Using Mobile Ticketing Data to Estimate an Origin-Destination Matrix for New York City Ferry Service

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The views and opinions expressed in this presentation are those of the authors and do not necessarily represent those of New York City Economic Development Corporation or The City of New York.
Outline

• Background
  • What is mobile ticketing?
  • Where is mobile ticketing used?
  • How does mobile ticketing work?

• Analysis of mobile ticketing data from the East River Ferry
  • Origin-Destination Estimation
  • Survey Responses
  • Conclusions & Future Research
What is mobile ticketing?

Mobile ticketing applications allow passengers to buy tickets directly on their smartphone using a credit, debit card or other electronic payment.
Where is mobile ticketing available?

- **2012**
  - New York Waterway
  - Massachusetts Bay Transportation Authority (MBTA)

- **2013**
  - New Jersey Transit
  - North County Transit District (NCTD)
  - Dallas Area Rapid Transit (DART)
  - Tri-County Metropolitan Transportation District (TriMet)

- **2014**
  - Northern Indiana Commuter Transportation District (NICTD)
  - Nassau Inter County Express (NICE) Bus
  - The Comet in Columbia
  - Capital Metropolitan Transportation Authority (CapMetro)

- **2015**
  - Virginia Railway Express (VRE)
  - San Francisco Municipal Transportation Authority (MUNI)
  - Chicago Transit Authority (CTA)
  - New Orleans Regional Transit Authority (NORTA)
  - Others planned

How does mobile ticketing work?

http://www.nywaterway.com/MobileAppDownloads.aspx
Analysis of Mobile Ticketing Data

• **Research Question:** Can we use the backend data from mobile ticketing systems for transportation planning?

• **Objective:** Create origin-destination (OD) matrices of passenger movements using passively collected, backend mobile ticketing data

• **Area of Analysis:** East River Ferry

• **Data Sources:** Survey responses, mobile ticketing data, on/off counts

• **Method:** Iterative proportional fitting to create origin-destination matrices
Area of Analysis: East River Ferry

http://www.eastriverferry.com/RouteMap.aspx
Data

• Three Sources
  • Mobile ticketing transactions
  • Onboard survey
  • On/off counts

• Time Periods (October 2014)
  • AM Peak
  • PM Peak
  • Midday
  • Weekend

Onboard Survey Card

LONG ISLAND CITY

Please return this card to the staff person when you disembark
Filling out the questions below is optional

1. What is the purpose of your trip today?
   - Commuting
   - Leisure/ fun

2. How many trips did you take on the East River Ferry last week? (Count each direction as one trip.)
   - 11 or more
   - 4 to 10
   - 2 or 3
   - 0 or 1
   - First time rider

3. How did you get to the ferry today? (To ferry)
   - Walked
   - Subway
   - Bicycle (locked near pier)
   - Bicycle (brought on board)
   - CitiBike
   - Dropped off by car
   - Drove and parked
   - MTA bus
   - Free shuttle bus
   - Taxi/car service

4. How will you get to your final destination? (From ferry)

1. What is the purpose of your trip today?
2. How many trips did you take on the East River Ferry last week? (Count each direction as one trip.)
3. How did you get to the ferry today? (To ferry)
4. How will you get to your final destination? (From ferry)
Methodology for OD Estimation

Onboard Survey Data

Seed Matrix (Onboard survey)

Adjusted OD Matrix (Onboard survey)

Iterative Proportional Fitting (IPF)

Total Origins (Actual ridership data)

Total Destinations (Actual ridership data)

Total Origins

Total Destinations

Comparison of Matrices using Euclidean Distance

Mobile Ticketing Data

Seed Matrix (Mobile ticketing)

Adjusted OD Matrix (Mobile ticketing)

IPF

Total Origins (Actual ridership data)

Total Destinations
Comparison of Survey & Mobile Ticketing OD Matrices

Euclidean Distance (Final IPF Matrices)

AM Peak
Midday
PM Peak
Weekend
Survey Questions

Trip Purpose

<table>
<thead>
<tr>
<th>Time Period</th>
<th>Commuting</th>
<th>Leisure /Fun</th>
<th>No Response</th>
</tr>
</thead>
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<tr>
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<td>18%</td>
</tr>
<tr>
<td>PM Peak</td>
<td>83%</td>
<td>12%</td>
<td>5%</td>
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<tr>
<td>Weekend</td>
<td>69%</td>
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<td>8%</td>
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</table>

Trips/Week on the East River Ferry

<table>
<thead>
<tr>
<th>Time Period</th>
<th>0 or 1</th>
<th>2 or 3</th>
<th>4 to 10</th>
<th>11 or more</th>
<th>First time rider</th>
<th>No Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>AM Peak</td>
<td>0%</td>
<td>0%</td>
<td>8%</td>
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<td>18%</td>
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<td>Midday</td>
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<td>PM Peak</td>
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<td>Weekend</td>
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</table>
Conclusions and Future Research

Conclusions

• OD matrices from mobile ticketing and survey data closely align during peak periods
• Survey data shows that the majority of peak period passengers are commuters and/or regular passengers
• Mobile ticketing systems are likely to provide the most reliable travel behavior information during peak periods when travel patterns are more consistent

Future Research

• Expand to additional ferry routes / other transit systems
• Identify other planning / operations uses for mobile ticketing data
Questions?

Email cbrakewood@ccny.cuny.edu

Rahman, Wong and Brakewood. *Using Mobile Ticketing Data to Estimate an Origin-Destination Matrix for New York City Ferry Service*. (2016). Accepted for publication in the *Transportation Research Record*, Transportation Research Board of the National Academies.
## Results for the AM Peak Period

### Seed Matrix (Onboard survey data)

<table>
<thead>
<tr>
<th>Origins</th>
<th>Pier 1</th>
<th>DUMBO</th>
<th>S. Williamsburg</th>
<th>N. Williamsburg</th>
<th>Greenpoint</th>
<th>Long Island City</th>
<th>E 34th street</th>
<th>Total</th>
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<tbody>
<tr>
<td>Pier 11</td>
<td>38</td>
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### Adjusted OD Matrix (Onboard survey data)

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<th>Origins</th>
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