The Bay Area Now and Then:

A Longitudinal Evaluation of Household Travel Surveys in the Bay Area

SAN FRANCISCO COUNTY TRANSPORTATION AUTHORITY

May 19, 2015
Bay Area Overview

- Bay Area Overview
- Changes from 2000 to 2010
  - Overall growth
  - Demographic changes
  - Transportation changes
- Survey Findings
- Discussion of Survey Consistency
- Conclusions / Next Steps
Bay Area Overview

Bay Area Households in 2000

- **Households / Sq. M.**
  - 0.0 - 180
  - 190 - 550
  - 560 - 1,000
  - 1,100 - 1,600
  - 1,700 - 2,100
  - 2,200 - 2,700
  - 2,800 - 3,300
  - 3,400 - 4,200
  - 4,300 - 5,200
  - 5,300 - 6,300
  - 6,400 - 7,400
  - 7,500 - 8,700
  - 8,800 - 10,000
  - 11,000 - 13,000
  - 14,000 - 16,000
  - 17,000 - 20,000
  - 21,000 - 28,000
  - 29,000 - 41,000
  - 42,000 - 65,000
  - 66,000 - 110,000

Bay Area Population

<table>
<thead>
<tr>
<th>Year</th>
<th>Households</th>
<th>Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>1990</td>
<td>2.25 M</td>
<td>6.02 M</td>
</tr>
<tr>
<td>2000</td>
<td>2.46 M</td>
<td>6.78 M</td>
</tr>
<tr>
<td>2010</td>
<td>2.61 M</td>
<td>7.15 M</td>
</tr>
</tbody>
</table>
### How has the population changed?

#### Household Type by Household Size

<table>
<thead>
<tr>
<th></th>
<th>2000</th>
<th></th>
<th>2010</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>(24%)</td>
<td></td>
<td>(24%)</td>
</tr>
<tr>
<td>Family</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 Person</td>
<td>593,764</td>
<td>(24%)</td>
<td>613,232</td>
<td>(24%)</td>
</tr>
<tr>
<td>3 Person</td>
<td>362,953</td>
<td>(15%)</td>
<td>396,044</td>
<td>(15%)</td>
</tr>
<tr>
<td>4 Person</td>
<td>335,693</td>
<td>(14%)</td>
<td>363,496</td>
<td>(14%)</td>
</tr>
<tr>
<td>5+ Person</td>
<td>302,060</td>
<td>(12%)</td>
<td>313,200</td>
<td>(12%)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1,594,470</strong></td>
<td></td>
<td><strong>1,685,972</strong></td>
<td></td>
</tr>
<tr>
<td>Nonfamily</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 Person</td>
<td>637,575</td>
<td>(26%)</td>
<td>680,925</td>
<td>(26%)</td>
</tr>
<tr>
<td>2 Person</td>
<td>179,385</td>
<td>(7%)</td>
<td>184,607</td>
<td>(7%)</td>
</tr>
<tr>
<td>3 Person</td>
<td>34,379</td>
<td>(1%)</td>
<td>33,087</td>
<td>(1%)</td>
</tr>
<tr>
<td>4 Person</td>
<td>12,364</td>
<td>(1%)</td>
<td>13,993</td>
<td>(1%)</td>
</tr>
<tr>
<td>5+ Person</td>
<td>7,846</td>
<td>(0%)</td>
<td>9,439</td>
<td>(0%)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>871,549</strong></td>
<td></td>
<td><strong>922,051</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>2,466,019</strong></td>
<td></td>
<td><strong>2,608,023</strong></td>
<td></td>
</tr>
</tbody>
</table>

*Census 2000 and Census 2010*
How has the population changed?

**Age Shifts**

- **Lower share of householders under 44**
- **Higher share of householders over 55**

### Age of Head of Household

<table>
<thead>
<tr>
<th>Age Range</th>
<th>2000</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>15-24</td>
<td>89,753 (4%)</td>
<td>84,953 (3%)</td>
</tr>
<tr>
<td>25-34</td>
<td>458,327 (19%)</td>
<td>407,062 (16%)</td>
</tr>
<tr>
<td>35-44</td>
<td>601,166 (24%)</td>
<td>528,091 (20%)</td>
</tr>
<tr>
<td>45-54</td>
<td>535,869 (22%)</td>
<td>575,739 (22%)</td>
</tr>
<tr>
<td>55-64</td>
<td>326,830 (13%)</td>
<td>479,097 (18%)</td>
</tr>
<tr>
<td>65-74</td>
<td>226,969 (9%)</td>
<td>272,843 (10%)</td>
</tr>
<tr>
<td>75+</td>
<td>227,105 (9%)</td>
<td>260,238 (10%)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>2,466,019</strong></td>
<td><strong>2,608,023</strong></td>
</tr>
</tbody>
</table>

*Census 2000 and Census 2010*
How has the population changed?

- Population increased marginally
  - 140,000 households (6%)
  - 370,000 people (5%)
- Household size, owner / renter, family / nonfamily rates relatively unchanged
- Modest increase in age of householders
How has transportation changed?

Passengers vs Service, 2000/01 - 2012/13

- Total Passengers (000) vs Revenue Vehicle Miles (000)

- Graph showing the trend of passengers and revenue vehicle miles from 2000/01 to 2012/13.
What do the surveys say?

Mode Share — Lowest Auto Mode Share

OVERVIEW > BACKGROUND CHANGES > FINDINGS > SURVEY OBSERVATIONS > CONCLUSIONS

BATS 2000 Mode Shares by County

- San Francisco
- San Mateo
- Santa Clara
- Alameda
- Contra Costa
- Solano
- Napa
- Sonoma
- Marin
- Total

BATS 2000 Auto Mode Share
- 56%
- 57% - 79%
- 80% - 86%
- 87% - 99%
- 99% - 100%

0% 50% 100%

0 5 10 20 Miles
What do the surveys say?

Mode Share — Lowest Auto Mode Share

OVERVIEW > BACKGROUND CHANGES > FINDINGS > SURVEY OBSERVATIONS > CONCLUSIONS

BATS 2000 Mode Shares by County

<table>
<thead>
<tr>
<th>County</th>
<th>2000</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>San Francisco</td>
<td>56%</td>
<td>52%</td>
</tr>
<tr>
<td>Alameda</td>
<td>86%</td>
<td>82%</td>
</tr>
<tr>
<td>Marin</td>
<td>79%</td>
<td>78%</td>
</tr>
</tbody>
</table>

- Auto
- Transit
- Walk
- Bike
- Other
What do the surveys say?

Mode Share — Biggest Change

OVERVIEW > BACKGROUND CHANGES > FINDINGS > SURVEY OBSERVATIONS > CONCLUSIONS

CHTS 2010 Mode Shares by County

- San Francisco
- San Mateo
- Santa Clara
- Alameda
- Contra Costa
- Solano
- Napa
- Sonoma
- Marin
- Total

Legend:
- Auto
- Transit
- Walk
- Bike
- Other

BATS 2000 Auto Mode Share
- 56%
- 57% - 79%
- 80% - 86%
- 87% - 88%
- 89% - 92%

0 5 10 20 Miles

San Francisco County Transportation Authority
What do the surveys say?

Mode Share – Biggest Change

Mode Shares by County, 2000 vs 2010

San Francisco 2000: 56% 2010: 52%
Santa Mateo 2000: 86% 2010: 82%
Santa Clara 2000: 90% 2010: 86%
Sonoma 2000: 92% 2010: 87%
Marin 2000: 85% 2010: 80%
What do the surveys say?

Mode Share — By Area Type

OVERVIEW > BACKGROUND CHANGES > FINDINGS > SURVEY OBSERVATIONS > CONCLUSIONS

2000

Regional Core

2010

Central Business District

Urban Business

Urban

Suburban

Rural
What do the surveys say?

Mode Share — By Area Type

OVERVIEW > BACKGROUND CHANGES > FINDINGS > SURVEY OBSERVATIONS > CONCLUSIONS

2000

- Auto, 26%
- Regional Core
- Central Business District
- Urban Business
- Urban
- Suburban
- Rural

2010

- Auto, 18%
- Regional Core
- Central Business District
- Urban Business
- Urban
- Suburban
- Rural

Auto, 91%

Auto, 89%
### What do the surveys say?

**Mode Share**

<table>
<thead>
<tr>
<th>Age of Householder</th>
<th>2000</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age 18 – 24</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age 25 – 44</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age 45 - 64</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age 65+</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Children in Household?</th>
<th>100%</th>
<th>80%</th>
<th>60%</th>
<th>40%</th>
<th>20%</th>
<th>0%</th>
<th>20%</th>
<th>40%</th>
<th>60%</th>
<th>80%</th>
<th>100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
What do the surveys say?

Mode Share

- Land use density
  - Increasing density -> decreasing driving
- Age
  - Transit use decreases with age, until 65+
- Presence of children increases likelihood of driving
A closer look at the surveys...

Survey Consistency

OVERVIEW > BACKGROUND CHANGES > FINDINGS > SURVEY OBSERVATIONS > CONCLUSIONS

- BATS 2000
  - Bay Area travel survey sponsored by MTC
  - Two-day travel survey
  - Activity diary (encouraged) with follow-up phone interview

- CHTS 2010
  - Statewide travel survey with Bay Area over-sampling
  - One-day travel survey
  - Activity diary
  - Summer month travel diaries*

- Significantly higher trip rates with CHTS survey
A closer look at the surveys...

Survey Consistency — Trip Rates

Weighted Trip Rates, BATS vs CHTS

<table>
<thead>
<tr>
<th></th>
<th>Trips per Household</th>
<th>Trips per Person</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>BATS</td>
<td>CHTS</td>
</tr>
<tr>
<td>auto trip rate</td>
<td>6.5</td>
<td>8.0</td>
</tr>
<tr>
<td>transit trip rate</td>
<td>0.2</td>
<td>0.2</td>
</tr>
<tr>
<td>walk trip rate</td>
<td>0.7</td>
<td>1.2</td>
</tr>
<tr>
<td>bike trip rate</td>
<td>0.1</td>
<td>0.2</td>
</tr>
<tr>
<td>other trip rate</td>
<td>0.2</td>
<td>0.4</td>
</tr>
<tr>
<td>all trip rate</td>
<td>7.6</td>
<td>10.0</td>
</tr>
</tbody>
</table>
What do the surveys say?

*Survey Consistency — Trip Rates*

OVERVIEW > BACKGROUND CHANGES > FINDINGS > SURVEY OBSERVATIONS > CONCLUSIONS

<table>
<thead>
<tr>
<th></th>
<th>BATS</th>
<th>CHTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Households</td>
<td>15,193</td>
<td>7,187</td>
</tr>
<tr>
<td>People</td>
<td>33,282</td>
<td>15,866</td>
</tr>
<tr>
<td>Avg HHLD Size</td>
<td>2.19</td>
<td>2.21</td>
</tr>
<tr>
<td>trips (multiday)</td>
<td>212,566</td>
<td>70,000</td>
</tr>
<tr>
<td>trips (avg weekday)</td>
<td>123,747</td>
<td>70,000</td>
</tr>
<tr>
<td>trips / hhld</td>
<td>8.1</td>
<td>9.7</td>
</tr>
<tr>
<td>trips / person</td>
<td>3.7</td>
<td>4.4</td>
</tr>
<tr>
<td>hhldr trip rate</td>
<td>4.2</td>
<td>4.8</td>
</tr>
<tr>
<td>non hhldr trip rate</td>
<td>3.8</td>
<td>4.1</td>
</tr>
<tr>
<td>tours / hhld</td>
<td>3.07</td>
<td>3.53</td>
</tr>
<tr>
<td>tours / person</td>
<td>1.48</td>
<td>1.60</td>
</tr>
</tbody>
</table>

*Source: BATS 2000 and CHTS 2010*
Decennial surveys give a brief snapshot
- May lose context of local (in time) trends

Many sources of potential bias
- Survey instrument
- Sampling method
- Survey weighting and expansion methods

Direct comparisons may be quite difficult
Next steps / stuff to think about

- Potential investigation / estimation / correction of trip under-reporting
- Investigation into data cleaning methods
- Ongoing (ACS-style) household travel surveying
Sources

OVERVIEW > BACKGROUND CHANGES > FINDINGS > SURVEY OBSERVATIONS > CONCLUSIONS

- Census 2000
- Census 2010
- ACS 2007-2011
- Bay Area Travel Survey 2000
- California Household Travel Survey 2010-2012
- Statistical Summary of Bay Area Transit Operators: Fiscal Years 2008-09 Through 2012-13
- Statistical Summary of Bay Area Transit Operators: Fiscal Years 2007-08 Through 2011-12
- Statistical Summary of Bay Area Transit Operators: Fiscal Years 2006-07 Through 2010-11
- Statistical Summary of Bay Area Transit Operators: Fiscal Years 2005-06 Through 2009-10
- Statistical Summary of Bay Area Transit Operators: Fiscal Years 2000-01 Through 2004-05
Thank you!

drew.cooper@sfcta.org