

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

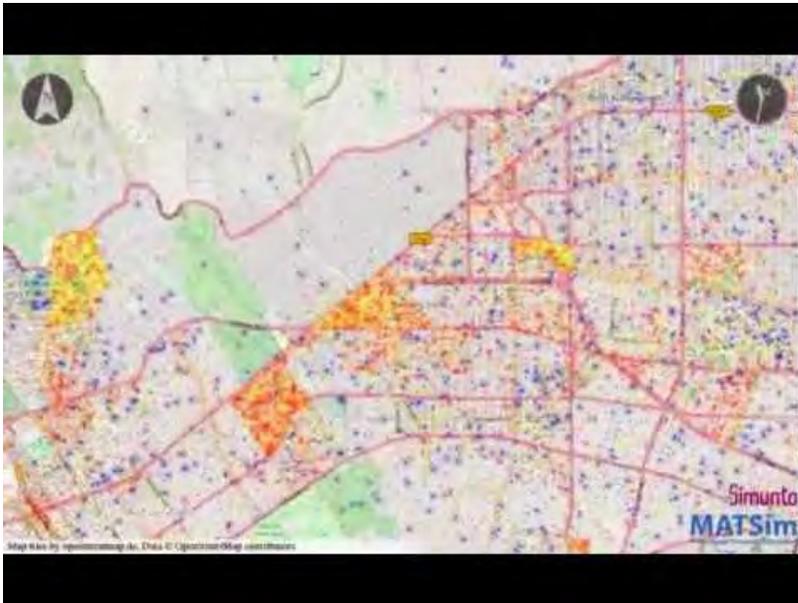
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Huajun Chai

# 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>

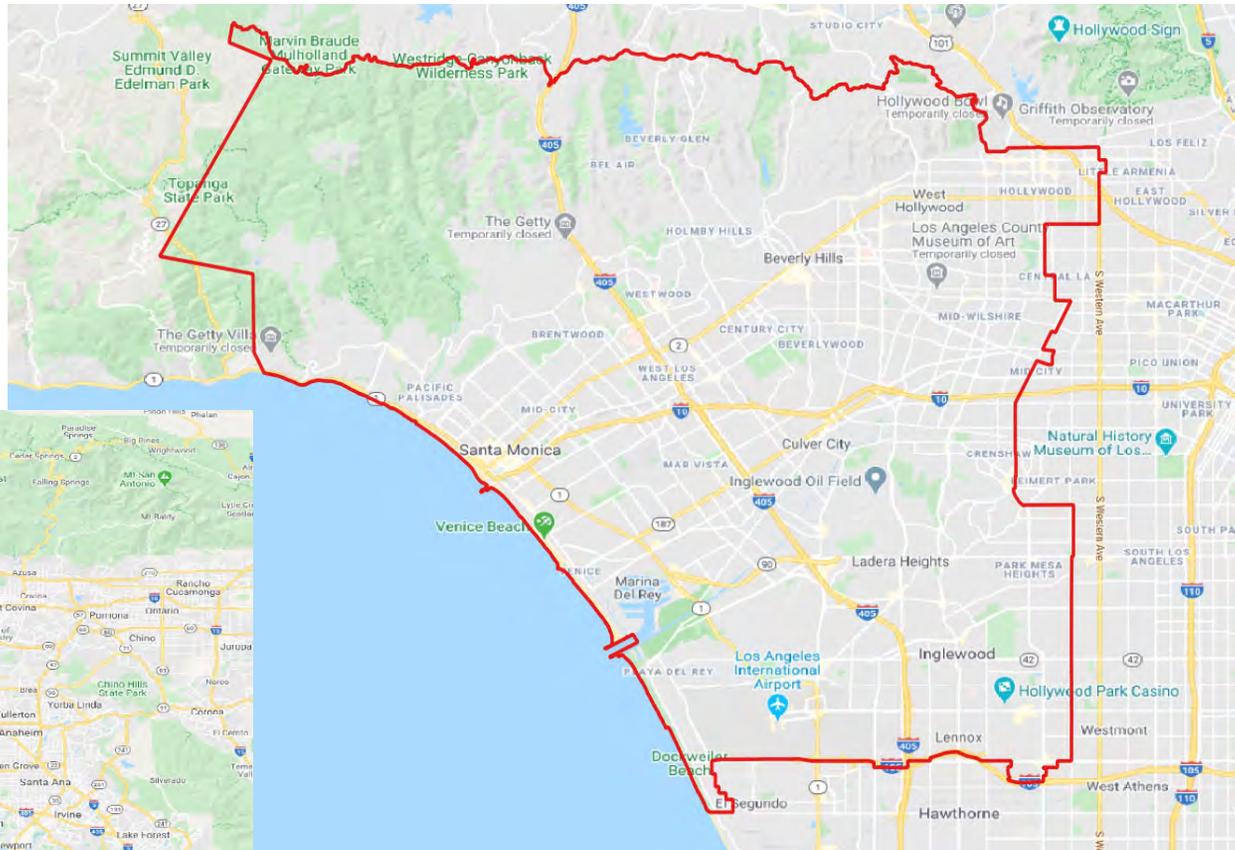
**MATSim**  
Multi-Agent Transport Simulation

# Study Area

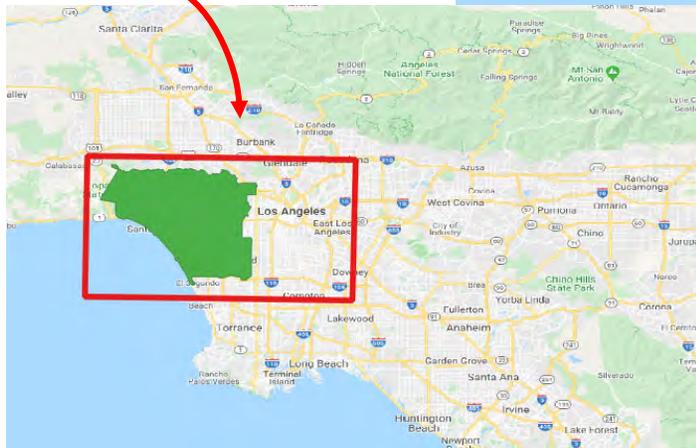
HC1



Planning area.



Map data ©2020 Google



## Slide 4

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HC1

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

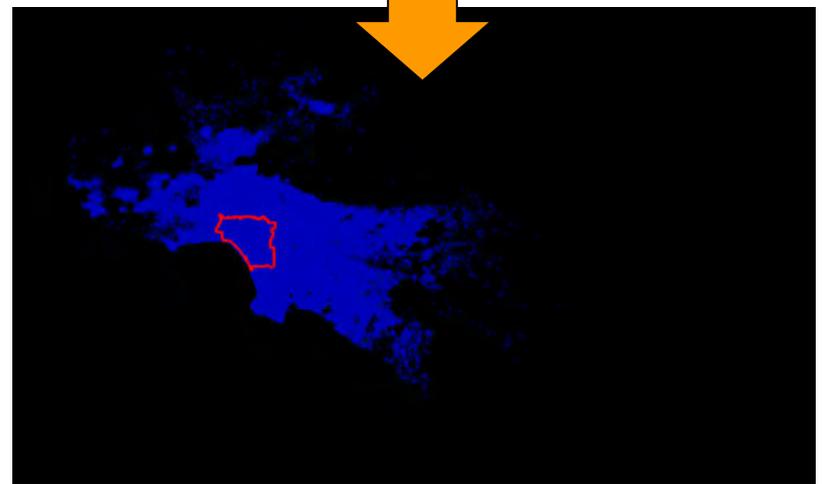
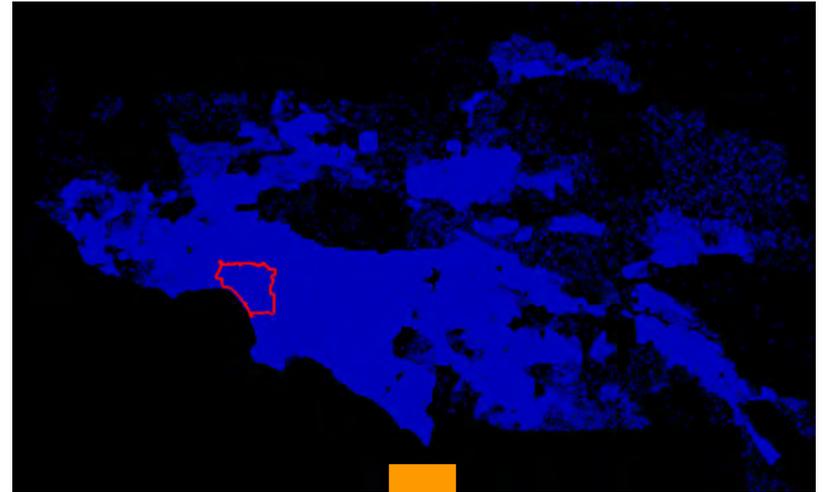
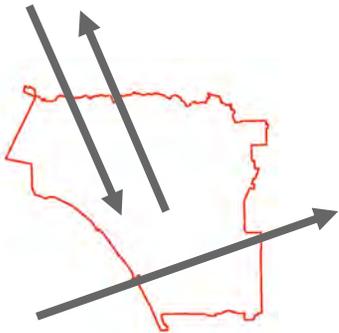
\_Assigned to you\_

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

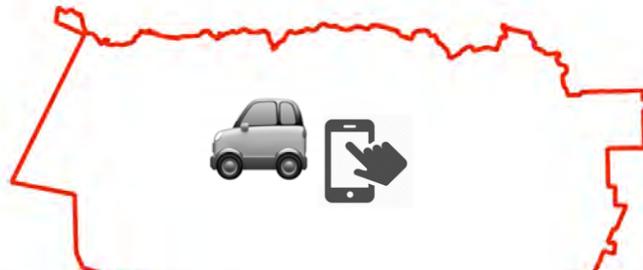


**Blue** = Agents' home locations

# 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

	Scenario 1		Scenario 2		Scenario 3	
	The WSCCOG area	The rest SCAG region	The WSCCOG area	The rest SCAG region	The WSCCOG area	The rest SCAG region
Personal vehicle VMT tax	None		None		\$0.17/mile	
Automated taxi fare (Single passenger): DRT1	\$0.55/mile	No service	\$0.55/mile	No service	\$0.55/mile	No service
Automated taxi fare (shared): DRT2	\$0.15/mile	No service	\$0.15/mile	No service	\$0.15/mile	No service
Transit cost	\$7.00 daily fare	\$7.00 daily fare	Free	Free	Free	Free

# MATSim: How it works

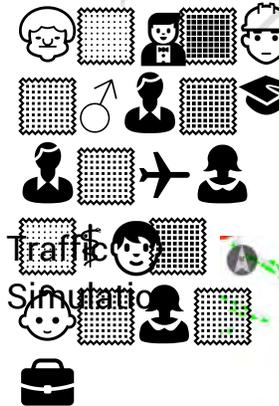


Network, Public transit schedule, ...

Daily plans, person attributes, ...

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

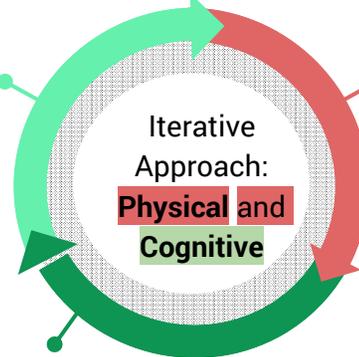
**Home** (dep: 12:42)  
trip (bike)  
**Shopping** (dep: 14:05)  
trip (bike)  
**Home**



Plan Modification / Plan Selection

Plan Scoring

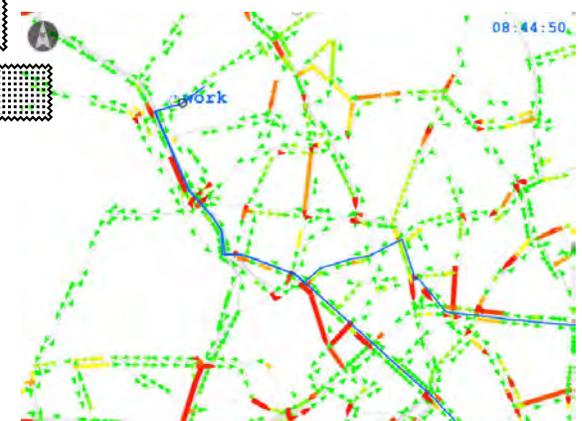
Input



Output



Traffic Simulation

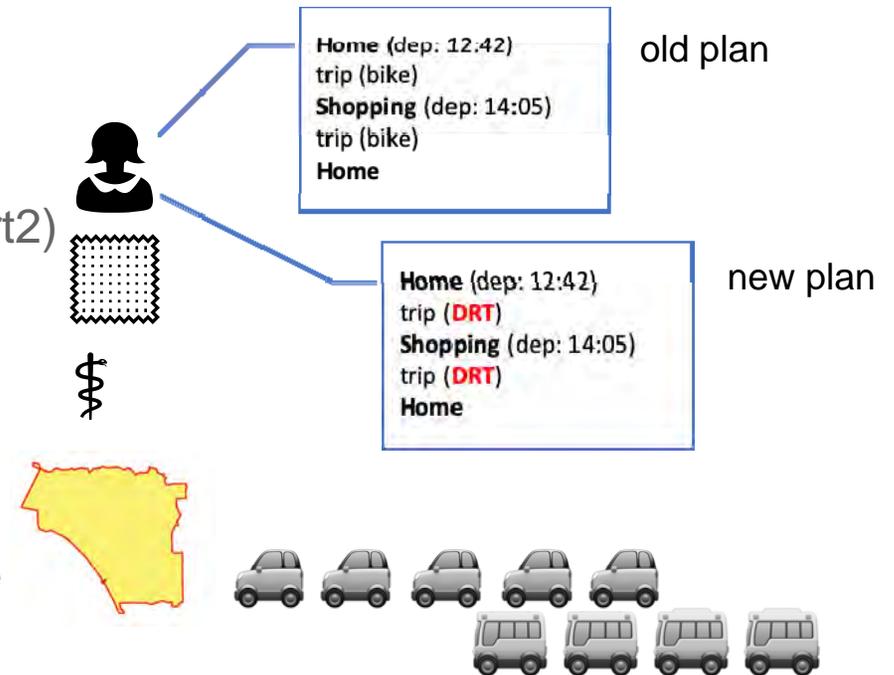


# Simulation of Demand Responsive Transport (DRT)

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

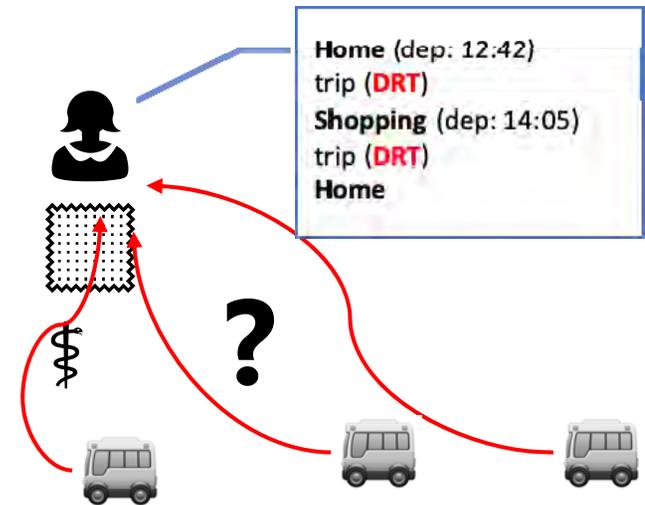
Additional input:

- 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, ...)

# **DRT vehicle fleet**

Challenges:

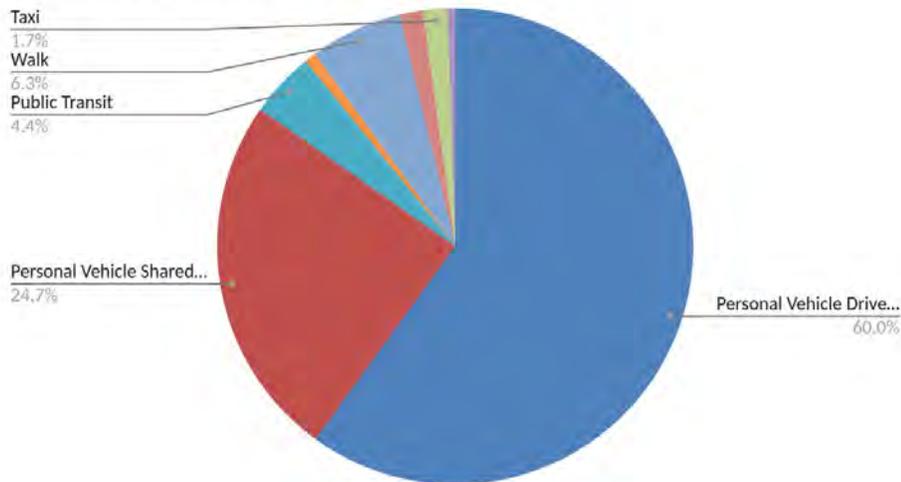
- Too small vehicle fleet: Very long waiting times → number of DRT trips limited by the fleet size
- Too large vehicle fleet: Very short waiting times, no pooling effects → too attractive service → too many DRT trips

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

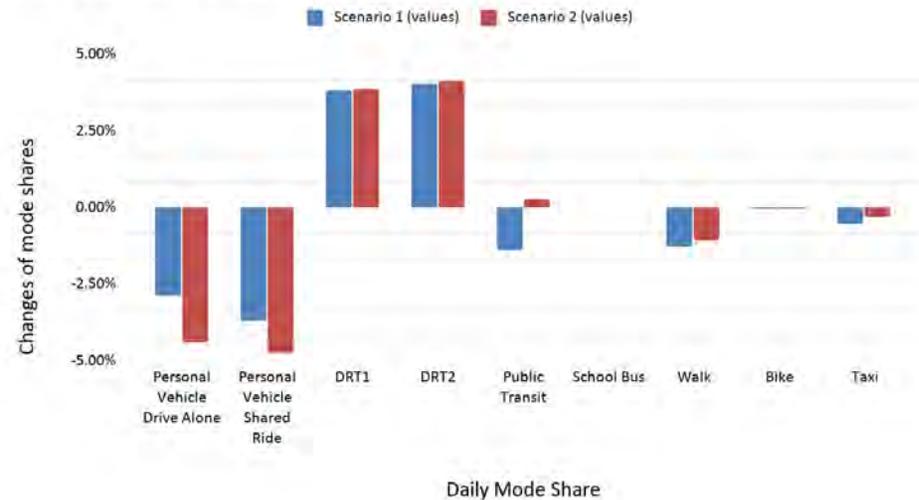
# Preliminary Results

- 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**).

West Side Cities: base case mode shares



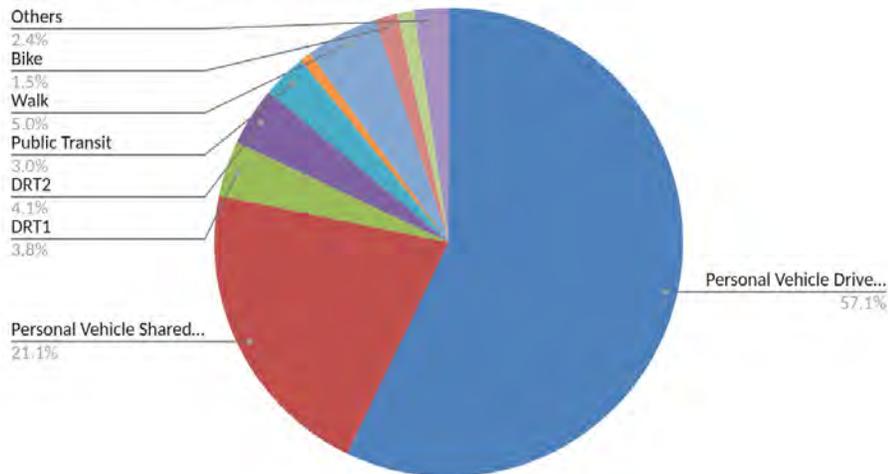
West Side Cities: alternative scenarios vs. base case



# Preliminary Results

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

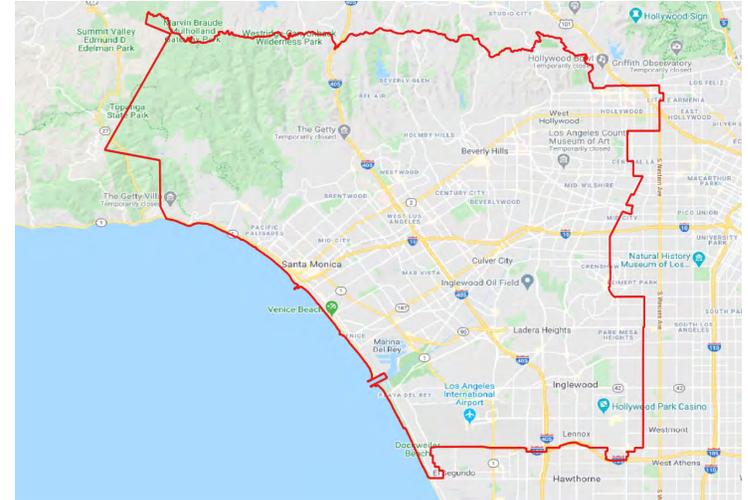
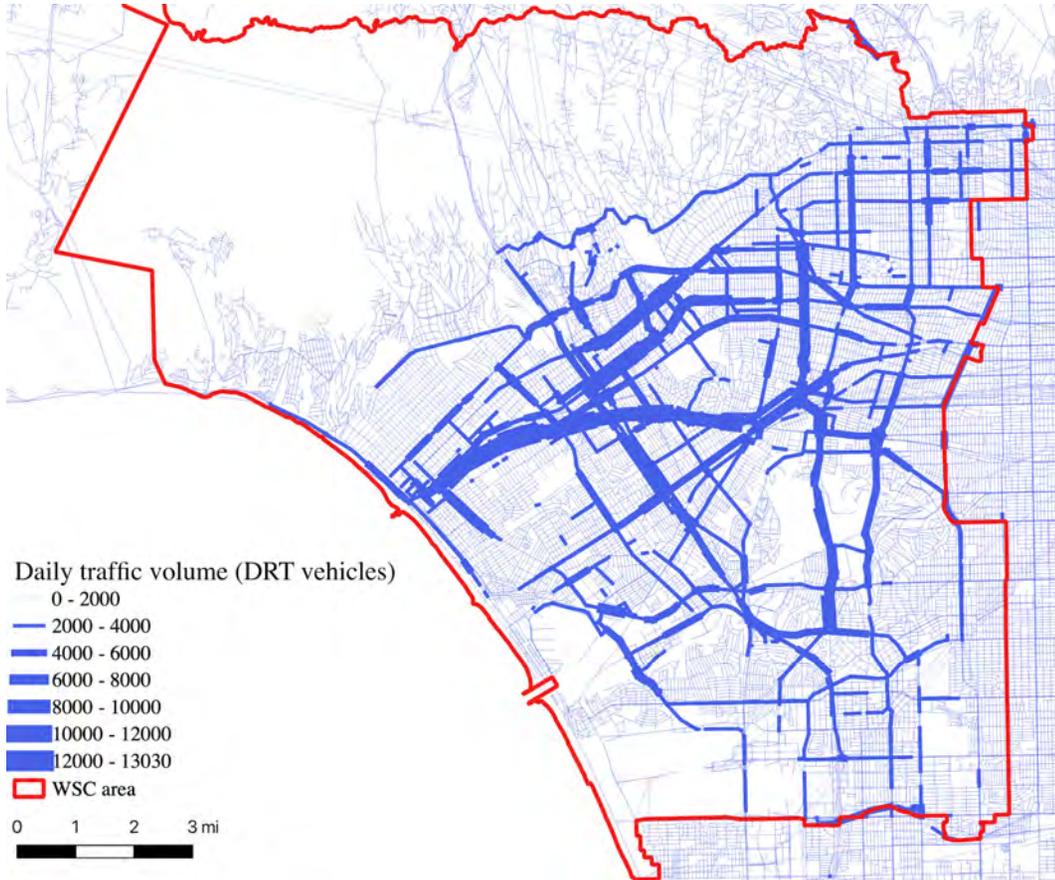
West Side Cities: scenario 1 mode shares



West Side Cities: scenario 2 vs. scenario 1



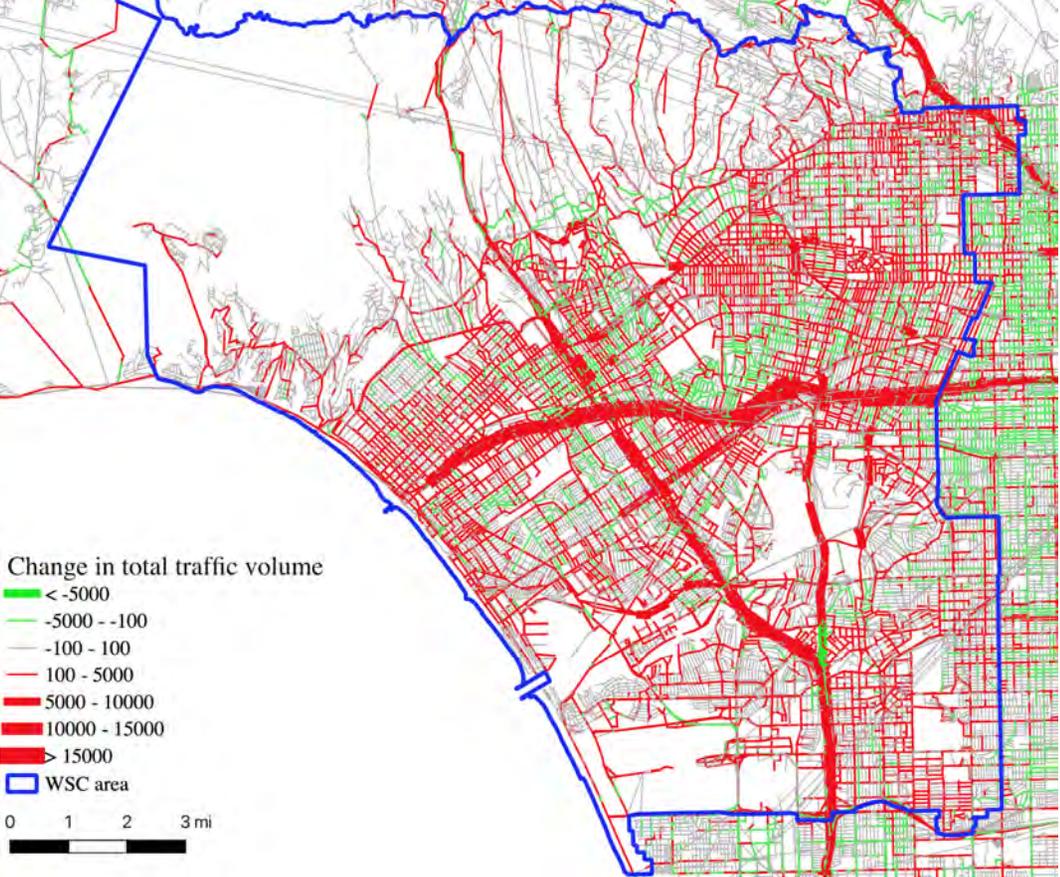
# DRT traffic volumes



Map data ©2020 Google

Scenario 1

# Change in total traffic volume



Scenario 1 - Base case

# Thank you!

## Acknowledgements

We are grateful to the Southern California Association of Governments (<http://www.scag.ca.gov/>) for supporting this model developing effort with data and staff time. We are also grateful to the California Department of Transportation (<https://dot.ca.gov>) for funding this research through their sustainable planning grant programs.

**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>) + Active community