Case Studies of Travel Demand Analysis on Transport Disadvantaged Communities

Tierra Bills
Wayne State University

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Case Studies of Travel Demand Analysis on Transport Disadvantaged Communities

Dr. Tierra Bills | Assistant Professor | CEE | Wayne State University
Friday Transportation Seminar
Portland State University
October 30, 2020
Black Bottom, Detroit, Early 1960’s: Demolished in early-1960’s to make way for I-75, as a part of Detroit’s Urban Renewal Commission.

Bus Riders Union vs. LACMTA, 1996: A case was brought against the LA County Metro Transportation Authority because of inequitable transit investments.


Smarter Transportation Technologies – Data Generators

- Google Maps
- du
- waze
- TOMTOM
- lyft
- DiDi
- zipcar
- chariot
- CAR2GO
- commute solved
Smarter Transportation Technologies – Data

- Trip trajectories
- Accurate travel times
- Trip origins and destinations
- Imputed travel activities

- Trip trajectories
- Accurate travel times
- Trip origins and destinations
- Trip fares

- + Real-time and prompted survey delivery (travel purpose, perceptions, etc.)
Objectives: Smarter Transportation and accessibility for Broader Societal Needs
Outline

• Motivation

• Overview of TDA Process – where does travel data fit in?
  • What do we know about data quality?

• Benton Harbor Travel Needs Survey
  • Overview of Methods
  • Results

• Detroit Microtransit Scenario Analysis
Travel Demand Analysis

Case Study 1

Data Collection

Data cleaning/expansion

Representative?

Model estimation/prediction

Representative?

Analysis/decision-making

Representative?

Case Study 2
Representativeness of Travel Data?

Known:
- There are known challenges with conventional travel Surveys:
  - Response biases ("unit" and "item" nonresponse)¹
  - sampling error ¹
- Solutions:
  - Increase sample size overall (i.e. using emerging big data sources)¹
  - Stratified sampling¹
  - Increase sample anticipating non-response for certain demographics²

Unknown:
- To what extent can “big data” sources fix known problems with conventional surveys?³
- Relevance and ramifications of relative representativeness?
- Solutions (sampling design, data expansion methods, modeling methods, etc.)?

References:
Examples – “relative representation” of Transport Disadvantaged Communities

<table>
<thead>
<tr>
<th>2017 – NHTS HH Weights (n= 129,696)</th>
<th>2010 – CA HH Weights (n = 21,225) – w/GPS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Min</strong></td>
<td><strong>Mean</strong></td>
</tr>
<tr>
<td>0 Veh HHs</td>
<td>11</td>
</tr>
<tr>
<td>1+ Veh HHs</td>
<td>7</td>
</tr>
<tr>
<td>Low Income HHs</td>
<td>7</td>
</tr>
<tr>
<td>Other Income HHs</td>
<td>7</td>
</tr>
</tbody>
</table>

Case Study 1: Benton Harbor Travel Needs Survey

**Objectives**
- Recommend operator level transit improvement that can target accessibility to employment, education, healthcare, and grocery store locations
- Survey transport disadvantage groups to characterize travel behaviors and identify underserved needs

Outreach partners

Survey Modes
Case Study 1: Benton Harbor Travel Needs Survey

**Methods**

- We used a mix of survey modes to target hard-to-reach communities (i.e. low income, transit dependent, elderly, and un/underemployed residents)
- To recruit participants, we:
  - Distributed fliers to Kinexus clients (and throughout the community)
    - Posted in Dial-A-Ride shuttles
    - Posted in local newspapers
    - Circulated press releases
    - Made announcements on a local radio station
    - Shared events on Facebook.
Case Study 1: Benton Harbor Travel Needs Survey

**Insights**
1. Even when *comparing with the most disadvantaged groups* from the conventional survey, we find significant differences:
   - Much smaller share of auto users *(44% vs. 66%)*
   - Much higher share of transit users *(26% vs. 8%)*
Case Study 1: Benton Harbor Travel Needs Survey

**Insights**
2. Paper surveys + target outreach matter
   - Participants who used paper surveys are **less likely** to drive or carpool and have highest non-response rates
   - They were also more **elderly**, and more likely to have a **disability**.

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**Survey Mode Comparison**

<table>
<thead>
<tr>
<th></th>
<th>Drive Alone</th>
<th>Shared Ride/ Carpool</th>
<th>Transit</th>
<th>Walk</th>
<th>Missing</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Travel Needs Survey (Online)</strong></td>
<td>49%</td>
<td>16%</td>
<td>22%</td>
<td>9%</td>
<td>4%</td>
</tr>
<tr>
<td><strong>Travel Needs Survey (Paper)</strong></td>
<td>34%</td>
<td>7%</td>
<td>34%</td>
<td>4%</td>
<td>21%</td>
</tr>
</tbody>
</table>

N = 75
N = 56

---
Case Study 1: Benton Harbor Travel Needs Survey

**Insights**

3. Travel needs
   - Identifying clear accessibility needs based on survey questions
   - We asked more direct questions about travel needs

Blue – Home locations
Black – Challenging work locations
Green – Challenging Grocery Store Locations
Orange – Challenging Shopping Locations
Case Study 1: Benton Harbor Travel Needs Survey

*Insights*
3. Travel needs
   - Identifying clear accessibility needs based on survey questions
   - We asked more direct questions about travel needs

![Transportation Struggles Chart]

- **Challenge getting to Grocery Stores?**
  - Yes: 25.00%
  - No: 75.00%
  - No Answer: 0%

- **Challenge getting to Stores?**
  - Yes: 20.19%
  - No: 79.81%
  - No Answer: 0%

- **Challenge getting to work?**
  - Yes: 23.08%
  - No: 76.92%
  - No Answer: 0%

- **Job Lost due to unreliable transportation?**
  - Yes: 24.04%
  - No: 75.96%
  - No Answer: 0%
Case Study 1: Benton Harbor Travel Needs Survey

Next steps and Remaining Questions
• We are currently building our mode and destination choice modes using our travel needs survey + MDOT survey
• Can we improve model predictions using our sample of data?

• Questions that we expect to investigate:
  • What sample strategies lead to more representative data sets
  • How effective are conventional data expansion methods in addressing under-representativeness?
  • What is the nature of model prediction distortions that can result from under-representativeness

• Broader questions: How far off the mark are we? And how might transportation decisions change with more representative data?
Case Study 2: Detroit Microtransit Scenario Analysis

Motivating: How can we support transit accessibility for Detroit households who most need it?

This study uses SEMCOG's Travel model to assess the equity outcomes of various Microtransit scenarios.

[Diagram showing the decision-making process for travel modes and destinations.]

SEMCOG Travel Demand Model
Case Study 2: Detroit Microtransit Scenario Analysis

Critical Questions:
When forecasting the equity impacts of new transit options, the question becomes: **is the model structure appropriate to all groups?**

- For some groups it make be **more appropriate** for the new micro transit option to fall under auto modes (more like a shared-van experience), and for others it may be mostly correlated with transit modes.
- What is the **cost of mis-specification**, in this case?
Thank you!

tbills@wayne.edu

Dr. Tierra Bills | Assistant Professor | CEE | Wayne State University

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