situation that Texas is facing. Texas is changing dramatically, “Higher international immigration, a high Hispanic birthrate and less domestic immigration—resulted in Texas’ Anglo population dipping below the majority level of 50% in 2003 for the first time since the 1800s.”¹ The 2000 US Census found that “half of all Hispanics [in the United States] live in just two states: Texas and California”. In 2000 California had 10,966,556 Hispanics and Texas followed it with 6,669,666 Hispanics². The Hispanic populations are growing much faster than any other race/ethnicity cohort, and the Anglo population are getting older and growing at a much slower rate³. This demographical change is astonishing, and the Federal Reserve Bank (FRB) of Dallas has already stated implications for the education, the housing, and the health care industries (Petersen and Assanie, 2005). In the transportation sector these demographic changes are likely to have an impact, but little is known about it. Consequently, understanding how the changing face of Texas will impact the transportation industry is the motivating force behind this thesis, and an objective for this research.

1.2 Immigrants: A Major Factor for Hispanic Growth

The changing face of Texas is dependent largely upon the large groups of Hispanic immigrants that come to live and work in Texas. The 2000 US census

¹ D’Ann Petersen and Laila Assanie, “The Changing Face of Texas: Population Projections and Implications,” Federal Reserve Bank of Dallas, (October 2005): 38.

² U. S. Census Bureau. “The Hispanic Population,” Census 2000 Brief. Issued May 2001.

³ Petersen and Assanie, “The Changing Face of Texas,” (October 2005): 1.

indicated that 13.9%⁴, almost 3 million people, of the Texas population was foreign-born. In addition, 74.9%⁵ of this foreign-born population is Hispanic or Latino. Hispanic immigrant estimates may be lower than reality, since many illegal immigrants may have not been accounted for. The FRB of Dallas indicated: “In recent years, growth of the foreign-born has been even more rapid in Texas’ major metros than its border metros.” Austin, Dallas, and Fort Worth experienced the most rapid growth of foreign-born population. Rapidly growing foreign-born populations may play an important role in the transportation sector, because “Immigrants who are not yet captives of the American norms and attitudes may play an important role as agents of change, for example by using new transit services”.⁶

In 2005, Handy and Tal analyzed the travel behavior of immigrants; their main objective was to determine if immigrant’s place of birth, race/ethnicity, and year of entry to the United States would significantly affect their travel behavior. Their study was conducted at a national level, using the aggregated 2001 NHTS data, and they found that “multivariate analyses show that immigrant status, race/ethnicity, and place of birth are associated with certain aspects of travel behavior, even after accounting for socio-demographic factors.”⁷ This finding is crucial, because it suggests that rapidly rising minority cohorts—such as the Hispanic cohorts in Texas—may have different travel behaviors and attitudes, which current assumptions in transportation models and

⁴ U. S. census Bureau, Census profile: Texas 2000.

⁵ U. S. Census Bureau, Census profile: Texas 2000.

⁶ Gil Tal and Susan Handy, “The Travel Behavior of immigrants and race/ethnicity Groups: An Analysis of the 2001 National household Travel Survey,” Institute of Transportation Studies (Davis: University of California, 2005): 2.

transportation policy may not be accounting for. Given the rapidly changing demographics in Texas, these differences are likely to make an impact. Needless to say, understating the travel behavior of immigrants and other minority cohorts is important for Texas' transportation planners.

Hispanic immigrants are a major factor for Hispanic growth in Texas, but Hispanic immigration is not the only cause for Hispanic growth. The Federal Reserve Bank of Dallas noted that Hispanics have much higher birthrates than Anglos or Blacks, and they state that "Texas will continue to see large natural increases in its population despite changes in economic conditions or immigration policies."⁸ Texas' transportation analyst and professionals should not only understand the travel behavior of immigrants, but more importantly the travel behavior of burgeoning minority cohorts, like U. S. born and foreign-born Hispanics.

Understanding the travel behavior of Blacks, Hispanics, immigrants and other minority communities will also allow transportation planners to be better prepared to answer sensitive transportation policy issues within the state, and address cultural and societal transportation needs of these minority communities. Moreover, understanding the needs of minority groups and how these needs may affect transportation policy in the future is an important objective for this research.

1.3 The Challenge for Texas and its Transportation Professionals

Demographic changes in Texas have been studied in the recent past by Texas' Metropolitan Planning Organizations (MPOs) and state organizations; however, not

⁷ Ibid., 33.

much is known about the impacts that these changes will bring to the transportation industry. To my knowledge, no research has been done on this critical issue in Texas. Today, some transportation planners are wondering how these cultural changes will affect the transportation system. In Texas, minority communities are on the rise, and these minorities have already become the majority within the State. Environmental justice issues will be especially relevant in the near future, since it has been noted that Hispanics and Blacks tend to have more young children in their households, and statistical test reveal that about 25% of young urban Hispanic and Black children live below the poverty line (Berube and Kneebone, 2006). In Transportation, environmental justice problems could be encountered if minority population were to experience undue delays, and poor transportation services in their communities.

Given that Hispanics are the fastest growing community in Texas, it would be important to meet their transportation needs, so as to facilitate their access to jobs and educational hubs. The FRB of Dallas states that “Texas’ Hispanics tend to have lower levels of education, have lower wages and depend more on state services. This is partly a result of immigration—Mexican immigrants tend to have average wages 40 percent below those of natives. These wage differences reflect that the immigrants are young, have scant job experience and speak little English.”⁹ In order to bridge the economic gap between these race/ethnicity groups the FRB of Dallas suggests:

⁸ Petersen and Assanie, “The Changing Face of Texas,” (October 2005): 38.

⁹ Petersen and Assanie, “The Changing Face of Texas,” (October 2005): 40.

Disparities in income and education between Hispanics and other ethnic groups may be a challenge to Texas and its resources. The state could reduce such socioeconomic differences through increased educational attainment and training so that in coming decades, the state's workforce will continue to be one of the most competitive in the nation.¹⁰

Therefore, transportation professionals in Texas must be aware of the travel characteristics of Hispanics and other minority groups, so as to foster transportation equity for all the peoples of Texas, and facilitate their access to jobs and educational opportunities.

1.4 Research Overview

Minority cohorts are expected to grow and become more than 65% of the Texas population before 2035.¹¹ These changes will dramatically impact the State of Texas, and transportation professionals must be aware of these changes while modeling transportation, assessing transportation projects, and evaluating environmental justice issues within the State. In order to achieve the three previously stated objectives of this research, it is necessary to make a cross-sectional analysis of the demographic and socio-economic tendencies of these minority groups in the state.

First, a literature review on the travel behavior of race/ethnicity groups is presented. This review encompasses two sections, one that deals with the demographical characteristics, and the other that deals with prior findings on the travel behavior of race/ethnicity cohorts. Then, the research methodology and the Texas NHTS sample are presented, and the six cohorts chosen for this study are explained in

¹⁰ Petersen and Assanie, "The Changing Face of Texas," (October 2005): 44.

¹¹ Population Estimates and Projections Program, Texas State Data Center Population. (2006).

greater detail. Next, descriptive statistics are shown that relate to each particular minority cohort; these statistics illustrate the prevalent socio-economic circumstances of each cohort, their perceptions of the transportation system, and their prevalent travel behavior. Finally, results from the multivariate analysis undertaken for this research are presented; the analysis demonstrates how these demographic changes may impact transportation modeling. This research hopes to further the discussion, and encourage more studies on this critical subject within the State of Texas. Besides, any urban area in the U. S. experiencing rapid demographic changes needs to engage in research and discussion of these critical topics.

CHAPTER 2

LITERATURE REVIEW ON THE TRAVEL BEHAVIOR OF MINORITY COHORTS

2.1 Introduction

In the recent past, few papers have been written regarding the travel behavior of race and ethnicity groups in the United States. The majority of these papers have come from the State of California, sponsored by California's Department of Transportation, the Transportation Center of the University of California, and other non-governmental organizations (NGOs). They have analyzed cities within their boundaries (Mondschein et al., 2005); also they have conducted targeted surveys for specific areas within California (Valenzuela et al; 2004, Taylor and Mauch; 1998), and some research at the national level has been done at California Universities (Tal and Handy; 2005, Pamuk, A; 2004). In Texas, Casas and others (2004), from *NuStats* International, published a nation-wide study on the *Latino Immigrant and Its impact on Future Travel Behavior*. These papers, and other related transportation statistics, have shed light on the travel behavior of immigrants and minority cohorts within the United States.

While some research on the travel behavior of Hispanic immigrants and other race/ethnicity groups has been done, generalizations on these issues are hard to make, because Hispanic populations are different for each state. In Texas, the Hispanic population goes back before the founding of the State; in fact, at one time, the majority of the Texas population was Hispanic. Thus, the majority of Hispanics in Texas are not

recently arrived immigrants; instead, some Hispanics in Texas may have roots in the state going back several generations. Some Hispanics are not very different from Anglos, and many Texans classify themselves as “White & Hispanic”. According to the 2000 US census, 67.4% of the Hispanic population in Texas was born in the United States. While, the State of California has a similar history, only 55% of California’s Hispanics were born in the United States. Furthermore, there is a marked difference of immigrant share between California and Texas. Only 55.6%¹² of the foreign born in California are Hispanic. On the other hand, Asians, the second largest immigrant group in California, account for 32.9% of the foreign born. Compare these figures to a 74.9% Hispanic and a 16.1% foreign-born Asian population in Texas¹³. These demographic variations present different challenges for each state; however, the travel behavior of the different cohorts is a common challenge for both states.

2.2 Demographic Characteristics of Race/Ethnicity Cohorts

In order to understand the travel behavior of race and ethnic cohorts, one must first understand the prevalent socio-demographic characteristics of these populations. Most travel demand models account for level of income, car ownership, and family size, along with other socio-demographic household information to predict trip generation; “individual travel behavior is heavily dependent on socioeconomic attributes.”¹⁴ However, in an ever globalizing world, cultural and social preferences may play an increasingly important role in determining travel demand and mode choice. Therefore,

¹² US census Bureau, Census profile: California 2000.

¹³ US census Bureau, Census profile: Texas 2000.

¹⁴ Ortuzar and Willumsen, (2002), “Modeling Transport,” Third Edition: 126.

in this subchapter the demographic trends for the four major race and ethnic groups in Texas will be analyzed. The Texas State Data Center (TSDC) has defined four major race/ethnicity groups within the state; these groups are Anglo, Hispanic, African American, and Other¹⁵. These broad minority categories are used throughout this paper.

2.2.1. Hispanics

Casas et al. (2004) found that “Hispanic households are more likely to settle in metropolitan statistical areas (MSA) of 3 million or more, predominantly in the western portions of the United States.”¹⁶ This is noteworthy, because in the recent years Dallas, Austin, Fort-Worth and Houston have increased their Hispanic populations dramatically¹⁷. In 2000, the fertility rate among Hispanics women in Texas (2.85) [was] much higher than it [was] for African-American women (2.05), Other Race/Ethnic women (1.89), and Anglo women (1.92).¹⁸ These numbers indicate that the Hispanic population will continue to grow, even with changes in immigration policies.

2.2.2 Anglo

This study will not attempt to carefully analyze the Anglo population, since most transportation surveys and travel demand models capture the needs of these populations well. However, it is important to consider that the Anglo population is

¹⁵ Population Estimates and Projections Program, Texas State Data Center Population Projection, “Projections of the Population of Texas and Counties in Texas by Age, Sex, Race/Ethnicity for 2000-2040,” (October 2006): 3-5.

¹⁶ Jesse Casas, Carlos H. Arce, and Christopher Frye, “Latino Immigrations and Its Impact on Future Travel Behavior,” (October 2004): 5.

¹⁷ Murdock et al, “The Texas Challenge in the Twenty-First Century: Implications of Population Change for the Future of Texas,” The Center for Demographic and Socioeconomic Research and Education, Texas A&M University System (December 2002).

¹⁸ Population Estimates and Projections Program, Texas State Data Center, (2006).

getting older. According to the Texas State Data Center (TSDC) the median age for Anglos in 2000 is 38.0 years, for Blacks 29.6, for Hispanics 25.5, and for the other population it is 31.1 years. Minorities have younger age structure than whites.¹⁹ Moreover, ‘baby boomers’ will be retiring in the next 15 years. Therefore, research on older-person travel is important throughout the U. S.; however, this research is critical for Texas because many U. S. retirees move to locations where the weather is pleasant and less extreme than northern states, such as Texas. Understanding the needs of upcoming older-driver populations may require a targeted survey in the near future that attempts to determine their needs and travel behavior, so that new transportation policies can be developed.

2.2.3 African-American (*Black*)

The African-American population is expected to remain a minority in Texas, “Blacks are expected to make up 9.5% of Texas’ population in 2040.”²⁰ After Hispanics, “Blacks had the second-highest poverty rate (23.4 percent) [but their] median income [is] less than that of the [U. S. born] Hispanics.”²¹ Immigration from African nations to Texas is low, and African-born immigrants account for only 2.2% of the foreign-born population in Texas. Thus, this race cohort is not experiencing rapid growth due to immigration; however, anecdotal accounts indicate that migrations due to Hurricane Katrina’s evacuation in September 2005 have slightly increased the African-American population in Texas.

¹⁹ Population Estimates and Projections Program, Texas State Data Center Population. (2006).

²⁰ Petersen and Assanie, “The Changing Face of Texas,” (October 2005): 44.

²¹ Petersen and Assanie, “The Changing Face of Texas,” (October 2005): 41.

2.2.4 Other Race/Ethnic Groups

The “Other” category accounts for all race/ethnicity groups that are not Hispanic, Black or Anglo, and in 2000, these groups accounted for only 3.3% of the Texas population. However, 18.5% of the foreign-born in Texas belong to the “Other” category. Most of these “Other” immigrants are coming from Asia. Tal and Handy (2005) examined Asian travel behavior with an appropriate level of statistical significance using the NHTS national sample. Relevant findings from their study will be explained in the following section of this chapter. Asians tend to be the most educated group amongst immigrants. Furthermore, as a race/ethnic group they have the highest median annual income in the U. S. (\$55,300)²². According to the FRB of Dallas, by 2040 in Texas “other races (not Anglo, Black, or Hispanic) are expected to grow [from 3.3 percent] to almost 6 percent of the population.”²³

2.3 Travel Behavior and Preferences of Minority Cohorts

Few papers have been written about the travel behavior of minority populations. These papers provide an idea of demographic trends and travel behaviors particular to minority and immigrant groups in the United States. In this section, a synthesis of the body of knowledge regarding the travel behavior and preferences of Hispanics, immigrants, and other minority race/ethnicity groups is presented.

2.3.1 Hispanics and Hispanic Immigrants

The Hispanic population in the US has been analyzed in different ways; Casas and others (2004) developed three categories: (1) US Hispanics (born in the US), (2)

²² U.S. Census: “People Income and Employment”. American Fact Finder 2002-2003. (2005).

Settled Hispanics (immigrants who have been in the US more than 2/3 of their lives), (3) Newcomer Hispanics (immigrants who have been in the US less than 1/3 of their lives). They study the Hispanic population at the National level, and their study suggests that “Hispanics will become increasingly dependent on transportation (whether it is public or otherwise) over the next five to ten years.”²⁴ This is because they found that Hispanic households make more trips on average than non-Hispanic households (Casa et al; 2004). Moreover, they also found that 14.6% of all US Hispanics live in zero vehicle households, whereas only 7.7% of non-Hispanic households have zero vehicles. In contrast, they found an average of 1.66 workers per Hispanic household and an average of 1.29 workers in non-Hispanic households. Nationally, they forecasted that 15.4% of all Hispanic households will have zero vehicles by 2009²⁵. Given their low vehicle ownership, these estimates indicate an increasing dependency on public transportation among Hispanics.

Recent research on Hispanic travel by Valenzuela, Schweitzer and others suggests that the Hispanic’s demand for public transportation is large, and this research may also indicate that public transportation services may not be meeting their demands. Many Hispanics use *Camionetas* (vans) as an alternative form of travel, instead of established transit services. Valenzuela and others (2005) studied the phenomenon of *Camionetas*, an informal—illegal—jitney service that meets the travel needs of

²³ Petersen and Assanie, “The Changing Face of Texas,” (October 2005): 44.

²⁴ Jesse Casas, Carlos H. Arce, and Christopher Frye, “Latino Immigrations and Its Impact on Future Travel Behavior,” (October 2004): 6.

²⁵ Jesse Casas, Carlos H. Arce, and Christopher Frye, “Latino Immigrations and Its Impact on Future Travel Behavior”, (October 2004): 16.

immigrants in the United States. “The American Bus Association estimates that 8 million Latinos in the United States use van and bus services annually, spending more than \$200 million, with a large amount of that going to *Camionetas* (Schrader, 2000)”. Valenzuela and others (2005) conducted a targeted survey to examine the characteristics of this *unofficial* traveling mode. “According to the interview sample, and ethnography, *Camioneta* travelers are overwhelmingly male (92 percent), comparatively young (42 percent under 30 years of age), and almost evenly split between documented (53 percent) and undocumented (47 percent) patrons.”²⁶ This study indicates that newcomer immigrants, legal or illegal, are likely to benefit from community oriented transportation services.

National implications of the recent Hispanic immigrant growth discussed by Casas and others (2004) also indicate that recent Hispanic immigrants tend to purchase used vehicles because they are less expensive, and “with the growth of this population and the increase in the ownership of older vehicles, a negative impact on air quality can be expected even with new or more stringent laws governing vehicle emissions.”²⁷ This statement needs to be considered carefully, since Hispanic populations are not very large in many states, and almost null in some U. S. urban areas. On the other hand, Anglos spend 40.1 percent of all their trips driving alone, more than Blacks and Hispanics; moreover, the Hispanic cohort is the race/ethnic group more likely to carpool, where 55.5 percent of their urban trips are done in a vehicle with two or more

²⁶ Valenzuela, Schweitzer, and Robles, “Getting Around in Camionetas (vans) Alternative Travel Among Immigrants.” Transportation Research. Part A, Policy and Practice. (2005).

occupants.²⁸ This may indicate that Hispanics are more likely to benefit from dedicated HOV lanes, and drive fewer vehicles to meet their travel needs. Therefore, this claim needs to be carefully researched, so as to accurately determine the environmental impacts that the Hispanic cohort may have on air quality in the future.

2.3.2 African-Americans (Blacks)

Previous research on African-American travel behavior indicates Blacks are much more likely to take transit than any other race/ethnic group. Pucher and Renne (2004) found that African-Americans and Hispanics make up more than half of the nation's transit users. Tal and Handy (2005) from their nation-wide study, state:

Differences in commute also differ for race/ethnicity groups. Although driving dominates as a commute for all groups, this dominance is greatest for white respondents and least for black respondents, whose share of commute trips by walking is twice as high as the share for white respondents and whose share of commute trips by public transportation is ten times as high as for white respondents and twice as high as for other race/ethnicity groups (Handy and Tal, 2005).

The Black cohort has been found to have very different travel patterns than any other race/ethnicity cohort, and these differences are mainly due to their prevalent socio-economic conditions. As confirmed by Handy and Tal's research, Blacks benefit more than any other race/ethnicity group from public transit in the United States.

²⁷ Jesse Casas, Carlos H. Arce, and Christopher Frye, "Latino Immigrations and Its Impact on Future Travel Behavior", (October 2004): 1.

²⁸ John Pucher and John Renne, "Urban and Rural Differences in Mobility and Mode Choice: Evidence from the NHTS 2001," Bloustein School of Planning and Policy, (New Brunswick: Rutgers University, 2004): 9.

2.3.3 Other Race/Ethnicity U.S. Born Groups

Asians are the largest ethnic group after Anglos, Hispanics, and African Americans; however, little is known about their travel behavior. Tal and Handy (2005) found that Asian NHTS survey respondents drive the least vehicle miles per year among all the race/ethnicity groups that they studied. They also found that on average Asian respondents make the fewest bicycle and walk trips per week. In addition, Tal and Handy (2005) found that other race/ethnic groups not classified as Asian, Hispanic, Anglo, or Black are the most likely to have a vehicle in their household after the Anglo cohort. Their findings indicate significant travel behavior differences amongst smaller minority groups.

2.3.4 Non-Hispanic Immigrants

Prior research on the travel behavior of immigrants has found that their behavior tends to mirror the travel behavior of U. S. born populations as they live longer in the United States (Tal and Handy; 2005, Casas et al; 2004, and Myers; 1996). Nonetheless, Tal and Handy (2005) indicated that “immigrant status, race/ethnicity, and place of birth are associated with certain aspects of travel behavior even after accounting for [...] socio-demographics.” They found that “immigrants in general drive less [than U.S. born] but the influence is more significant for recent arrivals.²⁹” Also, they found that “White immigrants account for more than half [of the] immigrants who arrived more than twenty years before the [2001 NHTS] survey, but only about one-third for

²⁹ Tal and Handy, “The Travel Behavior of immigrants and race/ethnicity Groups”, (Davis: University of California, 2005): 32.

immigrants who arrive recently”.³⁰ Tal and Handy also developed multivariate models to test for significance of place of birth and immigrant status in travel behavior, and their finding shows that people born in Eastern Europe, Canada, and the Caribbean, “drive 600 to 700 miles more per year than any other immigrants,”³¹ even after accounting for socio-demographics. Their vehicle miles of travel linear model indicates that Hispanics, U. S. born or not, drive 1357 more miles per year on average than non-Hispanics (Tal and Handy, 2005).

National studies on the travel behavior of immigrants and race/ethnicity groups have indicated that correlations exist between travel behavior, race/ethnicity, and immigrant status. It has been established that as immigrants, Hispanics or not, assimilate into the American way of life, their travel behavior mirrors that of the U.S. born (Casas et al; 2004, Tal and Handy; 2005). Moreover, it has been noted that Hispanic households as a group produce more trips on average than non-Hispanic Households (Casas et al; 2004), no reasons were noted for this behavior.

These are key national findings that need to be considered carefully by transportation planners in Texas. Given Texas’ unique population forecast, and its unique geographical location, an analysis of the travel behavior of minority cohorts will be undertaken analyzing only Texas-specific data.

³⁰ Tal and Handy, “The Travel Behavior of immigrants and race/ethnicity Groups”, (Davis: University of California, 2005): 9.

³¹ Ibid., 27.

CHAPTER 3

RESEARCH METHODOLOGY AND TEXAS DATA SET

3.1 Data Set and Research Methodology

From 2001 to 2002 the Federal Highway Administration (FHWA) conducted the latest National Household Travel Survey (NHTS). This survey is one of the most comprehensive and costly transportation surveys undertaken in the United States. The FHWA allowed States and Metropolitan Planning Organizations (MPOs) to purchase additional data for their jurisdictions. The State of Texas purchased extra data, and the travel statistics that comprise the Texas “Add-On” are thought to provide statistical rigor for state analysis. A total of 3,716 households and 8,928 respondents were interviewed. However, the full clean, that is free from outliers and incomplete record, un-weighted sample reveals information for only about 1,500 households, and 3,500 people in Texas. This paper presents an analysis of the clean un-weighted Texas Add On person sample NHTS (Version 3) released in January 2004 by the FHWA. This survey provides enough variables to identify immigrant status, race, ethnicity, occupational category, and other pertinent socio-demographical data that previous transportation surveys did not collect. To my knowledge, nobody has yet used the Texas NHTS to examine the travel behavior of emerging race/ethnic groups within the State. The Texas 2001 NHTS Add-On unweighted sample will be referred as “the Add-On survey” or just the “NHTS survey” throughout this thesis.

In order to analyze the different race/ethnic groups in the Add-On survey, aggregations for the four major race/ethnic groups in the state are developed following the methodology used by the Texas State Data Center (TSDC). This methodology is described in their October 2006 population forecast technical paper. Moreover, the population forecasts presented are also taken from the TSDC. Population projections are always estimates, accounting for many assumptions, which may or may not become true. However, the Texas State Data Center uses state-of-the-art methodologies that provide the State with the best possible projections.

3.2 Defining Race/Ethnic Cohorts to be Analyzed

In order to examine the Add-On survey, respondents are aggregated into Anglo, Black, Hispanic, and an Other population group. “Whites who are referred to as Anglos, Non-Hispanic Blacks or African Americans, Hispanics of all races, and persons in all other non-Hispanic racial groups referred to as the Other population group.”³² The Add-On survey specifies 17 race/ethnic categories, and aggregating these cohorts may be difficult. Therefore, the TSDC standardized race/ethnicity aggregation is followed. Moreover, the survey allows us to identify respondents that classified themselves as foreign-born, and where applicable, their country of origin is also noted. Therefore, two extra categories of immigrants are introduced, Foreign-Born Hispanic or Hispanic Immigrant, and Foreign-Born Non-Hispanic (Appendix B presents in detail the Race/Ethnicity aggregations determine for this study in SAS code format). The Add-On

³² Texas State Data Center, Projections of the Population of Texas and Counties in Texas by Age, Sex and Race/Ethnicity for 2000-2040. San Antonio: Texas State Data Center, The University of Texas at San Antonio (October 2006).

survey is not large enough to provide statistical rigor to specify more than two foreign-born groups. Since 74.9% of the foreign-born in Texas are of Hispanic origin, analyzing other non-Hispanic immigrants would require a larger survey or a targeted survey to capture meaningful statistics for these minority populations. The six major race/ethnic groups examined in this paper are the following:

- 1) Anglo or White
- 2) African-American or Black
- 3) Hispanic (Aggregated as an Ethnic groups, this includes Hispanics of any race)
- 4) Other (All other non-Hispanic U.S. born)
- 5) Hispanic Immigrant or Foreign-Born Hispanic (F-B Hispanic)
- 6) Other Non-Hispanic Immigrant or Foreign-Born Non-Hispanic (F-B Other)

The Non-Hispanic Immigrant category is composed of multiple races; Figures 3.1 and 3.2 depict the share of race and ethnicity for each group. From Figure 3.1, one notices that most of the Foreign-Born Non-Hispanic respondents in Texas are White/European, and that the second largest populations of Foreign-Born Non-Hispanic is Asian. In addition, Figure 3.2 indicates that the “American Indian & White” cohort comprises a large share of the U. S. born Other category. Understanding the share of race/ethnic groups in these two cohorts is interesting; however, the statistics presented for these two groups should not be applied to these cohorts individually, since there is not enough data to make significant statements.

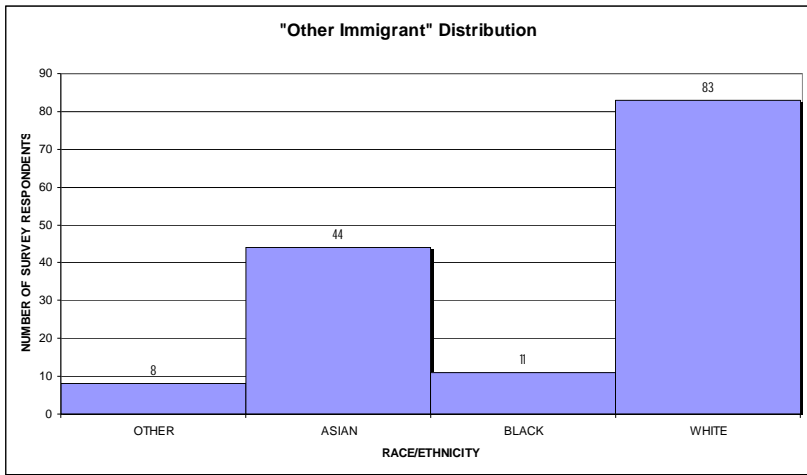


Figure 3.1 Share of Race/Ethnic Cohorts in the Foreign-Born Non-Hispanic Group

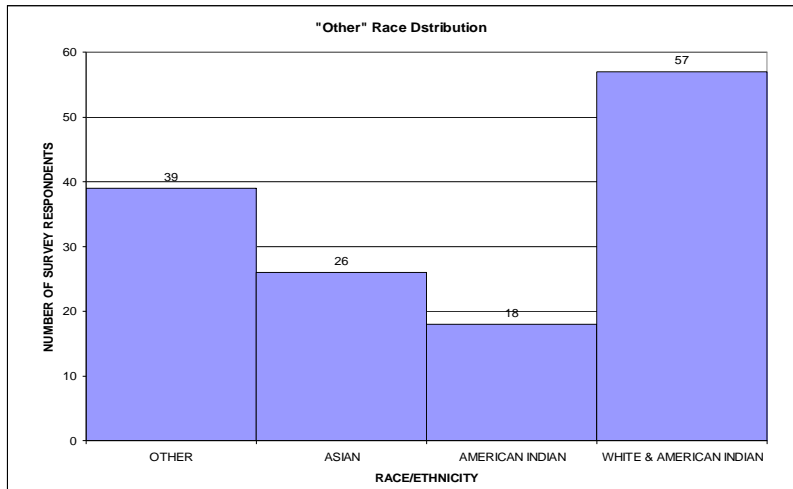


Figure 3.2 Share of Race/Ethnic Cohorts in the U.S. Born ‘Other’ Group

3.2.1 Survey Languages: Spanish vs. English

Survey respondents were given the opportunity to answer in Spanish. About 70% of foreign-born Hispanics answered in Spanish, while only about 5% of U. S. born Hispanics answered in Spanish. This statistic is noteworthy given the fact that in order to reach out to minority populations, survey personnel must include Spanish speakers that can relate to this minority groups, and understand their traveling needs. Moreover, it has been indicated that the NHTS has serious limitations for looking at new-comer

Hispanic travel patterns (Casas et al. 2004), because there is not an overwhelming majority of ‘new-comer’ Hispanics interviewed in Spanish at the national level. Nonetheless, the NHTS Texas data set shows that an overwhelming majority of Foreign-Born Hispanics (70%) were interviewed in Spanish, which indicates that the Texas Add-On data may provide better estimates for analyzing this cohort.

3.3 Trends and Demographic Estimates

Scenario 0.5 is the recommended population forecast by the TSDC. It assumes that net migration to be equal to one-half of that between 1990 to 2000. However, given the high birth-rates among the non-Anglo populations, the population forecast still indicates that the Hispanic population will continue to increase, while the Anglo population will decrease slightly. According to this forecast, the Black and Other populations will also experience slight increases in the coming decades.

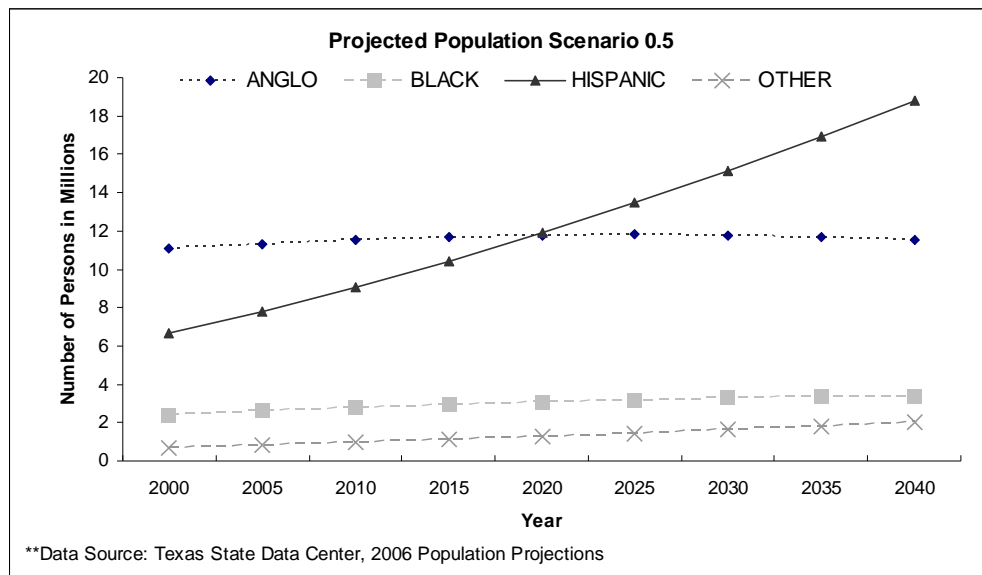


Figure 3.3 Population Forecast for Race/Ethnicity Cohorts

CHAPTER 4

DESCRIPTIVE STATISTICS

4.1 Introduction

The Texas NHTS un-weighted Add-On has about 3,500 usable personal records. Although small, this database is large enough to explore many travel characteristics for the four major race and ethnicity U. S. born cohorts in Texas, and the two foreign-born groups. Using this comprehensive survey, this section explores the socio-demographics of the respondents, their travel behavior, their perception of the transportation system, and their trip generation patterns by activity and by mode. Before presenting the descriptive statistics, one must consider the share of population that each of the defined race/ethnic cohorts has in this data set. Table 4.1 shows the distribution of each race/ethnic cohort and compares it with the 2000 U. S. census estimates for each population. Comparing NHTS records against 2000 census data is desirable, because the latest NHTS survey was conducted from 2000 to 2001, immediately after the 2000 U. S. Census. Thus, comparing these figures provides temporal stability.

Table 4.1 Number of Records in the NHTS Texas Add On by Race/Ethnicity

| Race/Ethnicity | Number of Records | | | |
|------------------------|-------------------|--------------|-------------------|--------------|
| | Add-On | Distribution | 2000 Census | Distribution |
| Anglo | 2,157 | 62.6% | 11,074,716 | 53.1% |
| Black | 227 | 6.6% | 2,421,653 | 11.6% |
| Hispanic | 483 | 14.0% | 4,497,190 | 21.6% |
| Other | 156 | 4.5% | 148,113 | 0.7% |
| Hispanic Immigrant | 279 | 8.1% | 2,172,476 | 10.4% |
| Non-Hispanic Immigrant | 146 | 4.2% | 537,672 | 2.6% |
| | 3,448 | 100.0% | 20,851,820 | 100.0% |

Table 4.1 shows that the Anglo respondents are over-counted, and that other race/ethnic cohorts—with the exception of the “Other” categories—are under-counted. Previous studies note that Hispanics, Blacks and other minorities tend to be undercounted in most surveys, and this is especially true for foreign-born Hispanics (Casas et al. 2004). A weighted approach can be used to analyze this Add-On data; however, since weighted approaches will not allow us to examine in detail these minority populations, the researcher decided to focus primarily on full survey respondents, and not the adjusted data. Differences in cohort distribution and survey response rates within the six groups under study could generate survey response errors; therefore, a careful usage of the results presented in this study is suggested.

4.2 Socio-Demographics by Race and Ethnicity

In order to better understand the travel behavior of the six cohorts studied, an analysis of the socio-demographic patterns of survey respondents is presented. Transportation planners depend heavily on socio-demographic variables to forecast trip generation and determine mode choice, since it has been established that these factors heavily affect travel behavior (Ortuzar and Willumsen, 2002). Household size, income levels, number of vehicles in the household, and other variables have been used to forecast traffic, and develop trip generation models. For this study, an analysis of a variety of socio-demographics is presented, and t-test statistics are used to determine the level of significance for the presented results.

Unless otherwise indicated, most of the t-tests presented in the upcoming tables are obtained by comparing the Anglo population to all others. Therefore, t-tests are

done for two sample populations with the assumption of unequal variances. In other words, the study tests the difference between each cohort and the Anglo population, and the probability value indicates the probability that the mean of each cohort is not different from the mean of the Anglo population.

Table 4.2 indicates evident differences among these cohorts. Foreign-Born Hispanics have the highest household size on average (3.798 person per house), and U. S. born Hispanics have the second largest household size (3.125 persons per house), while the Anglo (2.403 persons per house) and Black (2.469 persons per house) cohorts show the lowest household size on average.

Table 4.2 Comparison of Household Size

| | Anglo | Black | Hispanic | Other | F-B Hispanic | F-B Other |
|------------------|--------------|--------------|-----------------|--------------|---------------------|------------------|
| Mean | 2.403 | 2.469 | 3.125 | 2.750 | 3.798 | 2.775 |
| Standard Dev. | 1.203 | 1.203 | 1.480 | 1.591 | 1.563 | 1.441 |
| Observations | 941 | 98 | 152 | 48 | 94 | 80 |
| df | | 118 | 185 | 50 | 104 | 89 |
| t Stat | | -0.5217 | -5.7200 | -1.4903 | -8.4093 | -2.2455 |
| P(T<=t) two-tail | | 0.6028 | 0.0000 | 0.1424 | 0.0000 | 0.0272 |

The survey contains 18 income level strata, which increase by \$5,000 per strata. In Table 4.3 an approximation for the mean income for each of the race/ethnic cohorts is presented. Table 4.3 indicates that the Foreign-Born Hispanics are the poorest cohort in Texas, and the U. S. born Hispanics and Blacks are in the second lowest income ranges. It is important to note that significant income gaps exist among each cohort surveyed, and this fact alone may affect their travel behavior significantly. It is also interesting to point out that the average income range (\$45k to \$50k) between Foreign-Born Non-Hispanic respondents and Anglos is not significantly different.

Table 4.3 Comparison of Household Income

| | Anglo | Black | Hispanic | Other | F-B Hispanic | F-B Other |
|------------------|--------------|--------------|-----------------|--------------|---------------------|------------------|
| Mean | 10.833 | 7.337 | 8.147 | 9.978 | 6.034 | 10.877 |
| | \$49,100 | \$31,600 | \$35,700 | \$44,900 | \$25,100 | \$49,300 |
| Standard Dev. | 5.158 | 5.069 | 5.203 | 4.947 | 3.966 | 5.096 |
| Observations | 860 | 95 | 143 | 45 | 87 | 73 |
| df | | 117 | 191 | 49 | 118 | 85 |
| t Stat | | 6.3674 | 5.7228 | 1.1274 | 10.4267 | -0.0710 |
| P(T<=t) two-tail | | 0.0000 | 0.0000 | 0.2651 | 0.0000 | 0.9436 |

On average, Foreign-Born and U.S. Born Hispanics, have the highest numbers of adults residing in a household (Table 4.4). This may be significant for transportation planners, since this could indicate a higher level of traveling needs. As a Hispanic, I know that Hispanic families are more likely to host the elderly grandparents instead of sending them into retirement homes. Moreover, it is also traditional for daughters and sons not to move out of the home until they get married. These reasons may help explain these statistics. Black respondents have the least number of adults per household (1.73 adults per household).

Table 4.4 Comparison of Number of Adults in Surveyed Household

| | Anglo | Black | Hispanic | Other | F-B Hispanic | F-B Other |
|------------------|--------------|--------------|-----------------|--------------|---------------------|------------------|
| Mean | 1.863 | 1.735 | 2.138 | 1.896 | 2.117 | 1.963 |
| Standard Dev. | 0.603 | 0.651 | 0.764 | 0.555 | 0.760 | 0.665 |
| Observations | 941 | 98 | 152 | 48 | 94 | 80 |
| df | | 115 | 183 | 53 | 105 | 90 |
| t Stat | | 1.8683 | -4.2349 | -0.3991 | -3.1446 | -1.2959 |
| P(T<=t) two-tail | | 0.0643 | 0.0000 | 0.6914 | 0.0022 | 0.1983 |

The average ages presented in Table 4.5 are all significantly different from that of the Anglos, and marked differences in household age structure is revealed. Hispanics show the youngest age structure, with a mean age of around 29 years, for both the U. S. and Foreign-Born Hispanics. There is about a 10 year gap between Hispanic (29.5

average age) and Anglo (41.05 average age) survey respondents, and this disparity may also affect their travel behavior.

Table 4.5 Comparison of Average Age for Survey Respondents

| | Anglo | Black | Hispanic | Other | F-B Hispanic | F-B Other |
|--------------------|--------------|--------------|-----------------|--------------|---------------------|------------------|
| Mean | 41.05 | 36.56 | 29.17 | 32.27 | 29.99 | 43.77 |
| Standard Deviation | 23.19 | 24.18 | 21.39 | 22.45 | 19.35 | 12.74 |
| Observations | 2155 | 227 | 482 | 140 | 279 | 146 |
| df | | 272 | 756 | 159 | 389 | 217 |
| t Stat | | 2.6755 | 10.8472 | 4.4761 | 8.7681 | -2.3325 |
| P(T<=t) two-tail | | 0.0079 | 0.0000 | 0.0000 | 0.0000 | 0.0206 |

Minority cohorts show significantly different household vehicle ownership compared to the Anglo survey respondents, with the exception of the Foreign-Born Others. Foreign-Born Hispanics and Blacks show the least vehicle availability per households (Table 4.6). Foreign-Born Hispanic respondents have a higher household vehicle count (1.745 vehicles per household) than Blacks (1.663 vehicles per household), even while belonging to a lower income group. And this may indicate that Foreign-Born Hispanics prize having a vehicle more than Blacks do. Another reason for this difference might be the fact that there are more adults living in Foreign-Born Hispanic households (2.117 adults per house), than in African-American households (1.735 adults per house). On the contrary, the Anglo cohort shows the largest share of vehicles in their household, with a 2.131 average vehicle count (Table 4.6).

Table 4.6 Household Vehicle Count Comparison

| | Anglo | Black | Hispanic | Other | F-B Hispanic | F-B Other |
|------------------|--------------|--------------|-----------------|--------------|---------------------|------------------|
| Mean | 2.131 | 1.663 | 1.954 | 1.917 | 1.745 | 2.013 |
| Standard Dev. | 1.130 | 0.973 | 1.025 | 0.986 | 0.891 | 0.921 |
| Observations | 941 | 98 | 152 | 48 | 94 | 80 |
| df | | 126 | 215 | 54 | 125 | 100 |
| t Stat | | 4.4521 | 1.9436 | 1.4564 | 3.8979 | 1.0811 |
| P(T<=t) two-tail | | 0.0000 | 0.0532 | 0.1511 | 0.0002 | 0.2823 |

As previously indicated, socio-economic differences alone can affect travel behavior. The statistics presented in this section indicate that minority groups are very different from each other: in terms of household income, household size, and other demographics. These differences may affect greatly their travel patterns; however, it is more significant to study where each cohort is predominantly located on the life-cycle. Some cohorts may have more families with children than others, and these life-cycle differences may also affect their travel behavior and needs.

4.2.1 Life-Cycle for Minority Cohorts

The Texas NHTS survey also collected information regarding household life cycle. Life-cycle is a general terminology to define the stage of life where a person is, such as single-life, married-life, with children or not, and the retired stage of life. Few transportation studies have analyzed this variable as a predictor to determine trip generation. This social variable can help the researcher understand the transportation needs for the different minority populations in Texas. In order to make a more representative analysis, the original ten life-cycle strata are aggregated into six (See Table 4.7). Basically, the study condenses three strata comprising one adult and children—where each of the three strata indicates the age range for the children—into a single category, called one adult and child(ren) under 18 years of age. Then, the three categories of two adults or more plus child(ren) is also aggregated into a single group in a similar fashion.

Table 4.7 shows household structure differences between each cohort. It is interesting to note that Hispanics, U. S. or Foreign-Born, have the biggest share of

households with two or more adults and children under 18 years of age, 71.6% and 75.3%, respectively. A large share of Anglo (19.5%) and Foreign Born Non-Hispanic (32.9%) survey respondents live in households where two or more adults are living together with no children. Moreover, the Black cohort has the largest percent of families comprising one-adult with children—or single parent households (12.8%); second to them are the Foreign-Born Hispanics (9.0%). A chi-square test statistic was performed to determine whether the Anglo life-cycle distribution is significantly different from each of the other minority groups, and whether the distributions of each cohort are significantly different from that of the Anglo cohort, all of them resulted significantly different than the Anglo cohort distribution. Figure 4.1 summarizes these findings in a visual manner; this figure compares each cohort’s share on that particular life-cycle stage.

Table 4.7 Comparison of Household Life-Cycle

| Life Cycle | Anglo | | Black | | Hispanic | | Other | | F-B Hispanic | | F-B Other | |
|-------------------------------|-------|--------|--------|--------|----------|--------------|-------|--------|--------------|--------------|-----------|--------|
| | n | % | n | % | n | % | n | % | n | % | n | % |
| Single | 109 | 5.1% | 12 | 5.3% | 15 | 3.1% | 7 | 5.0% | 5 | 1.8% | 10 | 6.8% |
| 2+ adult, no kid(s) | 420 | 19.5% | 30 | 13.2% | 59 | 12.2% | 23 | 16.4% | 21 | 7.5% | 48 | 32.9% |
| one adult, and kid(s) | 88 | 4.1% | 29 | 12.8% | 26 | 5.4% | 0 | 0.0% | 25 | 9.0% | 3 | 2.1% |
| 2+ adults, and kid(s) | 1037 | 48.1% | 108 | 47.6% | 345 | 71.6% | 89 | 63.6% | 210 | 75.3% | 72 | 49.3% |
| One adult, retired, no kid(s) | 88 | 4.1% | 11 | 4.8% | 5 | 1.0% | 2 | 1.4% | 1 | 0.4% | 2 | 1.4% |
| 2+ adults, retired, no kid(s) | 413 | 19.2% | 37 | 16.3% | 32 | 6.6% | 19 | 13.6% | 17 | 6.1% | 11 | 7.5% |
| n=3429 | 2155 | 100.0% | 227 | 100.0% | 482 | 100.0% | 140 | 100.0% | 279 | 100.0% | 146 | 100.0% |
| Chi-Square, Probability | | | 11.30, | 0.0008 | 15.15, | 0.0001 | 5.06, | 0.0245 | 30, | 0.0000 | 10.20, | 0.0014 |

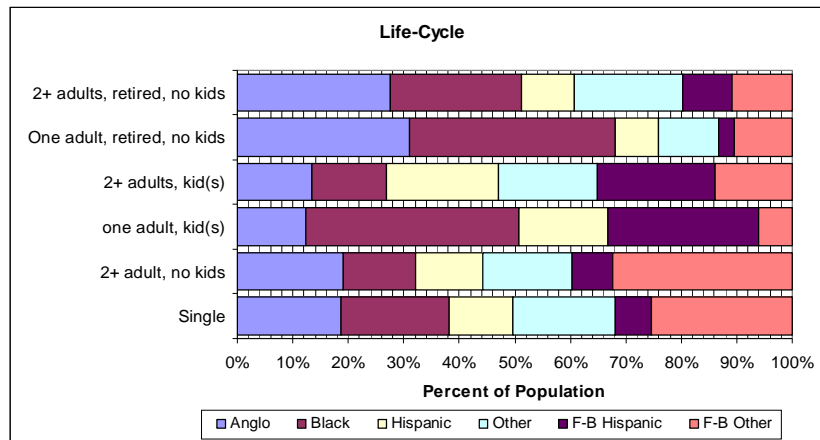


Figure 4.1 Comparing Distributions for Household Life-Cycle Amongst the Race/Ethnicity and Immigrant Cohorts.

4.2.2 Urban and Rural Population Share

The NHTS survey also collects information regarding the geographical location for each surveyed household. It is interesting to discern the residence of survey respondents, and determine the share of the population that each of the six cohorts under study has in Texas metropolitan areas, Metropolitan Statistical Areas (MSA, CMSA), and other urbanized and rural areas in Texas.

Table 4.8 Survey Respondents Share in CMSAs and MSAs

| | San Antonio, TX (MSA) | | Houston_Galveston-Brazoria, TX (CMSA) | | Dallas-Fort Worth, TX (CMSA) | | Austin-San Marcos, TX (MSA) | |
|-----------------|-----------------------|--------|---------------------------------------|--------|------------------------------|--------|-----------------------------|--------|
| ANGLO | 113 | 48.5% | 474 | 63.2% | 584 | 68.8% | 158 | 64.0% |
| BLACK | 18 | 7.7% | 64 | 8.5% | 75 | 8.8% | 22 | 8.9% |
| HISPANIC | 58 | 24.9% | 71 | 9.5% | 46 | 5.4% | 30 | 12.1% |
| OTHER | 8 | 3.4% | 37 | 4.9% | 38 | 4.5% | 13 | 5.3% |
| F-B HISPANIC | 30 | 12.9% | 52 | 6.9% | 65 | 7.7% | 7 | 2.8% |
| OTHER IMMIGRANT | 6 | 2.6% | 52 | 6.9% | 41 | 4.8% | 17 | 6.9% |
| TOTAL | 233 | 100.0% | 750 | 100.0% | 849 | 100.0% | 247 | 100.0% |

Table 4.9 Population Split between Urban and Rural

| | TOTAL URBAN | | TOTAL RURAL | |
|--------------------|-------------|-------|-------------|-------|
| ANGLO | 1329 | 63.9% | 826 | 61.2% |
| BLACK | 179 | 8.6% | 48 | 3.6% |
| HISPANIC | 205 | 9.9% | 277 | 20.5% |
| OTHER | 96 | 4.6% | 44 | 3.3% |
| HISPANIC IMMIGRANT | 154 | 7.4% | 125 | 9.3% |
| OTHER IMMIGRANT | 116 | 5.6% | 30 | 2.2% |
| | 60.63% | | 39.37% | |

Figure 4.2 shows that the majority of foreign born survey respondents live in urban areas, and this coincides with the information presented earlier from the FRB of Dallas and the TSDC. Moreover, the majority of Foreign-Born Hispanic respondents live in urban areas (55.2%), while the majority of U. S. Hispanic survey respondents live in rural areas (57.5%). Most of the Anglo (61.7%) and Black (78.9%) respondents were found to live in urban areas.

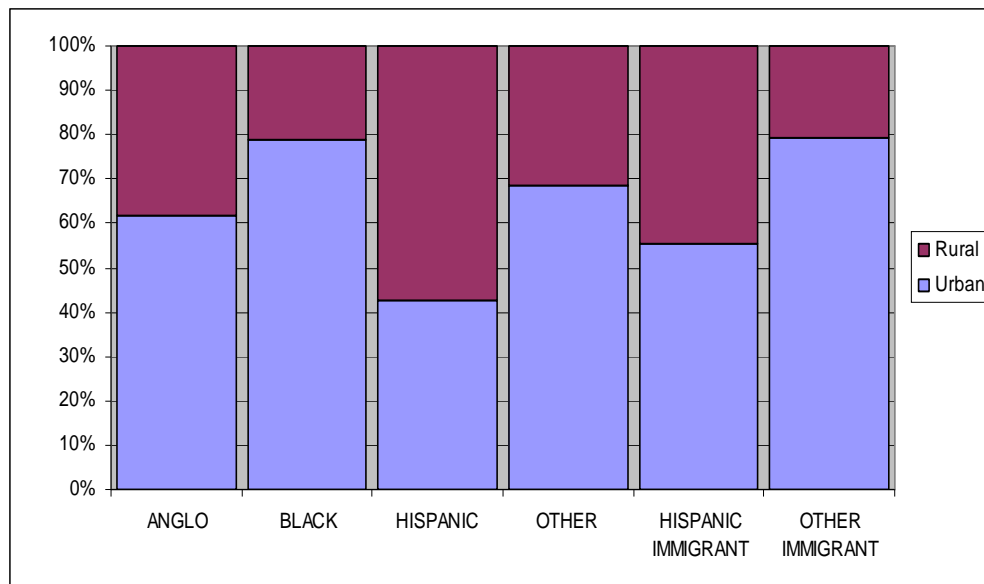


Figure 4.2 Comparing Rural and Urban Population Share

4.3 Travel Patterns by Minority Cohorts

One interesting feature of the NHTS is the ability to determine multiple travel characteristics from survey respondents. These characteristics help the researcher determine the level of trip activity that respondents have; moreover, they also explore the transportation mode chosen during a typical day or week. This data helps the researcher understand the travel behavior and other factors that impact travel decision making and trip generation.

The average total daily trips generated per cohort are the mean of the sum of all trips generated in a regular day per person. The largest share of these trips is by automobile, as one can determine in the upcoming tables. However, daily trips include those undertaken by any mode, including bicycling or walking. The highest daily trip generation rates belong to the Anglo cohort—with 4.12 trips per day, Foreign-Born Non-Hispanic—with 4.10 trips per day, and U. S. born Hispanics—with 4.07 trips per day (Table 4.10). The cohort that makes the least amount of trips per day is the U. S. born 'Other'. Both Foreign-Born Hispanic (3.75 trip per day) and Black (3.71 trips per day) respondents reported similarly low daily trip rates; however, the standard deviation for foreign born Hispanics is larger, and an F-test among these two cohorts indicates that their standard deviations are not equal, with 89% confidence level. Thus, Foreign-Born Hispanics may produce higher trip rates than African-Americans, even while being in a lower economic group. Of potential importance, U.S. born and Foreign-Born Hispanics have different daily trip rate characteristics; however, Table 4.11 shows that

for the data under study; the means for these cohorts are not significantly different from each other at 12.9% level.

Table 4.10 Average Total Day Trips per Respondent

| Cohort | Anglo | Black | Hispanic | Other | F-B Hispanic | F-B Other |
|--------------------|--------------|--------------|-----------------|--------------|---------------------|------------------|
| Mean | 4.12 | 3.71 | 4.07 | 3.35 | 3.75 | 4.10 |
| Standard Deviation | 2.96 | 2.44 | 2.91 | 2.57 | 2.65 | 3.02 |
| Observations | 2155 | 227 | 482 | 140 | 279 | 146 |
| df | | 301 | 721 | 164 | 374 | 164 |
| t Stat | | 2.3274 | 0.2886 | 3.3833 | 2.1221 | 0.0743 |
| P(T<=t) two-tail | | 0.0206 | 0.7729 | 0.0009 | 0.0345 | 0.9408 |

Table 4.11 Average Total Day Trips for Hispanics

| Cohort | Hispanic | F-B Hispanic |
|--------------------|-----------------|---------------------|
| Mean | 4.07 | 3.75 |
| Standard Deviation | 2.91 | 2.65 |
| Observations | 482 | 279 |
| df | | 626 |
| t Stat | | 1.5489 |
| P(T<=t) two-tail | | 0.1219 |

The number of drivers and the number of vehicles per household may be a good estimator for the amount of vehicle trip making expected from a household. Table 4.12 shows that Foreign-Born Non-Hispanic respondents have the most drivers in their household (1.938 drivers per household); however, on average they do not possess a larger number of adults in their household. Moreover, Hispanic respondents have the second largest amount of drivers in their household (1.888 adults per household). In addition, Hispanics—foreign (1.872 drivers per household) or U.S. born (1.888 drivers per household)—have the highest average number of drivers in their household than any other U.S. born cohort. This is noteworthy because Foreign-Born Hispanic respondents have lower incomes than Blacks on average, and this figure may indicate that Hispanic

respondents have higher driving potential than any other minority (with the exception of Foreign-Born Non-Hispanic), even while their average income levels are amongst the lowest.

Table 4.12 Average Number of Drivers per Household

| | Anglo | Black | Hispanic | Other | F-B Hispanic | F-B Other |
|------------------|--------------|--------------|-----------------|--------------|---------------------|------------------|
| Mean | 1.863 | 1.561 | 1.888 | 1.771 | 1.872 | 1.938 |
| Standard Dev. | 0.714 | 0.813 | 0.810 | 0.660 | 0.895 | 0.718 |
| Observations | 941 | 98 | 152 | 48 | 94 | 80 |
| df | | 113 | 191 | 53 | 105 | 93 |
| t Stat | | 3.5338 | -0.3622 | 0.9388 | -0.0991 | -0.8928 |
| P(T<=t) two-tail | | 0.0006 | 0.7176 | 0.3521 | 0.9213 | 0.3743 |

There is no evidence of major differences between the average distances to work between Anglos and other minority cohorts. However, U. S. born Hispanics respondents on average work closest to their homes (Table 4.13). The t-test indicates that there is a 6.73% probability that the mean distance to work of the Hispanics is not different from that of the Anglos. This figure is noteworthy, since it might be that Hispanics prefer to work close to where they live; however, more research needs to be conducted on this interesting subject.

Table 4.13 Average Distance to Work (in Miles)

| Cohort | Anglo | Black | Hispanic | Other | F-B Hispanic | F-B Other |
|--------------------|--------------|--------------|-----------------|--------------|---------------------|------------------|
| Mean | 14.4 | 15.2 | 12.2 | 16.9 | 14.6 | 13.7 |
| Standard Deviation | 16.9 | 12.1 | 13.5 | 14.4 | 14.4 | 12.2 |
| Observations | 901 | 88 | 167 | 42 | 76 | 90 |
| df | | 123 | 273 | 46 | 93 | 126 |
| t Stat | | -0.5743 | 1.8372 | -1.1144 | -0.1366 | 0.4930 |
| P(T<=t) two-tail | | 0.5668 | 0.0673 | 0.2709 | 0.8916 | 0.6229 |

Table 4.14 indicates that while there is a difference in the mean average distance to work between both Hispanic cohorts, the t-statistics show that these means are

significantly different only to a 78% confidence level, which is not very high. This low level of significance may be due to small sample sizes for these cohorts, and the large variances that exist for these two distributions. More research is required to determine how household locations differ between these two groups.

Table 4.14 Average Distance to Work (in Miles) for Hispanics

| Cohort | Hispanic | F-B Hispanic |
|--------------------|-----------------|---------------------|
| Mean | 12.19 | 14.61 |
| Standard Deviation | 13.470 | 14.423 |
| Observations | 167 | 76 |
| df | | 137 |
| t Stat | | -1.2352 |
| P(T<=t) two-tail | | 0.2189 |

Average commute time differences between minority cohorts are notable. Table 4.15 indicates that Black respondents have the longest commute time (28.4 minutes), while U. S. Born Hispanic respondents have the shortest commute time on average (19.8 minutes). This difference may be due to Blacks relying on transit for commute trips. Nonetheless, it is interesting to indicate that Foreign-Born Hispanics have almost identical commute times (22.6 minutes) as the Anglo population (22.8 minutes); in other words their average commutes are not significantly different. Foreign-Born and U. S. Born Hispanics have different average commute times. However, the t-test performed indicates that these cohorts are not significantly different, which may be due to large variances and a large disproportion in sample size among these cohorts (Table 4.16).

Table 4.15 Average Time to Work (Reported in Minutes)

| Cohort | Anglo | Black | Hispanic | Other | F-B Hispanic | F-B Other |
|--------------------|-------|---------|----------|---------|--------------|-----------|
| Mean | 22.8 | 28.4 | 19.8 | 27.9 | 22.6 | 25.3 |
| Standard Deviation | 18.0 | 21.8 | 14.6 | 20.4 | 15.6 | 17.1 |
| Observations | 873 | 87 | 169 | 40 | 78 | 88 |
| df | | 98 | 276 | 42 | 96 | 107 |
| t Stat | | -2.3425 | 2.3497 | -1.5464 | 0.0788 | -1.2978 |
| P(T<=t) two-tail | | 0.0212 | 0.0195 | 0.1295 | 0.9373 | 0.1972 |

Table 4.16 Average Time to Work (in Minutes) for Hispanics

| Cohort | Hispanic | F-B Hispanic |
|--------------------|----------|--------------|
| Mean | 19.8 | 22.6 |
| Standard Deviation | 14.63 | 15.59 |
| Observations | 169 | 78 |
| df | | 142 |
| t Stat | | -1.3653 |
| P(T<=t) two-tail | | 0.1743 |

The Texas NHTS allows the study of other travel modes beside automobile. However, this thesis presents just walk trip rates per week. Walking trips are usually taken when a car is not needed, available, or when someone wants to enjoy a nice day. Anglo respondents in Texas show the highest mean number of walk trips (3.70); on the other hand, Foreign-Born Hispanics respondents have the lowest mean rate for walk trips in a normal week (2.18), and the t-test presented (Table 4.17) indicates that this difference is statistically significant. Moreover, Foreign-Born Non-Hispanics have the second lowest average number of walk trips for the study period (3.06). In addition, Foreign-Born Hispanics' average walk trips per week differ significantly from that of the U. S. Born Hispanics (Table 4.18). These results indicate that Foreign-Born respondents tended to take the least amount of walking trips during the prescribed period.

Table 4.17 Average Number of Walk Trips in the Past Week

| Cohort | Anglo | Black | Hispanic | Other | F-B Hispanic | F-B Other |
|--------------------|-------|--------|----------|--------|--------------|-----------|
| Mean | 3.70 | 3.65 | 3.16 | 3.67 | 2.18 | 3.06 |
| Standard Deviation | 5.65 | 5.14 | 5.31 | 5.25 | 2.80 | 3.72 |
| Observations | 1711 | 158 | 316 | 89 | 187 | 144 |
| df | | 194 | 457 | 99 | 381 | 203 |
| t Stat | | 0.1066 | 1.6434 | 0.0413 | 6.1853 | 1.8748 |
| P(T<=t) two-tail | | 0.9153 | 0.1010 | 0.9671 | 0.0000 | 0.0623 |

Table 4.18 Average Number of Walk Trips in the Past Week for Hispanics

| Cohort | Hispanic | F-B Hispanic |
|--------------------|----------|--------------|
| Mean | 3.158 | 2.176 |
| Standard Deviation | 5.308 | 2.797 |
| Observations | 316 | 187 |
| df | | 495 |
| t Stat | | 2.7126 |
| P(T<=t) two-tail | | 0.0069 |

The NHTS also ascertained the Vehicle Miles Traveled (VMT) that respondents drove during the 12 months prior to the survey. Table 4.19 indicates that the two immigrant cohorts are the only ones significantly different from the Anglos. Foreign-Born respondents drive much less on average than Anglo respondents. Moreover, Foreign-Born Hispanics have the lowest VMT, and this may not be entirely due to their low car-ownership, but also due to the fact that they belong to the lowest income group. Foreign-Born Hispanic's VMT yearly average is significantly different from that of U.S. born Hispanics (Table 4.20).

Table 4.19 Average Number of Miles Respondents Drove Last 12 Months

| Cohort | Anglo | Black | Hispanic | Other | F-B Hispanic | F-B Other |
|--------------------|-------|---------|----------|---------|--------------|-----------|
| Mean | 14977 | 15103 | 14271 | 16509 | 9310 | 12873 |
| Standard Deviation | 16122 | 23685 | 19767 | 13010 | 9291 | 10483 |
| Observations | 1350 | 92 | 187 | 64 | 82 | 105 |
| df | | 97 | 222 | 72 | 113 | 145 |
| t Stat | | -0.0499 | 0.4679 | -0.9094 | 5.0791 | 1.8908 |
| P(T<=t) two-tail | | 0.9603 | 0.6403 | 0.3662 | 0.0000 | 0.0606 |

Table 4.20 Average Number of Miles Respondents Drove Last 12 Months (Hispanics)

| Cohort | Hispanic | F-B Hispanic |
|--------------------|----------|--------------|
| Mean | 14271 | 9310 |
| Standard Deviation | 19767 | 9291 |
| Observations | 187 | 82 |
| df | | 266 |
| t Stat | | 2.7988 |
| P(T<=t) two-tail | | 0.0055 |

4.4 Perception of the Transportation System by Race and Ethnicity

The NHTS allows us to explore the perception that each minority cohort has of different aspects of the transportation system. Perceptions are interesting to analyze, since some people have suggested that some transportation issues are assessed by subjective standards, in the case of traffic congestion, for example, people in Los Angeles, California, may have a different concept of traffic than people in San Antonio, Texas. Moreover, assessing how each cohort *‘feels’* about the different problems they encounter in their day-to-day travel, such as distracted drivers, drunk drivers, drivers speeding, and even the cost of gasoline, may provide assistance identifying potential policy concerns and other potential impacts. This section explores the responses that each cohort has to these transportation issues. Some survey respondents skipped some of these questions, either because the question did not apply to their life circumstances, or because survey respondents just omitted the questions. Given the subjective nature of the data, care must be exercised while reading these tables.

In order to understand the tables and figures in this section, one must reference the question asked regarding the respondent’s perceptions of the transportation system in the NHTS survey:

*Thinking about your day-to-day travel, please tell me how much of a problem each of the following issues is for you. Use a number between 1 and 5, where 1 means it is not a problem for you at all, and 5 means it is the worst travel problem it could be for you.*³³

The tables and figures presented in this section show the distribution that each race/ethnicity cohort has for each response.

Hispanics (36.2%), Blacks (35.0%), and Foreign-Born Non-Hispanics (35.1%) are the cohorts that indicated the most worry (“very much a problem” to “a severe problem”) with traffic accidents. Moreover, more than 75% of the Anglos indicate that getting into a traffic accident was somewhat of a problem, to not a problem at all. This distribution contrasts with that of the U.S. born Hispanics, where 60.9% find that getting into a traffic accident is around the “somewhat of a problem” category. The U. S. born ‘Other’ cohort has the most extreme opinion, with 46.4% of them indicating that traffic accidents are not a problem at all. The Foreign-Born Hispanics have a very different response distribution than U.S. born Hispanics, where Foreign-Born Hispanics are inclined towards the “not a problem category”, while the U. S. born group tends towards the “somewhat of a problem” category.

Table 4.21 Respondent Remarks on Worrying about getting into a Traffic Accident

| Response | Anglo | Black | Hispanic | Other | F-B Hispanic | F-B Other |
|---------------------|--------------|--------------|-----------------|--------------|---------------------|------------------|
| A severe problem | 10.7% | 20.0% | 21.9% | 14.3% | 12.9% | 27.0% |
| Very much a problem | 10.1% | 15.0% | 14.3% | 10.7% | 19.4% | 8.1% |
| Somewhat a problem | 21.8% | 17.5% | 29.5% | 14.3% | 19.4% | 21.6% |
| A little problem | 26.5% | 10.0% | 17.1% | 14.3% | 16.1% | 18.9% |
| Not a problem | 30.9% | 37.5% | 17.1% | 46.4% | 32.3% | 24.3% |
| n= 765 | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% |

³³ Appendix J, 2001 NHTS Questionnaire.

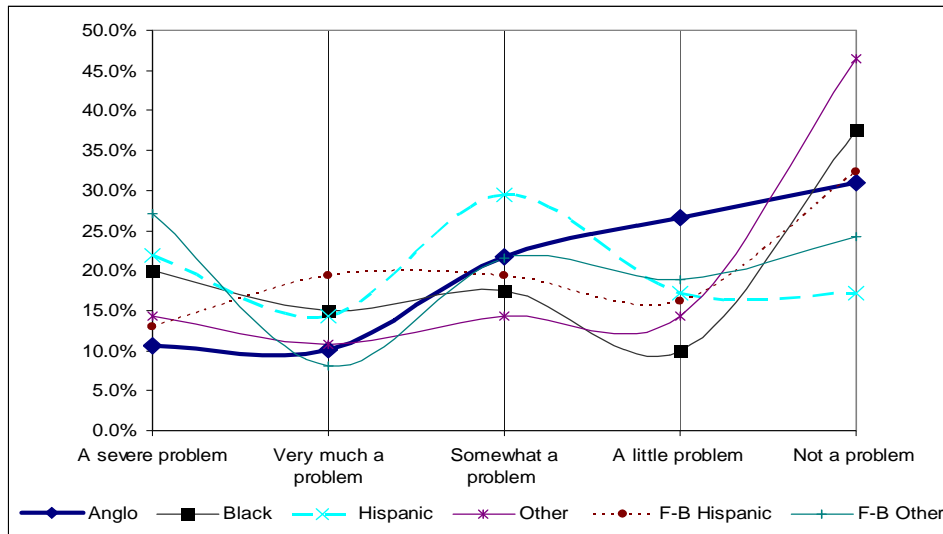


Figure 4.3 Distributions of Worrying about Getting into a Traffic Accident

Almost every cohort stated that distracted drivers are around the “somewhat of a problem” ranking for their day-to-day travel; however, 56.5% of the Foreign-Born Non-Hispanic cohort stated that they find distracted drivers to be “very much a problem” to “a severe problem” (Table 4.22). This may be because foreign born are used to driving in countries where most drivers are defensive drivers; such is the case in European and Asiatic nations. The Black cohort also believes that distracted drivers are very problematic (45.9%). Finally, U. S. Born Hispanics have a very similar distribution to that of Anglos.

Table 4.22 Respondent Remarks on Distracted Drivers on the Road

| Response | Anglo | Black | Hispanic | Other | F-B Hispanic | F-B Other |
|---------------------|--------|--------|----------|--------|--------------|-----------|
| A severe problem | 16.1% | 27.0% | 10.0% | 26.3% | 16.7% | 30.4% |
| Very much a problem | 20.1% | 18.9% | 25.0% | 15.8% | 26.7% | 26.1% |
| Somewhat a problem | 27.9% | 24.3% | 25.0% | 21.1% | 10.0% | 17.4% |
| A little problem | 22.0% | 10.8% | 20.0% | 21.1% | 26.7% | 13.0% |
| Not a problem | 13.9% | 18.9% | 20.0% | 15.8% | 20.0% | 13.0% |
| n= 492 | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% |

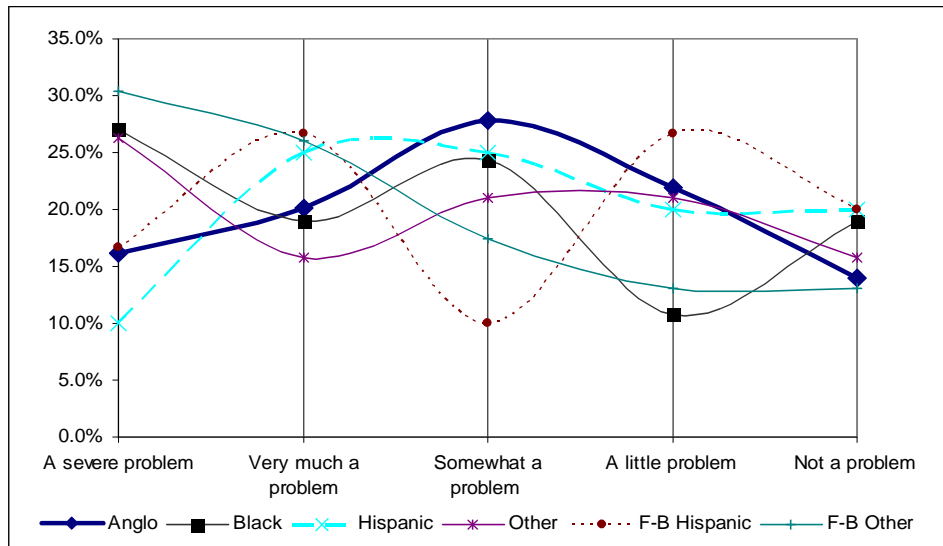


Figure 4.4 Distributions on Remarks on Distracted Drivers on the Road

Table 4.23 indicates that the Black cohort experiences the most problems with highway congestion (43.9%); a similar percentage of the Foreign-Born Non-Hispanic cohort (38.7%) feels the same way. One of the previous tables indicated that Blacks have the longest commute in Texas, averaging 28.4 minutes commute (Table 4.16); therefore, they may experience more highway congestion than others. These commute time estimates do not control for the mode use for commuting, which will be investigated through multivariate analysis in the next chapter. Also, two minority cohorts, Foreign-Born Hispanics (48.1%) and U. S. born ‘Other’ respondents (49.1%), have the least amount of concern regarding highway congestion. Furthermore, the response of U. S. born Hispanics does not seem different from the Anglo response distribution. In contrast, the Foreign-Born Hispanic response distribution is skewed towards the “not a problem” rating, which likely indicates a higher tolerance to congestion in their native country.

Table 4.23 Respondent Remarks on Highway Congestion

| Response | Anglo | Black | Hispanic | Other | F-B Hispanic | F-B Other |
|---------------------|--------|--------|----------|--------|--------------|-----------|
| A severe problem | 18.4% | 22.7% | 17.4% | 20.3% | 13.7% | 22.5% |
| Very much a problem | 14.0% | 21.2% | 11.2% | 8.7% | 11.5% | 16.2% |
| Somewhat a problem | 23.0% | 19.7% | 30.3% | 21.7% | 26.7% | 23.4% |
| A little problem | 18.8% | 9.8% | 17.0% | 10.1% | 14.5% | 14.4% |
| Not a problem | 25.9% | 26.5% | 24.1% | 39.1% | 33.6% | 23.4% |
| n= 2030 | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% |

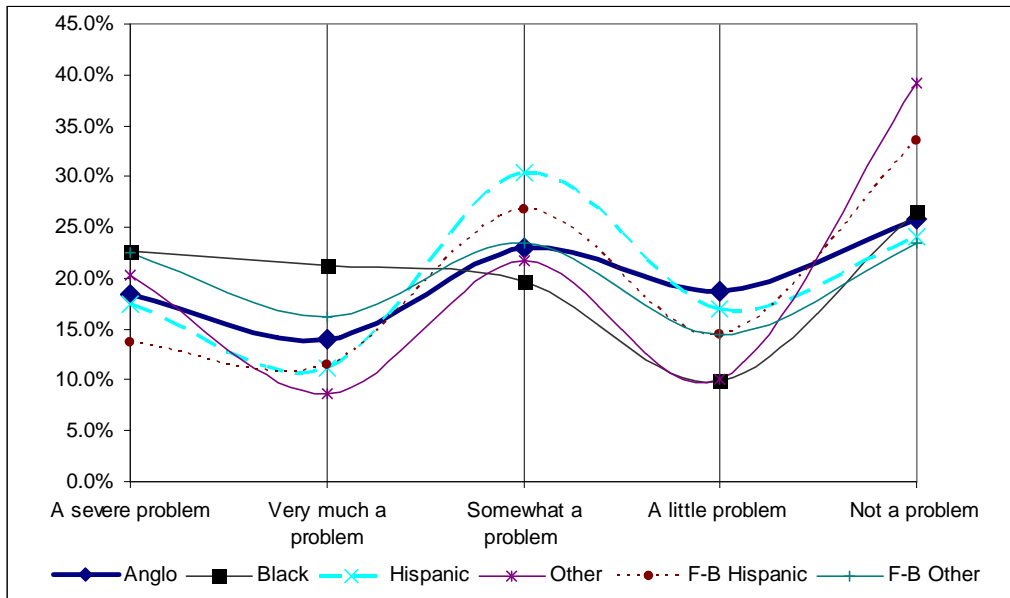


Figure 4.5 Distributions on Remarks on Highway Congestion

Drunk drivers are always a problem; however, this question assesses the real day-to-day concern drunk drivers pose for each of the cohorts under study. Figure 4.6 indicates that Black respondents have the largest concerns with respect to drunk drivers; 35.5% of their responses indicated a “severe problem” to “very much a problem”. Foreign-Born Hispanic (63.9%), Other (68.8%), and Anglo (62.3%) respondents state that they have lesser concern regarding drunk drivers (Table 4.24).

Table 4.24 Respondent Remarks on Drunk Drivers on the Road

| Response | Anglo | Black | Hispanic | Other | F-B Hispanic | F-B Other |
|---------------------|--------|--------|----------|--------|--------------|-----------|
| A severe problem | 20.5% | 29.4% | 24.1% | 12.5% | 22.2% | 16.1% |
| Very much a problem | 5.8% | 5.9% | 9.3% | 12.5% | 5.6% | 9.7% |
| Somewhat a problem | 11.4% | 17.6% | 18.5% | 6.3% | 8.3% | 19.4% |
| A little problem | 18.7% | 17.6% | 13.0% | 31.3% | 13.9% | 19.4% |
| Not a problem | 43.6% | 29.4% | 35.2% | 37.5% | 50.0% | 35.5% |
| N= 513 | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% |

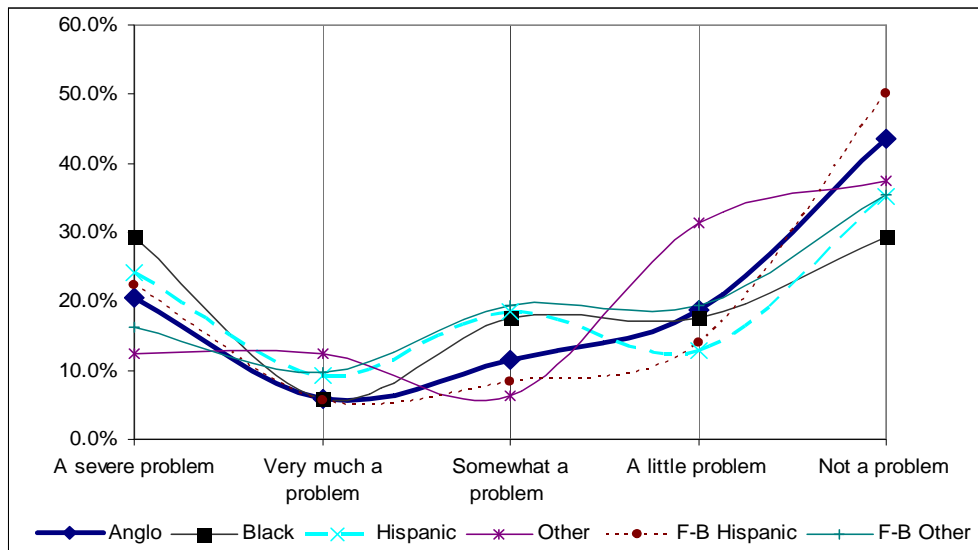


Figure 4.6 Distributions on Remarks on Drunk Drivers on the Road

Figure 4.7 indicates that the Black cohort (37.3%) respondents have the most extreme problems with gasoline prices, while Anglos (44.1%) and U. S born Hispanics (44.6%) have the least problem with them. The Black cohort respondents may experience gas prices more intensely, because of their below-average economic conditions. In addition, U.S. born Hispanics have a similar response distribution to that of Anglos, with the exception that Hispanics are a little more extreme on the ends. The ‘Other’ race/ethnic cohort found low problems with gasoline prices (45.4%). Finally, the Foreign-Born Non-Hispanic cohort found the least problem with gas prices (45.5%),

and this may be due to their recent memories of inflated gas prices in their country of origin, and to their prosperous economic status in the Texas.

Table 4.25 Respondent Remarks on Gasoline Prices

| Response | Anglo | Black | Hispanic | Other | F-B Hispanic | F-B Other |
|---------------------|--------|--------|----------|--------|--------------|-----------|
| A severe problem | 15.4% | 27.1% | 19.0% | 23.6% | 19.8% | 17.2% |
| Very much a problem | 12.6% | 10.2% | 12.8% | 7.3% | 17.5% | 13.1% |
| Somewhat a problem | 28.0% | 25.4% | 23.6% | 23.6% | 19.8% | 24.2% |
| A little problem | 20.7% | 17.8% | 19.0% | 12.7% | 19.0% | 27.3% |
| Not a problem | 23.4% | 19.5% | 25.6% | 32.7% | 23.8% | 18.2% |
| n= 1745 | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% |

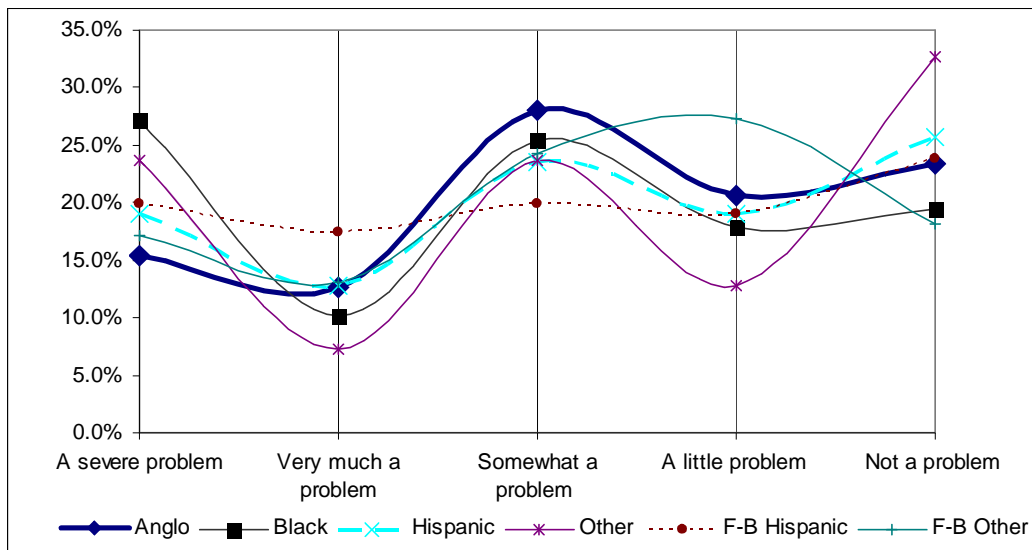


Figure 4.7 Distributions on Remarks on Gasoline Prices

Hispanic (52.2%) and Black (54.9%) respondents state that they experience the most problem with aggressive drivers. The Anglo distribution follows a flat uniform distribution, while U. S. born Hispanics and Blacks have a distribution skewed towards the “severe problem” response (Figure 4.8). In addition, Foreign-Born Hispanics and the U. S. Born ‘Other’ have a response distribution skewed towards the “not a problem” ranking, which sharply contrasts with the response distribution of the U. S. Born

Hispanics; once again, their attitudes may be shaped by experiences in their native countries.

Table 4.26 Respondent Remarks on Aggressive Drivers on the Road

| Response | Anglo | Black | Hispanic | Other | F-B Hispanic | F-B Other |
|---------------------|--------|--------|----------|--------|--------------|-----------|
| A severe problem | 18.1% | 35.5% | 32.8% | 26.3% | 20.0% | 20.0% |
| Very much a problem | 21.8% | 19.4% | 19.4% | 5.3% | 11.4% | 23.3% |
| Somewhat a problem | 21.8% | 29.0% | 22.4% | 21.1% | 17.1% | 16.7% |
| A little problem | 21.2% | 6.5% | 14.9% | 21.1% | 28.6% | 26.7% |
| Not a problem | 17.0% | 9.7% | 10.4% | 26.3% | 22.9% | 13.3% |
| n= 535 | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% |

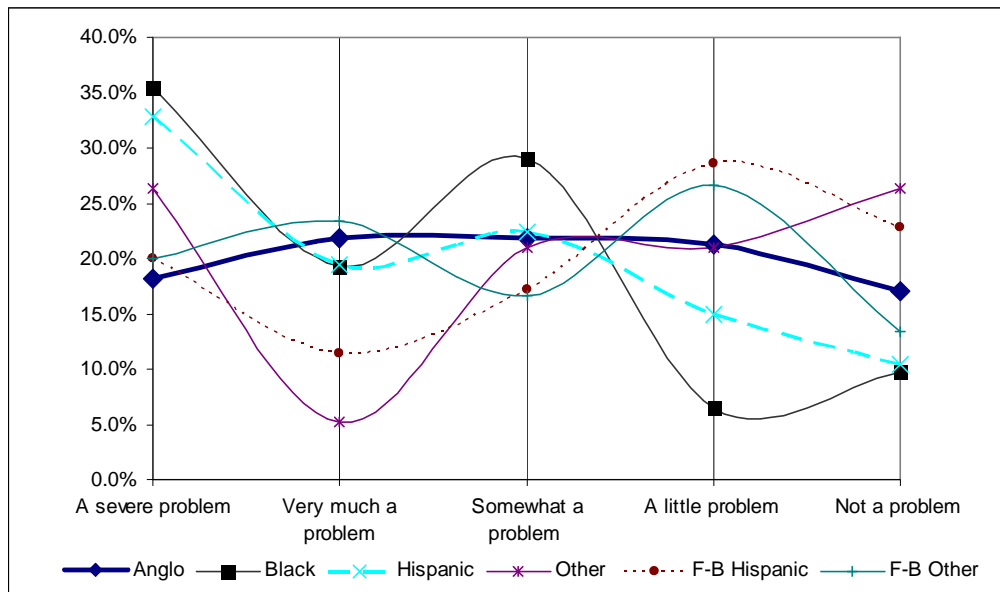


Figure 4.8 Distributions on Aggressive Drivers on the Road

Black cohort respondents have the most extreme responses, because similar numbers regard drivers speeding as a problem (45.7%) and not a problem (42.9%); this distribution is depicted in Figure 4.9. Moreover, 50% of Foreign-Born Non-Hispanic respondents indicate that driver speeding is “a severe problem” to “very much a problem”. U. S. and Foreign-Born Hispanics both have similar response distribution, which may indicate that they experience driver speeding in similar fashion.

Table 4.27 Respondent Perceptions on Driver Speeding on the Road

| Response | Anglo | Black | Hispanic | Other | F-B Hispanic | F-B Other |
|---------------------|--------|--------|----------|--------|--------------|-----------|
| A severe problem | 20.6% | 35.7% | 25.0% | 28.6% | 14.8% | 19.2% |
| Very much a problem | 17.8% | 10.7% | 8.3% | 0.0% | 14.8% | 30.8% |
| Somewhat a problem | 22.7% | 10.7% | 33.3% | 35.7% | 33.3% | 23.1% |
| A little problem | 20.6% | 17.9% | 11.7% | 14.3% | 11.1% | 23.1% |
| Not a problem | 18.4% | 25.0% | 21.7% | 21.4% | 25.9% | 3.8% |
| n= 481 | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% |

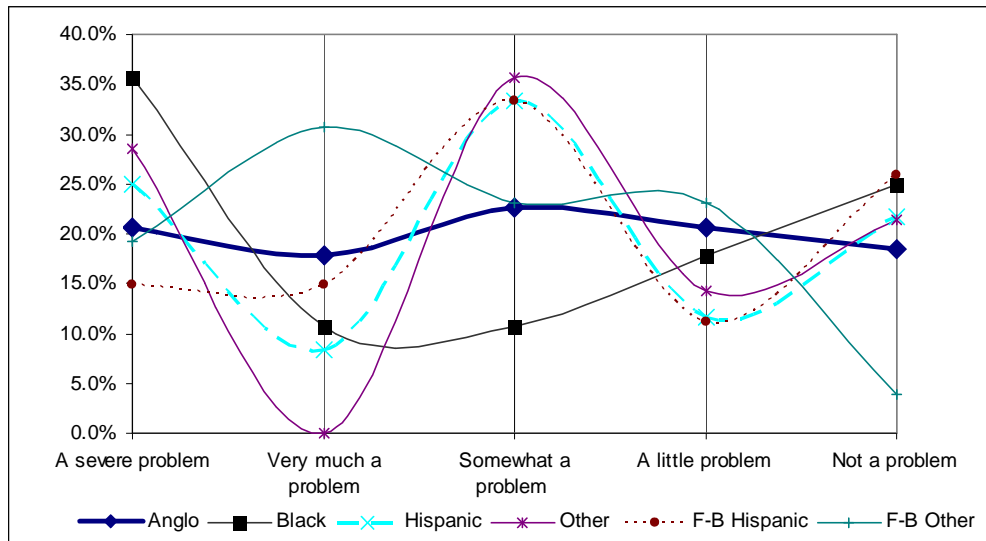


Figure 4.9 Distributions on Drivers Speeding on the Road

Every cohort indicates that not having walkways or sidewalks is problematic. Anglo respondents experience the most problems with a lack of sidewalks; 70.9% of them indicate “a severe problem” to “very much a problem” (Table 4.28). This correlates with their high walk trip rates per week (3.70 walk trips per week), and their propensity to live in suburban areas that may lack sidewalks. Some Foreign-Born Hispanics also indicate severe problems; nonetheless, more than half of the Foreign-Born Hispanic (51.4%) respondents tend towards the “not a problem” category; perhaps this is due to their recent experience of sidewalk shortages in their home countries.

Thus, they may not experience it as a real problem; in addition, Foreign-Born Hispanics do not walk as much per week as Anglos do (Table 4.17).

Table 4.28 Respondent Perceptions on Lack of Sidewalks

| Response | Anglo | Black | Hispanic | Other | F-B Hispanic | F-B Other |
|---------------------|--------|--------|----------|--------|--------------|-----------|
| A severe problem | 58.4% | 43.8% | 45.6% | 42.1% | 42.9% | 30.0% |
| Very much a problem | 12.5% | 18.8% | 13.2% | 15.8% | 5.7% | 23.3% |
| Somewhat a problem | 9.1% | 6.3% | 19.1% | 21.1% | 5.7% | 6.7% |
| A little problem | 8.2% | 15.6% | 7.4% | 5.3% | 17.1% | 10.0% |
| Not a problem | 11.9% | 15.6% | 14.7% | 15.8% | 28.6% | 30.0% |
| n= 537 | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% |

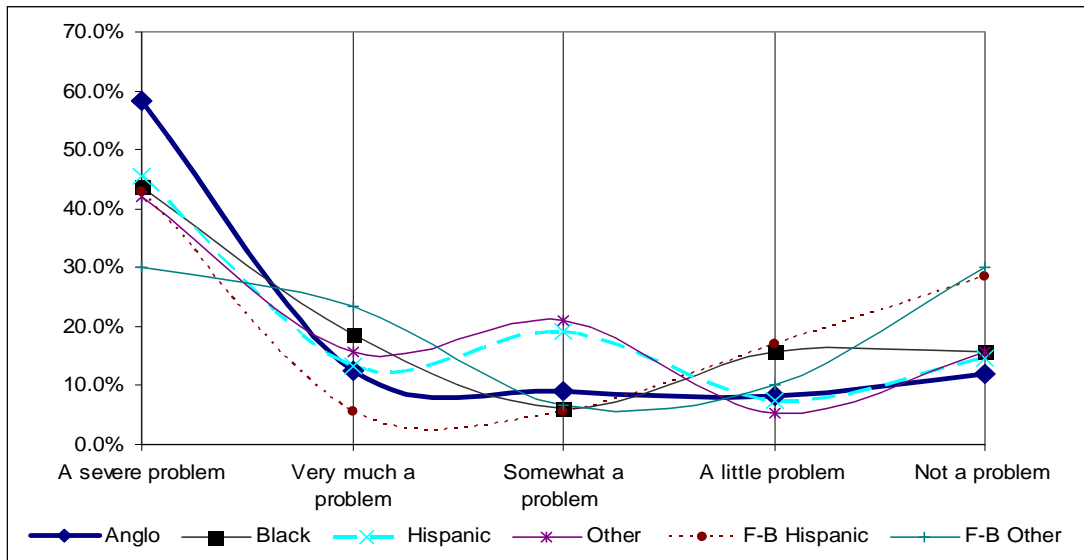


Figure 4.10 Respondent Perceptions on Lack of Sidewalks

4.5 Daily Trip Production by Activity

The NHTS allows the study to determine the amount of daily trips that respondents made to accomplish specific activities. These activities are work, work-related, family or personal, church or school, and social or recreational reasons. The tables presented in this section show only reasons for trip-making and not mode of travel.

Table 4.29 indicates that Foreign-Born Non-Hispanic, as a cohort, produces the most daily trips to work on average, with 0.932 trips per day per person. Recall that the life-cycle study in this document indicates that this minority cohort has the largest share of working adults with no children (Table 4.7). Thus, they are expected to make the most trips to work. The statistics from Table 4.30 indicate that most minority groups are not significantly different from the Anglo cohort on work-trip generation.

Table 4.29 Mean Daily Trips to Work

| | Anglo | Black | Hispanic | Other | F-B Hispanic | F-B Other |
|--------------------|--------------|--------------|-----------------|--------------|---------------------|------------------|
| Mean | 0.559 | 0.630 | 0.494 | 0.429 | 0.470 | 0.932 |
| Standard Deviation | 1.014 | 1.037 | 0.991 | 0.858 | 0.872 | 1.118 |
| Observations | 2155 | 227 | 482 | 140 | 279 | 146 |
| Df | | 274 | 724 | 165 | 382 | 162 |
| t Stat | | -0.9870 | 1.2947 | 1.7186 | 1.5754 | -3.9207 |
| P(T<=t) two-tail | | 0.3245 | 0.1958 | 0.0876 | 0.1160 | 0.0001 |

Minorities in this Texas sample make the least work-related trips, with the exception of the Foreign-Born Non-Hispanic cohort, which shows a 0.158 average daily work-related trips per cohort. The results indicate that there are no significant differences between Foreign-Born Non-Hispanic and Anglo respondents. This similarity may be due to the similar life-cycle characteristics, where the biggest share is among the two or more working adults household with no children. Black respondents make on average the least (0.035 trips/day/person) work related trips.

Table 4.30 Mean Daily Trips Work Related

| | Anglo | Black | Hispanic | Other | F-B Hispanic | F-B Other |
|--------------------|--------------|--------------|-----------------|--------------|---------------------|------------------|
| Mean | 0.158 | 0.035 | 0.095 | 0.043 | 0.061 | 0.158 |
| Standard Deviation | 0.820 | 0.246 | 0.531 | 0.265 | 0.480 | 0.595 |
| Observations | 2155 | 227 | 482 | 140 | 279 | 146 |
| Df | | 929 | 1063 | 357 | 519 | 184 |
| t Stat | | 5.0903 | 2.0814 | 4.0311 | 2.8723 | 0.0046 |
| P(T<=t) two-tail | | 0.0000 | 0.0376 | 0.0001 | 0.0042 | 0.9964 |

Table 4.31 indicates that the mean daily trips due to family or personal reasons for minorities are not significantly different from that of Anglo respondents. However, on average, U. S. born Hispanics generate the most family or personal trips per day on average (1.919 trips per day per person), and this may be due to their prevalent life-cycle stage.

Table 4.31 Mean Daily Trips due to Family or Personal Reasons

| | Anglo | Black | Hispanic | Other | F-B Hispanic | F-B Other |
|--------------------|--------------|--------------|-----------------|--------------|---------------------|------------------|
| Mean | 1.898 | 1.846 | 1.919 | 1.621 | 1.832 | 1.815 |
| Standard Deviation | 2.287 | 2.056 | 2.288 | 2.134 | 2.288 | 2.683 |
| Observations | 2155 | 227 | 482 | 140 | 279 | 146 |
| Df | | 288 | 712 | 160 | 354 | 160 |
| t Stat | | 0.3590 | -0.1837 | 1.4789 | 0.4560 | 0.3642 |
| P(T<=t) two-tail | | 0.7198 | 0.8543 | 0.1411 | 0.6487 | 0.7162 |

Table 4.32 indicates that Hispanic, U.S. or foreign born, on average make the most daily trips to Church or School. These statistics are related to the life-cycle stage of these cohorts. Hispanics have the highest number of children in their households; therefore, they produce the most school trips: on average, 0.559 trips per day per Foreign-Born Hispanic, and 0.535 trips per day per U.S. born Hispanic. In addition, Church trips seem to be higher on average for the Hispanic cohorts; however, under this level of aggregation, no significant statistics can be given for church-trip-generation or

school-trips alone. The Black cohort in Texas has a large school and church trip generation per day.

Table 4.32 Mean Daily Trips to Church or School

| | Anglo | Black | Hispanic | Other | F-B Hispanic | F-B Other |
|--------------------|--------------|--------------|-----------------|--------------|---------------------|------------------|
| Mean | 0.366 | 0.537 | 0.535 | 0.486 | 0.559 | 0.240 |
| Standard Deviation | 0.847 | 0.918 | 0.993 | 0.993 | 1.023 | 0.625 |
| Observations | 2155 | 227 | 482 | 140 | 279 | 146 |
| Df | | 268 | 647 | 152 | 329 | 183 |
| t Stat | | -2.6937 | -3.4692 | -1.3929 | -3.0210 | 2.3050 |
| P(T<=t) two-tail | | 0.0075 | 0.0006 | 0.1657 | 0.0027 | 0.0223 |

Anglo and U.S. Born Hispanics have the highest mean of daily trips generated due to social and recreational reasons, 1.090 and 1.012, respectively. Moreover, the t-test statistics show that there is not a significant difference between U.S. Hispanics and Anglos on their average trip generation due to social or recreational reasons. In contrast, Black respondents have the lowest mean rate (0.630 trips per day) of social and recreational trips, and Foreign-Born Hispanics are the third lowest with (0.821 trips per day).

Table 4.33 Mean Daily Trips Due to Social or Recreational Activities

| | Anglo | Black | Hispanic | Other | F-B Hispanic | F-B Other |
|--------------------|--------------|--------------|-----------------|--------------|---------------------|------------------|
| Mean | 1.090 | 0.630 | 1.012 | 0.736 | 0.821 | 0.904 |
| Standard Deviation | 1.466 | 1.138 | 1.577 | 1.191 | 1.236 | 1.391 |
| Observations | 2155 | 227 | 482 | 140 | 279 | 146 |
| df | | 311 | 679 | 168 | 387 | 168 |
| t Stat | | 5.6178 | 0.9888 | 3.3581 | 3.3453 | 1.5572 |
| P(T<=t) two-tail | | 0.0000 | 0.3231 | 0.0010 | 0.0009 | 0.1213 |

4.6 Daily Trip Production by Mode of Travel

Understanding the mode choice characteristic of minority cohorts in Texas is crucial for proper planning forecasts. Given the new population dynamics, studying the prevalent characteristics of each cohort and comparing them against each other is

important. Prevalent cohort tendencies can help us think about policy issues related to mode-choice; moreover, having a deeper understanding of modal differences can help the development of policies to address environmental justice issues.

Table 4.34 Mean Daily Trips Generated by POV

| | Anglo | Black | Hispanic | Other | F-B Hispanic | F-B Other |
|--------------------|--------------|--------------|-----------------|--------------|---------------------|------------------|
| Mean | 3.802 | 3.405 | 3.664 | 3.043 | 3.262 | 3.740 |
| Standard Deviation | 2.960 | 2.587 | 2.855 | 2.617 | 2.722 | 2.896 |
| Observations | 2155 | 227 | 482 | 140 | 279 | 146 |
| Df | | 292 | 731 | 163 | 369 | 166 |
| t Stat | | 2.1650 | 0.9526 | 3.2977 | 3.0869 | 0.2505 |
| P(T<=t) two-tail | | 0.0312 | 0.3411 | 0.0012 | 0.0022 | 0.8025 |

Table 4.35 Mean Daily Trips Generated by POV for Hispanics

| | Hispanics | F-B Hispanics |
|--------------------|------------------|----------------------|
| Mean | 3.664 | 3.262 |
| Standard Deviation | 2.855 | 2.722 |
| Observations | 482 | 279 |
| df | | 603 |
| t Stat | | 1.9294 |
| P(T<=t) two-tail | | 0.0541 |

Anglos generate the highest mean daily trips by privately owned vehicle (POV), where 3.802 trips per day are generated by this cohort on average. Foreign-Born Non-Hispanics rank second, with 3.740 average trips per day. Interestingly enough, among U.S. born minorities, Hispanics are the ones that generate the most passenger vehicle trips on average, with a 3.664 trips per day. Table 4.35 indicates that there are significant differences between U. S. born and Foreign-Born Hispanics. There seems to be a tendency to drive more as Hispanics integrate into the American way of life, as previous research indicates (Casas et al., 2004). Moreover, these differences may also be due to the low vehicle availability for the Foreign-Born Hispanic (1.745 vehicles per

household), as opposed to a higher vehicle availability for the U. S. Born Hispanic cohort (1.954 vehicles per household).

Table 4.36 Mean Daily Transit Trips

| | Anglo | Black | Hispanic | Other | F-B Hispanic | F-B Other |
|--------------------|--------------|--------------|-----------------|--------------|---------------------|------------------|
| Mean | 0.006 | 0.066 | 0.023 | 0.000 | 0.068 | 0.000 |
| Standard Deviation | 0.112 | 0.399 | 0.227 | 0.000 | 0.456 | 0.000 |
| Observations | 2155 | 227 | 482 | 140 | 279 | 146 |
| df | | 230 | 534 | 2154 | 282 | 2154 |
| t Stat | | -2.2572 | -1.5825 | 2.5049 | -2.2667 | 2.5049 |
| P(T<=t) two-tail | | 0.0249 | 0.1141 | 0.0123 | 0.0242 | 0.0123 |

Table 4.37 Mean Daily Transit Trips for Hispanics

| | Hispanics | F-B Hispanics |
|--------------------|------------------|----------------------|
| Mean | 0.023 | 0.068 |
| Standard Deviation | 0.227 | 0.456 |
| Observations | 482 | 279 |
| df | | 359 |
| t Stat | | -1.5524 |
| P(T<=t) two-tail | | 0.1215 |

It is not surprising that Foreign-Born Hispanics generate the highest transit trips per day, with a cohort average of 0.068 transit trips per day, whereas the Foreign-Born Non-Hispanic respondents fail to register any transit trips in Texas. Black respondents rank second for the highest amount of transit trips, with 0.066 transit trips per day. Furthermore, U.S. born Hispanics (0.023 transit trips per day) tend to make more transit trips than Anglos (0.006 transit trips per day). Even then, U. S. born Hispanics still produce much fewer transit trips than the Foreign-Born Hispanics (0.068 transit trips per day).

The NHTS examined other travel modes used per day; however, few daily trips by modes, other than car or transit, were recorded by minority cohorts. More research should be conducted for non-motorized modes of transportation among minorities. This

study presents only non-motorized trips, since significant differences were noted. The few data available for non-motorized trips reveals that U. S. born Hispanic respondents appear to have the highest propensity to use other modes of transportation, such as bicycles or other non-motorized vehicles, with an average of 0.0835 trips per day by using non-motorized vehicles. Also, Foreign-Born Hispanics are significantly different than U. S. born Hispanics at an 89% confidence level. Given the fact that U.S. born Hispanics are Texas' highest growing population, understanding how they use these non-motorized vehicles is important for transportation planners. The recorded high rate of non-motorized vehicle trips is partly due to Hispanic children taking trips to shop, to the barber, and other activities; U. S. born Hispanic children (less than 18 years of age) produce 67.7% of all the non-motorized trips recorded by this cohort, while U. S. born Hispanic adults produced the remainder of these trips (32.3%). Again, this finding is just an indication that more research needs to be conducted in order to understand how minority communities use non-motorized vehicles in Texas.

Table 4.38 Mean Daily Trips by Using Non-Motorized Vehicles

| | Anglo | Black | Hispanic | Other | F-B Hispanic | F-B Other |
|--------------------|--------------|--------------|-----------------|--------------|---------------------|------------------|
| Mean | 0.050 | 0.026 | 0.085 | 0.057 | 0.054 | 0.007 |
| Standard Deviation | 0.366 | 0.209 | 0.459 | 0.312 | 0.241 | 0.083 |
| Observations | 2155 | 227 | 482 | 140 | 279 | 146 |
| df | | 392 | 624 | 165 | 463 | 701 |
| t Stat | | 1.4861 | -1.5628 | -0.2552 | -0.2216 | 4.1426 |
| P(T<=t) two-tail | | 0.1381 | 0.1186 | 0.7989 | 0.8247 | 0.0000 |

Table 4.39 Mean Daily Trips by Using Non-Motorized Vehicles for Hispanics

| | Hispanics | F-B Hispanics |
|---------------------|------------------|----------------------|
| Mean | 0.085 | 0.054 |
| Standard Deviation | 0.459 | 0.241 |
| df | | 753 |
| t Critical one-tail | | 1.6469 |
| P(T<=t) two-tail | | 0.2188 |

4.7 Summary of Findings

The descriptive statistics presented in this chapter reveal different travel behaviors and attitudes for each of the minority cohorts studied. These differences must be understood by transportation policy makers, and transportation professionals. In general, the U.S. Born Hispanics tend to emulate Anglo travel behavior and attitudes more closely than any other minority cohort. However, U.S. born Hispanics have much lower incomes than Anglos, and their average household size is larger on average than Anglos (Table 4.2). In addition, vehicle ownership for U. S. born Hispanics is significantly lower than the Anglo cohort (Table 4.6). Moreover, the data indicate that Foreign-Born Hispanics show different travel behavior and perceptions of the transportation system than U.S. born Hispanics. And the Foreign-Born Non-Hispanic cohort in Texas has very similar socio-demographic characteristics than those of Anglos (Tables 4.2 to 4.8); however, the Foreign-Born Non-Hispanic cohort has lower trip generation rates than Anglo, besides trips related to work, which correlates to their prevalent life cycle—2 working adults with no kid(s).

The Black cohort was found to have lower trip rates, besides church and school trips, than Anglo respondents. Also, the Black cohort indicated facing the most problems on the transportation system in Texas (Tables 4.12 to 4.28). The next chapter will determine whether travel behavior differences are due to cultural or socio-economic differences.

CHAPTER 5

MULTIVARIATE MODELING

Multiple Linear Regression Models are developed to explore the relationship between minority cohorts and travel behavior. Some models are developed to predict trip generation of daily work trips and non-work trips. In addition, other interesting variables are studied, such as yearly miles driven, commute time, and transit usage. The five minority cohorts under this study are introduced as (dummy) variables into the models, so as to determine whether the cohorts under study are significant predictors for the dependent variables.

Linear models are used because they can determine whether race and ethnicity have an impact on travel behavior, while controlling for other socio-demographic explanatory variables. The previous chapter details significant travel behavior differences between each cohort. Yet, the previous analysis has not determined whether these travel differences are due to prevalent socio-economic characteristics or only to due to cultural/ethnic differences. One may validly argue that the travel differences presented in the descriptive statistics chapter are only due to social and economic gaps; however, this argument diminishes cultural differences, and previous research has indicated that cultural differences impact travel behavior and mode choice (Handy and Tal, 2005). Moreover, the multivariate analysis undertaken in this research shows that

even after accounting for life-cycle stage, car availability, income and other socio demographics, some minority groups still show differences in travel behavior.

Most of the models built with the NHTS Texas data set produced low coefficients of determination. However, low R^2 values are expected, since we are dealing with many categorical variables, and with human travel behavior issues. The models developed for this research are built for Texan respondents living in urbanized areas. This analysis is limited to urban respondents in order to achieve the geographical stability expected for this type of transportation model (Ortuzar and Willumsen, 2001).

A person-category approach is followed, for several reasons:

(1) A person-level trip generation model is compatible with other components of the classical transport demand modeling system, which is based on trip makers rather than on households, (2) It allows a cross-classification scheme that uses all important variables and yields manageable number of classes; this in turn allows class representation to be forecasted more easily. (3) The sample size required to develop a person-category model can be several times smaller than that required to estimate a household-category model. (4) Demographic changes can be more easily accounted for in a person-category model [...] and (5) Person categories are easier to forecast than household categories.³⁴

5.1 Variables Developed for this Study

In order to study the different minority cohorts, a set of variables were developed to account for socio-demographic characteristics. Most of the variables studied are categorical by nature and they are introduced as indicator (dummy) variables into the models. Dummy variables help the author analyze whether different personal categories are significant in a given model. Before building the model, a base cohort is

³⁴ Ortuzar and Willumsen, (2002), "Modeling Transport." (Proposed by Supernak et al. 1983).

determined; hence, when all indicator variables are ‘zero’, the category that is left as a base of reference in the model belongs to the Mid-Income Anglo family—with two adults and kid(s), and with 2 cars available in their household. This categorical cohort is used as a base for modeling because they comprise about 30% of all survey respondents, and as such it is the biggest categorical-cohort in this data set. Therefore, a robust base was chosen as a source of comparison.

Table 5.1 Variable Definition

| Variable | Definition |
|----------------|--|
| BLACK | African-American or Black Respondent |
| HISPANIC | Hispanic Respondent |
| OTHER | Other Race/Ethnicity Respondent |
| FB_HISPANIC | Hispanic Immigrant or Foreign-Born Hispanic |
| FB_OTHER | Other Immigrant of Foreign-Born Non-Hispanic |
| LIF_CYC_1A | Life Cycle of respondent 1 Adult no kid(s) |
| LIF_CYC_2A | Life Cycle of respondent 2+ Adults no kid(s) |
| LIF_CYC_SAK | Life Cycle of respondent 1 Adult with kid(s) |
| LIF_CYC_1RA | Life Cycle of respondent 1 Retired Adult no kid(s) |
| LIF_CYC_2RA | Life Cycle of respondent 2 Retired Adults no kid(s) |
| HHINCTTL_LOW | Total Household income of respondent is below \$30,000 |
| HHINCTTL_HIGH | Total Household income of respondent is above \$65,000 |
| HHVEHCNT_DUM_0 | Respondent lives in a zero vehicle household |
| HHVEHCNT_DUM_1 | Respondent lives in a 1 vehicle household |
| HHVEHCNT_DUM_3 | Respondent lives in a 3+ vehicles household |
| WRKCOUNT | Number of worker the respondents household |
| DISTTOWK | Distance to work in miles |
| TIMETOWK | Number of minutes to get to work (Used as dependent variable) |
| NUMADLT | Number of adults in the household |
| TOT_DTNWRK | Total number of Not-Work Related Trips (Used as dependent variable) |
| TOT_DTWORK | Total number of Work and Work Related Trips (Used as dependent variable) |
| R_SEX_MALE | Respondent's sex is male |
| LYEARMILE | The Natural Log of the number of miles that respondent drove the last 12 months (Used as dependent variable) |

The life cycle indicator variables help categorize the level of activity that may be present in a given household. As previously shown in the descriptive statistics chapter, the prevalent life-cycle stage is different for each minority cohort. The

prevalent life-cycle for Hispanic respondents is that of families with children under 18 years of age that may also be hosting adult children or parents. Another benefit appears to be that the life-cycle variable accounts for the age of the respondents in an implicit way along with household size. Moreover, Life-cycle has rarely entered into trip generation models or cross-classification methods; however, given the rapidly changing demographics—large segments of the population getting older, household sizes on average decreasing, and single-person households on the rise—it is important to consider these life-cycle shifts in our models (Ortuzar and Willumsen, 2001)³⁵.

5.2 Trip Generation Models for Work-Trips and Non-Work-Trips

5.2.1 Trip Generation Model for Non-Work Trips

A model to estimate the number of Non-Work Daily Trips is developed based on a total of 1120 observations. The number of observations is reduced because only urban workers are included in these models, and from those workers, only those that provided their distance to work are incorporated into the model. The adjusted R^2 is 0.102, which is weak, and indicates that only about 10% of the variability can be explained by this model; however, a low R^2 value for these types of models is expected. This is true because there are numerous categorical variables; moreover, the random-human-component in trip generation can not be accounted for very easily. This model may still reveal some information that may be helpful for policy guidance, but it is of limited use for forecasting purposes.

³⁵ Ortuzar and Willumsem, (2002), “Modeling Transport,” Third Edition: 155-6

In order to build this model, a standard backward variable elimination procedure was used, and statistical tests were conducted to determine the homogeneity of variance and the normality of error terms, among others. The Non-Work related trip generation model shows that 4.253 (the intercept) is the average number of non-work related trips for the base socio-demographic characteristics, which is the Mid-Income Anglo family—with two adults and kid(s), and with 2 cars available, and as their distance to work increases, the number of non-work trips decreases. Moreover, males tend to take fewer non-work trips than females. Also, the most powerful variable in these two models is TOT_DTWORK; this variable accounts for the number of work or work-related trips taken per day, and based on the model results, each work trip takes away about half of a non-work trip. Moreover, Foreign-Born Non-Hispanic and the U. S. born Other cohort are the only minority cohorts that show some significance in this model. Respondents in these two groups tend to take fewer non-work related trips, even after accounting for other socio-demographics and life-cycle characteristics.

Table 5.2 Non-Work Daily Trips (Urban Texas)

| Variable | Estimate | Error | t-value | Pr> t |
|----------------|---------------|--------|----------|--------|
| Intercept | 4.253 | 0.1919 | 22.16 | <.0001 |
| OTHER | -1.001 | 0.4078 | -2.45 | 0.0143 |
| FB_OTHER | -0.521 | 0.2956 | -1.76 | 0.0783 |
| LIF_CYC_2A | -0.510 | 0.1737 | -2.93 | 0.0034 |
| LIF_CYC_1RA | 3.899 | 1.8391 | 2.12 | 0.0342 |
| LIF_CYC_2RA | -0.978 | 0.3801 | -2.57 | 0.0102 |
| HHINCTTL_LOW | -0.485 | 0.2146 | -2.26 | 0.0240 |
| HHVEHCNT_DUM_O | -1.920 | 0.7171 | -2.68 | 0.0075 |
| HHVEHCNT_DUM_1 | 0.395 | 0.2297 | 1.72 | 0.0856 |
| HHVEHCNT_DUM_3 | 0.294 | 0.1762 | 1.67 | 0.0956 |
| DISTTOWK | -0.009 | 0.0054 | -1.73 | 0.0831 |
| TOT_DTWORK | -0.451 | 0.0513 | -8.8 | <.0001 |
| R_SEX_MALE | -0.329 | 0.1567 | -2.1 | 0.0361 |
| n=1120 | R-Square= | 0.112 | MSE= | 6.673 |
| df=1108 | Adj R-Square= | 0.102 | F-value= | 11.64 |

5.2.2 Trip Generation Model for Work and Work-Related Trips

A work trip generation model is also developed, and the dependent variable for this model is the total amount of work trips and work-related trips generated per person. Again, this model results in a low coefficient of determination, with an adjusted R^2 of 0.087. Different variables are introduced one by one into the model; also a backward elimination technique is used, but none of the race/ethnicity variables show any significance. Interestingly enough, the intercept, 2.199, indicates the average number of work trips generated by the base structure. This value is greater than two, because non-home-based-work-trips are also incorporated as a dependent variable. Thus, trips generated from work to lunch and other are also counted. The model also indicates that for every Non-Work related trip taken, there is a negative impact to the amount of work related trips one generates, which is expected. One may expect the intercept to be lower

than two; however, a work trip in this model also incorporates non-home-based work trips. Moreover, males take 0.205 extra work trips than females, and households with low vehicle availability also produce fewer work related trips on average.

Table 5.3 Work and Work Related Daily Trips (Urban Texas)

| Variable | Estimate | Error | t-value | Pr> t |
|----------------|--------------|--------|----------|--------|
| Intercept | 2.199 | 0.1977 | 11.12 | <.0001 |
| NUMADLT | -0.244 | 0.0952 | -2.56 | 0.0107 |
| LIF_CYC_2A | 0.189 | 0.0964 | 1.96 | 0.0502 |
| HHVEHCNT_DUM_O | -0.713 | 0.3963 | -1.8 | 0.0721 |
| HHVEHCNT_DUM_1 | -0.222 | 0.1337 | -1.66 | 0.0972 |
| WRKCOUNT | 0.162 | 0.0912 | 1.78 | 0.0759 |
| DISTTOWK | -0.010 | 0.0030 | -3.28 | 0.0011 |
| TOT_DTNWRK | -0.143 | 0.0162 | -8.83 | <.0001 |
| R_SEX_MALE | 0.205 | 0.0890 | 2.3 | 0.0214 |
| n=1120 | R-Square | 0.0934 | MSE= | 2.124 |
| df=1107 | Adj R-Square | 0.0869 | F-value= | 14.320 |

5.3 Annual Miles Driven for Texan Urban Drivers

The model developed to predict Yearly Miles Driven per Respondent results in a low, yet significantly improved coefficient of determination, with an adjusted R^2 of 0.157. In order to build an appropriate linear model, the Yearly Miles Driven reported by respondents is transformed using a log-normal transformation. Therefore, the year miles driven estimates are also presented transformed back into miles. A yearly miles driven model was previously attempted with NHTS national data to account for the significance of immigrant arrival; that model resulted in an R^2 of 0.090 (Tal and Handy, 2005). Modeling this dependent variable is a difficult task, because few respondents

answered this question and the magnitude of this value can be significantly affected by vacation trips and other random events.

This model only accounts for Texan urban drivers, and the model developed indicates that three minority cohorts are significant: Hispanics, Foreign-Born Hispanics, and Foreign-Born Non-Hispanic. These minority cohort respondents show fewer yearly vehicle miles traveled, than any other race/ethnicity cohort, even after accounting for socio-demographic variables. These results coincide with the descriptive statistics presented in Chapter 4, where Foreign-Born respondents show low VMT per year. In general, and accounting for the fact that this model only explains 15.7% of the variability, Hispanics families drive 2,327 miles less, per year, than a Mid-Income Anglo Family—with two adults and kid(s), and with 2 cars available (base category structure), Foreign-Born Hispanics in Texas drive 180 miles less than U.S. Born Hispanics in a similar socio-demographic group per year. Foreign-Born Non-Hispanics drive 1,615 miles less per year than the base cohort structure. A person under the single-adult household life-cycle drives 7,146 more miles per year than a person living under any other life-cycle stage. Furthermore, an adult living in a 2 or more adult household with no kids drives 938 miles less than those living in a family household with children. Moreover, drivers living in a low income household drive 2,489 miles less, per year on average, than those living in a mid-income household, while a driver respondent living in a high-income household drives 1,848 more miles per year. Also, this model indicates that males tend to drive 2,694 more miles per year than females; also for every mile to work, an additional 105 miles are added to the yearly average.

Table 5.4 Yearly Miles Driven Per Respondent (Urban Texas)

| Variable | ln(Estimate) | Error | Year Miles | t-value | Pr> t |
|----------------|--------------|--------|------------|---------|--------|
| Intercept | 8.9128 | 0.0932 | 7426 | 95.60 | <.0001 |
| HISPANIC | -0.3760 | 0.1091 | -2327 | -3.45 | 0.0006 |
| FB_HISPANIC | -0.4118 | 0.1752 | -2507 | -2.35 | 0.0190 |
| FB_OTHER | -0.2452 | 0.1388 | -1615 | -1.77 | 0.0777 |
| LIF_CYC_1A | 0.6741 | 0.1515 | 7146 | 4.45 | <.0001 |
| LIF_CYC_2A | -0.1350 | 0.0786 | -938 | -1.72 | 0.0861 |
| HHINCTTL_LOW | -0.4083 | 0.1176 | -2489 | -3.47 | 0.0005 |
| HHINCTTL_HIGH | 0.2222 | 0.0793 | 1848 | 2.80 | 0.0052 |
| HHVEHCNT_DUM_1 | -0.4404 | 0.1240 | -2645 | -3.55 | 0.0004 |
| DISTTOWK | 0.0140 | 0.0024 | 105 | 5.86 | <.0001 |
| TOT_DTWORK | 0.0660 | 0.0237 | 507 | 2.78 | 0.0055 |
| R_SEX_MALE | 0.3095 | 0.0722 | 2694 | 4.29 | <.0001 |
| n=859 | R-Square | 0.167 | MSE= | 1.08128 | |
| df=847 | Adj R-Square | 0.157 | F-value= | 15.49 | |

5.4 Commute Time Linear Model

Commute time models were developed, and some of the models developed barely incorporated some minority cohort variables. However, after carefully examining each variable, the author determined that they only added 3% to the overall model performance; thus, in order to avoid confusion they were dropped. An examination of this model shows that it only accounts for Texas' workers that drive a privately owned vehicle (POV) to work on a regular weekday. An adjusted R^2 of 0.670 is revealed, which indicates that this model accounts for a high amount of variability. Time to work is highly correlated to distance to work. An access time of 7.97 minutes is estimated, which adds 1.08 minutes for every mile driven. In other words, a 15 mile commute in an urban area in Texas will take a respondent an average of about 24.17 minutes,

traveling at an average speed of 37 mph. The socio-demographics variables developed did not show noteworthy significance in this model.

Table 5.5 Time to Work for Texas Urban Workers (in Minutes)

| Variable | Estimate | Error | t-value | Pr> t |
|-----------|--------------|--------|----------|--------|
| Intercept | 7.97 | 0.4699 | 16.96 | <.0001 |
| DISTTOWK | 1.08 | 0.0277 | 38.91 | <.0001 |
| n=744 | R-Square | 0.671 | MSE= | 73.650 |
| df=742 | Adj R-Square | 0.670 | F-value= | 202.53 |

5.5 Transit Usage Model

The model presented in this section is not a transit trip generation model; it is instead a model that is meant to reveal the categories of persons that are likely to take transit among urbanized Texas survey respondents. The dependent variable is the total number of daily trips taken by public transit. The linear regression model shows an adjusted R^2 of 0.1478, which is weak, yet it is to be expected, since this includes all types of people that may or may not use transit.

The model reveals that two minority cohorts are very likely to use transit; these are African-American or Blacks, and Foreign-Born Hispanics. Moreover, persons living in single-parent households are also likely to benefit from transit services. Finally, not having a vehicle is the most powerful explanatory variable for transit usage in urbanized Texas.

Table 5.6 Transit Trip Usage

| Variable | Estimate | t-value | Pr> t |
|----------------|--------------|---------|--------|
| Intercept | -0.00361 | -0.6 | 0.5474 |
| BLACK | 0.09867 | 4.4 | <.0001 |
| FB_HISPANIC | 0.07051 | 3.45 | 0.0006 |
| LIF_CYC_SAK | 0.12589 | 4.45 | <.0001 |
| HHVEHCNT_DUM_O | 0.5729 | 12.2 | <.0001 |
| n=1385 | R-Square | 0.1502 | |
| df=1380 | Adj R-Square | 0.1478 | |
| F-value | 61.04 | <.0001 | |
| MSE= | 0.04144 | | |

The final model only considers the impact of work trips on transit, and the model gives an adjusted R^2 of 0.1048. This model indicates that Foreign-Born Hispanic is not a significant predictor variable for assessing work trips by transit. The fact that Foreign-Born Hispanics are significant in the Transit Usage Model and not in the Work Trip Transit Usage Model may be due to Foreign-Born Hispanics commuting with friends to work or using the single household vehicle to commute to work. As a result, the other members of his/her household are car-less, and in need of public transit.

Table 5.7 Work Trip Transit Usage

| Variable | Estimate | Error | t-value | Pr> t |
|----------------|--------------|---------|---------|--------|
| Intercept | 0.000225 | 0.00635 | 0.04 | 0.9717 |
| BLACK | 0.12152 | 0.02368 | 5.13 | <.0001 |
| LIF_CYC_SAK | 0.14799 | 0.03178 | 4.66 | <.0001 |
| HHVEHCNT_DUM_O | 0.37635 | 0.05375 | 7.00 | <.0001 |
| n=973 | R-Square | 0.1111 | MSE= | 0.0353 |
| df=969 | Adj R-Square | 0.1084 | F-value | 40.54 |

5.6 Summary of Findings

The multivariate analysis presented in this section corroborates previous findings, where it is indicated that race/ethnicity, and immigrant status impact travel behavior, even after accounting for socio-demographics (Handy and Tal, 2005). The models developed with this Texas data set reveal differences amongst minority cohorts. It was found that the Other race/ethnicity cohort tends to generate fewer non-work related trips than any other cohort; moreover, the Foreign-Born Non-Hispanic cohort was also found to produce fewer non-work-trips. The Work and Work-Related Trip Generation Model developed for this study indicates that no race/ethnicity cohort has significantly different travel behavior characteristics for work trips, and this may indicate that work-trip production differences in Texas may only be due to socio-demographic differences, and not cultural/ethnic differences. Furthermore, Foreign-Born Hispanic respondents were found to produce fewer vehicle miles of travel per year than any other cohort even after accounting for socio-demographic variables. Moreover, U.S. born Hispanics were found to generate fewer vehicle miles of travel per year, than any other U.S. born cohort. This finding contrasts with that of Tal and Handy (2005), who found that Hispanic Immigrants drive more than non-Hispanic Immigrants. In Texas, the study finds that Foreign-Born Hispanics drive 829 miles less than Foreign-Born Non-Hispanic, and this phenomenon may be due to the fact that Foreign-Born Non-Hispanics have higher income and higher vehicle ownership than Foreign-Born Hispanics.

Finally, the Transit Usage Models indicate that transit trips in urban areas in Texas are produced mainly by minority communities, such as, African-Americans, Foreign-Born Hispanics, single adults with kid(s), and persons without a car available. Moreover, Foreign-Born Hispanics do not seem to use transit for commuting to work. These findings may require further research, in order to understand how these minority communities are benefiting from transit services, and whether it is allowing them to have adequate access to jobs and educational opportunities in urban areas across Texas.

CHAPTER 6

CONCLUSIONS

The travel behavior of minority cohorts for one of the largest ‘melting-pot’ states in America is analyzed. The aggregation of minority cohorts follow similar standardized minority grouping techniques developed by the Texas State Data Center. In consequence, an accessible point of comparison throughout this paper is used. The fastest growing minority cohort in Texas, the U. S. born Hispanics have different travel behavior characteristics than those of Anglos, Blacks, and the two Foreign-Born groups. Significant travel-behavior differences are found among U. S. born and Foreign-Born Hispanics. Some of the more interesting findings of this study are elaborated upon in this concluding chapter.

6.1 U.S. Born Hispanics in Texas

The data indicates that U.S. born Hispanics tend to emulate Anglo travel behavior and attitudes more closely than any other minority cohort. However, U.S. born Hispanics have much lower incomes than Anglos (\$14,000 less on average), and their average household size is greater on average than that of Anglos (Table 4.2). In addition, vehicle ownership for U. S. born Hispanics is significantly lower than the Anglo cohort (Table 4.6). This may indicate that travel demand models that include income, vehicle availability, and household size alone, may need to be calibrated based on the new Texas demographics. This is the case because the data indicate that the

Hispanic cohort makes a comparable amount of work trips as the Anglo cohort (Table 4.30); also, the family and personal trip rate production is very similar to that of the Anglos (Table 4.31). Furthermore, it was found that the U.S. born Hispanic cohort produces a lot more trips per person to Church and School than the Anglo cohort (Table 4.32), which in turn indicates that Hispanics may produce more non-work-related trips. Hispanics' high travel activity may be contrary to what it is commonly shown in cross-classification methods, where less money and fewer cars, means less trips; which appears to not be the case for U. S. born Hispanics.

U. S. born Hispanics typically live in households with children—single adult with children and two adults with children—life cycles (77.7%), and they possess the largest share for this type of life-cycle, among all cohorts, with the exception of the Foreign-Born Hispanics (Table 4.7). This fact alone makes the U.S. born Hispanic cohort very active in trip production for family, church, and school trips reasons (Tables 4.31 and 4.32), which may cause peak time variations in the near future. This is because more and more U.S. born Hispanics will bring their kids to either day-care or school before they can actually arrive at work in the morning, and this fact alone may impact traffic. More research is needed in order to understand this forthcoming phenomenon.

Moreover, the data indicates that U. S. born Hispanics tend to live closer to work than Anglos (Table 4.13), and their commute times are also lower than any other race/ethnicity cohort (Table 4.15). In contrast, the statistics seem to indicate (at an 80% confidence level) that Foreign-Born Hispanics live 2.4 miles farther away from work, than U. S. born Hispanics (Table 4.14). These statistics may indicate that U.S. born

Hispanics may prefer to live closer to work, so as to be able to have more time available for non-work related trips; such a relationship is found through the multivariate model presented in Table 5.2. However, more research is needed to understand their preferences, or otherwise, for living closer to their place of work.

The perception of the transportation system chapter shows that U. S. Born Hispanics worry the most about traffic accidents; moreover, they also experience aggressive drivers, on their day-to-day travel, more than any other race/ethnicity groups besides African-Americans. This is an issue that may need more research, since they may be worried about traffic accidents because some of them may be “uninsured motorists”, or else because for them getting into an accident may have more adverse effects than for any other minority cohort, since, on average, they have big families and lower incomes, and a traffic accident can create severe financial and mobility strains.

6.2 U.S. Born Hispanics v.s. Foreign-Born Hispanics in Texas

The data indicate that Foreign-Born Hispanics show different travel behavior and perceptions of the transportation system than U.S. born Hispanics. Moreover, ‘new-comer’ Hispanic immigrants have different travel patterns than ‘settled’ Hispanics immigrants, since national data indicate that as Hispanics assimilate in the American way of life they emulate the travel behavior of U.S. born Hispanics (Casas et al., 2004). This study corroborates the findings of Casas, where, in general, U. S. born Hispanics have different travel behavior than Foreign-Born Hispanics. However, given the small sample for Foreign-Born Hispanics in Texas, no distinctions among Hispanic immigrants are possible. However, more research needs to be conducted on this critical

issue for Hispanics in Texas. A future study may use the next NHTS data survey, to be conducted in 2008, to analyze longitudinal data instead of cross-sectional data, to determine how the large groups of Hispanic immigrants that came to America between 1990 to 2000 are integrating into the U.S.

This research indicates that Foreign-Born Hispanics produce fewer trips on average than U.S. born Hispanics (Table 4.11). Moreover, 84.3% of their population lives in family households with children (single adult with children and two adults with children), and this fact may help explain their higher church and school trip rate production than any other race/ethnicity cohort (Table 4.32). Moreover, Foreign-Born Hispanics produce more transit trips than U. S. born Hispanics (Table 4.36). However, multivariate analysis shows that Foreign-Born Hispanics do not take a significant amount of trips to work by transit (Table 5.7). This may indicate that trips generated by transit for this cohort may be taken by the non-worker members in the Foreign-Born Hispanic household. More research needs to be conducted on this issue. Last, a large number of Foreign-Born Hispanics do not have a car; therefore, they may be incurring mobility problems, and given that they are not using transit to commute to work, transit availability, for them and for their families, may be inadequate to facilitate their access to jobs and educational institutions in urban Texas.

Multivariate analysis indicates that Foreign-Born Hispanics drive less than U.S. born Hispanics, even after accounting for socio-demographics. Moreover, U.S. Born Hispanic respondents drive fewer vehicle miles than Anglo cohort respondents (Table 5.4). Furthermore, the Foreign-Born Hispanic is the only cohort that did not find any

problems with the transportation system, which is significant, since they may not want to voice their opinion loudly, or else they may experience these problems minimally, since they may be used to poorer transportation conditions in their home countries (Tables 4.21 to 4.28). Future research may be able to consider their perceptions on the transportation system as they assimilate in the American way of life. Given that the NHTS survey was conducted in 2001, an analysis of how this population is changing over time by analyzing future surveys can quantify this effect. However, learning more about this cohort requires that the transportation survey data includes the race/ethnicity, immigrant status, and year of arrival variables that the previous NHTS survey acquired for the first time.

6.3 African-Americans (Blacks) in Texas

One of the most interesting findings of this research is that the African-American cohort seems to incur the longest commute times (Table 4.15), and a significant number of African-Americans commute to work by transit, as the model in Table 5.7 indicates. Moreover, the African-American cohort did not appear significant in any of the other models, indicating that African-Americans may have the same cultural-travel-behavior as Anglos, but their differences in travel behavior are mainly determined by their socio-economic circumstances. Black respondents second largest life-cycle stage is that of single parent families, and the transit model presented in Table 5.6 indicates that people living under single adult with kid(s) family households are a significant predictor for transit usage. These findings are interesting, and they were similar to previous national findings (Tal and Handy, 2005). Furthermore, the findings

in this study tend to indicate that the majority of the public transit system in urban Texas is mainly utilized by minority groups, such as Foreign-Born Hispanics, African-Americans, and persons living under single parent households (Table 5.7). As Texas' urban areas expand their transit systems, research should focus on how the different cohorts benefit from these improvements. Last, Black respondents indicated long commutes, and high discomfort with traffic congestion. They are also the cohort that experienced the most problems with the transportation system (Table 4.21 to 4.28).

6.4 Foreign Born Non-Hispanic and U. S. Born Other in Texas

The most interesting finding for the Foreign-Born Non-Hispanics in Texas, is that they have very similar socio-demographic characteristics to those of Anglos. This is mainly due to the fact that about 60% of these immigrants are White/Europeans that arrived before the 1990s (Figure 3.1). Moreover, the second largest share of life-cycle for them is that of two working adults with no kids (Table 4.7), and this is similar to Anglo characteristics. These figures explain the fact that this cohort makes the most trips to work on average (Table 4.3), and this relates to their low non-work related trip rates. In addition, the multivariate model presented in Table 5.2 indicates that even after accounting for socio-demographics, the Foreign-Born Non-Hispanic cohort produces fewer non-work daily trips than Anglos. In addition, they tend to drive fewer vehicle miles per year on average than U.S. born Anglos, as the model in Table 5.4 indicates. Moreover, the 'Other' race/ethnicity cohort under study shows the lowest work trip generation rates (Table 4.29); the lowest family and personal reason trip rates also belong to this group (Table 4.31). Finally, multivariate analysis shows that even after

accounting for socio-demographic variables, the 'Other' race/ethnicity group produces less non-work daily trips than any other race/ethnicity cohort.

The findings of this study relating to the travel behavior of minority cohorts in Texas are not only interesting social and cultural transportation issues, but these findings can help transportation planners understand the needs of minority communities in Texas, and ensure that equitable transportation services are provided among them all. Moreover, given the demographic forecasts presented earlier in this study and the findings from this study, significant changes to the transportation plans of the future may be necessary. Tracking and understanding the Hispanic and other minority cohorts and determining how foreign-born communities integrate into the American way of life is crucial for transportation planners and travel demand modelers, and this is of special importance to Texas' transportation professional. The findings in this study indicate that Texas may be facing a transportation-cultural change, due to the different travel behaviors and attitudes of burgeoning minority communities.

APPENDIX A
SUMMARY OF FINDINGS TABLES

Summary of Findings Table A.1

| | Anglo | Hispanic | F-B Hispanic | Black | Other | F-B Other |
|-----------------------------|------------|-----------|--------------|-----------|----------|-----------|
| Income | \$49,100 | \$35,700 | \$25,100 | \$31,600 | \$44,900 | \$49,300 |
| HH size | 2.40 | 3.13 | 3.80 | 2.47 | 2.28 | 2.78 |
| Population (2005) | 11,228,854 | 5,102,240 | 2,274,908 | 2,528,798 | 153,119 | 568,727 |
| Adults in HH | 1.86 | 2.14 | 2.12 | 1.74 | 1.90 | 1.96 |
| Average Age | 41.05 | 29.17 | 29.99 | 36.56 | 32.27 | 43.77 |
| HH Vehicles | 2.131 | 1.954 | 1.745 | 1.636 | 1.917 | 2.013 |
| Number of Drivers | 1.863 | 1.888 | 1.872 | 1.561 | 1.771 | 1.938 |
| Single Adult | 5.1% | 3.1% | 1.8% | 5.3% | 5.0% | 6.8% |
| 2 Adults no kids | 19.5% | 12.2% | 7.5% | 13.2% | 16.4% | 32.9% |
| Single Parent Family | 4.1% | 5.4% | 9.0% | 12.8% | 0.0% | 2.1% |
| Families | 48.1% | 71.6% | 75.3% | 47.6% | 63.6% | 49.3% |
| One retired | 4.1% | 1.0% | 0.4% | 4.8% | 1.4% | 1.4% |
| Two retired | 19.2% | 6.6% | 6.1% | 16.3% | 13.6% | 7.5% |
| Urban | 61.7% | 42.5% | 55% | 78.9% | 68.6% | 79.5% |
| Rural | 38.3% | 57.5% | 45% | 21.1% | 31.4% | 20.5% |
| Distance to Work (mi) | 14.4 | 12.2 | 14.6 | 15.2 | 16.9 | 13.7 |
| Time to Work (min) | 22.8 | 19.8 | 22.6 | 28.4 | 27.9 | 25.3 |
| Commute Average Speed (mph) | 37.9 | 37.0 | 38.8 | 32.1 | 36.3 | 32.5 |
| Walk Trips (week) | 3.7 | 3.16 | 2.18 | 3.65 | 3.67 | 3.06 |
| VMT (miles) | 14977 | 14271 | 9310 | 15103 | 16509 | 12873 |

Summary of Findings Table A.2

| | Anglo | Hispanic | F-B Hispanic | Black | Other | F-B Other |
|---------------------------|------------------|------------------|---------------------|------------------|------------------|------------------|
| Traffic Accidents | Not a problem | A problem | Not a problem | More-or-Less | Not a problem | More-or-Less |
| Distracted Drivers | More-or-Less | More-or-Less | More-or-Less | A problem | A problem | A problem |
| Highway Congestion | Not a problem | Not a problem | Not a problem | A problem | Not a problem | More-or-Less |
| Drunk Drivers | Not a problem | More-or-Less | Not a problem | More-or-Less | Not a problem | Not a problem |
| Price of Gasoline | Not a problem | Not a problem | Not a problem | A problem | Not a problem | Not a problem |
| Aggressive Drivers | More-or-Less | A problem | Not a problem | A problem | Not a problem | More-or-Less |
| Drivers Speeding | More-or-Less | More-or-Less | Not a problem | A problem | Not a problem | A problem |
| Lack of Side Walks | A problem | A problem | More-or-Less | A problem | A problem | A problem |
| Average Total Daily Trips | 4.12 | 4.07 | 3.75 | 3.71 | 3.35 | 4.1 |
| To Work | 0.559 | 0.494 | 0.470 | 0.630 | 0.429 | 0.932 |
| Work Related | 0.158 | 0.095 | 0.061 | 0.035 | 0.043 | 0.158 |
| Family/Personal | 1.898 | 1.919 | 1.832 | 1.846 | 1.621 | 1.815 |
| Church/School | 0.366 | 0.535 | 0.559 | 0.537 | 0.486 | 0.240 |
| Social/Recreational | 1.090 | 1.012 | 0.821 | 0.630 | 0.736 | 0.904 |
| POV | 3.802 | 3.664 | 3.262 | 3.405 | 3.043 | 3.262 |
| Percent of Trips | 92.5% | 90.1% | 86.9% | 91.8% | 90.8% | 91.3% |
| Transit | 0.006 | 0.023 | 0.068 | 0.066 | 0 | 0 |
| Percent of Trips | 0.1% | 0.6% | 1.8% | 1.8% | 0.0% | 0.0% |

APPENDIX B

SAS CODE: AGREGATION OF RACE/ETHNICITY GROUPS

```

data subsetCOHORT;
  set saslib.person;

  if URBRUR =1;

  *IF WORKER=1;
  *IF FRSTHM=1;
  *IF PTUSED=1 OR PTUSED=2;
  *if URBRUR =2 then RURAL=1; *ELSE RURAL=0;

  IF R_SEX = 1 THEN R_SEX_MALE=1; ELSE R_SEX_MALE=0;

  IF TIMETOWK=<-1 THEN TIMETOWK=.;
  IF DISTTOWK=<-1 THEN DISTTOWK=.;
  IF YEARMILE=<-1 THEN YEARMILE=.;

  *IF TOT_DTM2=0 THEN DELETE;

  TOT_DTWORK= TOT_DTR1 + TOT_DTR2;
  TOT_DTNWRK= TOT_DTR3 + TOT_DTR4 + TOT_DTR5 + TOT_DTR6;
  *TOT_DTnoCAR= TOT_DTM2 + TOT_DTM4 + TOT_DTM5;

  LYEARMILE= LOG(YEARMILE);
  *AVG_SPEED=(DISTTOWK/TIMETOWK)*60;

  *****ONLY WORK WEEK TRIPS*****;

  *IF TRAVDAY=2 OR TRAVDAY=3 OR TRAVDAY=4 OR TRAVDAY=5 OR
  TRAVDAY=6;

  *****TRANSPORTATION MODE*****;

  *IF WRKTRANS=01 OR WRKTRANS=02 OR WRKTRANS=03 OR WRKTRANS=04 OR
  WRKTRANS=05 OR WRKTRANS=07 OR WRKTRANS=08 OR WRKTRANS=09;

  *IF R_AGEWGT=>18;

  *IF AGERANGE=1;
  *if URBRUR=1 then URB_OR_RUR=1;
  *ELSE URB_OR_RUR=0;

  /*
  IF OCCAT=<-1 THEN DELETE;
  IF OCCAT=01 THEN SALE_SERV=1; ELSE SALE_SERV=0;
  IF OCCAT=02 THEN CLERK_ADM=1; ELSE CLERK_ADM=0;
  IF OCCAT=03 THEN BLUE_COLLAR=1; ELSE BLUE_COLLAR=0;
  *IF OCCAT=04 THEN WHITE_COLLAR=1; *ELSE WHITE_COLLAR=0;

  /*
  IF MSACAT=1 THEN MSA_1M_RAIL=1; ELSE MSA_1M_RAIL=0;
  IF MSACAT=2 THEN MSA_1M_NORAIL=1; ELSE MSA_1M_NORAIL=0;
  IF MSACAT=3 THEN MSA_L1M=1; ELSE MSA_L1M=0;
  IF MSACAT=4 THEN MSA_L1M=0; ELSE MSA_L1M=0;

```

```

/*
IF HHC_MSA=0640 THEN AUSTIN=1;           ELSE AUSTIN=0;
IF HHC_MSA=1922 THEN DFW=1;             ELSE DFW=0;
IF HHC_MSA=3362 THEN HOUSTON=1;        ELSE HOUSTON=0;
IF HHC_MSA=7240 THEN SANANTON=1;      ELSE SANANTON=0;

/*
If HHSIZE=1           THEN HHSIZE_S2=0; ELSE HHSIZE_S2=0;
IF HHSIZE=2           THEN HHSIZE_S2=1; ELSE HHSIZE_S2=0;
IF HHSIZE=3           THEN HHSIZE_S3=1; ELSE HHSIZE_S3=0;
IF HHSIZE=4           THEN HHSIZE_S4=1; ELSE HHSIZE_S4=0;
IF HHSIZE=>5          THEN HHSIZE_S5=1; ELSE HHSIZE_S5=0;
*/
*DUMMY VARIABLES FOR INCOME;

IF HHINCTTL=<-1 THEN HHINCTTL=.;

*BASE OF COMPARISON MID INCOME;
IF HHINCTTL=01 OR HHINCTTL=02 OR HHINCTTL=03 OR HHINCTTL=04 OR
HHINCTTL=05 OR HHINCTTL=06
THEN HHINCTTL_LOW=1; ELSE HHINCTTL_LOW=0;

*****IF HHINCTTL=07 OR HHINCTTL=08 OR HHINCTTL=09 OR HHINCTTL=10
OR HHINCTTL=11 OR HHINCTTL=12 OR HHINCTTL=13 THEN
HHINCTTL_LOW=0;
*ELSE HHINCTTL_LOW=0;

IF HHINCTTL=14 OR HHINCTTL=15 OR HHINCTTL=16 OR HHINCTTL=17 OR
HHINCTTL=18
THEN HHINCTTL_HIGH=1; ELSE HHINCTTL_HIGH=0;

/*VARIABLE FOR VEHICLES IN HH*/;
*BASE OF COMPARISON 2CARS;
if HHVEHCNT=0       then  HHVEHCNT_DUM_O=1;           ELSE
HHVEHCNT_DUM_O=0;
if HHVEHCNT=1       then  HHVEHCNT_DUM_1=1; ELSE HHVEHCNT_DUM_1=0;
*if HHVEHCNT=2       then  HHVEHCNT_DUM_1=0; *ELSE
HHVEHCNT_DUM_1=0;
if HHVEHCNT=>3       then  HHVEHCNT_DUM_3=1; ELSE HHVEHCNT_DUM_3=0;

*****Life Cycle Dummy Variables*****;

IF LIF_CYC=01           THEN LIF_CYC_1A=1;           ELSE
LIF_CYC_1A=0;
IF LIF_CYC=02           THEN LIF_CYC_2A=1;           ELSE
LIF_CYC_2A=0;
IF LIF_CYC=03 OR LIF_CYC=05 OR LIF_CYC=07           THEN
LIF_CYC_SAK=1; ELSE LIF_CYC_SAK=0;
*BASE FAMILY;
*IF LIF_CYC=04 OR LIF_CYC=06 OR LIF_CYC=08           THEN
LIF_CYC_SAK=0; *ELSE LIF_CYC_SAK=0;

```

```

        IF LIF_CYC=09                THEN LIF_CYC_1RA=1;        ELSE
LIF_CYC_1RA=0;
        IF LIF_CYC=10                THEN LIF_CYC_2RA=1;        ELSE
LIF_CYC_2RA=0;

```

/*DUMMY VARIABLE FOR RACE/ETHNIC COHORTS*/

```

*BASE OF COMPARISON ANGLO;
*IF HHR_RACE=01 AND BORNINUS=<1
        then BLACK=0;                *ELSE BLACK= 0;
IF HHR_RACE=02 AND BORNINUS=<1
        then BLACK=1;                ELSE BLACK= 0;

IF (HHR_RACE=06 OR HHR_RACE=10 OR HHR_RACE=11 OR HHR_RACE=12)
AND BORNINUS=1 OR ( HHR_HISP=1 AND (BORNINUS=-1 AND LANG=1))
then HISPANIC=1; ELSE HISPANIC= 0;

IF (HHR_RACE=16 OR HHR_RACE=14 OR HHR_RACE=13 OR HHR_RACE=09
OR HHR_RACE=05 OR HHR_RACE=04
OR HHR_RACE=03 AND BORNINUS=1) OR (HHR_RACE=16 OR HHR_RACE=14
OR HHR_RACE=13 OR HHR_RACE=09 OR HHR_RACE=08
OR HHR_RACE=04 OR HHR_RACE=03 AND BORNINUS=-1 AND HHR_HISP=2)
then OTHER=1; ELSE OTHER= 0;

IF (HHR_RACE=06 OR HHR_RACE=10 OR HHR_RACE=11 OR HHR_RACE=12)
AND BORNINUS=2 OR (BORNINUS=-1 AND LANG=2)
        then FB_HISPANIC=1; ELSE FB_HISPANIC= 0;

IF (HHR_RACE=01 OR HHR_RACE=02 OR HHR_RACE=03 OR HHR_RACE=04 OR
HHR_RACE=05
OR HHR_RACE=07 OR HHR_RACE=08 OR HHR_RACE=13 OR HHR_RACE=14 OR
HHR_RACE=09
OR HHR_RACE=15 OR HHR_RACE=16 OR HHR_RACE=17) AND BORNINUS=2
then FB_OTHER=1; ELSE FB_OTHER= 0;

run;

```

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BIOGRAPHICAL INFORMATION

Gustavo Jimenez graduated from UT Arlington in May 2006 with a Bachelor of Science in Civil Engineering—Magna Cum Laude. As an undergraduate he participated in Transportation/Environmental Engineering Research pertaining to the environmental effects of signal retiming. As a graduate student he was a Research Assistant for a semester in the Counseling and Advising Center of the College of Engineering, he also taught the Civil Engineering Surveying Lab in Fall of 2006. Since January 2007, he has been interning with NCTCOG, the Metropolitan Transportation Planning agency of Dallas-Fort-Worth. In fall of 2007, Gustavo will be pursuing a career as Transportation Planner Engineer at The Louis Berger Group, working in their Manhattan, New York City offices. In New York City he hopes to gain experience that will allow him to pursue his Professional Engineering license, and thereafter pursue an advance graduate degree in Transportation Planning Engineering.