Shared Mobility in LA County - A Case Study in Westside Cities

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Outline

- The study area (Westside Cities) - Ihab
- Scenarios - Huajun
- Demand Responsive Transport (DRT) in MATSim
- DRT services in LA MATSim model
- Some draft results - Huajun, Ihab
The LA County MATSim model

Simulated activities
- **blue** = home
- **red** = work
- **yellow** = leisure/shopping
- **green** = education

Simulated vehicles

https://github.com/matsim-scenarios/matsim-los-angeles
https://www.matsim.org
Study Area

Planning area.
HC1

Replace this with LA planning area map. @chauhuajun@gmail.com

Assigned to you

Huajun Chai, 7/18/2020
Model reduction

To improve computational performance, the population from the LA County MATSim model is reduced to the relevant agents:

Agents with at least one trip to, from, or through the WSC area plus a buffer of 0.62 miles

Blue = Agents’ home locations
Scenarios

Base case: No automated taxi services

Scenario 1

Scenario 2 + Free public transportation

Scenario 3 + Free public transportation
+ VMT tax for cars
# Alternative Scenarios

<table>
<thead>
<tr>
<th>Scenario 1</th>
<th>Scenario 2</th>
<th>Scenario 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>The WSCCOG area</strong></td>
<td><strong>The WSCCOG area</strong></td>
<td><strong>The WSCCOG area</strong></td>
</tr>
<tr>
<td><strong>The rest SCAG region</strong></td>
<td><strong>The rest SCAG region</strong></td>
<td><strong>The rest SCAG region</strong></td>
</tr>
<tr>
<td><strong>Personal vehicle VMT tax</strong></td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td><strong>Automated taxi fare (Single passenger): DRT1</strong></td>
<td>$0.55/mile</td>
<td>No service</td>
</tr>
<tr>
<td><strong>Automated taxi fare (shared): DRT2</strong></td>
<td>$0.15/mile</td>
<td>No service</td>
</tr>
<tr>
<td><strong>Transit cost</strong></td>
<td>$7.00 daily fare</td>
<td>$7.00 daily fare</td>
</tr>
</tbody>
</table>
MATSim: How it works

Input

Plan Modification / Plan Selection

Iterative Approach: Physical and Cognitive

Plan Scoring

Output

Network, Public transit schedule, ...

Daily plans, person attributes, ...

Home (dep: 06:43)
trip (car)
Work (dep: 16:04)
trip (car)
Shopping (dep: 18:04)
trip (car)
Home

Home (dep: 12:42)
trip (bike)
Shopping (dep: 14:05)
trip (bike)
Home
Simulation of Demand Responsive Transport (DRT)

Iterative learning cycle: Add DRT (drt1, drt2) as an additional mode of transportation

Additional input:

- Service area
- DRT vehicle fleet: initial position on the network, capacity, ...
- DRT configuration: Operation mode (stop-based, door-to-door), rebalancing, fares, ...
Simulation of Demand Responsive Transport (DRT)

1. Step outside the house or walk to the DRT stop
2. Request a DRT trip + Waiting for the DRT vehicle
3. DRT vehicle dispatching
4. Passenger pick-up
5. (With ride-sharing: dispatching/insertion algorithm + additional DRT passenger pick-ups/drop-offs)
6. Passenger drop-off
7. Walk to trip destination / Starts an activity

- More empty vehicles than customers: Send the closest vehicle to the customer.
- In times of undersupply (many people are waiting): Send the vehicle to the closest waiting customer.
- With pooling: insertion algorithm; definition of certain service criteria and thresholds, e.g. for the trip detour
DRT in LA County MATSim Model

Red: single-passenger taxis
Blue: multi-passenger taxis
Gray: other vehicles (private cars, busses, trains, ...)

[Map diagram showing the use of different colors to represent types of vehicles in the MATSim Model for LA County]
DRT vehicle fleet

Challenges:

- Too small vehicle fleet: Very long waiting times → number of DRT trips limited by the fleet size
- Too large vehicle fleet: Very short waiting times, no pooling effects → too attractive service → too many DRT trips

Way out: Iteratively adapt the DRT vehicle fleet size in order to keep certain service criteria at a desired level, e.g. a 90% waiting time percentile of 10 minutes
Preliminary Results

- DRT services provide cheap and convenient transportation service.
  - In Scenario 1: a decrease in public transit ridership.
  - In all scenarios: a decrease in personal vehicle usage (drive alone and shared).
Preliminary Results

- Reducing public transit fees could (scenario 2 vs scenario 1):
  - Increases PT mode share.
  - Reduces personal vehicle usage.
  - Encourages DRT ridership.
DRT traffic volumes

Daily traffic volume (DRT vehicles)
- 0 - 2000
- 2000 - 4000
- 4000 - 6000
- 6000 - 8000
- 8000 - 10000
- 10000 - 12000
- 12000 - 13030

Map data ©2020 Google

Scenario 1
Change in total traffic volume

Scenario 1 - Base case
Thank you!

Acknowledgements

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Backup
MATSim Overview

MATSim = Multi-Agent Transport Simulation

Key features:

- **Agent-based**: Simulates vehicle and individuals in household context
- **Dynamic**: Entire day, traffic congestion, attributes of drivers and passengers
- **Activity-based**: Travel demand based on individual activity patterns
- **Multi-modal**: Cars, public transit, bicycles, demand responsive transit, …
- Allows for **large-scale** simulations (city, region)
- **Modular** approach: Several extensions (taxis, MaaS, congestion pricing, …)
- **Open-source** ([https://github.com/matsim-org](https://github.com/matsim-org)) + Active community