Household Travel Survey at TDOT
Tennessee Department of Transportation
Mar. 8-9, 2023

David Jung-Hwi Lee, Ph.D.
NHTS Add-On History

1969: None

1977: None

1983: None

1990: New York State; Commonwealth of Massachusetts; Oklahoma City, OK; Tulsa, OK

1995: New York State; Commonwealth of Massachusetts; Oklahoma City, OK; Tulsa, OK

2001: New York State; Commonwealth of Massachusetts; Oklahoma City, OK; Tulsa, OK

2009: New York State; Commonwealth of Massachusetts; Oklahoma City, OK; Tulsa, OK

2017: Tennessee; Virginia

2022: Tennessee; Virginia

TN Not Participated

TN Participated
TDOT Add-on Q’s

- Important Transportation Investments
- Willingness to Pay in Tolls (Work/School)
- Willingness to Pay in Tolls (Shopping/Recreation)
- Reasons for Not Walk or Bike
- Reasons for Public Transit
- Willingness to Participate in Follow-up Surveys

Potentials

- Bicycle and pedestrian travel
- Transit use
- Shared mobility
- Emerging transportation modes
- Special populations
- Telecommuting
Combined Survey

**FIGURE 6: COMBINED SURVEY HOME LOCATIONS AND WEIGHTING REGIONS**

NuStats (Knoxville)
Westat (Nashville)
## Combined Survey

### TABLE 18. HOUSEHOLD TRAVEL SURVEYS

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sampling Frame</strong></td>
<td>Address-Based Sample (ABS)</td>
<td>Address-Based Sample (ABS)</td>
<td>List-assisted random digit dialing (RDD)</td>
</tr>
<tr>
<td><strong>Survey Instrument</strong></td>
<td>Computer-Assisted Telephone Interviewing (CATI)</td>
<td>Web-based with phone-in option</td>
<td>Computer-Assisted Telephone Interviewing (CATI)</td>
</tr>
<tr>
<td><strong>Season of Travel Dates</strong></td>
<td>November-December 2000, and January-May 2008</td>
<td>April-May and August-November 2012</td>
<td>Full year 2009</td>
</tr>
<tr>
<td><strong>Survey Geography</strong></td>
<td>Knox, Blount, Anderson, Servier, Roane, Loudon, Jefferson and Union</td>
<td>Davidson, Rutherford, Williamson, Sumner, Wilson, Maury and Robertson</td>
<td>Entire state</td>
</tr>
<tr>
<td><strong>Includes Weekends</strong></td>
<td>No</td>
<td>No</td>
<td>Yes (Sat &amp; Sun)</td>
</tr>
</tbody>
</table>

Source: [Department of Transportation](https://www.tn.gov/tdot)
## Table 19. The Combined Household Travel Survey Dataset

<table>
<thead>
<tr>
<th>Dataset</th>
<th>Households</th>
<th>Persons</th>
<th>Trips</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knoxville</td>
<td>2,938</td>
<td>7,028</td>
<td>24,472</td>
</tr>
<tr>
<td>Nashville</td>
<td>5,164</td>
<td>11,114</td>
<td>39,828</td>
</tr>
<tr>
<td>NHTS</td>
<td>2,242</td>
<td>4,885</td>
<td>16,765</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>10,344</strong></td>
<td><strong>23,027</strong></td>
<td><strong>81,065</strong></td>
</tr>
</tbody>
</table>
# Re-Weighting

## TABLE 22: TRIPS IN COMBINED HOUSEHOLD SURVEY

<table>
<thead>
<tr>
<th>Type</th>
<th>Purpose</th>
<th>SOV</th>
<th>HOV</th>
<th>TRANSIT</th>
<th>ACTIVE</th>
<th>OTHER</th>
<th>ALL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trip Counts</td>
<td>HBW</td>
<td>10,817</td>
<td>1,214</td>
<td>63</td>
<td>276</td>
<td>20</td>
<td>12,390</td>
</tr>
<tr>
<td></td>
<td>HBO</td>
<td>15,817</td>
<td>19,252</td>
<td>187</td>
<td>2,270</td>
<td>1,383</td>
<td>38,909</td>
</tr>
<tr>
<td></td>
<td>NHB</td>
<td>14,514</td>
<td>12,384</td>
<td>642</td>
<td>1,700</td>
<td>522</td>
<td>29,762</td>
</tr>
<tr>
<td></td>
<td>All</td>
<td>41,148</td>
<td>32,850</td>
<td>892</td>
<td>4,246</td>
<td>1,925</td>
<td>81,061</td>
</tr>
<tr>
<td>Weighted Trips</td>
<td>HBW</td>
<td>10,554</td>
<td>1,292</td>
<td>67</td>
<td>289</td>
<td>17</td>
<td>12,219</td>
</tr>
<tr>
<td></td>
<td>HBO</td>
<td>13,538</td>
<td>17,610</td>
<td>188</td>
<td>2,269</td>
<td>1,633</td>
<td>35,238</td>
</tr>
<tr>
<td></td>
<td>NHB</td>
<td>13,134</td>
<td>11,040</td>
<td>648</td>
<td>1,687</td>
<td>588</td>
<td>27,097</td>
</tr>
<tr>
<td></td>
<td>All</td>
<td>37,226</td>
<td>29,942</td>
<td>903</td>
<td>4,245</td>
<td>2,239</td>
<td>74,554</td>
</tr>
</tbody>
</table>
Re-Weighting

FIGURE 47. AGE GROUPS: ACS VS SURVEY

- 65 or older
- 55-64
- 45-54
- 35-44
- 25-34
- 18-24
- 5-17
- Under 5

[Bar chart showing age groups with weighted and unweighted data compared to ACS 2007-2011]
Where in Travel Demand Modeling

- Model Estimation
  - Trip Generation Model
  - Mode Choice Model
  - Destination Choice Model
  - Time of Day Model

- Model Validation
  - Trip generation was validated by applying the TSM V4.0 and comparing the resulting trip rates for Tennessee with those observed in the survey and with national defaults from NCHRP 716.
  - The applied mode choice models were validated against three data sources:
    - 2014 ACS (HBW model only),
    - The combined survey (both HBW and HBO models),
    - Ridership data from the National Transit Database (both models)
Regional HTS

- The survey collected information on travel behavior, mode choice, trip purpose, trip frequency, and other key travel factors.


- Chattanooga TPO conducted a HTS in 1994, 2007, 2016. The survey was conducted in collaboration with the GDOT and the Walker County Chamber of Commerce in Georgia.
HTS vs. Big-Data

- Cellular (cell tower signaling and call data records)
- GPS (Global Positioning System)
- Location-based services (LBS) or smartphone application data
- Smartphone travel survey data (hybrid passive/active data)

- More Data Driven Approaches
- Supplement to Traditional Data Source
- Advantage:
  - Scale
  - Continuity
  - Cost
- Disadvantage:
  - Limited Scope
  - Representativeness
  - Privacy
# HTS vs. Big-Data

The Transportation Data Marketplace includes six data categories that are critical for Coalition members’ operations, planning and performance measures, traveler information, and their safe and efficient management of the inter-regional roadway system.

<table>
<thead>
<tr>
<th>Volumes Estimates</th>
<th>Carto INRIX HERE Iteris Timmons Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volumes Estimates</td>
<td>Future Mobility HERE INRIX Iteris iTraffic Streetlight</td>
</tr>
</tbody>
</table>

Ubiquitous volume data has long been a missing link in the tool box of transportation agencies. Volume estimates (not collected using hardware) would assist agencies by providing real-time traffic volumes network-wide including during inclement weather or special events, and enable more robust planning and PM tools.

This is an emerging area, with Coalition research contributing to industry progress.

<table>
<thead>
<tr>
<th>Conflation Services</th>
<th>1Spatial INRIX iTraffic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conflation Services</td>
<td>Conflation services provide support for translating from one mapping system to another or combining mapping systems, for example the TMC network and a state’s own linear reference system (LRS). Translating data between vendor-provided and Coalition member base maps has proved time intensive and costly. Providers of these services will be able to translate from any base map to any other base map as needed by a Coalition member.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Waypoint Data</th>
<th>AirSage Future Mobility INRIX Stellar Wejo</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waypoint Data</td>
<td>Waypoint data reflects the path movement of vehicles and people and is based on ‘bread-crum trail’ of GPS latitude longitude point data. Data is collected either through connected vehicle technology or location-based services. Data is provided in such a way to protect privacy (such as the obfuscation of home/work info and aggregated to census boundaries), and supports in-depth analysis such as traffic signal performance.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>O-D Data</th>
<th>AirSage Future Mobility Geotab INRIX Streetlight</th>
</tr>
</thead>
<tbody>
<tr>
<td>O-D Data</td>
<td>O-D data is closely associated with Waypoint Data, but includes only end points, and information related to the endpoints that reveal trip purpose. O-D data is derived from Waypoint data that is scalable, timely and statistically representative to provide trip data for various agency needs. Similar to Waypoint data, O-D data is provided in a manner to protect privacy, and is a great asset for planning, behavioral, and before &amp; after studies.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Freight Data</th>
<th>Future Mobility Geotab INRIX Quetsica Streetlight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freight Data</td>
<td>A variety of freight related data is being provided including the following: Travel Time, Speed and Volume data (as well as reliability), Origin and Destination information for long-haul and regional fleets, and Parking data including availability and utilization. In addition, commodity movement is also being provided. This will enable broader understanding of freight movement.</td>
</tr>
</tbody>
</table>

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Issues and Potentials

- Potential Duplication of Investment
  - Conventional: NHTS NextGen + Add-On
  - Passive Big-Data: RITIS-PDA
  - INRIX Trip Analytics (O-D) vs. RSG (e.g. ATRI; AirSage – V3; LBS or smartphone application data – V4)
  - TETC potential Big-Data

- Leverage NHTS vs. RHTS
  - Any National Repository/Warehouse
  - Survey Questionnaires
  - Actual Data

- Retain Collective Knowledge as a Community
  - Continuous turnovers
  - Continuation (Procurement/Contract Cycle)
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Cell: (615) 906-4555

- AASHTO Special Committee on Research & Innovation (R&I)
- AASHTO Special Committee on Research Advisory Committee (RAC)
- TRB State Representative
- TRB Standing Committee
  - AT010: Freight Economics and Regulation
  - AED10: Statewide & National Transportation Data and Information Management