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

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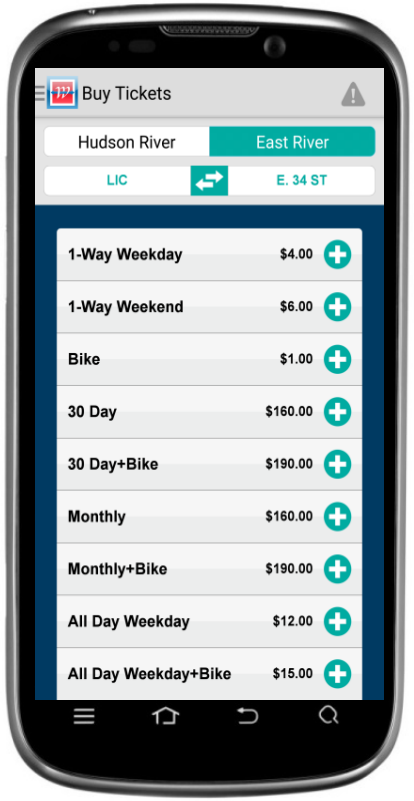
Outline

- 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

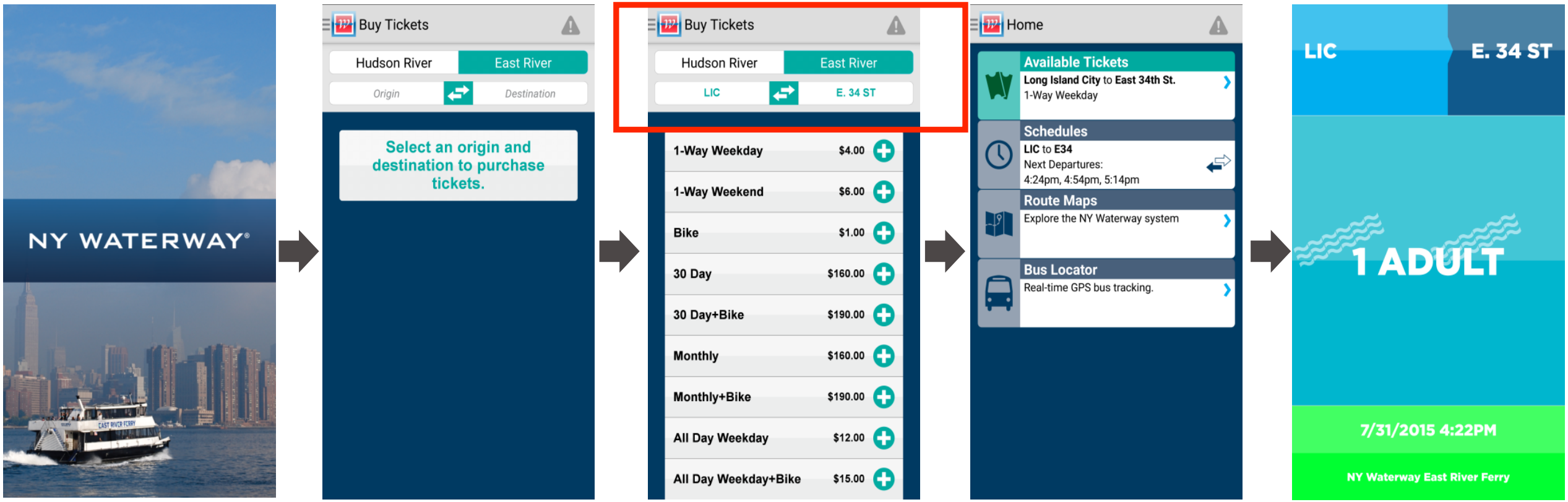
- Northern Indiana Commuter Transportation District (NICTD)
- Nassau Inter County Express (NICE) Bus
- The Comet in Columbia
- Capital Metropolitan Transportation Authority (CapMetro)

2015

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

Source: Sion, Brakewood and Alvarado. *Planning for New Fare Payment Systems: Analysis of Smartphone, Credit Card, and Potential Mobile Ticketing Adoption by Bus Riders in Nassau County*. (2016). TRB Annual Meeting Compendium.

How does mobile ticketing work?

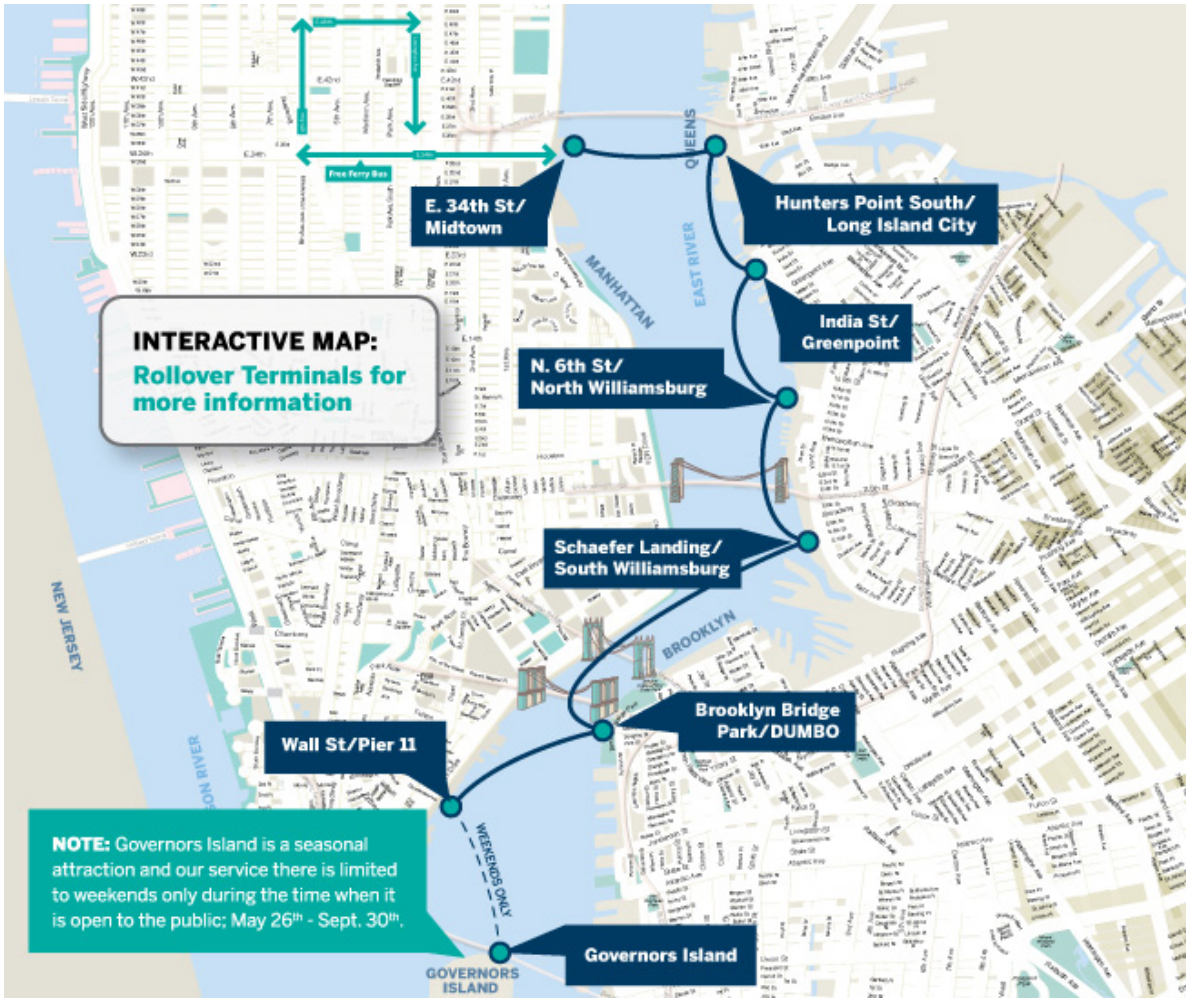


http://www.nywaterway.com/MobileAppDownloads.aspx

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



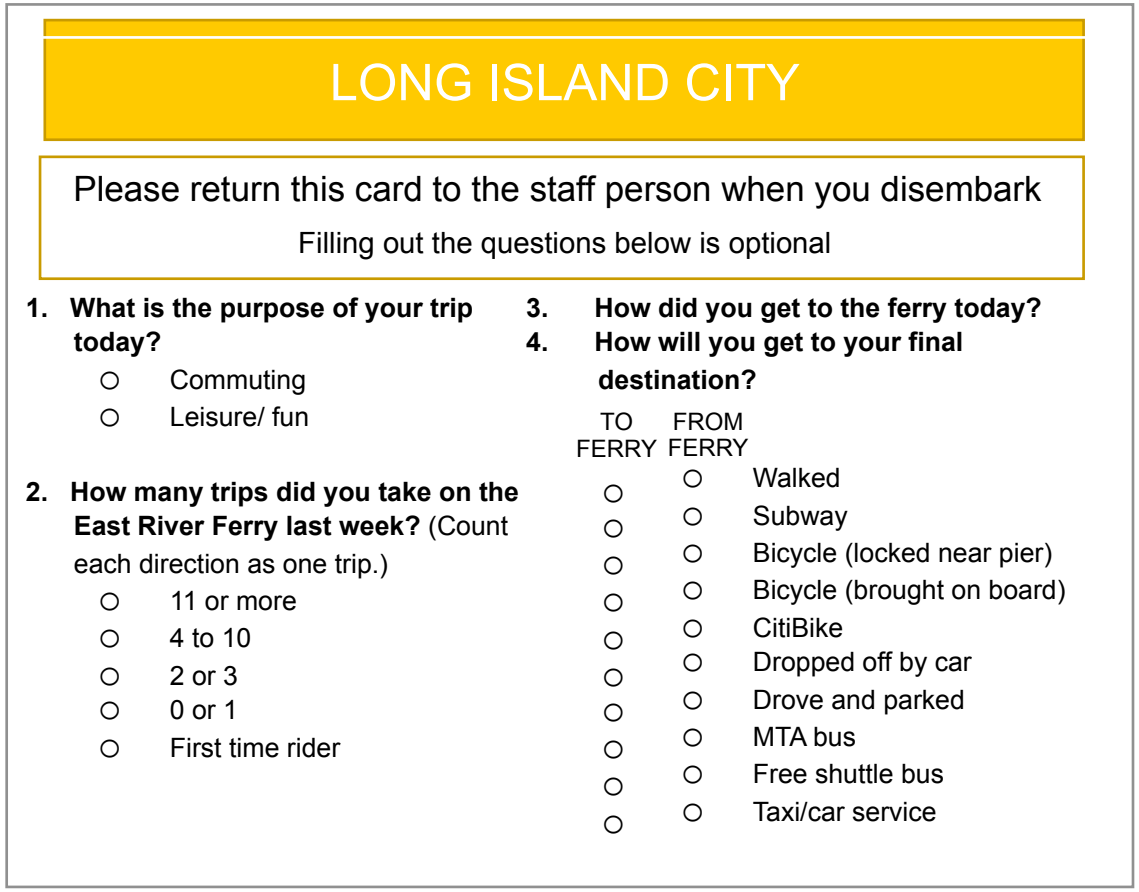
http://www.eastriverferry.com/RouteMap.aspx

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

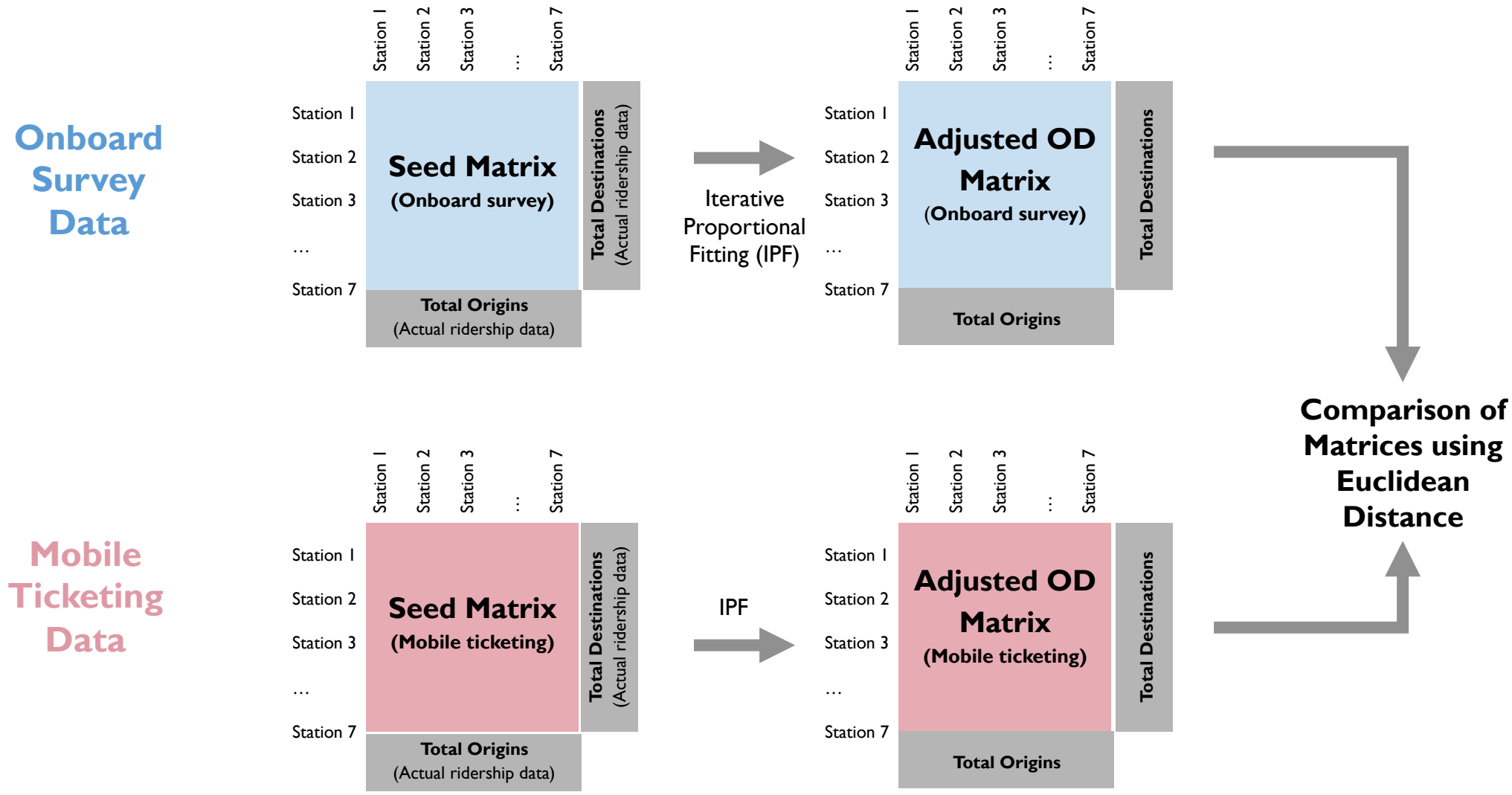
2. **How many trips did you take on the East River Ferry last week?** (Count each direction as one trip.)
   - ○ 11 or more
   - ○ 4 to 10
   - ○ 2 or 3
   - ○ 0 or 1
   - ○ First time rider

3. **How did you get to the ferry today?**

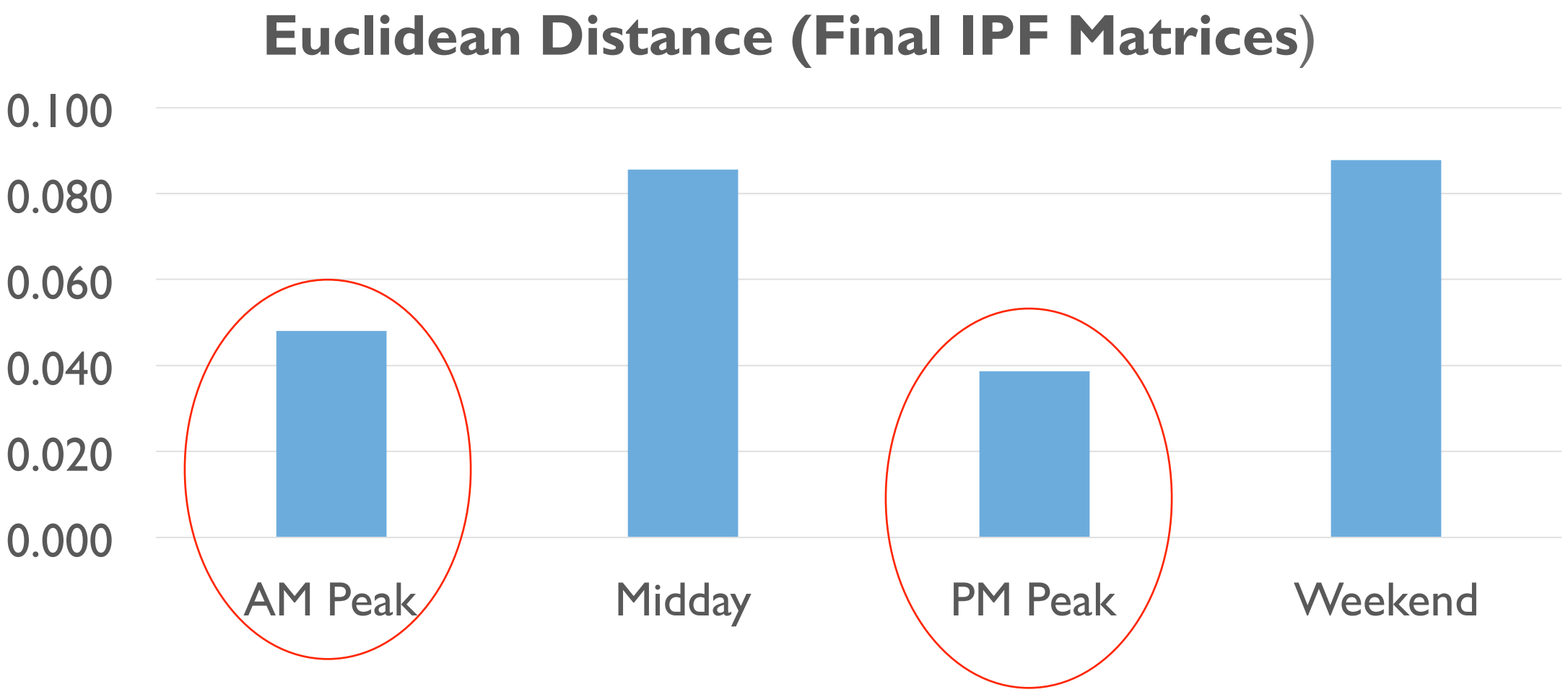
4. **How will you get to your final destination?**

TO FERRY	FROM 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

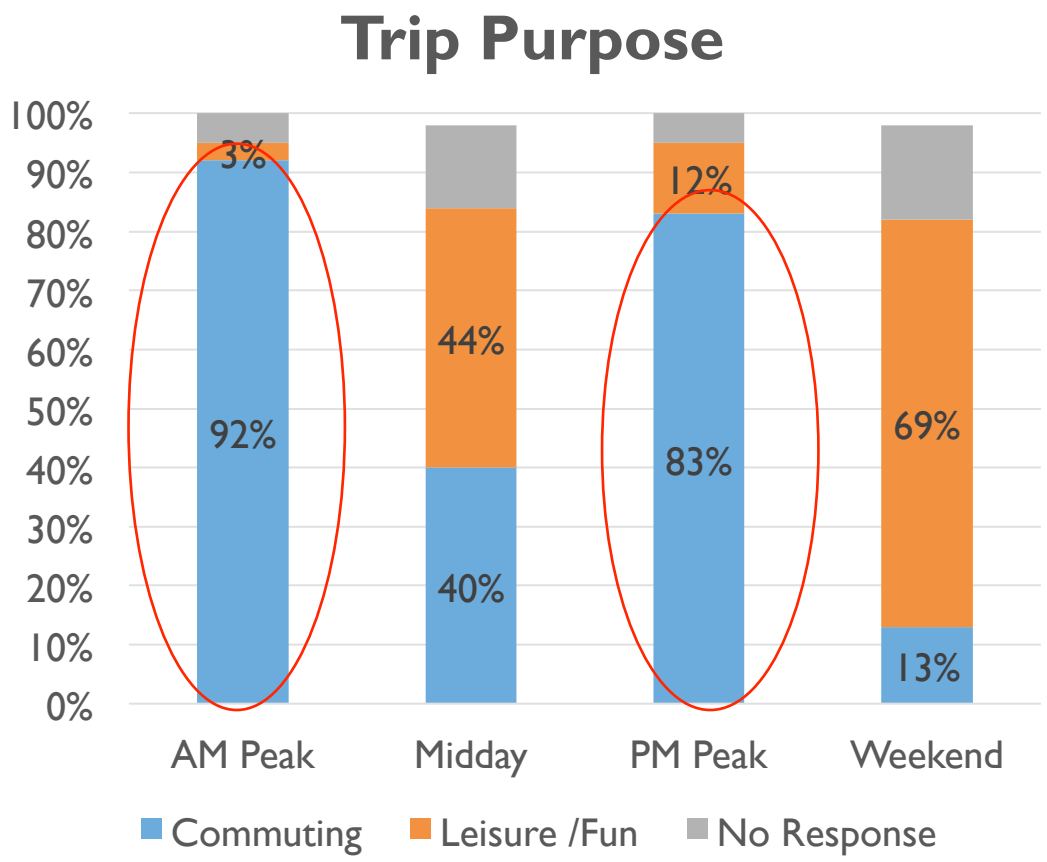
Methodology for OD Estimation

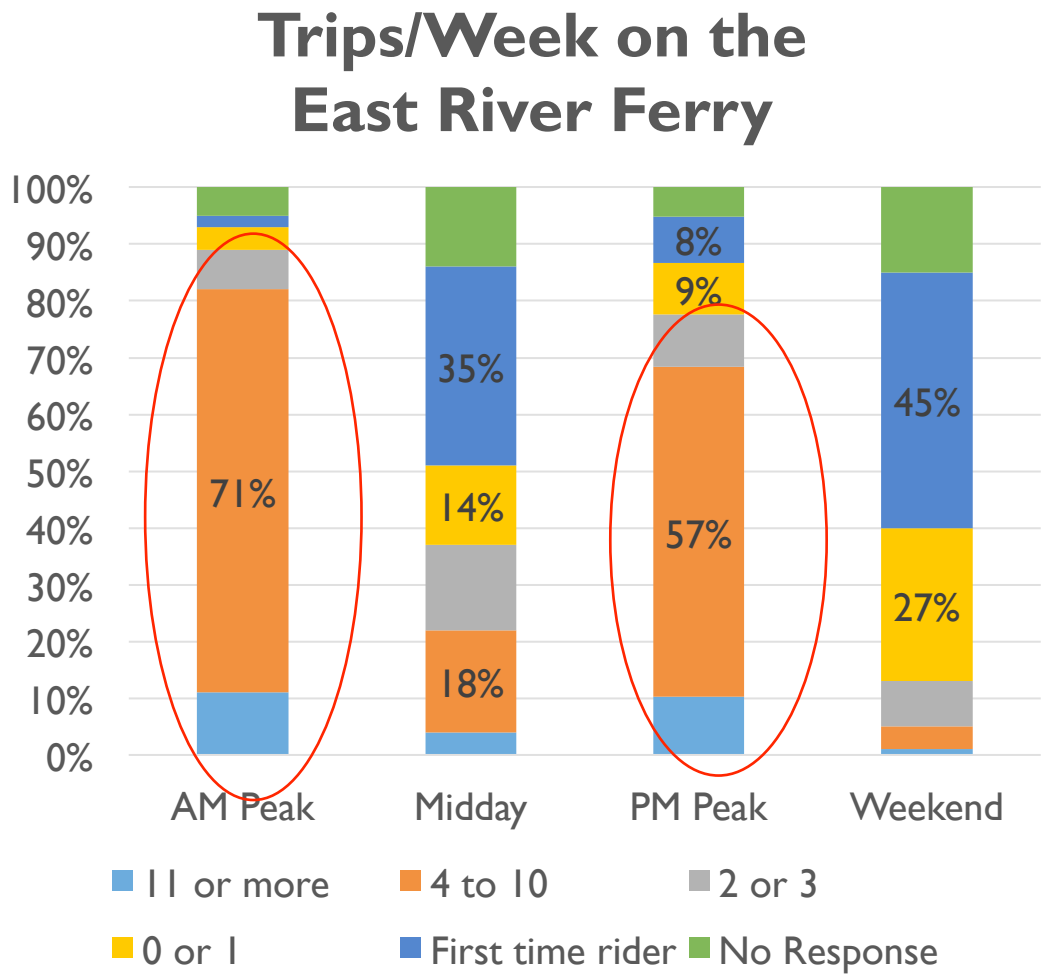


Comparison of Survey & Mobile Ticketing OD Matrices



Survey Questions





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)

Origins ▼ / Destinations ▶	Actual Ridership	Pier 11	DUMBO	S. Williamsburg	N. Williamsburg	Green point	Long Island City	E 34th street	Total
Actual Ridership ▼▶	524	100	12	23	17	18	651	**1345**	
Pier 11	38	0%	1%	0%	1%	1%	0%	0%	**2%**
DUMBO	104	7%	0%	0%	1%	0%	0%	1%	**8%**
S.Williamsburg	140	3%	2%	0%	0%	0%	0%	6%	**11%**
N.Williamsburg	530	14%	3%	0%	0%	0%	0%	21%	**38%**
Greenpoint	190	6%	2%	0%	0%	0%	0%	6%	**15%**
Long Island City	259	11%	1%	0%	0%	0%	0%	9%	**22%**
E 34th St	84	1%	1%	0%	1%	1%	1%	0%	**4%**
Total	**1345**	**42%**	**10%**	**1%**	**2%**	**1%**	**1%**	**43%**	**100%**

IPF Method ➡

Adjusted OD Matrix (Onboard survey data)

Actual Ridership ▼▶	Pier 11	DUMBO	S. Williamsburg	N. Williamsburg	Green point	Long Island City	E 34th street	Total
Actual Ridership ▼▶	524	100	12	23	17	18	651	**1345**
38	0%	1%	0%	1%	1%	0%	0%	**3%**
104	6%	0%	0%	0%	0%	0%	1%	**8%**
140	3%	1%	0%	0%	0%	0%	6%	**10%**
530	13%	2%	0%	0%	0%	0%	24%	**39%**
190	5%	1%	0%	0%	0%	0%	7%	**14%**
259	9%	1%	0%	0%	0%	0%	9%	**19%**
84	2%	1%	1%	1%	1%	1%	0%	**6%**
1345	**39%**	**7%**	**1%**	**2%**	**1%**	**1%**	**48%**	**100%**

Seed Matrix (Mobile ticketing data)

Actual Ridership ▼▶	Actual Ridership	Pier 11	DUMBO	S. Williamsburg	N. Williamsburg	Green point	Long Island City	E 34th street	Total
Actual Ridership ▼▶	524	100	12	23	17	18	651	**1345**	
Pier 11	38	0%	2%	2%	5%	1%	3%	1%	**15%**
DUMBO	104	3%	0%	0%	1%	1%	0%	2%	**7%**
S. Williamsburg	140	3%	1%	0%	0%	0%	0%	4%	**8%**
N.Williamsburg	530	14%	1%	0%	0%	0%	0%	17%	**32%**
Greenpoint	190	6%	1%	0%	0%	0%	0%	7%	**14%**
Long Island City	259	6%	1%	0%	0%	0%	0%	5%	**12%**
E 34th St	84	1%	0%	1%	6%	2%	2%	0%	**12%**
Total	**1345**	**32%**	**7%**	**4%**	**13%**	**4%**	**5%**	**36%**	**100%**

IPF Method ➡

Adjusted OD Matrix (Mobile ticketing data)

Actual Ridership ▼▶	Pier 11	DUMBO	S. Williamsburg	N. Williamsburg	Green point	Long Island City	E 34th street	Total
Actual Ridership ▼▶	524	100	12	23	17	18	651	**1345**
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259	9%	1%	0%	0%	0%	0%	9%	**19%**
84	1%	1%	1%	1%	1%	1%	0%	**6%**
1345	**39%**	**7%**	**1%**	**2%**	**1%**	**1%**	**48%**	**100%**