Title
Data Analysis of the 2000 SCAG Post-Census Regional Travel Survey and the 2010-2012 California Household Travel Survey

Permalink
https://escholarship.org/uc/item/7143937v

Author
Timothy, Andrew Kimble

Publication Date
2015

Peer reviewed|Thesis/dissertation
UNIVERSITY OF CALIFORNIA,
IRVINE

Data Analysis of the 2000 SCAG Post-Census Regional Travel Survey and the 2010-2012
California Household Travel Survey

THESIS

submitted in partial satisfaction of the requirements
for the degree of

MASTER OF SCIENCE

in Civil Engineering

by

Andrew Kimble Timothy

Thesis Committee:
Professor Michael G. McNally, Chair
Professor R. Jayakrishnan
Professor Will Recker

2015
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>LIST OF FIGURES</td>
<td>iii</td>
</tr>
<tr>
<td>ACKNOWLEDGMENTS</td>
<td>vii</td>
</tr>
<tr>
<td>ABSTRACT OF THE THESIS</td>
<td>viii</td>
</tr>
<tr>
<td>INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>CHAPTER 1: SCAG Year 2000 Travel Survey</td>
<td>2</td>
</tr>
<tr>
<td>Demographics</td>
<td>2</td>
</tr>
<tr>
<td>Trip Characteristics</td>
<td>10</td>
</tr>
<tr>
<td>Vehicle Characteristics</td>
<td>18</td>
</tr>
<tr>
<td>CHAPTER 2: 2010-2012 California Household Travel Survey</td>
<td>25</td>
</tr>
<tr>
<td>Demographics</td>
<td>25</td>
</tr>
<tr>
<td>Trip Characteristics</td>
<td>33</td>
</tr>
<tr>
<td>Vehicle Characteristics</td>
<td>41</td>
</tr>
<tr>
<td>REFERENCES</td>
<td>49</td>
</tr>
</tbody>
</table>
# LIST OF FIGURES

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Figure 1</td>
<td>Age Distribution (Imperial County 2000)</td>
<td>2</td>
</tr>
<tr>
<td>Figure 2</td>
<td>Age Distribution (Los Angeles County 2000)</td>
<td>3</td>
</tr>
<tr>
<td>Figure 3</td>
<td>Age Distribution (Orange County 2000)</td>
<td>3</td>
</tr>
<tr>
<td>Figure 4</td>
<td>Age Distribution (Riverside County 2000)</td>
<td>4</td>
</tr>
<tr>
<td>Figure 5</td>
<td>Age Distribution (San Bernardino County 2000)</td>
<td>4</td>
</tr>
<tr>
<td>Figure 6</td>
<td>Age Distribution (Ventura County 2000)</td>
<td>5</td>
</tr>
<tr>
<td>Figure 7</td>
<td>Age Distribution (All Counties 2000)</td>
<td>5</td>
</tr>
<tr>
<td>Figure 8</td>
<td>Vehicles per HH by Income (Imperial County 2000)</td>
<td>6</td>
</tr>
<tr>
<td>Figure 9</td>
<td>Vehicles per HH by Income (Los Angeles County 2000)</td>
<td>7</td>
</tr>
<tr>
<td>Figure 10</td>
<td>Vehicles per HH by Income (Orange County 2000)</td>
<td>7</td>
</tr>
<tr>
<td>Figure 11</td>
<td>Vehicles per HH by Income (Riverside County 2000)</td>
<td>8</td>
</tr>
<tr>
<td>Figure 12</td>
<td>Vehicles per HH by Income (San Bernardino County 2000)</td>
<td>8</td>
</tr>
<tr>
<td>Figure 13</td>
<td>Vehicles per HH by Income (Ventura County 2000)</td>
<td>9</td>
</tr>
<tr>
<td>Figure 14</td>
<td>Vehicles per HH by Income (All Counties 2000)</td>
<td>9</td>
</tr>
<tr>
<td>Figure 15</td>
<td>Average # of Trips per Day (Imperial County 2000)</td>
<td>10</td>
</tr>
<tr>
<td>Figure 16</td>
<td>Average # of Trips per Day (Los Angeles County 2000)</td>
<td>11</td>
</tr>
<tr>
<td>Figure 17</td>
<td>Average # of Trips per Day (Orange County 2000)</td>
<td>11</td>
</tr>
<tr>
<td>Figure 18</td>
<td>Average # of Trips per Day (Riverside County 2000)</td>
<td>12</td>
</tr>
<tr>
<td>Figure 19</td>
<td>Average # of Trips per Day (San Bernardino County 2000)</td>
<td>12</td>
</tr>
<tr>
<td>Figure 20</td>
<td>Average # of Trips per Day (Ventura County 2000)</td>
<td>13</td>
</tr>
<tr>
<td>Figure 21</td>
<td>Average # of Trips per Day (All Counties 2000)</td>
<td>13</td>
</tr>
</tbody>
</table>
Figure 22  Trip % by Mode (Imperial County 2000) 14
Figure 23  Trip % by Mode (Los Angeles County 2000) 14
Figure 24  Trip % by Mode (Orange County 2000) 15
Figure 25  Trip % by Mode (Riverside County 2000) 15
Figure 26  Trip % by Mode (San Bernardino County 2000) 16
Figure 27  Trip % by Mode (Ventura County 2000) 16
Figure 28  Trip % by Mode (All Counties 2000) 17
Figure 29  Vehicle Body Types (Imperial County 2000) 18
Figure 30  Vehicle Body Types (Los Angeles County 2000) 19
Figure 31  Vehicle Body Types (Orange County 2000) 19
Figure 32  Vehicle Body Types (Riverside County 2000) 20
Figure 33  Vehicle Body Types (San Bernardino County 2000) 20
Figure 34  Vehicle Body Types (Ventura County 2000) 21
Figure 35  Vehicle Body Types (All Counties 2000) 21
Figure 36  Vehicle Fuel Type (Imperial County 2000) 22
Figure 37  Vehicle Fuel Type (Los Angeles County 2000) 22
Figure 38  Vehicle Fuel Type (Orange County 2000) 23
Figure 39  Vehicle Fuel Type (Riverside County 2000) 23
Figure 40  Vehicle Fuel Type (San Bernardino County 2000) 23
Figure 41  Vehicle Fuel Type (Ventura County 2000) 24
Figure 42  Vehicle Fuel Type (All Counties 2000) 24
Figure 43  Age Distribution (Imperial County 2012) 25
Figure 44  Age Distribution (Los Angeles County 2012) 26
Figure 45  Age Distribution (Orange County 2012)  26
Figure 46  Age Distribution (Riverside County 2012)  27
Figure 47  Age Distribution (San Bernardino County 2012)  27
Figure 48  Age Distribution (Ventura County 2012)  28
Figure 49  Age Distribution (All Counties 2012)  28
Figure 50  Vehicles per HH by Income (Imperial County 2012)  29
Figure 51  Vehicles per HH by Income (Los Angeles County 2012)  30
Figure 52  Vehicles per HH by Income (Orange County 2012)  30
Figure 53  Vehicles per HH by Income (Riverside County 2012)  31
Figure 54  Vehicles per HH by Income (San Bernardino County 2012)  31
Figure 55  Vehicles per HH by Income (Ventura County 2012)  32
Figure 56  Vehicles per HH by Income (All Counties 2012)  32
Figure 57  Average # of Trips per Day (Imperial County 2012)  33
Figure 58  Average # of Trips per Day (Los Angeles County 2012)  34
Figure 59  Average # of Trips per Day (Orange County 2012)  34
Figure 60  Average # of Trips per Day (Riverside County 2012)  35
Figure 61  Average # of Trips per Day (San Bernardino County 2012)  35
Figure 62  Average # of Trips per Day (Ventura County 2012)  36
Figure 63  Average # of Trips per Day (All Counties 2012)  36
Figure 64  Trip % by Mode (Imperial County 2012)  37
Figure 65  Trip % by Mode (Los Angeles County 2012)  38
Figure 66  Trip % by Mode (Orange County 2012)  38
Figure 67  Trip % by Mode (Riverside County 2012)  39
Figure 68  Trip % by Mode (San Bernardino County 2012)  39
Figure 69  Trip % by Mode (Ventura County 2012)  40
Figure 70  Trip % by Mode (All Counties 2012)  40
Figure 71  Vehicle Body Types (Imperial County 2012)  41
Figure 72  Vehicle Body Types (Los Angeles County 2012)  42
Figure 73  Vehicle Body Types (Orange County 2012)  42
Figure 74  Vehicle Body Types (Riverside County 2012)  43
Figure 75  Vehicle Body Types (San Bernardino County 2012)  43
Figure 76  Vehicle Body Types (Ventura County 2012)  44
Figure 77  Vehicle Body Types (All Counties 2012)  44
Figure 78  Vehicle Fuel Type (Imperial County 2012)  45
Figure 79  Vehicle Fuel Type (Los Angeles County 2012)  45
Figure 80  Vehicle Fuel Type (Orange County 2012)  46
Figure 81  Vehicle Fuel Type (Riverside County 2012)  46
Figure 82  Vehicle Fuel Type (San Bernardino County 2012)  47
Figure 83  Vehicle Fuel Type (Ventura County 2012)  47
Figure 84  Vehicle Fuel Type (All Counties 2012)  48
I would like to thank Professor Stephen Ritchie for encouraging me to pursue a graduate education at UC Irvine. I would also like to thank my committee members Professor Michael McNally, Professor R. Jayakrishnan, and Professor Will Recker for their support throughout the entire process. Finally, I would like to thank the University of California Center on Economic Competitiveness in Transportation (UCCONNECT) for the financial support given to me for the 2014-2015 academic year.
ABSTRACT OF THE THESIS

Data Analysis of the 2000 SCAG Post-Census Regional Travel Survey and the 2010-2012 California Household Travel Survey

By

Andrew Kimble Timothy

Master of Science in Civil Engineering

University of California, Irvine, 2015

Professor Michael G. McNally, Chair

Results from the 2000 SCAG Post-Census Regional Travel Survey and the 2010-2012 California Household Travel Survey are used to study the demographics and characteristics of Imperial, Los Angeles, Orange, Riverside, San Bernardino, and Ventura counties. Graphs for each county are created to show pertinent data to transportation applications, such as the average number of vehicles a household owns or how many trips certain individuals make in one day. Studying both sets of data gives perspective on how the SCAG region has evolved over 12 years. The overwhelming majority of trips are still travelled by personal vehicle, despite walking trips seeing an increase over 2000, and trips are more frequent overall.
Introduction

To effectively plan transportation networks in a region, it is important to know people’s travel habits and patterns. One way to gauge this is through the use of a travel survey. By taking a poll on a random sample of households in a region, engineers and planners can best decide how to improve infrastructure by analyzing the data received. Over a period of time between two surveys, the data should reflect changes in travel behavior or household characteristics.

In studying the six counties which comprise the Southern California Association of Governments, or SCAG, there are two sources of recent data to compare. The first is a post-census regional travel survey which was conducted by SCAG in 2000. It contains travel data specifically for Imperial, Los Angeles, Orange, Riverside, San Bernardino, and Ventura counties. The second source is the 2010-2012 California Household Travel Survey led by Caltrans. While having information for the entire state of California, data for just the SCAG region can be extracted from the CHTS. The following sections will explore what data is of interest in each survey.
Chapter 1: SCAG Year 2000 Travel Survey

SCAG conducted a post-census regional travel survey starting in the fall of the year 2000. The purpose of the survey was to gather information based on travel patterns and network usage in the six SCAG counties. Telephone surveys as well as mail home travel diaries were used to collect data. Each piece of trip data is drawn from a single sample day.

Demographics

When the travel survey was conducted, SCAG contacted households by interacting with a single person. Each household can be made up of multiple people with different traits. The following charts show the age distribution of everyone who participated in the study.

Figure 1: Age Distribution (Imperial County 2000)
Figure 2: Age Distribution (Los Angeles County 2000)

Figure 3: Age Distribution (Orange County 2000)
Figure 4: Age Distribution (Riverside County 2000)

Figure 5: Age Distribution (San Bernardino County 2000)
Figure 6: Age Distribution (Ventura County 2000)

Figure 7: Age Distribution (All Counties 2000)
Each county shows a similar distribution of ages. Imperial County has the largest percentage of young people under 25 and Orange County and Ventura County are tied for the largest percentage of people over 44. These age distributions are important for differentiating travel patterns.

Another important detail to learn about the survey sample is how many vehicles each household owns. The average number of vehicles per household is shown for each county categorized by income.

![Figure 8: Vehicles per HH by Income (Imperial County 2000)](image)
Figure 9: Vehicles per HH by Income (Los Angeles County 2000)

Figure 10: Vehicles per HH by Income (Orange County 2000)
Figure 11: Vehicles per HH by income (Riverside County 2000)

Figure 12: Vehicles per HH by Income (San Bernardino County 2000)
Figure 13: Vehicles per HH by Income (Ventura County 2000)

Figure 14: Vehicles per HH by Income (All Counties 2000)
Unsurprisingly, as household income increases, so do the number of cars a household is likely to own. The average number of vehicles for the lowest income bracket shows that in all counties except Orange County, car ownership is not guaranteed. Riverside County has the highest average peak of 3.3 cars per household in the highest income bracket.

**Trip Characteristics**

Trip data collected from the survey takes place over the course of one sample day for the participant. To make better use of the number of trips each person takes, trips have been averaged and divided based on age distribution.

![Figure 15: Average # of Trips per Day (Imperial County 2000)](image-url)
Figure 16: Average # of Trips per Day (Los Angeles County 2000)

Figure 17: Average # of Trips per Day (Orange County 2000)
Figure 18: Average # of Trips per Day (Riverside County 2000)

Figure 19: Average # of Trips per Day (San Bernardino County 2000)
Figure 20: Average # of Trips per Day (Ventura County 2000)

Figure 21: Average # of Trips per Day (All Counties)
Every county shows that the most trips are from people aged 25 to 64. The majority of the workforce is in this age range, as are parents taking children to school.

Figure 22: Trip % by Mode (Imperial County 2000)

Figure 23: Trip % by Mode (Los Angeles County 2000)
Figure 24: Trip % by Mode (Orange County 2000)

Figure 25: Trip % by Mode (Riverside County 2000)
Figure 26: Trip % by Mode (San Bernardino County 2000)

Trip % by Mode (San Bernardino County)

- Not Reported: 0.4%
- Other: 0.1%
- Airplane: 0.0%
- Walk: 4.4%
- Bicycle: 0.2%
- Motorcycle: 0.0%
- Taxi/Shuttle: 0.1%
- Para Transit: 0.0%
- Heavy Rail: 0.2%
- LA Metro: 0.0%
- Bus: 3.0%
- Car: 91.6%

Figure 27: Trip % by Mode (Ventura County 2000)

Trip % by Mode (Ventura County)

- Not Reported: 0.1%
- Other: 0.0%
- Airplane: 0.1%
- Walk: 5.6%
- Bicycle: 0.7%
- Motorcycle: 0.0%
- Taxi/Shuttle: 0.0%
- Para Transit: 0.0%
- Heavy Rail: 0.1%
- LA Metro: 0.1%
- Bus: 1.5%
- Car: 91.8%
The overwhelming majority of trips are taken in a personal vehicle. Walking trips take second place. Los Angeles County shows the highest percentage of bus travel since it has the highest density.
Vehicle Characteristics

In addition to knowing which trips people make in personal vehicles, it is also important to know what kind of vehicles are being used. There is a wide variety of passenger vehicles available. Studying the types people buy can give insight into how they use their vehicle or what styles are the most popular. There are many car manufacturers, but there is a small subset of standard vehicle body types that can be compared across all brands.

Figure 29: Vehicle Body Types (Imperial County 2000)
Figure 30: Vehicle Body Types (Los Angeles County 2000)

Figure 31: Vehicle Body Types (Orange County 2000)
**Figure 32: Vehicle Body Types (Riverside County 2000)**

**Figure 33: Vehicle Body Types (San Bernardino County 2000)**
Figure 34: Vehicle Body Types (Ventura County 2000)

Figure 35: Vehicle Body Types (All Counties 2000)
Traditional autos such as sedans and coupes remain the majority for all counties. Regions with more rural land, such as San Bernardino and Riverside counties, see a significant portion of pick-up trucks. The auto category can include many smaller subsets such as sedans or coupes, but the survey data does not differentiate between them.

Figure 36: Vehicle Fuel Type (Imperial County 2000)

Figure 37: Vehicle Fuel Type (Los Angeles County 2000)
Figure 38: Vehicle Fuel Type (Orange County 2000)

Figure 39: Vehicle Fuel Type (Riverside County 2000)

Figure 40: Vehicle Fuel Type (San Bernardino County 2000)
For personal vehicles, internal combustion gasoline engines are the standard. Other fuel
types exist, but are not as cost effective or widespread. The gasoline powered engine is
dominant with a 97.8% share of all vehicles. The year 2000 did not see an environmental
movement to push alternative fuel vehicles.
Chapter 2: 2010-2012 California Household Travel Survey

The CHTS was a statewide travel survey led by Caltrans. Information was collected for every county in California. Using each county’s identification number, the six SCAG counties were extracted from the larger pool of data.

2.1 Demographics

When the travel survey was conducted, Caltrans contacted households by interacting with a single person. Each household can be made up of multiple people with different traits. The following charts show the age distribution of everyone who participated in the study.

Figure 43: Age Distribution (Imperial County 2012)
Figure 44: Age Distribution (Los Angeles County 2012)

Figure 45: Age Distribution (Orange County 2012)
Figure 46: Age Distribution (Riverside County 2012)

Figure 47: Age Distribution (San Bernardino County 2012)
Imperial County continues to have the highest percentage of young people under 25.
The average number of vehicles per household is shown for each county categorized by income. The 2012 survey had income categories from $150,000 to $200,000 and from $200,000 to $250,000, but they were consolidated into the $150,000+ category to remain consistent with the results from 2000.

*Figure 50: Vehicles per HH by Income (Imperial County 2012)*
Figure 51: Vehicles per HH by Income (Los Angeles County 2012)

Figure 52: Vehicles per HH by Income (Orange County)
Figure 53: Vehicles per HH by Income (Riverside County 2012)

Figure 54: Vehicles per HH by Income (San Bernardino County 2012)
Figure 55: Vehicles per HH by Income (Ventura County 2012)

Figure 56: Vehicles per HH by Income (All Counties 2012)
The trend seen from the 2000 data continues in 2012 with an increase in income being associated with owning more vehicles. Overall the highest average car per household is down from 3.3 to 2.7. With a higher population and higher trip rate, the data shows that the overall number of cars has increased.

2.2 Trip Characteristics

As with the 2000 SCAG data, the average number of individual trips is divided and processed by age. This helps give a better sense of who is traveling at what rate.

![Average # of Trips per Day (Imperial County 2012)](image)

Figure 57: Average # of Trips per Day (Imperial County 2012)
Figure 58: Average # of Trips per Day (Los Angeles County 2012)

Figure 59: Average # of Trips per Day (Orange County 2012)
Figure 60: Average # of Trips per Day (Riverside County 2012)

Figure 61: Average # of Trips per Day (San Bernardino County 2012)
Figure 62: Average # of Trips per Day (Ventura County 2012)

Figure 63: Average # of Trips per Day (All Counties 2012)
Knowing how people travel is just as important as knowing where they are going. For each county, the number of trips taken by each individual is split based on the travel mode used. This provides a way to determine how trips are being made.

![Figure 64: Trip % by Mode (Imperial County 2012)](image-url)
Figure 65: Trip % by Mode (Los Angeles County 2012)

Figure 66: Trip % by Mode (Orange County 2012)
Figure 67: Trip % by Mode (Riverside County 2012)

Figure 68: Trip % by Mode (San Bernardino County 2012)
Mode choice remains dominated by the personal vehicle. Walking has seen an increase from 2000, but transit rates are still below desired levels.
2.3 Vehicle Characteristics

The 2012 CHTS data provides a much more diverse range of responses to vehicle type than in the SCAG data. The group “Autos” that was ambiguous in the previous set has been divided into Sedan, Coupe, Convertible, Hatchback, and Wagon. This gives a more refined insight into the types of vehicles owned in each county.

![Vehicle Body Types (Imperial County)](image)

*Figure 71: Vehicle Body Types (Imperial County 2012)*
Figure 72: Vehicle Body Types (Los Angeles County 2012)

Figure 73: Vehicle Body Types (Orange County 2012)
Figure 74: Vehicle Body Types (Riverside County 2012)

Figure 75: Vehicle Body Types (San Bernardino County 2012)
Figure 76: Vehicle Body Types (Ventura County 2012)

Figure 77: Vehicle Body Types (All Counties 2012)
The 2012 CHTS data uses the same distinctions for fuel type as the 2000 data, but also includes Biofuel and CNG. Unfortunately these inclusions are not relevant due to the low availability in consumer vehicles.

**Figure 78: Vehicle Fuel Type (Imperial County 2012)**

**Figure 79: Vehicle Fuel Type (Los Angeles County 2012)**
Figure 80: Vehicle Fuel Type (Orange County 2012)

Figure 81: Vehicle Fuel Type (Riverside County 2012)
Figure 82: Vehicle Fuel Type (San Bernardino County 2012)

Figure 83: Vehicle Fuel Type (Ventura County 2012)
Figure 84: Vehicle Fuel Type (All Counties 2012)
REFERENCES
