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UNIVERSITY OF CALIFORNIA,
IRVINE

Changes in the Travel patterns of Two-person Households in California between 2001 and
2012

THESIS

submitted in partial satisfaction of the requirements
for the degree of

MASTER OF SCIENCE

in Civil Engineering

by

Dhanya Pranab Kumar

Thesis Committee:
Professor Michael. G. McNally, Chair
Professor R. (Jay) Jayakrishnan
Professor Wilfred Recker

2015

DEDICATION

To

My loving, supporting and handsome Husband Babapranab
for his constant support and encouragement to finish my thesis,

my loving son Devang,
for being such a sweet heart and for his patience throughout this journey,

and my Parents and God
for giving me the strength and blessing me always from heaven.

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ABSTRACT OF THE THESIS

Changes in the Travel patterns of Two-person Households in California between 2001 and 2012

By

Dhanya Pranab Kumar

Master of Science in Civil Engineering

University of California, Irvine, 2015

Professor Michael. G. McNally, Chair

The main objective of this thesis is to highlight the travel patterns of two-person households in California as captured in the 2000-2001 and 2010-2012 California Household Travel Surveys (CHTS). The intent is to present basic travel characteristics of households with two people who are couples, are employed and do not have kids at home (denoted as DINK - Dual Income No Kids at home) along with comparisons with two-person households who does not belong to the aforementioned category (NON-DINK) using the CHTS 2000-2001 and 2010-2012 datasets. The results highlight significant differences in travel patterns between the two categories, DINKs and NON-DINKs during the eleven years from 2001 to 2012. The average number of daily trips is higher for DINKs compared to NON-DINKs and the trip rate has reduced in 2012 compared to 2001 for both categories. Auto (driver of auto/truck/van) trips is the primary mode of travel for DINKs and NON_DINKs in CHTS 2001 and 2012. During the eleven years, there has been a decrease in auto trips and an increase in the percentages of passenger, bike, walk and transit trips. The primary trip purpose for

DINKs are work or work-related, whereas the primary trip purpose for NON-DINKs are shopping/maintenance trips according to both survey results.

CHAPTER 1. INTRODUCTION

1.1 MOTIVATION FOR STUDY

In the United States, almost every person is affected in some way or the other by the quality of our transportation system. It has greatly influenced the quality of people's daily life and it has also invariably contributed in important ways to the physical, economical, and social structure of this world. A safe and efficient transportation system can support economic well-being and enhance the quality of life for people in the nation by providing opportunities for work, education, shopping and personal errands, social networking, medical accessibility, rest and recreation and all other transportation needs.

Transportation planners and policy makers are sure to face special challenges in the next few decades as the population continues to increase at a rapid rate of growth. There has been a tremendous growth in population in the United states in the last half of the past century, and population growth is expected to increase at a rate of 25 million per decade until 2050(Alan E. Pisarski, 2006). California's population is expected to increase significantly in the next half century, and the demand for travel will likely rise as well. To better understand the transportation needs of Californians, it is useful to examine how travel patterns differ across different types of households. In order to understand and improve the transportation system of California, policymakers and transportation planners require data that answer questions about current travel behavior, such as who is traveling, how, why, when, where, and how far (D.V. Collia et al., 2003). The process of improving our

transportation system also requires a deeper understanding of the unique travel behavior of each type of household.

One of the primary sources of data on current travel behavior and patterns of the California population is the California Household Travel survey (CHTS) led by the California Department of Transportation (Caltrans), and jointly funded by the California Strategic Growth Council, the California Energy Commission (Energy Commission), and eight transportation planning agencies across the state. The type of household defined in terms of people living in a household, such as how many people, how many workers, and whether children are present, has historically determined the amount and type of travel generated by that household (Nancy McGuckin, 2012). The average household size was 2.36(unweighted) according to CHTS 2000-2001 and 2.57(unweighted) according to CHTS 2010-2012. In CHTS 2001 and CHTS 2010-2012, around 41% and 39 % of the households are of size two respectively, and approximately 35% and 29% household trips are made by two-person households respectively (see Figure 1). This research examines how the travel patterns of typical two-person households has changed over the last ten years (from 2001 to 2011) in terms of trip rates, mode choice and purpose of trips, using the California Household Travel Surveys of 2000-2001 and 2010-2012. In this research the two person households are separated into two categories: DINK (Dual Income No Kids at home) and NON-DINKs (households that does not belong to the DINKs category).

The motivation behind this research is to gain a better understanding of two-person households' travel behaviors and how it has changed in the last ten years. In this thesis DINKs are defined as households with couples who are both employed and who does not have kids at home. They are considered as less constrained due to dual income and no kids at home

compared to the NON-DINKS. In this thesis NON-DINKS are defined as households with two persons who may or may not be related (couples or not), may or may not live with kids, and may or may not both be employed_ i.e., who are just the opposite of DINKS. NON-DINKS are considered to have more constraints than DINKS, including kids at home, unemployment, single income etc. A better understanding of the travel behavior of such different types of households would be helpful to transportation planners and policy makers in efficiently designing and implementing accessible, reliable and affordable transportation system which increases the mobility of people, thereby providing opportunities for work, education, shopping and personal errands and many other transportation needs (D.V. Colia et al., 2003).

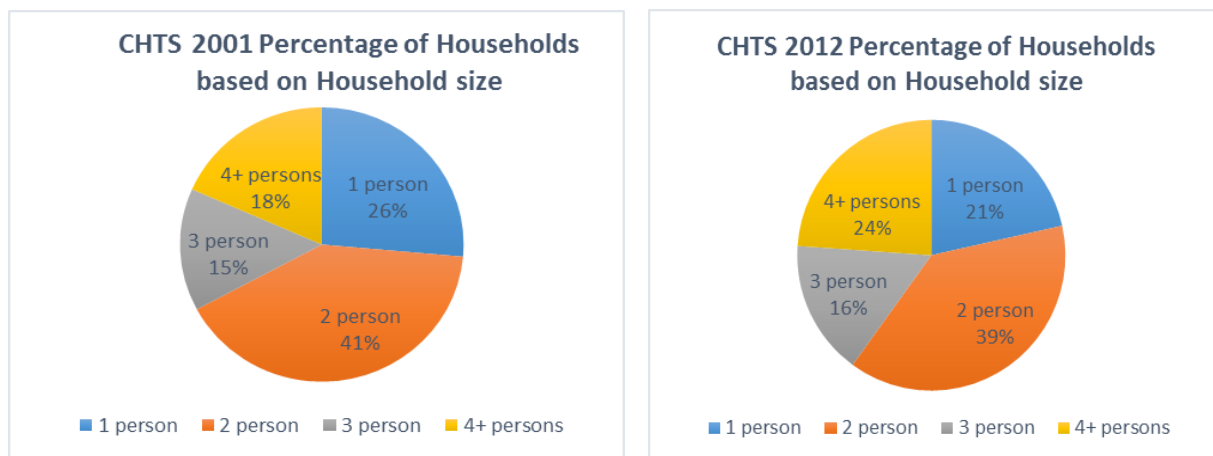


Figure 1: Percentage of households based on household size in the CHTS 2001 and 2010-12

1.2 DATABASE AND RESEARCH DIRECTION

In this research, California household travel surveys 2000-2001 and 2010-2012 are used to study the travel behaviors of two-person households. More specifically the research will examine how the travel patterns of typical two-person households (DINKS and NON-DINKS) has changed over the last ten years (from 2001 to 2011) in terms of trip rates, mode choice

and purpose of trips. The intent is to present basic travel characteristics of Dual Income No Kids at home households and allow for comparisons with two-person households who do not belong to the DINKs category. The travel and trip characteristics of DINKs and NON-DINKs, such as

- Who is travelling - Male or female, Young or old, Employed or unemployed or High income or Low income households?
- How are they travelling - by private mode or public transit?
- Why are they travelling - work trips or shopping trips?

are examined and the differences between the eleven years are compared using the California household travel surveys 2000-2001 and 2010-12.

1.3 OUTLINE OF THESIS

This thesis begins in chapter 2, with information on the data used and the methodology used to filter the sample (DINK and NON-DINK) from the main dataset. In Chapter 3, the household and person demographics and trip characteristics for key demographic household characteristics of the sample are described. In chapter 4, the main results about the travel characteristics of daily trips taken in California by DINKs and NON-DINKs are given. Chapter 5 summarizes the results and conclusions and recommendations for future research are given.

CHAPTER 2. DATA AND METHODOLOGY

The data used in this research comes from multiple sources and most of the work is done in the preparation and assembly of data. The data sources include two travel surveys - California household travel survey 2000-2001 and California household travel survey 2010-2012 and data from US Census Bureau.

2.1 BACKGROUND ON THE CALIFORNIA HOUSEHOLD TRAVEL SURVEY 2001 AND 2010-2012.

2.1.1 CALIFORNIA HOUSEHOLD TRAVEL SURVEY 2001

The 2000-2001 California Statewide Household Travel Survey (CHTS) was conducted to update the statewide database of household socioeconomic and travel information maintained by the California Department of Transportation (Caltrans). The database is used in regional and statewide travel demand forecasting and helps refine travel estimates, models, and forecasts throughout the State. The data in this periodically-updated database is used to estimate and forecast trip generation and distribution, mode choice and trip assignments and it is also used for vehicle emissions analyses and estimates (NuStats, 2002).

The 2000-2001 survey was conducted between October 2000 and December 2001 among households located in each of the 58 counties throughout California and a total of 17,040 households participated in the survey. Detailed Travel information was collected for every day for a full year and all participating households were first recruited to record their travel in a diary for a pre-assigned 24-hour period. Household socioeconomic data gathered in this survey includes information on household size, income, vehicle ownership, employment status of each household member, and housing unit type among other data.

Travel information was also collected including trip times, mode, activity at location, origin and destination, and vehicle occupancy among other travel-related data. The CHTS was conducted among randomly selected households using the telephone recruitment/diary mail-out/telephone trip retrieval method and all the trip-level results presented throughout the main report are based on unlinked trips (NuStats, 2002).

The 17,040 households represent 40,146 persons, 33,540 vehicles and 134,173 trips and these particular figures are the actual number of records (unweighted and unexpanded). From the CHTS 2001 the mean household size is 2.8 and the mean number of vehicles available to each household is 1.9 and the statewide median household income is \$54,946 (NuStats, 2002).

2.1.2 CALIFORNIA HOUSEHOLD TRAVEL SURVEY 2010-2012

The 2010-2012 California household travel survey is the largest single regional household travel survey ever conducted in the United States. It was jointly sponsored and funded by CALTRANS, California Strategic Growth Council, the California Energy Commission, and the local transportation planning agencies. CHTS 2010-2012 was a multimodal study of the demographic and travel behavior characteristics of residents across California. The main objective of CHTS 2010-2012 was to be able to apply the data to develop and update transportation models in order to meet statutory requirements at both Federal and State level. The other objectives included gathering data from a considerably larger sample than in the past, data on all travel modes, walk and bicycle trips data, long distance travel data and an accurate representation of weekday and weekend travel (NuStats, 2013).

CHTS was designed to collect travel information from households in all of California's 58 counties and portions of three adjacent counties in Nevada, using multiple data collection methods. The travel information was collected using different methods including Computer assisted telephone interviewing (CATI), Online data entry, Mail surveys, wearable GPS, in-vehicle GPS and using On-board diagnostic (OBD) sensors which gathers data directly from the vehicles engine. Detailed Travel information was collected for every day for a full year and all participating households were first recruited to record their travel in a diary for a pre-assigned 24-hour period as well as record their long distance travel in the prior eight weeks (NuStats, 2013).

A total of 42,431 households completed the survey which includes 36,714 non GPS households and 5,717 GPS households. The key data elements identified and collected were household and person characteristics, vehicle characteristics, activities and trip data. Household and person characteristics includes household size, type of residence, home ownership status, use of public transportation, vehicle availability, name, Gender, Age and Race, relationship among household members, employment status, location of employment and if more than one employer, type of industry and occupation, number in household who possess driver's license etc. Vehicle characteristics includes questions about the vehicles available to the household like year, make, model, vehicle fuel type (hybrid, gasoline, diesel, etc.), vehicle owned, borrowed or leased, electric vehicle or not etc. Activities data include each person's activities throughout their assigned travel period, whether participation in activity/activities alone or with others and the number of others who participated and also activity start time/end time. Trip data was collected for each household member and

included data of number of household members who traveled, trip modes, arrival and departure time, trip place name and address etc. (NuStats, 2013)

The 42,431 households represent 109,113 persons, 79,009 vehicles and 351,774 trips and these particular figures are the actual number of records (unweighted and unexpanded). From CHTS 2010-2012, the mean household size is 2.57 and the mean number of vehicles available to each household is 1.8. According to CHTS 2010-2012, approximately 46% of the households reported annual incomes less than \$50,000, and 54% of the households reported incomes above \$50,000. Table 1 shows the major demographic characteristics of households in California Household Travel Surveys 2001 and 2010-2012(Unweighted and Unexpanded).

Table 1: Major household demographic characteristics of CHTS 2000-2001 and CHTS 2010-2012 (Unweighted)

Variables	CHTS 2001	CHTS 2010-12
Households	Total	Total
ALL	17040 (100%)	42431 (100%)
Vehicles per household		
0	601 (3.5%)	2459 (5.8%)
1	5123 (30.1%)	12678 (29.9%)
2	7342 (43.1%)	18656 (44.0%)
3	2742 (16.1%)	6369 (15.0%)
4+	1232 (7.3%)	2269 (5.4%)
Workers per Household	17040 (100%)	42431 (100%)
0	4835 (28.4%)	9120 (21.5%)
1	6502 (38.2%)	17915 (42.2%)
2	4940 (29.0%)	12818 (30.2%)
3+	764 (4.5%)	2579 (6.1%)
OWN/RENT status of Households	17040 (100%)	42431 (100%)
Own home	12272 (72.0%)	32814 (77.3%)
Rent home	4548 (27.0%)	9493 (22.4%)
Trips per Household	134,172 (100%)	351774 (100%)
1	15331 (11.4%)	33480 (9.5%)
2	46464 (34.6%)	101992 (29.0%)
3	23897 (17.8%)	64157 (18.2%)
4+	48480 (36.1%)	152145 (43.3%)

Trips per HH: The number and percent of trips made by one, two, three and 4+ person households on survey day.

From Table 1, it can be seen that there has been a 2.3% increase in the number of households with zero vehicles and 0.9% increase in the households with two vehicles in 2010-2012 compared to the CHTS 2001 whereas households with 1, 3 and 4+ vehicles has decreased in CHTS 2012 compared to CHTS 2001. A possible reason for the increase in the percentage of households with zero vehicles could be an increase in the number of households using public transit, or an increase in the number of households whose trip mode is bike or walk.

The number of households with owned homes has increased by 5.3% and the number of households in rented homes has decreased by 4.3% in 2012 compared to 2001.

Another important change in demographics in CHTS 2010-2012 compared to CHTS 2001 is the number of workers in each household. The number of households with zero workers has decreased by 6.8% in CHTS 2010-2012 and the number of households with one, two and three plus workers has increased in CHTS 2010-2012 compared to CHTS 2000-2001.

Overall, the number of trips made by one person and two-person households decreased in CHTS 2010-2012 compared to CHTS 2001 whereas the number of trips made by households with 3 persons and above has increased in CHTS 2010-2012. The number of trips made by one person households decreased by 1.9% in CHTS 2012 and number of trips made by two-person households decreased by 5.6% in CHTS 2010-2012 compared to CHTS 2001. There may be many factors which contributed to the decline in number of trips made by households - it could be the increased gas prices and unemployment or it could be the effect of electronic communication technology on travel like internet shopping and work at home (Nancy McGuckin, 2012).

The major person demographic characteristics are shown below in Table 2.

Table 2: Major person demographic characteristics of CHTS 2001 and CHTS 2010-2012 (Unweighted)

Persons	CHTS 2001	CHTS 2010-12
All	40146 (100%)	109113 (100%)
under 16	7537 (18.8%)	18822 (17.3%)
16-19	1980 (4.9%)	5349 (4.9%)
20-65	24123 (60.1%)	65798 (60.3%)
65+	5445 (13.6%)	15221 (13.9%)
Male	19542 (48.7%)	52939 (48.5%)
Female	20415 (50.9%)	55863 (51.2%)
Licensed drivers		
All	29107 (72.5%)	78957 (72.4%)
Male	14377 (49.4%)	38711 (49.0%)
Female	14730 (50.6%)	40108 (50.8%)
Employed	31911 (100%)	51838 (100%)
Male	15916 (49.9%)	27259 (52.6%)
Female	15836 (49.6%)	24483 (47.2%)
Person Trips		
ALL	134,065 (100%)	351764 (100%)
Male	63066 (47.1%)	166493 (47.3%)
Female	70470 (52.6%)	184268 (52.4%)

Person trips: The number and percent of trips made by male and female and all persons on survey day.

The age group that represented the largest percentage among CHTS respondents was between 20 and 65 years (working age group), at 60.1% and 60.3% in CHTS 2001 and 2010-12 respectively. The next largest group was those younger than 16 years of age _ 18.8% and

17.3% in CHTS 2001 and 2010-12 respectively. 13.6 % and 13.9% of the CHTS respondents were 65 years of age or older in CHTS 2001 and 2010-12 respectively, while 4.9 % of respondents were between the ages of 16 and 19 in both surveys.

Table 2 shows respondent age distribution. Among the CHTS respondents, around 49 % were female and the remaining 51% were male in both 2001 and 2010-2012 surveys. Overall, 72.5% and 72.4% of the CHTS respondents have valid driver's license according to CHTS 2001 and 2010-2012 respectively. Among the licensed drivers, the percentage of male drivers decreased by 0.4% from 2001 to 2012 whereas the percentage of female drivers increased by 0.2% from 2001 to 2012.

Among the percentage of employed respondents in both surveys, the percent of male workers increased by 2.7% from 2001 to 2010-12 and the percent of female workers decreased by 2.4% from 2001 to 2010-2012. Overall, the percentage of male and female trips remained approximately the same percentage around 47% and 52% respectively in CHTS 2001 and 2010-12, albeit the percentage of male trips had a slight increase and percentage of female trips had a slight decrease during the ten years.

2.2 METHODOLOGY

In this research, California household travel surveys 2000-2001 and 2010-12 are used to study how the travel behaviors of typical two-person households, i.e., DINKs and NON-DINKs has changed over the last ten years (from 2001 to 2011) in terms of trip rates, mode choice and purpose of trips. For this purpose, first we have to abstract the two-person households from the whole dataset and then use that data to identify DINKs and NON-DINKs and filter out the classified samples into one dataset to examine the changes in the number of trips,

types of modes and purpose of trips made by these particular households in the surveys 2001 and 2010-12.

From the CHTS 2001 dataset there are 17,040 household samples and 40,146 person samples. Overall 40.5 % of these households are of size two, i.e., 6944 households are of size two and 46464 (34.6%) trips are made by two-person households. The mean number of trips per household is 6.4 and the mean number of trips per person is 3.2. Figure 2 shows the percentage of DINKs and NON-DINKs among the total number of two-person households in CHTS 2001.

Pie chart showing percentage split of two person HH into DINK and NON-DINK HH of CHTS 2001

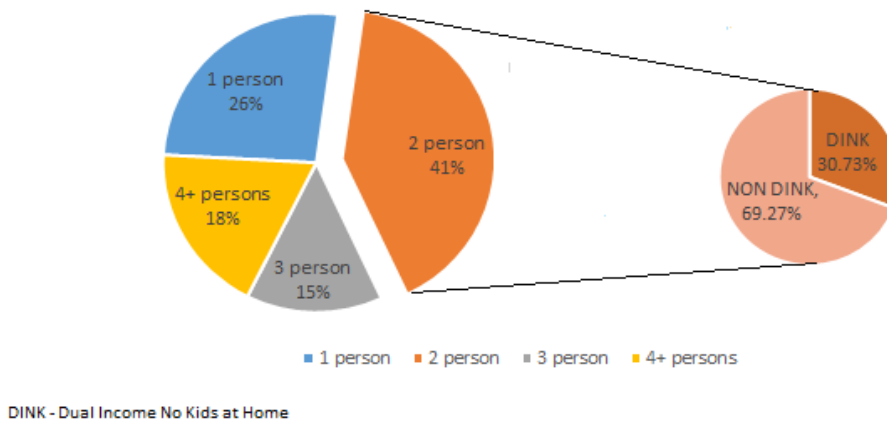


Figure 2: Percentage of DINKs and NON-DINKs among the total percent of two-person households in CHTS 2001

From Figure 2, it can be seen that overall 31% of the two-person households are DINKs and 69% of the households are NON-DINKs. Among the two-person households after filtering the samples based on household size (size=2) and household employed (both), we have 2521 household samples. From the person data, there are 40,146 person samples total out of which 19,631 samples are related as husband and wife. After matching the 2521 household samples to the 19631 person samples, there are 2142 household samples and 4276 person samples

of Household size 2 and employed. From this, 8 samples were filtered out since they were not related as couples (spouse). So the final sample size for CHTS 2001 based on households who are couples and both employed in a household of size two, aka, DINKs are 2134 households (12.5%) and 4268 person samples and the total number of household trips is 16322 (12.2%). The mean number of trips per household for DINKs is 7.2 and the mean number of person trips is 3.6 in CHTS 2001. The sample size for CHTS 2001 households who does not belong to the DINKs category is 4810 households (28.2%) and 9620 person samples and the total number of household trips is 30,142 (22.5%). The mean number of trips per households for NON_DINKs is 5.9 and the mean number of person trips is 3.0 in CHTS 2001.

In the CHTS 2010-12 dataset, there are 42,431 household samples and 109,113 person samples. Overall, 38.5 % of these households are of size two, i.e., 16319 households are of size two and 101992 (28.9%) trips are made by two-person households. The mean number of trips per household is 6.3 and the mean number of trips per person is 3.1. Figure 3 shows the percentage of DINKs and NON-DINKs among the total number of two-person households in CHTS 2010-12.

Pie chart showing percentage split of total two person HH into DINK and NON-DINK HH of CHTS 2012

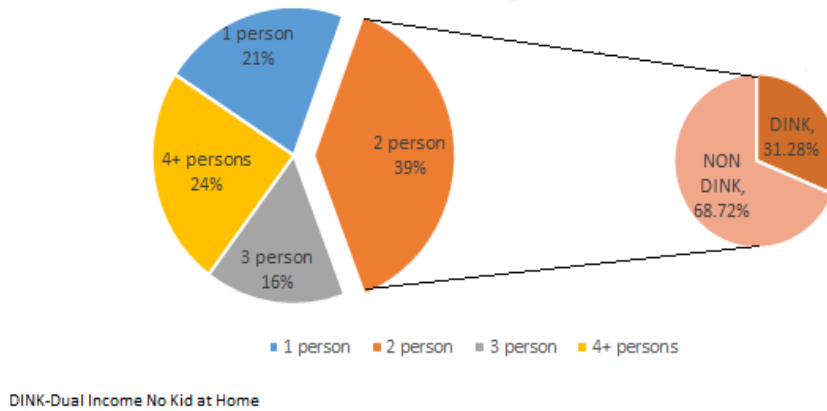


Figure 3 Percentage of DINKs and NON-DINKs among the total percent of two-person households in CHTS 2010-12

As shown in the above figure among the two-person households approximately 31% of the households are DINKs and 69% of the households are NON-DINKs in the CHTS 2010-12. After filtering the samples based on household size equals two and both employed there are 5355 samples. From the person data we have 53,225 samples who are related as husband and wife out of the total 109,113 person samples. After matching the household samples and person samples from the CHTS 2012 data there are 5105 (12.0%) households and 10,210 person samples who are DINKs and the total number of household trips is 36102 (10.3%). The average number of daily trips per household for DINKs is 7.1 and the average number of trips per person is 3.5 in 2012. The sample size for CHTS 2010-12 households who does not belong to the DINKs category, aka NON-DINKs is 11214 households (26.4%) and 22428 person samples and the total number of household trips is 65888 (18.7%). The mean number of trips per households for NON_DINKs is 5.8 and the mean number of trips per person is 2.9 in CHTS 2010-12.

After the samples of DINKs and NON-DINKs were identified from the household dataset, it was used to match the samples in the trip files and activity files, so as to examine the mode of trips and purpose of trips. In CHTS 2001, there are a total of 175,860 and 41,802 trips among them are recorded as blank and without information. So the final number of trips by all persons is 134058. In CHTS 2001, the total number of trips by DINKs by all modes is 20,823. Among them, 37 samples were showing wrong information of persons (more than two) in a household, and hence they were deleted. So 20,786 household samples were considered. Among the 20,786 trips, there were 4493 trips recorded as blank and 7 trips recorded as DK (don't know). Finally, the number of trips recorded as blank and by DK records were also removed from the data to get the final set of trips by DINKs which is 16,286 in CHTS 2001. Among the total trips data by all modes, 40,213 trips are made by NON-DINKs and among them 10,090 trips are recorded blank and without information. So finally, 30,123 trips recorded are made by NON-DINKs.

In CHTS 2010-12, there are a total of 460,523 trips by all persons and among them the type of mode by 108,778 trips are recorded blank and without information. So the final number of trips by all persons by all modes is 351745. In CHTS 2010-12, the total number of trips made by DINKs is 46,312 and after removing the blanks and no information trips which is 10,210 the final number of trips made by DINKs is 36102. Among the total trips data by all modes 88,316 trips are made by NON-DINKs and among them 22,428 trips are recorded as blank and without information. So finally 65,888 trips recorded are made by NON-DINKs in CHTS 2010-12.

CHAPTER 3. HOUSEHOLD AND PERSON DEMOGRAPHIC CHARACTERISTICS OF DINKs AND NON-DINKs IN CALIFORNIA.

The main objective of this thesis is to highlight travel patterns of DINKs and NON-DINKs as depicted in the 2001 and 2010-12 CHTS. The intent is to present basic travel characteristics of DINKs and allow for comparisons with NON-DINKs. Comparisons between DINKs and NON-DINKs are made because daily travel patterns of DINKs and NON-DINKs are considerably different. Table 3 shows the summary statistics on household and daily trip demographics of DINKs, NON-DINKs, all two-person households and all households in the CHTS 2001 and 2010-12 datasets.

Table 3: Summary statistics on household and trip demographics of DINKs, NON-DINKs, All two-person households and All households in CHTS 2010-12 (Unweighted)

Variables	CHTS 2001				CHTS 2010-12			
	DINKs	NON-DINKs	Two per household	All Households	DINKs	NON-DINKs	Two per household	All Households
Total number of households	2134 (12.5%)	4810 (28.3%)	6944 (40.8%)	17040 (100%)	5105 (12.0%)	11214 (26.4%)	16319 (38.5%)	42431 (100%)
Total number of household trips	16322 (12.2%)	30142 (22.5%)	46464 (34.6%)	134,172 (100%)	36102 (10.3%)	65888 (18.7%)	101992 (29.0%)	351774 (100%)
Mean no: of household trips	7.2	5.9	6.4	7.6	7.1	5.8	6.3	8.3
Standard deviation	4.8	5.0	5.0	7.1	4.9	5.0	5.0	7.8
Total number of person trips	16295 (12.2%)	30108 (22.5%)	46403 (34.7%)	134,065 (100%)	36102 (10.3%)	65888 (18.7%)	101990 (29.0%)	351764 (100%)
Mean no: of person trips	3.6	3.0	3.2	3.2	3.5	2.9	3.1	3.2
Standard deviation	2.8	3.0	2.9	2.9	2.9	2.9	2.9	3.0

Note:

1. Percentages shown are percentages of DINKs, Non-DINKs and all two-person households among total number of households participated on survey day (unweighted)
2. Mean number of household and person trips of DINKs, NON-DINKs and all two per households on survey day compared to total number of households trips on survey day (unweighted).

The households, persons and trips demographic characteristics of DINKs, NON-DINKs and all two-person households were compared to the total number of households in the CHTS 2001 and 2010-12. In 2001, 12.5% of the total number of households were DINKs and they took approximately 12.2% of the daily household trips in California. In 2001, 28.20% of the total number of households are NON-DINKs, i.e., more than double the population of DINKs are NON-DINKs and they make approximately double the number of household trips than DINKs, i.e., around 23%. In 2012 the percentage of DINKs reduced to 12.0% from 12.5% and the percentage of NON-DINKs reduced from 28.2% to 26.4% and the number of household trips also reduced by approximately two percent to 10.3% for DINKs and trips reduced by approximately four percent to 18.7 % for NON-DINKs.

The average trips per household of DINKs in 2001 was 7.2 but the average trip rate reduced to 7.1 in 2012. The average trips per household of NON-DINKs was 5.9% in 2001 and it reduced to 5.8% in 2012. The average trips per person for DINKs was 3.6 in 2001 and for NON-DINKs was 3.0 in 2001 and in 2012 the trips per person reduced to 3.5 for DINKs and 2.9 for NON-DINKs. Household and person demographics characteristics were examined for the two surveys conducted in 2001 and 2010-12.

3.1 HOUSEHOLD DEMOGRAPHICS OF DINKs AND NON-DINKs

The major travel indicators like vehicles per household, workers per household, students per household and home ownership were examined for both CHTS 2001 and 2010-12. Table 4 shows the summary statistics (unweighted and unexpanded) on household demographics of DINKs, NON-DINKs, all two-person households and all households in the CHTS 2001 and 2010-12 datasets.

Table 4: Summary statistics on household demographic characteristics of DINKs, NON-DINKs, All two-person households and All households in CHTS 2010-12

CHTS 2001					CHTS 2010-12			
Households	DINK	NON-DINK	Two per HH	All Households	DINK	NON-DINK	Two per HH	All Households
ALL	2134 (100%)	4810 (100%)	6944 (100%)	17040 (100%)	5105 (100%)	11214 (100%)	16319 (100%)	42431 (100%)
vehicles per Household	DINK	NON-DINK	Two per HH	All Households	DINK	NON-DINK	Two per HH	All Households
0	6 (0.3%)	88 (1.8%)	94 (1.4%)	601 (3.5%)	58 (1.1%)	396 (3.5%)	542 (3.3%)	2459 (5.8%)
1	154 (7.2%)	1142 (23.7%)	1296 (18.7%)	5123 (30.1%)	572 (11.2%)	2569 (22.9%)	3718 (22.8%)	12678 (30.0%)
2	1362 (63.8%)	2655 (55.2%)	4017 (57.9%)	7343 (43.1%)	3499 (68.5%)	6648 (59.3%)	9712 (59.5%)	18657 (44.0%)
3	424 (19.8%)	664 (13.8%)	1088 (15.6%)	2742 (16.0%)	756 (14.8%)	1269 (11.3%)	1834 (11.2%)	6369 (15.0%)
4+	189 (8.9)	261 (5.4%)	449 (6.5%)	1232 (7.3%)	221 (4.3%)	332 (3.0%)	514 (3.2%)	2269 (5.4%)
Own/Rent status	DINK	NON-DINK	Two per HH	All Households	DINK	NON-DINK	Two per HH	All Households
Own home	1661 (77.8%)	3787 (78.7%)	5448 (78.5%)	12272 (72.0%)	4446 (87.1%)	9529 (85.0%)	13838 (84.8%)	32814 (77.3%)
Rent home	444 (20.8%)	963 (20.0%)	1407 (20.3%)	4548 (26.7%)	651 (12.8%)	1667 (15.0%)	2444 (15.0%)	9493 (22.4%)
Workers per household	DINK	NON-DINK	Two per HH	All Households	DINK	NON-DINK	Two per HH	All Households
0	0	2279 (47.4%)	2279 (33.0%)	4835 (28.4%)	0	2907 (25.9%)	4094 (25.1%)	9120 (21.5%)
1	0	2144 (44.6%)	2144 (31%)	6502 (38.2%)	0	4473 (39.9%)	6504 (39.9%)	17915 (42.2%)
2	2134 (100%)	387 (8.1%)	2521 (36.0%)	4940 (29.0%)	5105 (100%)	3834 (34.2%)	5721 (35.1%)	12818 (30.2%)
Students per household	DINK	NON-DINK	Two per HH	All Households	DINK	NON-DINK	Two per HH	All Households
0	1829 (85.7%)	3996 (83.1%)	5825 (84.0%)	11275 (66.2%)	4752 (93.0%)	10056 (89.7%)	14612 (89.5%)	27219 (64.2%)
1	250 (11.7%)	697 (14.5%)	947 (13.6%)	3016 (17.7%)	327 (6.4%)	1056 (9.4%)	1559 (9.6%)	6984 (16.5%)
2	55 (2.6%)	117 (2.4%)	172 (2.5%)	1800 (10.6%)	26 (0.5%)	102 (0.9%)	148 (0.91%)	5374 (12.7%)

1. Number denotes the number of households among DINKs, NON-DINKs, all two-person households and ALL households participated on survey day in CHTS 2001 and 2010-12.

2. Percentage denotes percentage of households among DINKs, NON-DINKs, all two-person households and all households participated on survey day in CHTS 2001 & 2010-12.

The largest percentage of CHTS respondents have two vehicles per household according to both surveys. Among DINKs the percentage of households with zero, one and two vehicles have increased between the ten years from 2001 to 2011 whereas households with three and more vehicles has declined from 2001 to 2011. In the case of NON-DINKs, the percentage of households with zero vehicles has almost doubled from 1.8% in CHTS 2001 to 3.5% in CHTS 2010-12 whereas the percentage of households with one vehicle has decreased by 0.8% in CHTS 2010-12. The percentage of NON-DINK households with 3 or more vehicles has also decreased in CHTS 2010-12.

The largest percentage of CHTS respondents has owned homes and the percentage of household with owned homes increased during the ten years and the percent of households renting homes has decreased. Among the DINKs and NON-DINKs, the percentage of households with own homes has increased by 9.3% and 6.3% respectively in CHTS 2010-12 compared to CHTS 2001. The percentage of households renting homes has declined by 8% and 5% for DINKs and NON-DINKs respectively during the ten years.

Among all the respondents in CHTS the percentage of workers per household has increased during the ten years and the percentage of zero workers per household has decreased from 2001 to 2011. Among NON-DINKs the percentage of zero workers per household has decreased by 21.5% in CHTS 2010-12 compared to CHTS 2001 and 4.7% decrease in the percentage of households with one worker during the ten years. Another important observation is the increase in the percentage of households with two workers in NON-DINKs households. In the CHTS 2001 only 8.1% of the NON-DINK households had two workers and in CHTS 2010-12 it has increased to 34%. There has been approximately a 26% increase in the percentage of households with two workers during the ten years which is

tremendous. The overall percentage of households with zero students has decreased during the ten years whereas the DINKs and NON-DINK households with zero students has increased during the ten years. Among the DINK and NON-DINK households the percentage of households with one student has decreased by approximately 5% during the ten years and the percentage of households with two students has decreased by 2.1% among DINKs and 1.5% among NON-DINKs.

3.2 PERSON DEMOGRAPHICS OF DINKs AND NON-DINKs

Person demographics characteristics were examined for the two California household travel surveys conducted in 2001 and 2010-12. Table 5 shows the summary statistics (unweighted and unexpanded) on person demographics of DINKs, NON-DINKs, all two-person households and all households in the CHTS 2001 and 2010-12 datasets. The largest percentage of CHTS respondents were represented by the age group of between 20 and 65 years (working age group) at 60.1% and 60.3% in CHTS 2001 and 2010-12 respectively.

Among the DINKs, a majority of the respondents are between the age group 20-64 years. Approximately 94% of the respondents are between the age group 20-64 years in CHTS 2001 and in CHTS 2010-12 it reduced to approximately 88% percentage of the respondents. Among the DINKs there has been a 2.6% increase in the percentage of respondents above 65 years of age in CHTS 2010-12 compared to CHTS 2001. A majority of respondents in the NON-DINKs are also in the 20-65 years old age group in both surveys. The percentage of 20-65 years old age group NON-DINK respondents has increased by 2.3% in CHTS 2010-12 and the percentage of above 65 years old remained almost the same during the ten years- 34%.

Table 5: Summary statistics on person demographic characteristics of DINKs, NON-DINKs, All two-person households and All households in CHTS 2010-12

CHTS2001					CHTS 2010-12			
Persons	DINK	NON-DINK	Two per HH	All Persons	DINK	NON-DINK	Two per HH	All Persons
All	4268 (100%)	9620 (100%)	13888 (100%)	40146 (100%)	10210 (100%)	22428 (100%)	32638 (100%)	109113 (100%)
under 16	0 (0%)	276 (2.9%)	276 (2.0%)	7537 (18.8%)	0 (0%)	385 (1.7%)	385 (1.2%)	18822 (17.3%)
16-19	16 (0.4%)	201 (2.1%)	216 (1.6%)	1980 (4.9%)	1 (0%)	249 (1.1%)	250 (0.8%)	5349 (4.9%)
20-65	4014 (94.0%)	5461 (56.8%)	9475 (68.2%)	24123 (60.1%)	8954 (87.7%)	13255 (59.1%)	22209 (68.0%)	65798 (60.3%)
65+	239 (5.6%)	3287 (34.2%)	3921 (28.2%)	5445 (13.6%)	841 (8.2%)	7635 (34.0%)	8476 (26.0%)	15221 (13.9%)
Gender	DINK	NON-DINK	Two per HH	All Persons	DINK	NON-DINK	Two per HH	All Persons
Male	2136 (50.0%)	4624 (49.0%)	6760 (49.0%)	19542 (49.0%)	5163 (51.0%)	10618 (48.0%)	15781 (49.0%)	52939 (49.0%)
Female	2129 (50.0%)	4949 (51.0%)	7078 (51.0%)	20415 (51.0%)	5037 (49.0%)	11754 (52.0%)	16791 (51.0%)	55863 (51.0%)
Licensed drivers	DINK	NON-DINK	Two per HH	All Persons	DINK	NON-DINK	Two per HH	All Persons
All	4204 (98.5%)	8473 (88.2%)	12677 (91.3%)	29107 (72.5%)	10094 (98.9%)	20028 (89.3%)	30122 (92.3%)	78957 (72.4%)
Male	2113 (50.3%)	4150 (49.0%)	6263 (49.4%)	14377 (49.4%)	5123 (50.8%)	9682 (48.3%)	14805 (49.2%)	38711 (49.03%)
Female	2091 (49.7%)	4323 (51.0%)	6414 (50.6%)	14730 (50.6%)	4961 (49.1%)	10305 (51.5%)	15266 (50.7%)	40108 (50.7%)
Employed	DINK	NON-DINK	Two per HH	All Persons	DINK	NON-DINK	Two per HH	All Persons
ALL	4268 (100%)	5062 (52.6%)	9330 (67.2%)	31910 (79.5%)	10210 (100%)	7736 (34.5%)	17946 (55.0%)	51838 (47.5%)
Male	2316 (50.0%)	2439 (48.0%)	4575 (49.0%)	15916 (50.0%)	5163 (51.0%)	3943 (51.0%)	9106 (51.0%)	27259 (53.0%)
Female	2129 (50.0%)	2590 (51.0%)	4719 (51.0%)	15836 (50.0%)	5037 (49.0%)	3766 (49.0%)	8803 (49.0%)	24483 (47.0%)

1.Number denotes the number of persons among DINKs, NON-DINKs, all two-person households and ALL households participated on survey day in CHTS 2001 and 2010-12.

2.Percentage denotes percentage of persons participated among DINKs, NON-DINKs, all two-person households and all persons on survey day in CHTS 2001 & 2010-12.

Among all the survey respondents, 49% of the respondents are males and 51% of the respondents are females in CHTS 2001, and the percentages remained the same in CHTS 2010-12. Compared to the overall male respondents, the percentage of male respondents in DINKs is 50% in CHTS 2001 and it increased by one percent to 51% in CHTS 2010-12 whereas the percentage of female respondents in CHTS 2001 is 50% and it reduced by one percent to 49% in CHTS 2010-12. The percentage of males in NON-DINKs decreased by one percent from 49% to 48% during the ten years and the percentage of females increased by one percent from 51% to 52% during the ten years.

The percentage of licensed drivers among the respondents among DINKs and NON-DINKs increased during the ten years from CHTS 2001 to 2010-12. In both the surveys, among the DINK respondents the percentage of licensed male drivers is greater than the percentage of licensed female drivers whereas in NON-DINK respondents the percentage of female drivers is greater than male drivers.

The percentage of employed respondents among all the CHTS respondents declined significantly during the ten years from approximately 80% in 2001 to 48% in 2010-12. Among NON-DINKs the percentage of respondents who are employed decreased by approximately 18% during the ten years from CHTS 2001 to 2010-12.

The percentage of employed males and females among the DINK respondents are equal in CHTS 2001 whereas the percentage of employed males was greater than the female respondents by two percent in CHTS 2010-12. Among the NON-DINKs, employed males were three percent fewer than the employed female respondents in CHTS 2001 but in CHTS 2010-12 the percentage of employed males were two percent more than the employed females.

3.3 TRIP CHARACTERISTICS FOR KEY DEMOGRAPHIC HOUSEHOLD CHARACTERISTICS OF DINKs AND NON-DINKs

The survey trip characteristics based on key household demographic characteristics of DINKs and NON-DINKs are shown in Table 6 and Table 7 respectively.

Table 6: Trip characteristics based on Key household demographic characteristics of DINKs in CHTS 2001 & 2010-12(Unweighted)

Variables	CHTS 2001 DINKs			CHTS 2010-12 DINKs		
	Households trips	Total	16322 (100%)	Total	36102 (100%)	
Vehicles per Household	Percent of trips	Mean number of household trips	Standard deviation	Percent of trips	Mean number of household trips	Standard deviation
0	0.3%	7.1	5.1	1.8%	11.0	6.9
1	6.9%	6.9	4.9	12.7%	8.1	5.7
2	62.3%	7.1	4.6	67.0%	6.9	4.7
3	20.6%	7.5	5.0	14.4%	6.9	5.0
4+	9.9%	8.1	5.0	4.1%	6.7	5.2
Employee per Household						
0	N/A	N/A	N/A	N/A	N/A	N/A
1	N/A	N/A	N/A	N/A	N/A	N/A
2	100%	7.2	4.8	100%	7.1	4.9
Household Income level						
Less than \$10,000	0.5%	7.3	6.5	0.4%	5.9	4.9
\$10,000 to \$24,999	3.5%	6.5	5.4	1.3%	5.7	4.0
\$25,000 to \$34,999	6.4%	6.3	4.7	2.3%	6.3	4.6
\$35,000 to \$49,999	11.6%	6.9	4.4	5.5%	6.5	4.8
\$50,000 to \$74,999	29.4%	7.3	4.9	15.4%	6.8	5.1
\$75,000 to \$99,999	20.5%	7.4	4.6	18.8%	7.1	5.0
\$100,000 and above	28.1%	7.5	4.7	56.3%	7.3	4.9

Percent of trips indicates the percentage of total trips taken by households(DINKs) on survey day in CHTS 2001 & 2010-12.

As shown in Table 6, among DINKs, households with two vehicles makes the highest percentage of daily households trips and households with zero vehicles makes the lowest percentage of daily household trips according to both the surveys conducted in 2001 and

2010-12. The mean number of daily trips per households is greatest for households with more than three vehicles and the least number of daily trips are made by one vehicle households in CHTS 2001 but surprisingly in CHTS 2010-12 the mean number of daily trips per household is highest for households with zero vehicles and the mean number of daily trips per households is lowest by households with more than three vehicles.

The households with income less than \$10,000 makes the lowest percentage of trips- 0.5%, and the households with income level between \$50,000 and \$74,999 makes the highest percentage of daily household trips – 29.4% in CHTS 2001. The mean number of daily trips taken by households with income greater than \$100,000 is the highest – 7.5 and the mean number of daily household trips by households with income level between \$25,000 and \$34,999 is the lowest – 6.3 in CHTS 2001.

In CHTS 2010-12, the percentage of household trips made by households with income level greater than \$100,000 is the highest - 56.3% and those with income level less than \$10,000 has the lowest percentage of daily household trips – 0.4%. The mean number of daily trips taken by households with income greater than \$100,000 is the highest – 7.5 and the mean number of daily household trips by households with income level between \$10,000 and \$24,999 is the lowest – 5.7 in CHTS 2010-12.

Compared to CHTS 2001, the percentage of daily household trips made by households with income level greater than \$100,000 is significantly higher in CHTS 2010-12 – from 28% to 56%, whereas percentage of daily household trips made by all other income category households decreased in CHTS 2010-12 and also the average number of daily trips per household by all income categories decreased in CHTS 2010-12 compared to CHTS 2001.

Table 7: Trip characteristics based on Key household demographic characteristics of NON-DINKS in CHTS 2001 & 2010-12(Unweighted)

Variables	CHTS 2001 NON-DINKS			CHTS 2010-12 NON-DINKS		
	Households trips	Total	30142 (100%)	Total	69706 (100%)	
Vehicles per Household	Percent of trips	Mean number of household trips	Standard deviation	Percent of trips	Mean number of household trips	Standard deviation
0	1.2%	3.7	4.8	4.1%	7.2	7.0
1	21.5%	5.4	5.1	21.3%	5.8	5.2
2	56.5%	6.1	5.0	59.9%	6.3	4.7
3	14.8%	6.4	5.2	11.6%	6.4	5.0
4+	6.0%	6.4	5.1	3.0%	6.4	5.2
Employee per Household						
0	45.2%	5.7	5.2	21.8%	5.2	5.0
1	46.7%	6.2	5.0	39.9%	6.2	5.0
2	8.1%	6.0	4.3	38.4%	7.0	4.9
Household Income level						
Less than \$10,000	2.6%	3.9	4.1	2.4%	5.1	5.3
\$10,000 to \$24,999	13.6%	5.2	5.0	7.2%	5.3	5.1
\$25,000 to \$34,999	16.4%	5.7	5.1	6.3%	5.0	4.7
\$35,000 to \$49,999	19.1%	6.3	5.1	10.1%	5.7	4.9
\$50,000 to \$74,999	24.6%	6.6	4.9	19.5%	6.2	5.1
\$75,000 to \$99,999	12.3%	6.5	4.7	18.0%	6.5	4.8
\$100,000 and above	11.4%	7.0	5.3	36.5%	7.0	4.9
Employment status						
YES	54.8%	6.2	4.9	78.2%	6.6	5.0
NO	45.2%	5.7	5.2	21.8%	5.2	5.0

Percent of trips indicates the percentage of total trips taken by households (NON-DINKS) on survey day in CHTS 2001 & 2010-12

Among the NON-DINKs the lowest percent of daily household trips are made by household with zero vehicles in CHTS 2001 and by households with more than three vehicles in CHTS 2010-12 and the highest percentage are made by households with two vehicles in both surveys. The percentage of trips made by households with two vehicles increased during the ten years from 2001 to 2011. The average number of daily household trips is lowest for households with zero vehicles in 2001 in contrast to the highest average number of daily trips by households with zero vehicles in CHTS 2010-12.

Percentage of trips made by households with zero employees among NON-DINKs declined significantly in 2012 compared to 2001 – 45% to 29%, whereas the percentage of trips made by households with two employees significantly increased in 2012 compared to 2001– from 8% to 38%. The average number of daily trips is highest for households with one employee in 2001 and its highest for households with two employees in 2012. The average number of daily trips is made by households with zero employees in CHTS 2001 as well as in CHTS 2010-12.

In CHTS 2001 and 2010-12 households with incomes less than \$10,000 had the lowest percentage of daily household trips as well as the lowest average number of daily trips. In CHTS 2001 households with income range between \$50,000 and \$79,000 had the highest percentage of daily trips and in CHTS 2012, households with highest income range, greater than \$100,000 has the highest percentage of daily household trips. The highest average number of daily trips is made by households with income level \$100,000 and more in CHTS 2001 and 2010-12 – 7.0 in both surveys.

Households with employed persons made more percentage of trips compared to households with unemployed persons in both surveys and percentage of trips significantly

increased during the ten years. The average number of daily trips of households with employed people increased in CHTS 2010-12 and the average number of daily trips decreased for households with unemployed people in CHTS 2010-12 compared to CHTS 2001.

CHAPTER 4. TRAVEL CHARACTERISTICS OF DAILY TRIPS TAKEN IN CALIFORNIA BY DINKs AND NON-DINKs.

In CHTS 2001 and 2010-12 the data collected on daily trips include information such as the purpose of the trip, the means or modes of transportation used, the duration and length of the trip, the time of day and day of the week when the trip took place, and the number of people in the vehicle during the trip. In the 2001 and 2010-12 CHTS, a daily trip is one that occurred on the randomly selected travel day regardless of mode or distance traveled, as long as the person went from one address to another. If a driver stops to serve a passenger, a separate trip was recorded for that driver. One trip ends and another trip begins every time a traveler stops for a particular purpose, or a person changes his mode of travel, or when a driver stops to serve passenger, or when the trip maker reaches his destination (NuStats, 2002). In this section the trip characteristics of DINKs and NON-DINKS such as,

- Who is travelling - Male or female, young or old, employed or unemployed, High income or low income households?
- How are they travelling - by private mode or public transit?
- Why are they travelling - work trips, shopping trips or leisure trips?

are examined and answered.

4.1 WHO IS TRAVELLING?

For each individual, data were collected on daily trips taken during pre-assigned time frames and daily trips were examined to see whether male or female take more daily trips, young or old travel more, employed or unemployed persons or whether high income or low income households take more daily trips among DINKs, NON-DINKs and all two-person households.

4.1.1 MALE OR FEMALE?

The percentage of trips and the mean number of trips taken by males and females among the total number of daily trips by DINKs and NON-DINKs are shown in Table 8.

Table 8: Daily travel: Percent and mean number of daily trips by MALE and FEMALE in DINKs and NON-DINKs (Unweighted)

CHTS 2001				CHTS 2010-12		
MALE	Percent of daily trips	Mean no: of daily trips	Standard deviation	Percent of daily trips	Mean no: of daily trips	Standard deviation
DINK	49.8	3.6	2.9	51.2	3.6	3.0
NON-DINK	48.1	3.0	2.9	47.1	2.9	2.9
ALL two per HH	48.7	3.2	2.9	48.6	3.1	2.9
FEMALE	Percent of daily trips	Mean no: of daily trips	Standard deviation	Percent of daily trips	Mean no: of daily trips	Standard deviation
DINK	50.2	3.6	2.7	48.7	3.5	2.9
NON-DINK	51.3	3.0	3.0	52.6	3.0	2.9
ALL two per HH	50.9	3.2	2.9	51.2	3.1	2.9

1. Percent of daily trip- Percentage of trips made by males and females among DINKs, NON-DINKs and all Two-person households on survey day in CHTS 2001 & 2010-12.

2. Mean no: of trips denotes average number of trips taken on survey day in CHTS 2001 & 2010-12

Overall, 49% of the daily trips by all two-person households are made by males and 51% of the daily trips are made by females in both CHTS 2001 and in CHTS 2010-12. The average number of daily trips by males and females are the same in both CHTS surveys for two-person households – 3.2 trips per day in CHTS 2001 and 3.1 trips per day in CHTS 2010-12.

The percentage of daily trips made by males and females among DINKS are approximately the same, around 50% in CHTS 2001 and the average number of daily trips by males and females are also the same- 3.6 trips per day. In CHTS 2010-12 the percentage of daily trips by males is almost 2% greater compared to that of females- 51% by males and 49% by females. The average number of daily trips by males remained the same at 3.6 but the average number of daily trips by females reduced from 3.6 to 3.5 in CHTS 2010-12. The

percentage of daily trips made by females among NON-DINKS is greater than males- around 51% and 48% respectively in CHTS 2001 but the average number of daily trips by males and females are the same- 3.6 trips per day. The percentage of daily trips by males reduced by one percent in CHTS 2010-12 in contrast to daily trips by females which increased by one percent. In CHTS 2010-12 the percentage of daily trips by females is almost 6% greater compared to males- 47% by males and 53% by females. The average number of daily trips by females remained the same at 3.0 but the average number of daily trips by males reduced from 3.0 to 2.9 in CHTS 2010-12.

4.1.2 YOUNG OR OLD?

The percentage of trips and the mean number of trips taken by young and old among the total number of daily trips by DINKs and NON-DINKs are shown in Table 9.

Table 9: Daily travel: Percent and mean number of daily trips by YOUNG and OLD persons among DINKs and NON-DINKs (Unweighted).

CHTS 2001				CHTS 2010-12		
YOUNG	Percent of daily trips	Mean no: of daily trips	Standard deviation	Percent of daily trips	Mean no: of daily trips	Standard deviation
DINK	94.9	3.6	2.8	88.9	3.6	2.9
NON-DINK	64.5	3.1	3.0	66.5	3.2	3.0
ALL two per HH	75.2	3.3	2.9	74.4	3.3	3.0
OLD	Percent of daily trips	Mean no: of daily trips	Standard deviation	Percent of daily trips	Mean no: of daily trips	Standard deviation
DINK	3.3	3.4	2.9	7.3	3.1	2.6
NON-DINK	31.4	2.7	2.9	29.7	2.6	2.7
ALL two per HH	21.5	2.8	2.9	21.8	2.6	2.7

1.Young: All persons below or equal to 65 years are considered young.

2.Old: All persons above 65 years and less than 99 years are considered old.

3.Percent of daily trip- Percentage of trips made by males and females among DINKs, NON-DINKs and all Two-person households on survey day in CHTS 2001 & 2010-12.

4.Mean no: of trips denotes average number of trips taken by young and old participants on survey day in CHTS 2001 & 2010-12

For daily trips a significantly lower percentage of older travelers reported to have traveled, as compared to younger travelers. Overall, 75% of the daily trips by all two-person households are made by younger persons and only around 22% of the trips are made by older persons in CHTS 2001 and in CHTS 2010-12. The average daily trips among two-person households is 3.3 for younger persons and 2.8 for older persons in CHTS 2001. The average daily trips for younger persons remained at 3.3 but the average number of trips by older two-persons reduced to 2.6 in CHTS 2010-12.

The percentage of daily trips taken by younger persons is significantly higher than older persons among DINKS in both surveys. Around 95% of the daily trips are taken by younger persons in contrast to older persons who takes only around 3% daily trips in CHTS 2001. Even though the percentage of trips taken by older DINKs is less compared to younger persons, they take 3.4 trips per day as compared to younger persons who take 3.6 trips per day in CHTS 2001. In CHTS 2010-12 the percentage of daily trips by younger persons reduced by 6% in contrast to daily trips made by older persons, which significantly increased from 3% to 7% approximately. Even though the percentage of daily trips by older persons increased, the average number of daily trips reduced from 3.4 to 3.1 and the average number of daily trips by younger persons remained at 3.6 in CHTS 2010-12.

Among NON-DINKS, 65% of the daily trips are made by younger persons and only around 32% of the trips are made by older persons in CHTS 2001 and around 67% and 30% of the daily trips are made by younger persons and older persons respectively in CHTS 2010-12. Among NON-DINKs, younger persons take more trips per day than do older persons – 3.1 trips versus 2.7 trips, respectively in CHTS 2001. The average number of daily trips by

younger persons increased from 3.1 to 3.2 in contrast to reduction in older person's daily trips from 2.7 to 2.6 in CHTS 2010-12.

4.1.3 EMPLOYED OR UNEMPLOYED?

The percentage of trips and the mean number of trips taken by employed and unemployed persons among the total number of daily trips are shown in Table 10.

Table 10: Daily travel: Percent and mean number of daily trips by EMPLOYED and UNEMPLOYED persons among DINKs and NON-DINKs (Unweighted).

CHTS 2001				CHTS 2010-12		
EMPLOYED	Percent of daily trips	Mean no: of daily trips	Standard deviation	Percent of daily trips	Mean no: of daily trips	Standard deviation
DINK	100.0	3.6	2.8	100.0	3.7	2.9
NON-DINK	54.7	3.1	3.0	40.7	3.5	3.0
ALL two per HH	70.4	3.1	2.9	61.7	3.5	2.9
UNEMPLOYED	Percent of daily trips	Mean no: of daily trips	Standard deviation	Percent of daily trips	Mean no: of daily trips	Standard deviation
DINK	0.0	0.0	0.0	0.0	0.0	0.0
NON-DINK	45.3	2.8	3.0	57.1	2.7	2.9
ALL two per HH	29.4	2.8	3.0	36.9	2.7	2.9

1. Percent of daily trips: Percentage of trips made by employed persons and unemployed persons among DINKs, NON-DINKs and all two-person households on survey day in CHTS 2001 and 2010-12.

2. Mean no: of trips denotes average number of trips taken by employed and unemployed participants on survey day in CHTS 2001 & 2010-12.

The percentage of daily trips made by employed persons are significantly higher than daily trips made by unemployed persons in all two-person households as per CHTS 2001- 71% and 30% respectively. The average number of trips made by employed persons is 3.1 and unemployed persons is 2.8. In CHTS 2010-12 the percentage of daily trips made by employed persons reduce by approximately 8% and the percentage of daily trips made by unemployed

persons increased by approximately 7%. In contrast to the decrease in the percentage of trips made by employed persons, the average number of daily trips of employed persons increased to 3.5 from 3.1 in CHTS 2010-12. The average number of daily trips by unemployed persons decreased to 2.7 from 2.8, despite the 7% increase in the percentage of daily trips in CHTS 2010-12.

Among DINKs, the average number of daily trips made by employed persons increased from 3.6 trips per day to 3.7 trips per day during the ten years from 2001 to 2011 according to the CHTS. Since there are no unemployed persons in the DINKs no comparisons are made.

In CHTS 2001, the percentage of daily trips made by employed persons among NON-DINKs is significantly greater than trips made by unemployed persons - 55% and 45% respectively. The average number of trips made by employed persons are 3.1 and by unemployed persons are 2.8. In CHTS 2010-12 the percentage of trips made by employed persons significantly reduced by 14% and the percentage of trips made by unemployed persons significantly increased by approximately 12%. The average number of daily trips made by employed persons increased from 3.1 to 3.5 and average number of trips made by unemployed persons reduced from 2.8 to 2.7 during the ten years.

4.1.4 HIGH INCOME OR LOW INCOME HOUSEHOLDS?

Households were classified into high income and low income based on the income level.

Households with income levels greater than \$50,000 are considered high income and those with less than \$50,000 are considered low income households in both CHTS 2001 and 2010-12. The percentage of trips and the mean number of trips taken by high income and low income households among the total number of daily trips are shown in Table 11.

Table 11: Daily travel: Percent and mean number of daily trips by HIGH INCOME and LOW INCOME households among DINKs and NON-DINKs (Unweighted).

CHTS 2001				CHTS 2010-12		
HIGH INCOME	Percent of daily trips	Mean no: of daily trips	Standard deviation	Percent of daily trips	Mean no: of daily trips	Standard deviation
DINK	78.0	7.4	4.8	90.5	7.1	5.1
NON-DINK	48.3	6.7	5.0	74.0	6.6	4.9
ALL two per HH	59.0	7.0	4.9	74.6	6.7	5.0
LOW INCOME	Percent of daily trips	Mean no: of daily trips	Standard deviation	Percent of daily trips	Mean no: of daily trips	Standard deviation
DINK	22.0	6.8	5.2	9.5	6.1	4.7
NON-DINK	51.7	5.3	4.8	26.0	5.3	5.0
ALL two per HH	41.0	5.8	5.0	25.4	5.4	4.9

1. Percent of daily trip- Percentage of trips made by high and low income households among DINKs, NON-DINKs and all Two-person households on survey day in CHTS 2001 & 2010-12.

2. Mean no: of trips denotes average number of trips taken on survey day in CHTS 2001 & 2010-12

The percentage of daily trips made by high income household are significantly greater than low income households among all two-person households in CHTS 2001 and 2010-12 -59% and 41% respectively. The average number of trips made by high income households is 7.0 and low income households is 5.8 in CHTS 2001. In CHTS 2010-12 the percentage of daily trips made by low income households reduce by approximately 16% and the percentage of daily trips made by high income households increased by approximately 16%. The average

number of trips by high income as well low income households decreased in CHTS 2010-12 compared to CHTS 2001.

Among DINKs, the percentage of daily household trips increased among high income households and the percentage of daily trips by low income households decreased during the ten years from CHTS 2001 to CHTS 2010-12. The average number of daily trips by high income household DINKs are greater than low income household DINKs. Despite the increase in the percentage of households trips by high income households the average number of daily trips decreased in 2012 compared to 2001 – 7.4 to 7.1. The average number of daily trips by low income households also decreased from 6.8 to 6.1 in CHTS 2012 compared to CHTS 2001.

The average number of daily trips by high income household NON-DINKs is greater than that of low income household NON-DINKs. The percentage of household trips made by high income households among NON-DINKs increased significantly and the percentage of household trips made by low income households decreased significantly during the ten years from 2001 to 2011. Although the percentage of household trips made by high income households increased significantly, the average number of daily trips made by high income households decreased - 6.7 to 6.6. The average number of daily trips made by low income households remained the same, 5.3 in CHTS 2001 and CHTS 2010-12 despite the decrease in the percentage of household trips made by low income households.

4.2 HOW ARE THEY TRAVELLING?

For each individual, data were collected on daily trips taken during pre-assigned time frames and data were collected on the number of trips taken during a randomly assigned day and the mode of transportation used, if any, for making the trip. If more than one means of transportation was used in traveling from one point to another, each mode was recorded as a separate trip (NuStats, 2002). The mode of transportation used to make daily trips by DINKs and NON-DINKs in the CHTS 2001 and 2010-12 are examined in this section.

Table 12: Daily travel: Percent of daily trips by each mode among DINKs and NON-DINKs in CHTS 2001 & 2010-12.

CHTS 2001 Percent of trips by mode				CHTS 2010-12 Percent of trips by mode			
Modes	DINKs	NON-DINKs	All two per HH	DINKs	NON-DINKs	All two per HH	
Drove	83.2	75.3	78.1	69.2	64.0	65.9	
Passenger	10.4	18.7	15.8	13.3	18.7	16.8	
Bicycle	0.8	0.5	0.6	2.0	1.4	1.6	
Walk	3.8	3.8	3.8	10.8	11.1	11.0	
Transit	1.4	1.2	1.3	3.7	4.0	3.9	
All Other	0.3	0.5	0.5	1.0	0.8	0.9	
Total	100.0	100.0	100.0	100.0	100.0	100.0	

Percentage of trips by different modes taken by respondents on the survey day in CHTS 2001 and 2010-12.

Drove indicates driver of auto/truck/van

Passenger indicates passenger in auto/truck/van.

Transit includes all inter-and intra-city modes, such as local bus, subway, streetcar, shuttle bus, commuter bus and Amtrak.

Other includes airplane, ferry, wheelchair/mobility scooter, school bus, motorcycle/moped.

As shown in Table 12, driver trips by auto/truck/van remains the dominant mode of transportation in CHTS 2001 and 2010-12 among all two-person households consisting of DINKs and NON-DINKs. Percentage of trips made as passenger in auto/truck/van comprised the second highest compared to all other modes in both the survey reports. The percentage of bicycle and walk trips among DINKs and NON-DINKs were relatively low compared to auto

modes but, the percentage of trips by these modes increased during the ten years from 2001 to 2011 in contrast to auto trips which decreased during the ten years. The percentage of transit trips also increased in CHTS 2010-12 compared to CHTS 2001 and among DINKs and NON-DINKs the highest percentage of increase in transit trips was for NON-DINKs – 1.2% to 4% compared to DINKs – 1.4% to 3.7%.

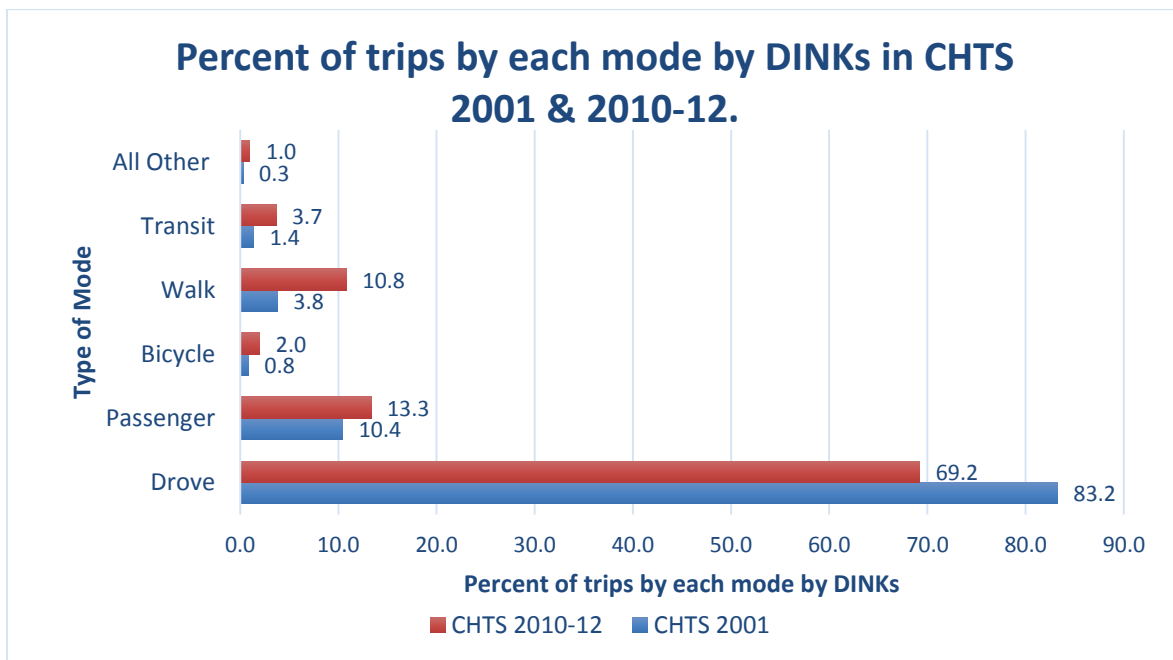


Figure 4: Percentage of trips by each mode on survey day by DINKs in CHTS 2001 and CHTS 2010-12. From the CHTS 2001 and 2010-12 results the percentage of driver trips by personal vehicles, Auto/van/truck, dominated all other modes of trips but an interesting finding was the increase in the percentage of bike and walk trips during the ten years. As shown in Figure 4, among DINKs driver trips contributed to around 83% in CHTS 2001 while it reduced to around 69% in CHTS 2010-12 whereas the percentage of bike trips more than doubled from 0.8% to 2.0% and walk trips increased by more than two fold from 3.8% to 10.8% in CHTS 2010-12. Another interesting result is the increase in the percentage of passenger trips from

2001 to 2012 – from 10.4% to 13.3%. Percentage of transit trips also increased during the ten years from 2001 to 2012 by almost 2.3%. This shows that more people among DINKs started using other modes of travel like bike, walk and public transit during the period between CHTS 2001 and CHTS 2010-12. The increase in walk trips can be accounted for better data collection and reporting in CHTS 2010-12 compared to CHTS 2001.

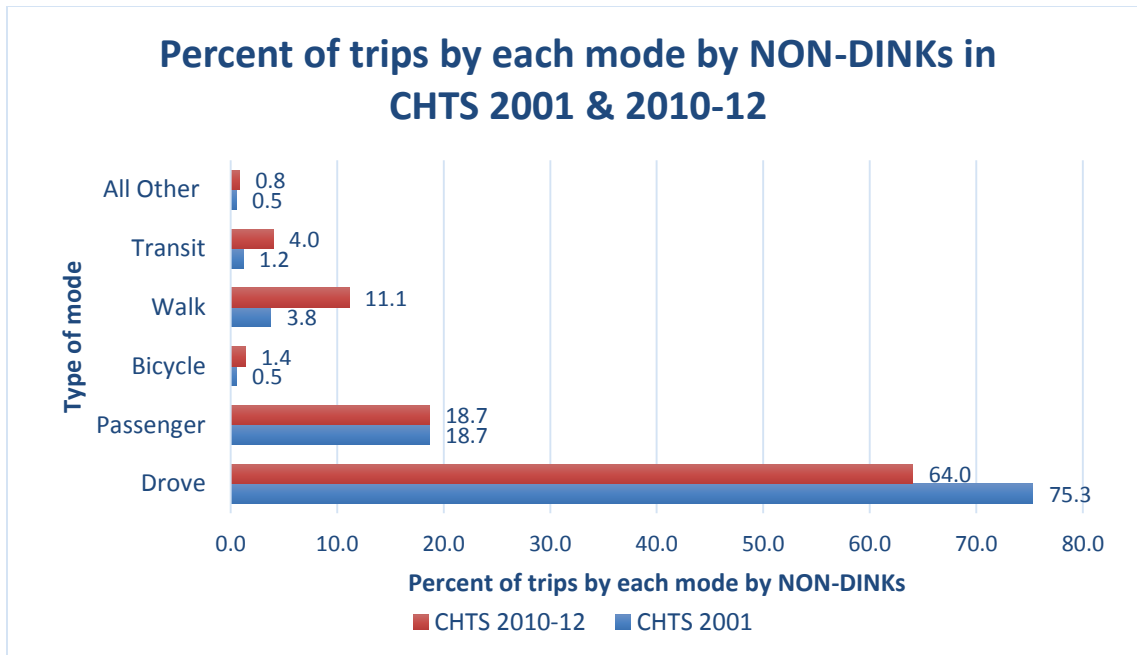


Figure 5: Percentage of trips by each mode on survey day by NON-DINKs in CHTS 2001 and CHTS 2010-12

As shown in the Figure 5, driver trips by auto/truck/van remains the dominant mode of transportation in CHTS 2001 and 2012 among NON-DINKs- 75% and 64% respectively in 2001 and 2012. The percentage of driver trips reduced by approximately 11% during the ten years but the percentage of passenger trips remained the same at approximately 19% during the ten years unlike DINKs. There is a significant increase in the percentage of walk and bike trips during the ten years among NON-DINK trips. Bike trips approximately tripled from 0.5% to 1.5% and walk trips also significantly increased from approximately 4% to 11% during the ten years. Another interesting result is the increase in the percentage of

transit trips among NON_DINKS – approximately 3.5% increase from 2001 to 2012. From this it can be assumed that the decline in the percentage of auto trips, i.e., approximately 11% decrease, is due to a shift to other modes of travel such as bike, walk and transit trips during the ten years. The increase in walk trips may be an artifact of better data collection and reporting in CHTS 2010-12 compared to CHTS 2001, however.

4.3 WHY ARE THEY TRAVELLING?

For each individual, data were collected on daily trips taken during pre-assigned time frames and daily trips were examined to see for what particular purpose the trip was made from a starting place to a stop. More specifically, the trip purpose at the starting place of the trip or the ending place include home, work, work-related business, entertainment or social events, recreational activities, shopping, education, serving a passenger, changing mode of travel, or “other” trip purposes (NuStats, 2002). The trip purposes were classified as work or work-related, Shopping/Maintenance and leisure trips and are shown in Table 13 and Table 14.

Table 13: CHTS 2001 trip purpose classification chart.

CHTS 2001 trip purpose classification
Work or work related
Work(includes regularly scheduled volunteer work)
Work related (sales calls, meetings, errands etc.)
Shopping/Maintenance
Incidental shopping(groceries, house wares, medicine etc.)
Major shopping (furniture, clothes, auto etc.)
ATM, Banking, post office, utilities
Other personal or household business
Buy gas, quick stop for coffee, newspaper etc.
Medical
Leisure
Recreational
Fitness activities
Eat Out (Restaurant, drive through etc.)
Entertainment
Visit friends/relatives
Community meetings, political or civil event, public hearing etc.

In the CHTS 2010-12 the trip purposes were classified a little different from the CHTS 2001 and the classification is shown in Table 14.

Table 14: CHTS 2010-12 trip purpose classification chart.

CHTS 2010-12 trip purpose classification
Work or work related
Work/Job duties
Training
Meals at work
work sponsored social activities/volunteer work activities
Work related meetings
All other work related activities
Shopping/Maintenance
Routine shopping(groceries, HH maintenance etc.)
Major shopping (furniture, clothes, auto etc.)
Household errands (Bank, dry cleaning etc.)
Personal business
Healthcare (Doctor, Dentist etc.)
Service private vehicle (Gas, oil, repairs)
Leisure
Entertainment
Social/Visit friends/relatives
Outdoor exercise (jogging, bicycling, walking the dog etc.)
Indoor exercise (GYM, Yoga etc.)
Eat Out (Restaurant, drive through etc.)
Civic/Religious activities

The trip purposes were examined for all DINKs, NON-DINKS and all two-person households in general. In CHTS 2010-12 there was a separate file for each place visited over the sample period and a description of upto three activities were collected. There is no separate file in CHTS 2001 for activities, but for each trip the primary and secondary trip purpose were collected and recorded in the Trip file.

The distribution of trips by trip purposes among DINKs and NON-DINKs in CHTS 2000-2001 and 2010-2012 are shown in Table 15.

Table 15: Distribution of trips by trip purpose among DINKs, NON-DINKs and All two-person households in CHTS 2001 & 2010-12.

Purpose of trip	CHTS 2001			CHTS 2010-12		
	Percent of trips			Percent of trips		
	DINK	NON-DINK	ALL two-person Households	DINK	NON-DINK	ALL two-person Households
Work / Work related	29.1%	12.1%	18.1%	15.3%	6.5%	9.6%
Shopping / Maintenance	20.4%	30.8%	27.2%	11.0%	15.1%	13.7%
Leisure	12.5%	15.9%	14.7%	11.5%	13.5%	12.8%

Percent of trips made on survey day by DINKs and NON-DINKs for various trip purpose in CHTS 2001&2010-12

As can be seen from the Table 15, among all two-person households large portion of daily trips are Shopping/Maintenance trips made for family and personal reasons such as shopping, running errands, medical etc. in CHTS 2001 and 2010-12. In CHTS 2001, work and work related trips were larger compared to leisure trips but in CHTS 2010-12, work and work-related travel constitutes a small percent of daily travel. During the ten years the percentage of work and work related trips as well as shopping and maintenance trips were significantly reduced – approximately 9% and 14% respectively, whereas leisure trips reduced by only 2% approximately.

Among DINKs the largest portion of daily trips are made for work or work related purposes in CHTS 2001 as well as in CHTS 2010-12. The DINKs made fewer percentage of leisure trips and Shopping and maintenance trips compared to NON-DINKs. The percentage of work trips and shopping/maintenance trips among DINKs were reduced almost by two

fold during the ten years whereas the percentage of leisure trips reduced by only one percent during the period from 2001 to 2012.

The largest portion of daily trips among NON-DINKs were Shopping/Maintenance trips made for family and personal reasons such as shopping, running errands, medical etc. in CHTS 2001 and 2010-12. Among NON-DINKs, work or work-related daily trips is the lowest compared to all other trip purposes in both surveys. The percentage of work or work-related trips as well as shopping/maintenance trips among NON-DINKs reduced approximately by two fold during the ten years from 2001 to 2011 whereas the percentage of leisure trips reduced only by approximately 1.5%.

CHAPTER 5. CONCLUSIONS AND RECOMMENDATIONS

5.1 CONCLUSIONS

There are similarities in travel characteristics between DINKs and NON-DINKs, as well as some striking differences. Some of the travel patterns of DINKs and NON-DINKs have changed significantly and some have not changed during the ten years from 2001 to 2011 based on the California household travel surveys. The DINK households make a larger number of daily trips compared to NON-DINKs and the average number of daily trips by DINKs and NON-DINKs have reduced during the ten years from 2001 to 2011. The percentage of work, shopping and leisure trips by DINKs and NON-DINKs have significantly reduced from 2001 to 2011.

The DINK households makes more daily work trips compared to NON-DINKs and they make less leisure trips and shopping/maintenance trips compared to NON-DINKs. Reduction in the work, shopping/maintenance and leisure trips during the ten years can be accounted for many reasons including the great recession in 2007-2008 which created unemployment and reduction in the median household income which resulted in less work trips as well as shopping and recreational trips. Another reason for the decline in the trips during the ten years from 2001 to 2011 could be increased gas prices and also the effect of electronic communications technology that facilitated online shopping and delivery of goods and also work-from-home options.

The primary mode of travel still remains auto trips (driver of auto/truck/van) among DINKs and NON-DINKs but the percentage of auto trips has significantly reduced during the ten years from 2001 to 2011. There has been a significant increase in passenger trips among

DINKs during the ten years while the percentage of passenger trips remains the same among NON_DINKs. The popularity of internet and smart phones among the working class facilitated the growth of Carpooling/Ride sharing trips which could be a reason for the decline in the auto driver trips and increase in the passenger trips.

The reduction in auto driver trips can be accounted for many reasons including more use of public transportation modes due to unemployment and the increased gas prices during the economic recession in 2007-2008 as well as modal shift to bike and walk trips. Also as the nation is becoming more urbanized and younger generation started to live in large metropolitan areas which provides more public transportation facilities their use of other non-motorized modes may have increased. The increase in the walk trips may also be an artifact of better data collection and reporting during the ten years from 2001 to 2011. During the ten years, there has been a growth in the percentage of households with zero vehicles among DINKs and NON-DINKs and these households are assumed to use public transportation modes or bicycles or even walk for their trip purposes like work, shopping or recreation as a part of healthy way of living and reducing environmental pollution.

5.2 RECOMMENDATIONS FOR FUTURE RESEARCH

This research focused on the travel characteristics of DINKS and compared it with NON-DINKS in California as depicted in the California household travel surveys 2000-2001 and 2010-12. In this research, only dual income couples who are opposite gender and who do not have kids at home are considered. Further research could be conducted on dual income couple with kids as well as same gender couples to see how their travel patterns differ from opposite gender couples who are DINKs. In this research the vehicle miles travelled by DINK

and NON-DINK households by different modes has not been studied which is a limitation of this study. Further research could be conducted to study the difference in the average number of trips taken during each day of the week as well as on weekends and also the vehicle miles travelled by each type of mode for DINKs as well as NON-DINKs in California.

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