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Acknowledgements

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Outline

- Background on Parking in Urban Areas
- SoHo Case Study
- Factors to Consider for Optimal Freight Parking
- Complementary Measures
- Conclusions & Next Steps
Background on Parking in Urban Areas
Parking in Urban Areas

- Parking is a major challenge for **ALL** vehicle users
- Most of the focus has been placed on passenger vehicles
- Commercial vehicles are usually met with many restrictions
- Freight transportation
  - Essential for a vibrant economy
  - Large number of truck trips inside metropolitan areas
  - Conduct pick-up/drop-off operations
Consequences

- Current restrictions often times result in inefficient operations, which impacts **ALL** in the network.
- 2014 - US travel delays estimated 6.9 billion hours \(^{(1)}\)
  - Congestion cost≈$160 billion
  - Freight ≈ $28 billion (17% of the total)
- Restriction on passenger cars may cause a shift to more sustainable modes, not the same for freight
- Types of truck restrictions include:
  - Vehicle size/weight restrictions
  - Time of Day
Consequences

- On average, a passenger vehicle takes $\approx 8$ minutes to find parking \(^{(2)}\)
  - More time for freight trucks that need to be closer to customers and fewer parking options
  - Increased miles-traveled
  - Increased congestion
  - Increased illegal parking (e.g. double parking)
  - Decreased safety
  - Decreases efficiency
  - Decreases reliability

- Need to develop parking policies that adequately account for urban freight traffic
Case: SoHo Commercial Area, Downtown NYC

- A commercial area located in lower Manhattan, NYC
- 21 establishments - 19 retail stores and 2 restaurants
- On-street parking is the only option for commercial vehicles
- 137 parking spots – 12 exclusively freight; 28 on the street in front of businesses
The SoHo area, the estimate for total FTA is 127.57 daily trips and for STA is 7.72 daily trips

Sensitivity analysis to assess the impacts of changes in parking duration on the parking needs for FSA vehicle

<table>
<thead>
<tr>
<th>Measure of FSA</th>
<th>Daily total</th>
<th>Peak hour as % of total</th>
<th>Vehicles/hr (peak hour)</th>
<th>Minimum</th>
<th>Average</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Parking time (hours)</td>
<td>Parking spaces</td>
<td>Parking time (hours)</td>
</tr>
<tr>
<td>FTA</td>
<td>127.57</td>
<td>25.00%</td>
<td>31.89</td>
<td>0.25</td>
<td>7.97</td>
<td>0.50</td>
</tr>
<tr>
<td>STA</td>
<td>7.72</td>
<td>12.50%</td>
<td>0.97</td>
<td>0.75</td>
<td>0.72</td>
<td>1.50</td>
</tr>
<tr>
<td>Total</td>
<td>135.29</td>
<td></td>
<td>32.86</td>
<td>8.70</td>
<td>17.39</td>
<td>69.58</td>
</tr>
</tbody>
</table>
Results and Policy Implications

- Demand for number of parking spots increase with:
  - duration of parking
  - distance of parking from delivery location

- A simplified simulation was conducted for SoHo case:
  - As parking is farther away the parking time increase by 44% (one block away) and 79% (two blocks away)

- The existing parking supply allocated for use of freight vehicles is inadequate

- This leads to parking violations which increases negative externalities of the delivery operations
Factors to Consider for Optimal Freight Parking
Approach to Determining a Social Optimal

- Minimize the social cost by accounting for impacts

Cost Allocation of Parking Space to Freight
Private Cost for Freight
Cost Allocation of Parking Space to Freight
Private Cost for Other Users
- Externalities

Cost
Allocation of Parking Space to Freight
Private Cost for Other Users
Private Cost for Freight + Externalities
Private Cost for Freight
Minimize social cost by determining the optimal number of freight parking to allocate and the location of these spaces.

Factors that impact quantity and location of parking allocated to freight:

- Duration
- Maneuverability in and out of the parking spot
  - Middle of block better for larger vehicles (e.g. bus, truck)
  - Impacts on traffic flow
- Opportunity cost of allocating to another user type
- Access to the delivery location
Factors to Consider in Optimizing Freight Parking

- Minimize total cost => sum of unit fixed cost for parking facility + sum of unit delivery cost
  - For each user

- Fixed cost captures the opportunity cost of space

- Constraints that should be considered
  - Curb capacity
  - Time of day
  - Land use/land value
  - Demand for parking space
  - Value of time of the user
Complementary Measures
Traffic Demand Management Initiatives

- **Scenario 0** – Base Case: FSA trips arrive as current conditions without any TDM
- **Scenario 1** – Receiver-Led Consolidation: assume all establishments reduce deliveries by one delivery/day
- **Scenario 2** – 30% Off-Hour Deliveries (OHD): 30% of deliveries switched to OHD (7:00 p.m. – 6:00 a.m.)
- **Scenario 3** – Staggered Deliveries: deliveries spread throughout working hours (7:00 a.m. – 5:00 p.m.)
- **Scenario 4** – 100% Off-Hour Deliveries (OHD): all deliveries switched to OHD (7:00 p.m. – 6:00 a.m.)
Transportation Demand Management: SoHo

- Parking space needs during peak hours are very high
- TDM strategies could significantly improve this issue
- TDM strategies applied to the freight traffic only

SoHo Area in Downtown New York City

- **Base Case**
- **Strategy 1: Receiver Led Consolidation**
- **Strategy 2: OHD (30%) for Freight Trips**
- **Strategy 3: Staggered Deliveries**
- **Strategy 4: OHD (100%) for Freight Trips**

**Reductions:**
- OHD(100%): ≈70%
- Staggered: ≈60%
- RLC & OHD(30%): 10-25%
Conclusion and Next Steps
Conclusions & Next Steps

- Conclusions:
  - A holistic look at the behaviors of freight as well as the other users in the network is necessary.
  - Parking duration an important factor.
  - Duration is impacted by the number of spaces allocated as well their location.
  - Location of the parking spot also may impact traffic flow.
  - The combination of TDM strategies and allocating sufficient and efficient parking locations can go a long way to alleviate some of the negative impacts of freight vehicles in urban areas.

- Next Steps:
  - Develop mathematical formulation to represent the problem with the objective function of minimizing cost
References


Thank you!

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