TNCs Today (Yesterday?)

- How many Ubers and Lyfts are on City streets?
- How many trips? When and where?
TNCs & Congestion

- Do TNCs affect roadway congestion in San Francisco?

- Report Contents
  - **Measures** of congestion
  - **Factors** that affect congestion
  - **Data** for quantifying changes in congestion
  - **Methods** for linking changes in congestion to factors
  - **Contributions of factors** to changes in SF congestion
Factors that Affect Congestion

- How could TNCs decrease congestion?
  - Increased **vehicle occupancy**
  - Mode **shift to transit** due to easier access (first/last mile)
  - Mode **shift away from auto** due to reduced auto ownership

- How could TNCs increase congestion?
  - Add “dead head” or **out-of-service vehicle miles**
  - Mode **shift away from transit and non-motorized** modes
  - **Disrupt traffic flow** due to pickups and drop-offs

- Background traffic and roadway performance
  - **Network** changes (increases or decreases in roadway capacity)
  - **Population** changes
  - **Employment** changes

- Other
Data

- **Congestion (INRIX)**
  - 1400 “TMCs” (segments) in SF
  - Speeds, imputed volumes

- **TNCs**
  - Nov / Dec 2016
  - In-service and out-of-service volumes
  - Pick up and drop off locations

- **Background traffic (CHAMP)**
  - 2010, 2016 (adjusted from 2015)
  - All streets in SF
  - Volumes, imputed speeds
Causes of Changes in Congestion (2010-2016)

SHARE OF CHANGE IN DELAY BY FACTOR
Network 2%
TNCs 51%
Population 24%
Employment 23%

SHARE OF CHANGE IN VMT BY FACTOR
Network 1%
TNCs 47%
Population 30%
Employment 22%

SHARE OF CHANGE IN SPEED BY FACTOR
Network 4%
TNCs 55%
Population 19%
Employment 22%
Factors Affecting Hours of Delay by Time Period

SHARE OF CHANGE IN HOURS OF DELAY BY FACTOR

Change in Hours of Delay

<table>
<thead>
<tr>
<th>Time Period</th>
<th>TNC Change</th>
<th>Network Change</th>
<th>Employment Change</th>
<th>Population Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>3:00a-6:00a</td>
<td>43%</td>
<td>37%</td>
<td>48%</td>
<td>20%</td>
</tr>
<tr>
<td>6:00a-9:00a</td>
<td>22%</td>
<td>24%</td>
<td>44%</td>
<td>29%</td>
</tr>
<tr>
<td>9:00a-3:30p</td>
<td>28%</td>
<td>22%</td>
<td>48%</td>
<td>29%</td>
</tr>
<tr>
<td>3:30p-6:30p</td>
<td>22%</td>
<td>24%</td>
<td>44%</td>
<td>29%</td>
</tr>
<tr>
<td>6:30p-3:00a</td>
<td>16%</td>
<td>15%</td>
<td>69%</td>
<td>16%</td>
</tr>
</tbody>
</table>
Factors Affecting Speed by Time Period

SHARE OF CHANGE IN SPEED BY FACTOR

<table>
<thead>
<tr>
<th>Time Period</th>
<th>Network Change</th>
<th>Population Change</th>
<th>Employment Change</th>
<th>TNC Change</th>
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<tbody>
<tr>
<td>3:00a-6:00a</td>
<td>31%</td>
<td>57%</td>
<td>40%</td>
<td>12%</td>
</tr>
<tr>
<td>6:00a-9:00a</td>
<td>15%</td>
<td>44%</td>
<td>20%</td>
<td>12%</td>
</tr>
<tr>
<td>9:00a-3:30p</td>
<td>21%</td>
<td>55%</td>
<td>26%</td>
<td>45%</td>
</tr>
<tr>
<td>3:30p-6:30p</td>
<td>24%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6:30p-3:00a</td>
<td></td>
<td>12%</td>
<td></td>
<td>75%</td>
</tr>
</tbody>
</table>
Factors Affecting Hours of Delay by District

SHARE OF CHANGE IN HOURS OF DELAY BY FACTOR

<table>
<thead>
<tr>
<th>District</th>
<th>TNC Change</th>
<th>Network Change</th>
<th>Employment Change</th>
<th>Population Change</th>
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</thead>
<tbody>
<tr>
<td>D1</td>
<td>2%</td>
<td>63%</td>
<td>73%</td>
<td>53%</td>
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<tr>
<td>D2</td>
<td>14%</td>
<td>20%</td>
<td>14%</td>
<td>2%</td>
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<tr>
<td>D3</td>
<td>6%</td>
<td>14%</td>
<td>72%</td>
<td>6%</td>
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<tr>
<td>D4</td>
<td>40%</td>
<td>40%</td>
<td>45%</td>
<td>45%</td>
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<tr>
<td>D5</td>
<td>5%</td>
<td>14%</td>
<td>22%</td>
<td>14%</td>
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<tr>
<td>D6</td>
<td>18%</td>
<td>18%</td>
<td>45%</td>
<td>36%</td>
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<tr>
<td>D7</td>
<td>2%</td>
<td>21%</td>
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<tr>
<td>D8</td>
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<td>D10</td>
<td>2%</td>
<td>33%</td>
<td>25%</td>
<td>25%</td>
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<tr>
<td>D11</td>
<td>21%</td>
<td>25%</td>
<td>36%</td>
<td>40%</td>
</tr>
</tbody>
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Interactive Data Visualization
Additional Resources

- Science Advances publication: http://advances.sciencemag.org/
- TNCs & Congestion Visualization: http://tncsandcongestion.sfcta.org/
- TNCs Today Report: https://www.sfcta.org/projects/tncs-today
- TNCs Today Visualization: https://tncestoday.sfcta.org/
Questions?
Presenter: Drew Cooper, drew.cooper@sfcta.org
Project Manager: Joe Castiglione, joe.castiglione@sfcta.org
Analysis Limitations

- **Freight**
  - No observed data on changes in freight / commercial / delivery activity
  - Increase traffic due to more deliveries?
  - Reduce traffic due to fewer shopping trips?
  - Use SF-CHAMP / MTC simplified commercial vehicle model

- **Visitors**
  - 56% increase in annual visitor travel
  - About 4.5% of total SF travel
  - Highest use modes are transit, though TNC share is certainly increasing

- **Pedestrians impeding traffic flow**
  - No data

- **Non-permitted, short term construction capacity impacts**
  - No data
How do we analyze changes in congestion?

- Empirical analysis
  - Before (2010) and after (2016)
  - Panel regression model
- Scenario analysis
  - Factors affecting change
  - CHAMP-based
- Combined analysis
  - Total change from empirical
  - Shares of change from scenario

### Empirical Model Parameters

<table>
<thead>
<tr>
<th>Variable</th>
<th>Parameter</th>
<th>StdErr</th>
<th>T-stat</th>
</tr>
</thead>
<tbody>
<tr>
<td>SF-CHAMP background volume</td>
<td>0.9172</td>
<td>0.0541</td>
<td>16.952</td>
</tr>
<tr>
<td>Presidio Parkway scaling factor</td>
<td>-0.3648</td>
<td>0.0189</td>
<td>-19.327</td>
</tr>
<tr>
<td>TNC Volume</td>
<td>0.6864</td>
<td>0.072</td>
<td>9.5387</td>
</tr>
<tr>
<td>Avg Impact Duration of TNC PUDO on major arterials</td>
<td>144.75</td>
<td>7.7195</td>
<td>18.751</td>
</tr>
<tr>
<td>Avg Impact Duration of TNC PUDO on minor arterials</td>
<td>79.486</td>
<td>12.114</td>
<td>6.5617</td>
</tr>
</tbody>
</table>

### Share of Change in Congestion Due to TNCs

<table>
<thead>
<tr>
<th>Metric</th>
<th>Empirical</th>
<th>Scenario</th>
</tr>
</thead>
<tbody>
<tr>
<td>VHD</td>
<td>64%</td>
<td>51%</td>
</tr>
<tr>
<td>VMT</td>
<td>44%</td>
<td>47%</td>
</tr>
<tr>
<td>Speed</td>
<td>65%</td>
<td>55%</td>
</tr>
<tr>
<td>Reliability</td>
<td>63%</td>
<td>41%</td>
</tr>
</tbody>
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