Parking Policy-Making
Academic View of Practical Needs

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http://geosimlab.tau.ac.il/

Geosimulation and Spatial Analysis Lab

Establishing parking policy…

Parking demand and supply

Drivers' parking behavior

Parking management and policy assessment

WE STUDY THE CURRENT STATE ***WE AIM AT FORECASTING***

Parking spatial pattern

Parking dynamics in space and time

Parking demand and supply

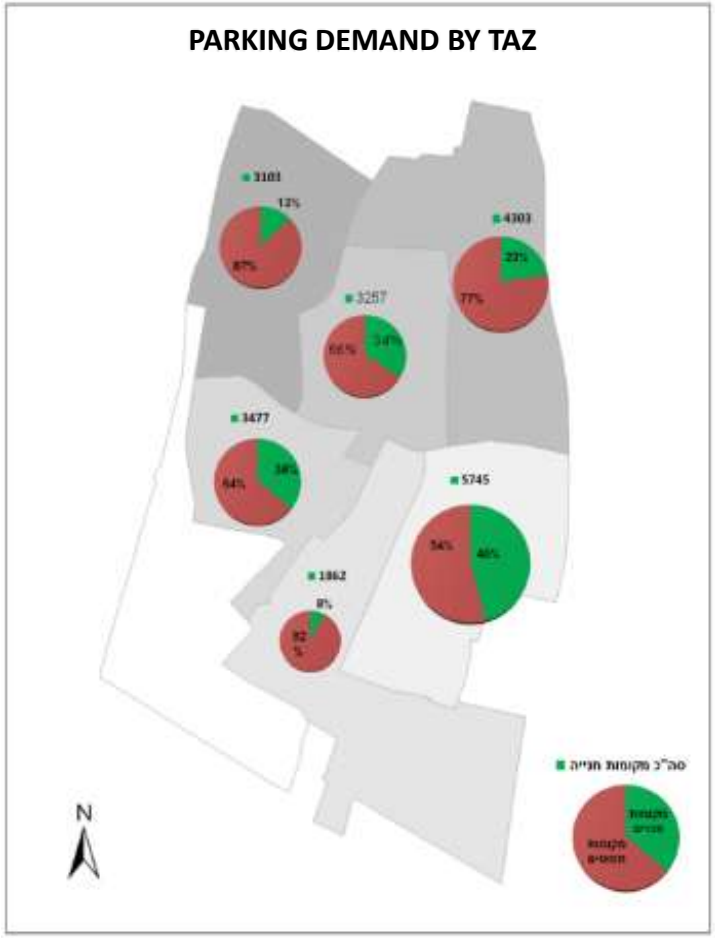
Parking spatial pattern

BASIC ESTIMATES OF PARKING DEMAND AND SUPPLY: GIS + Aerial photos + Population Census

URBAN GIS and AERIAL PHOTOS

Estimation of demand:
Night: Householders*car ownership rate
Day: Office area/20 or proportional to Shops' turnover

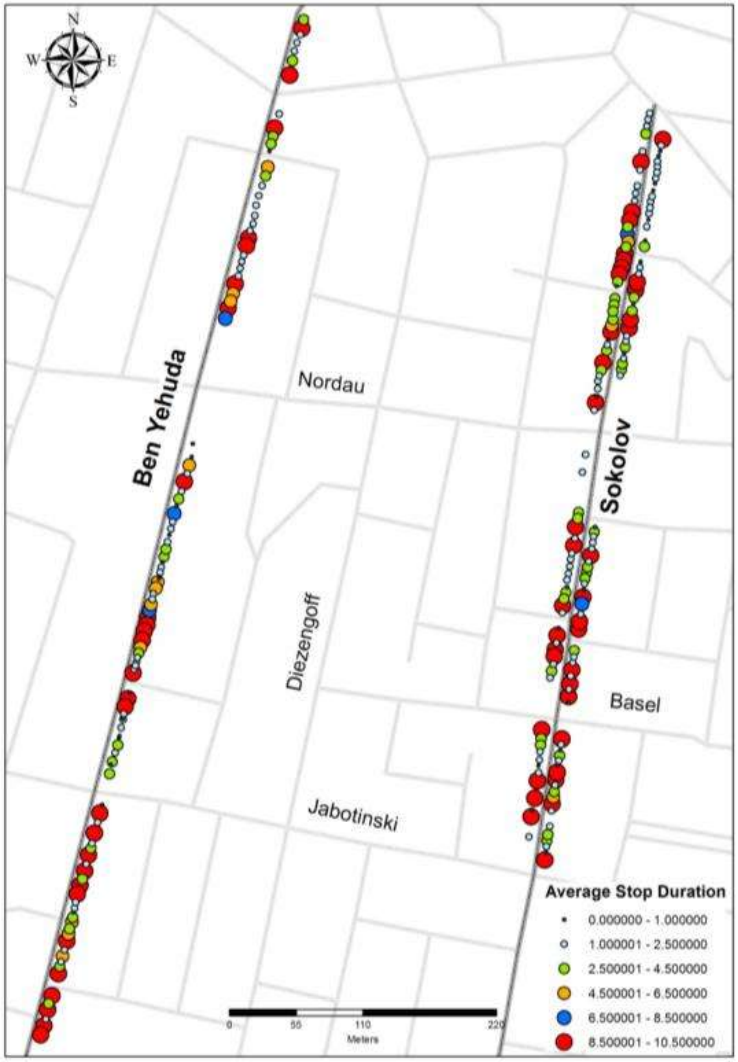
Estimation of supply:
Curb: Length of streets /5 m – prohibited places
Lots: Lots area /8 sq m * number of floors



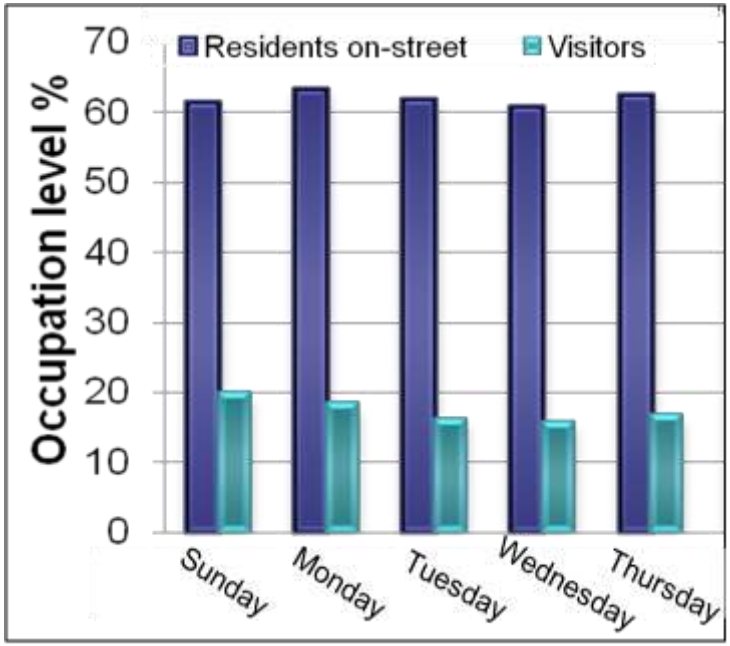
Parking demand and supply

Parking spatial pattern

TURNOVER and DRIVERS' TYPES: Field surveys



For a certain day of the week and hour, parameters of the parking system are stable



Residents		Visitors	
Average occupancy (weekdays)	STD	Average occupancy (weekdays)	STD
61.8%	0.94%	17.4%	1.77%

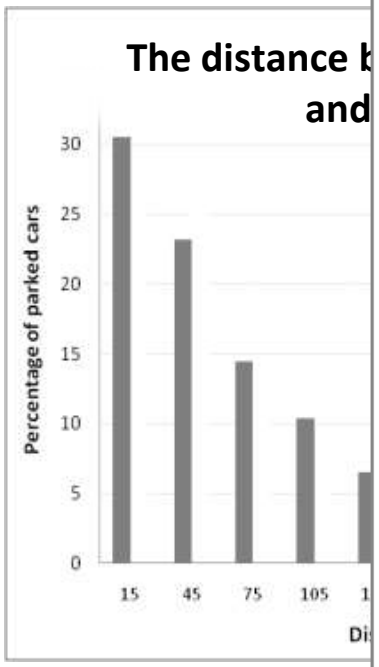
Parking demand and supply

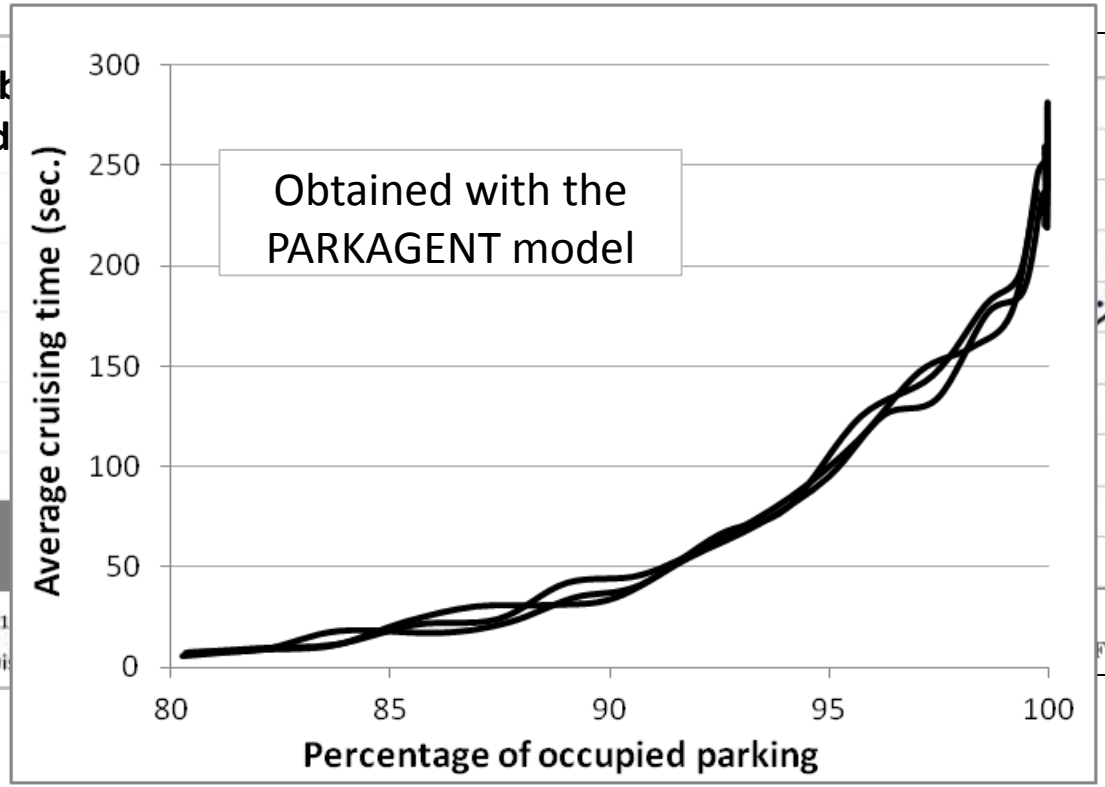
Parking spatial pattern

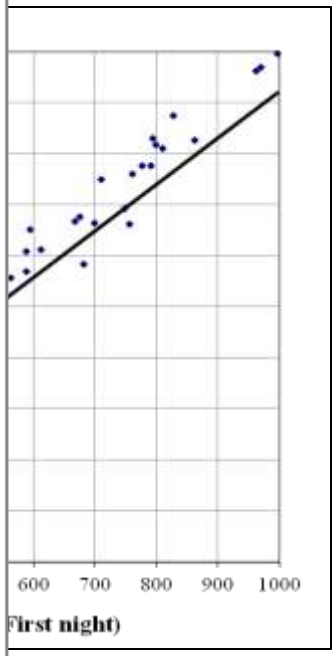
DESTINATION-PARKING PLACE DISTANCE: Field surveys + Population Census

Given the parking fees, driver's satisfaction is defined by

- *Duration of the parking search*
- *Distance between the parking place and destination*







Parking demand and supply

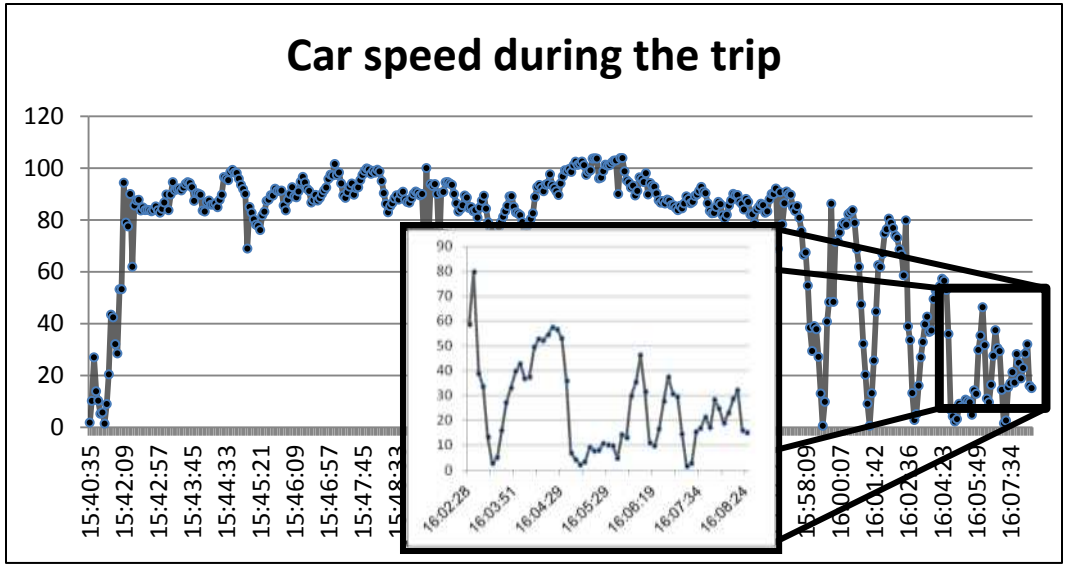
Parking spatial pattern

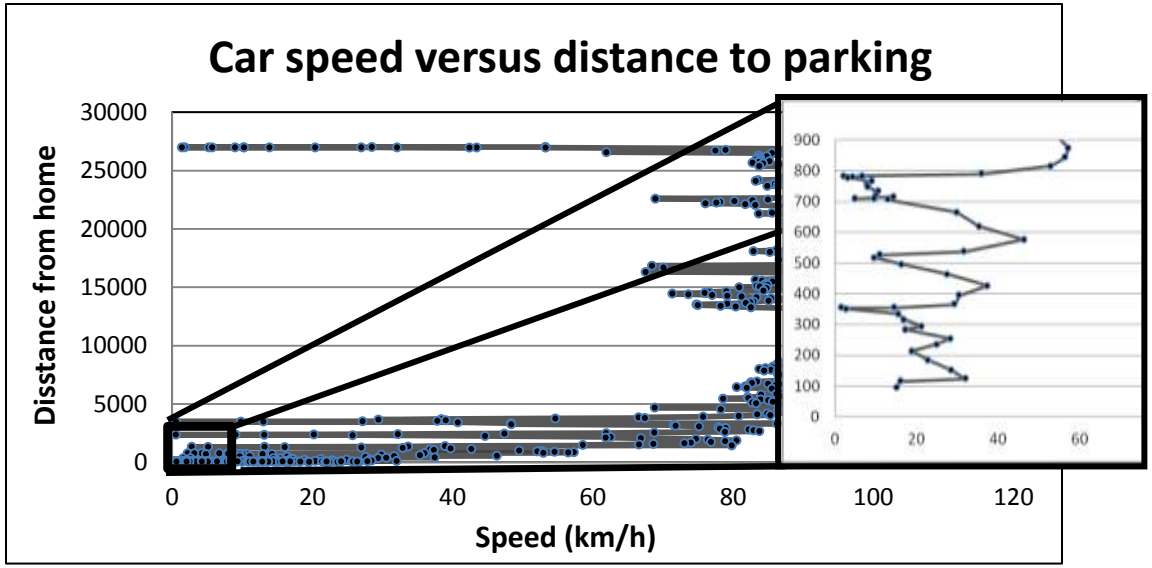
Standard GIS and census data together with the proper survey methodologies guarantee reliable estimates of parking demand, supply, and spatial patterns

For typical Western city,
field surveys demand 20-40 person-weeks and are performed in 2-4 weeks

Drivers' parking behavior

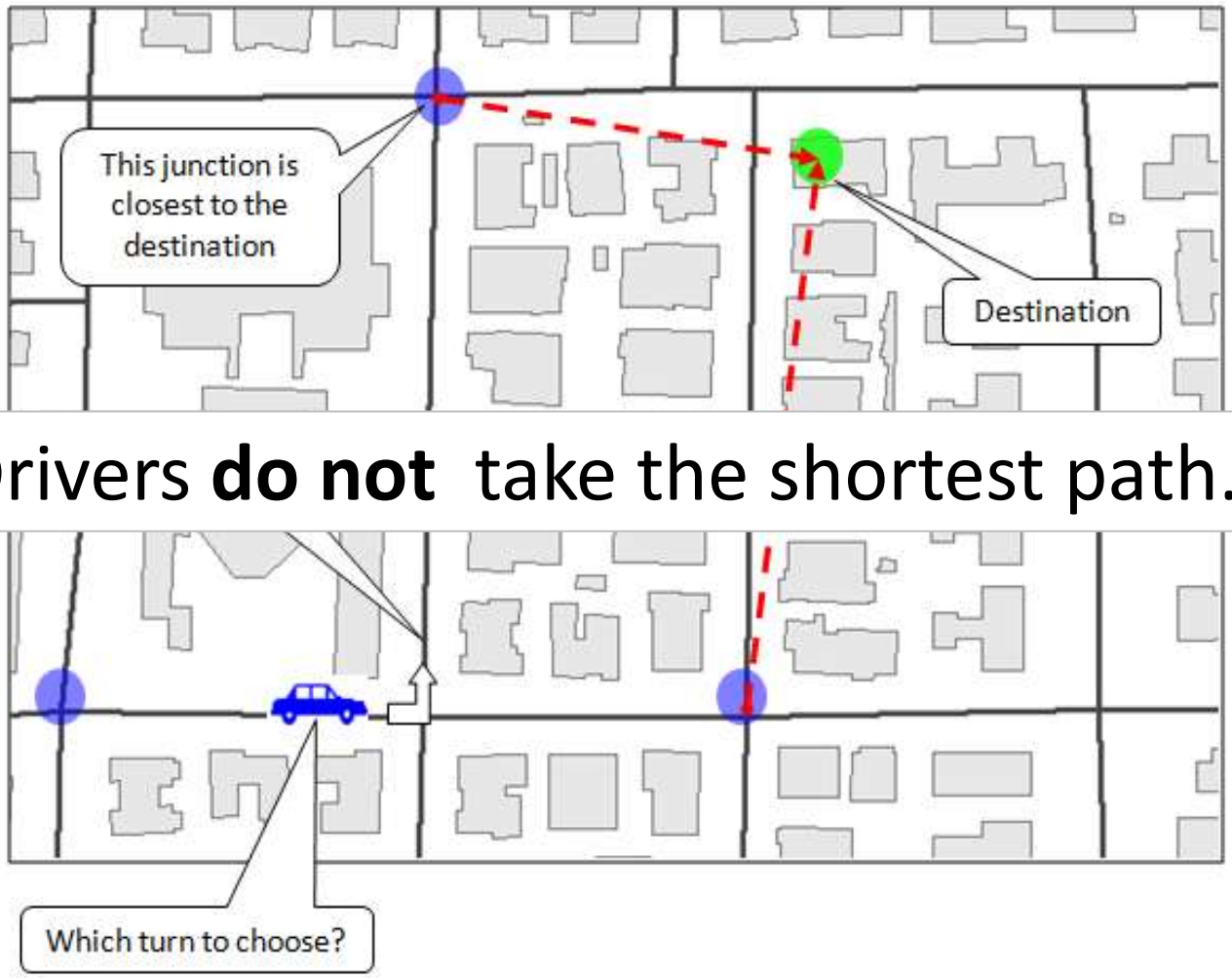
DRIVERS' PREFERENCES DURING PARKING SEARCH: GPS data loggers and interviews with drivers





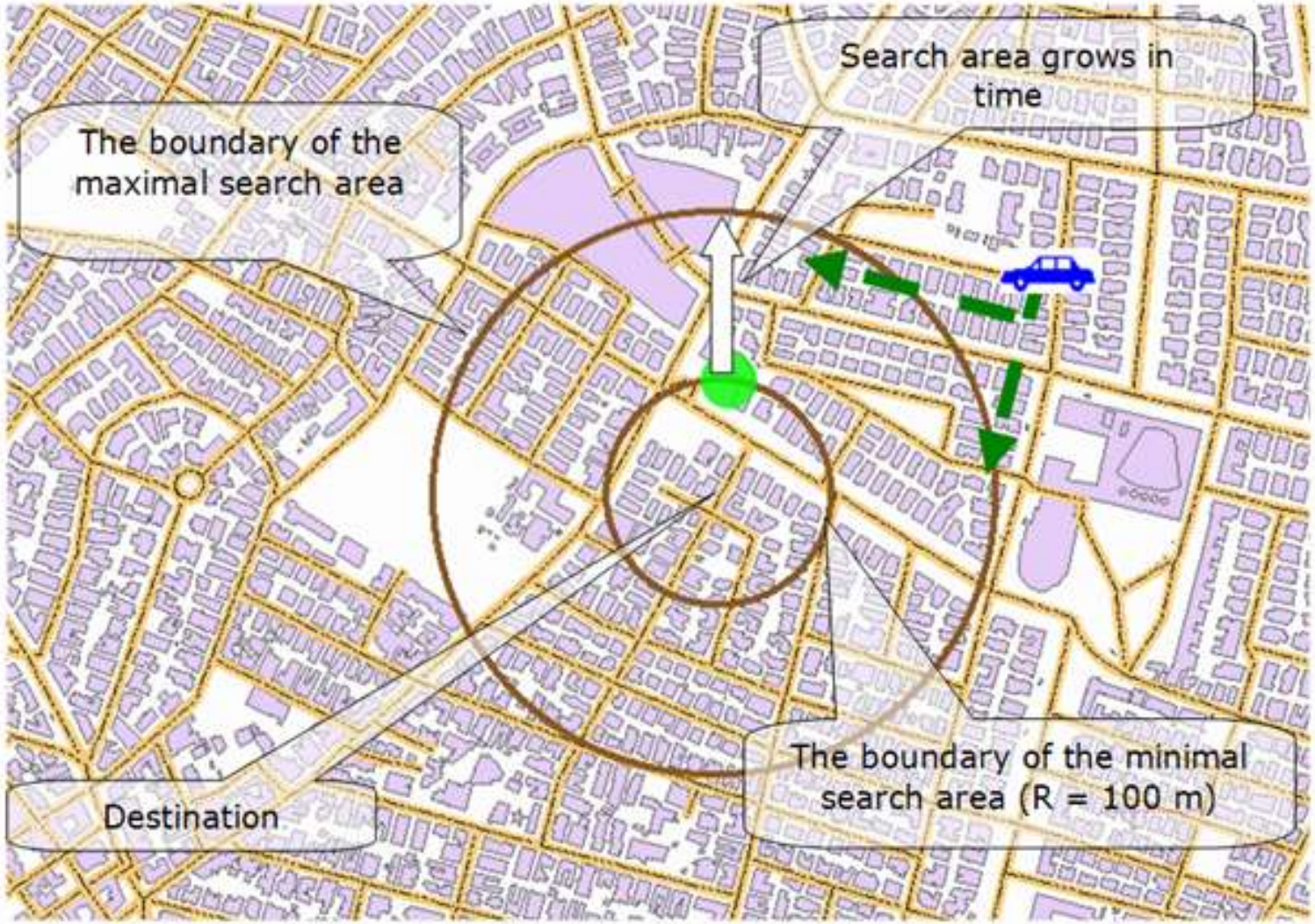
Drivers' parking behavior

DRIVERS' BEHAVIOR ON THE WAY TO DESTINATION: GPS data logging + GIS + Heuristics



Drivers **do not** take the shortest path…

DRIVER'S BEHAVIOR AFTER MISSING THE DESTINATION: GPS data logging + GIS + Heuristics



Drivers' parking behavior

Analysis of drivers' parking trajectories, as registered by the GPS, provides adequate heuristic algorithms of drivers' parking behavior

Parking behavior does not depend on gender and age. The only meaningful feature is driver's experience of parking in the area, and its effects are currently studied by Geert Tasseron (Nijmegen)

Parking dynamics in space and time

PARKING SPATIAL PATTERNS: PARKFIT algorithm

High-resolution data on parking demand and supply enable static estimate of the parking pattern for **constant (usually maximal) demand**

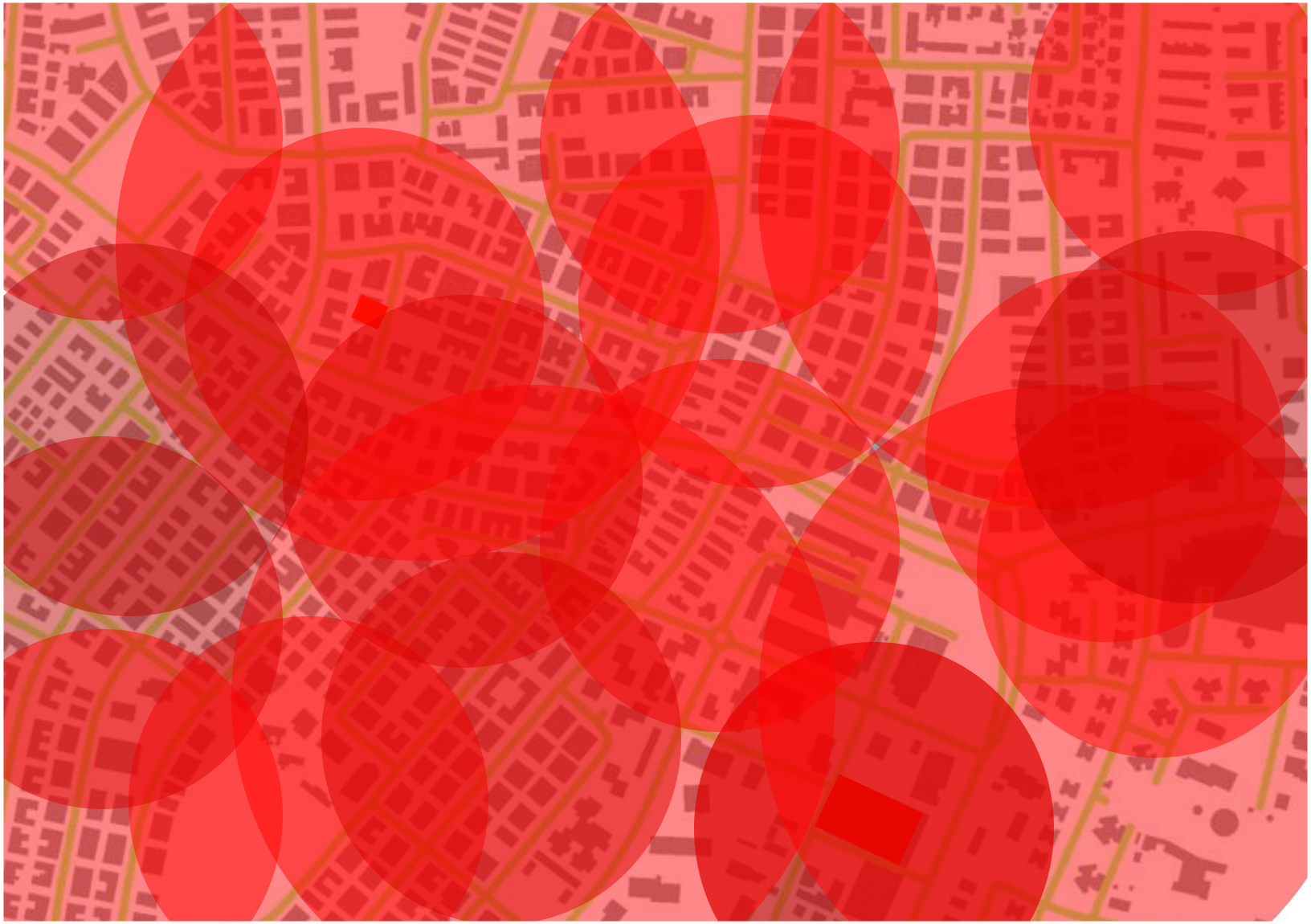
ID	Underground Parking	Residents demand	Workers demand
34	10	20	5

ID	Road ID	Curb Parking	Restrictions
4809	20394	10	Residents only

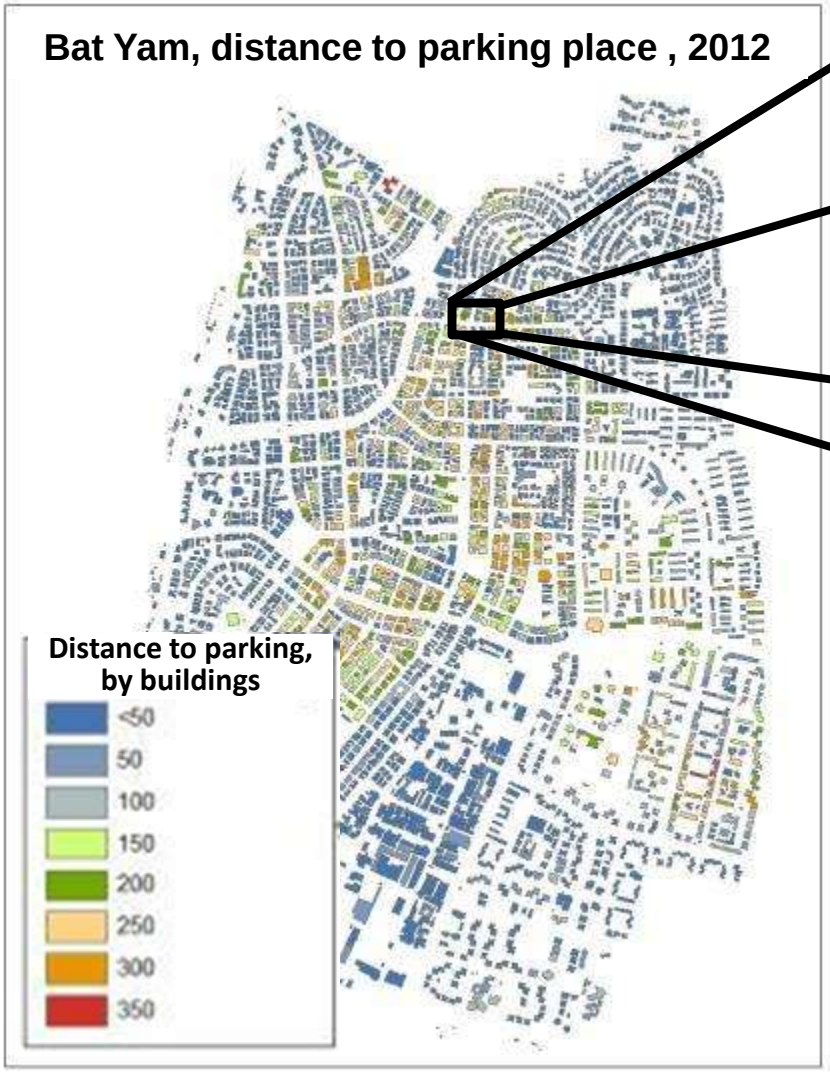
PARKING SPATIAL PATTERNS: PARKFIT algorithm

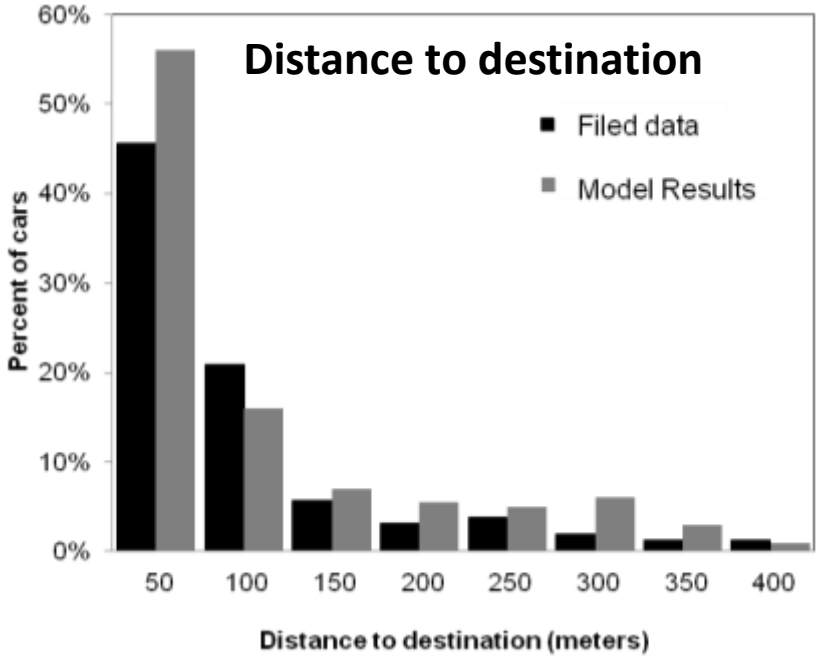
PARKFIT: fixed distance to destination

PARKFIT: varying distance to destination



PARKFIT outputs





PARKING *SPATIO-TEMPORAL* PATTERNS
Multi-Agent Simulation Model
PARKAGENT


Residents

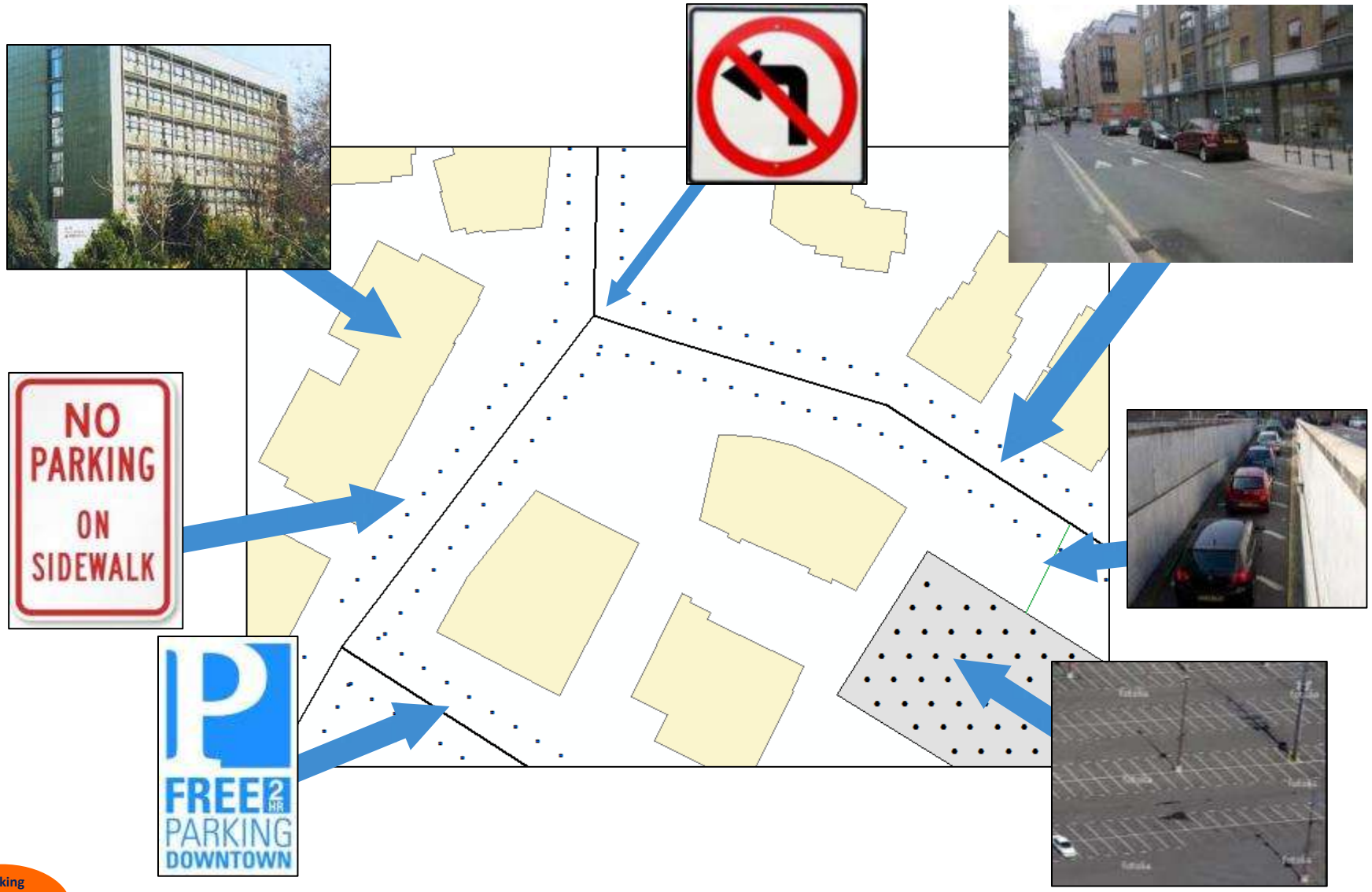

Commuters

Guests


Customers

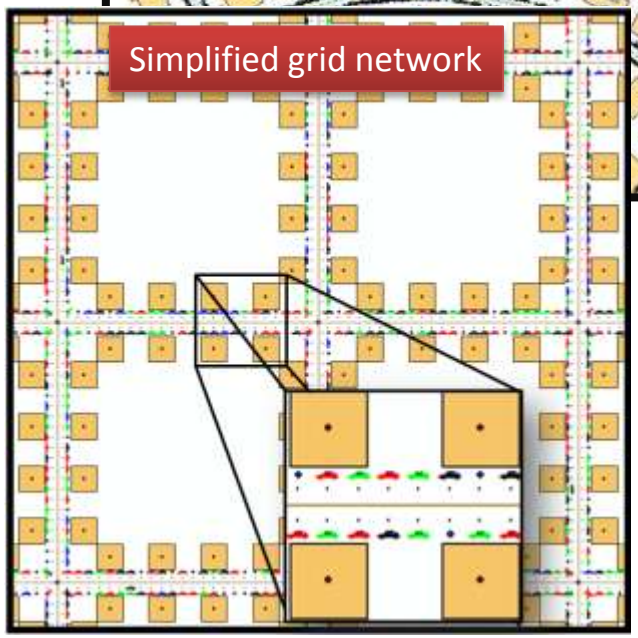
Parking dynamics in space and time

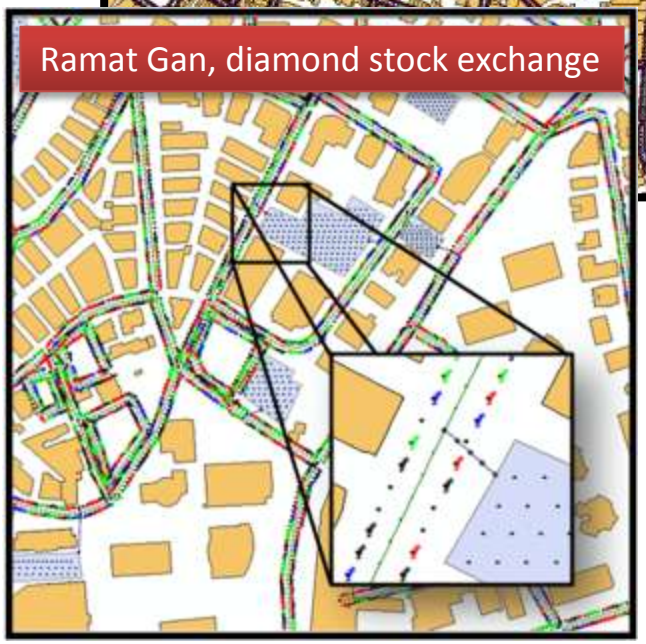
PARKAGENT is spatially explicit



Parking dynamics in space and time

PARKAGENT is easily adjustable to a new city





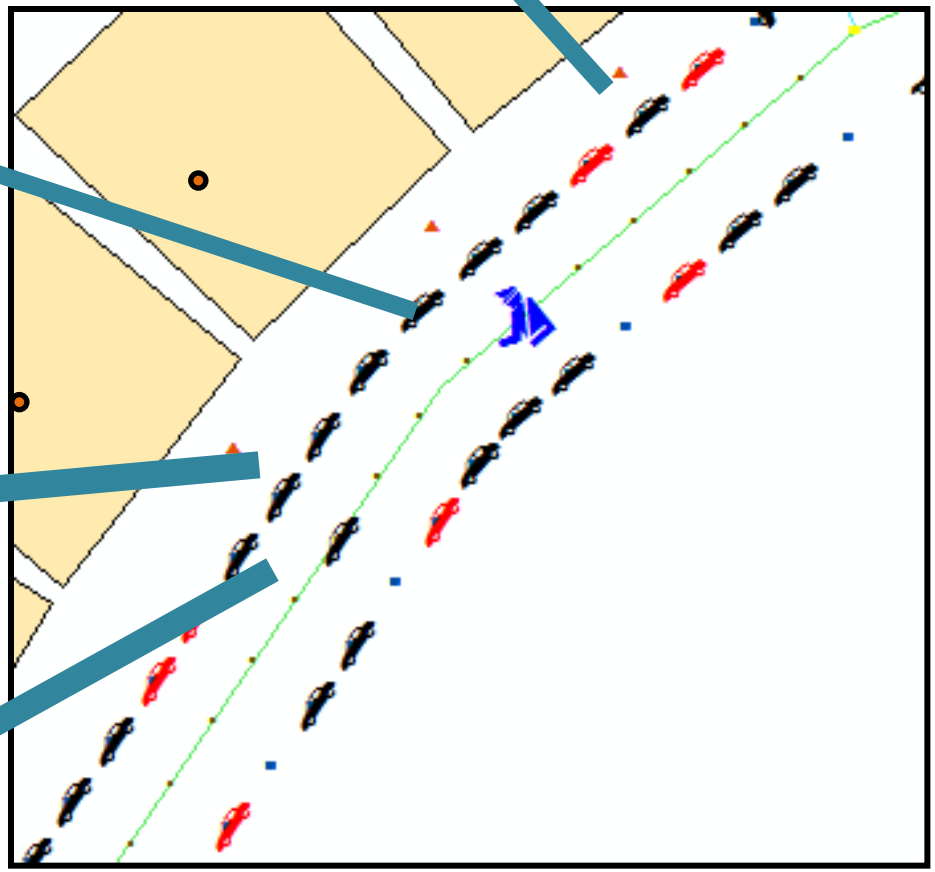
PARKAGENT generates great variety of parking statistics

Occupancy rate per street

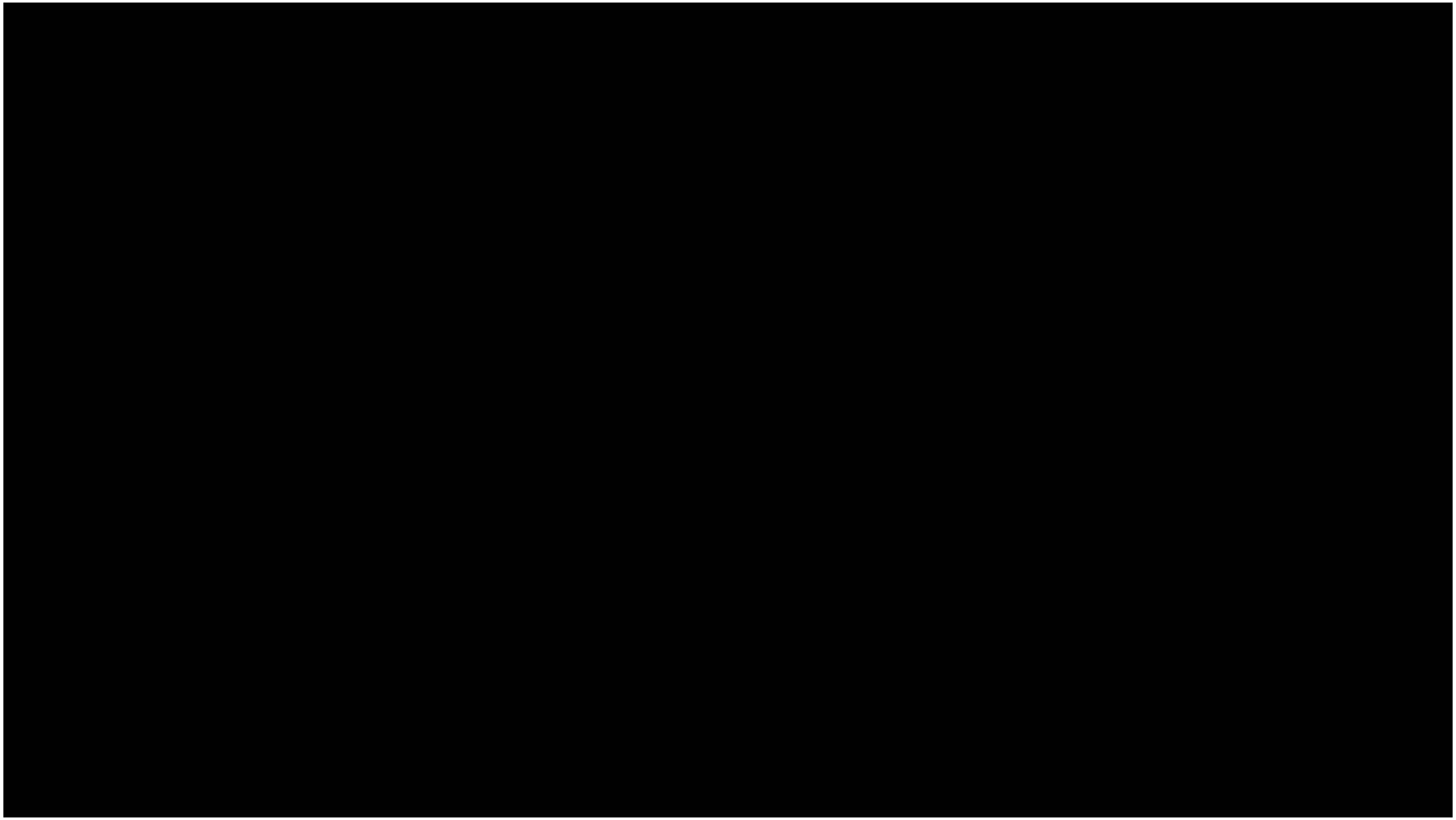
No of issued tickets

Distance to Destination

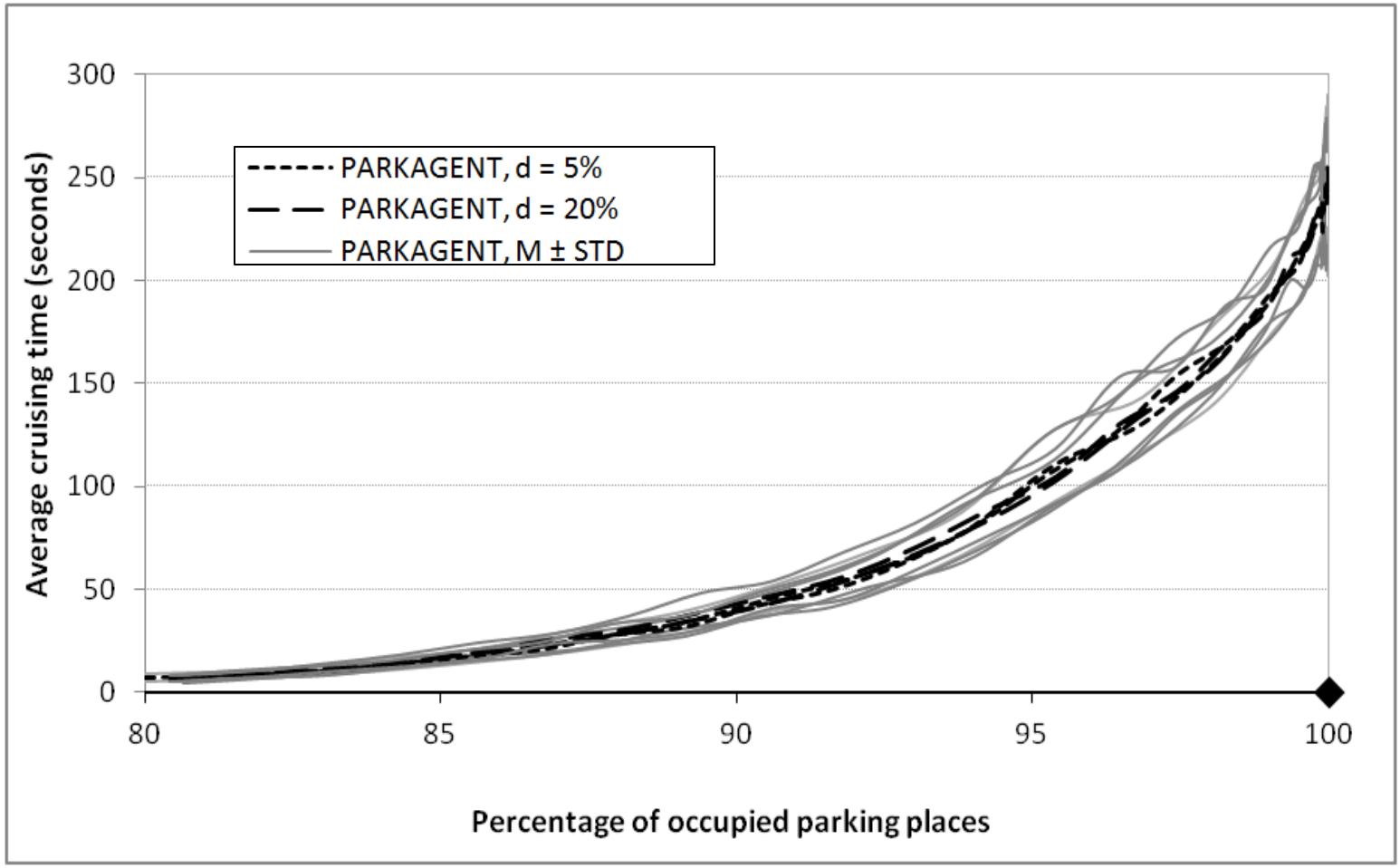
Cruising time



A closer look at the PARKAGENT

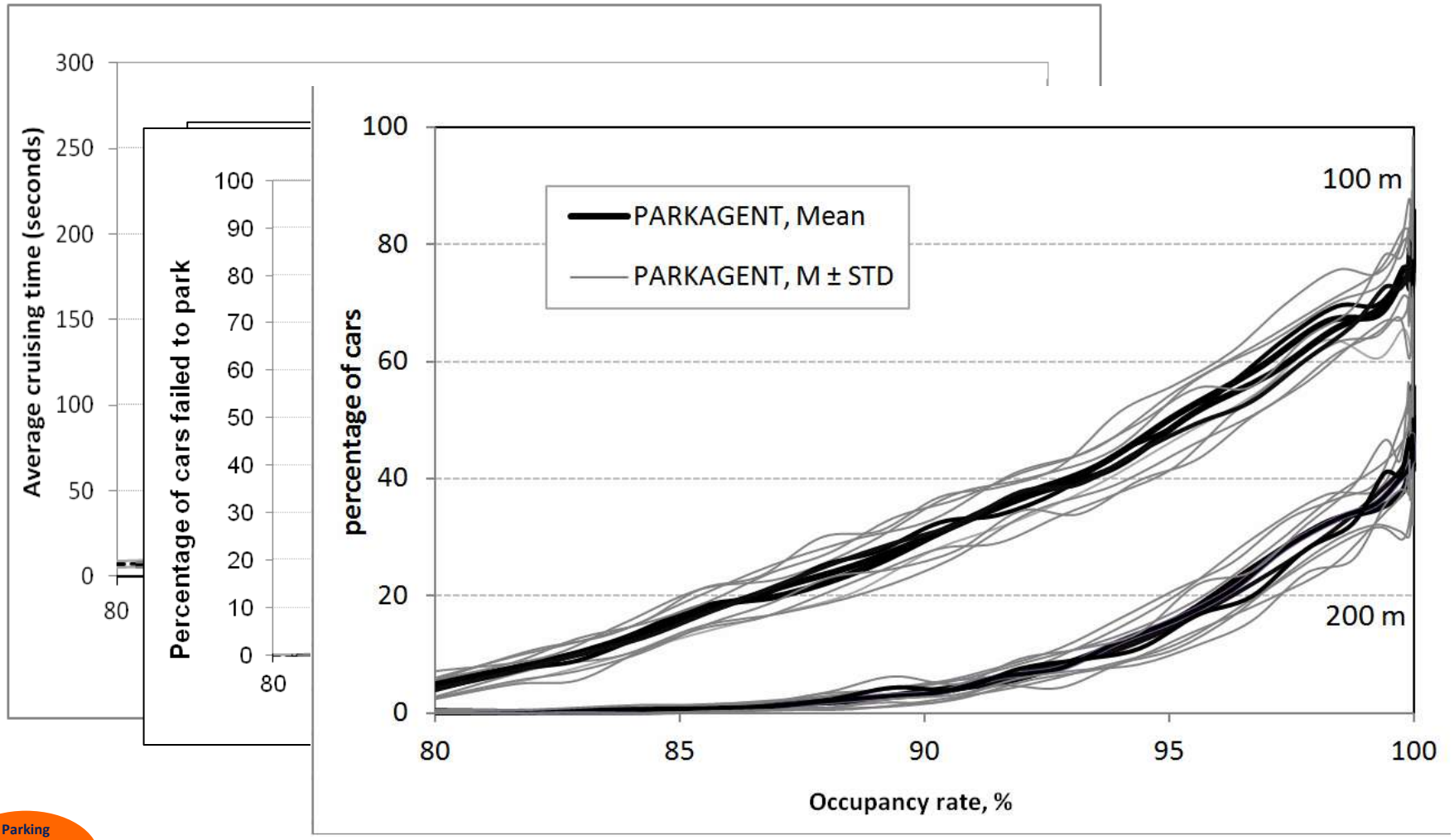


PARKAGENT REVEALS UNIVERSAL DEPENDENCIES
Driver's cruising time as a function of occupation rate



PARKAGENT REVEALS UNIVERSAL DEPENDENCIES

Average cruising time, fraction of drivers failed to park, fraction of drivers parking at a certain distance to destination as a function of OCCUPANCY RATE



Parking dynamics in space and time

Simulation models adequately describe parking dynamics in space and in time. The models exploit data on parking demand, supply, turnover and on the drivers' parking behavior, and are easily adjusted to a new city

The models reveal several universal characteristics of the urban parking patterns. Model results fit very well to the survey data

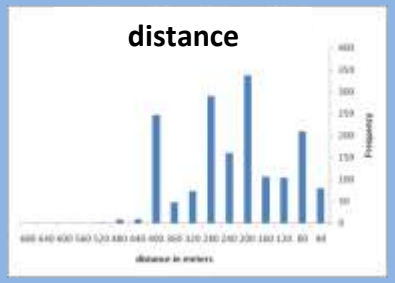
Parking management and policy assessment

PARKAGENT: Cost-benefit analysis of new parking facility

Different development plans were interpreted as the models scenarios:

1 – 10: Planned office buildings

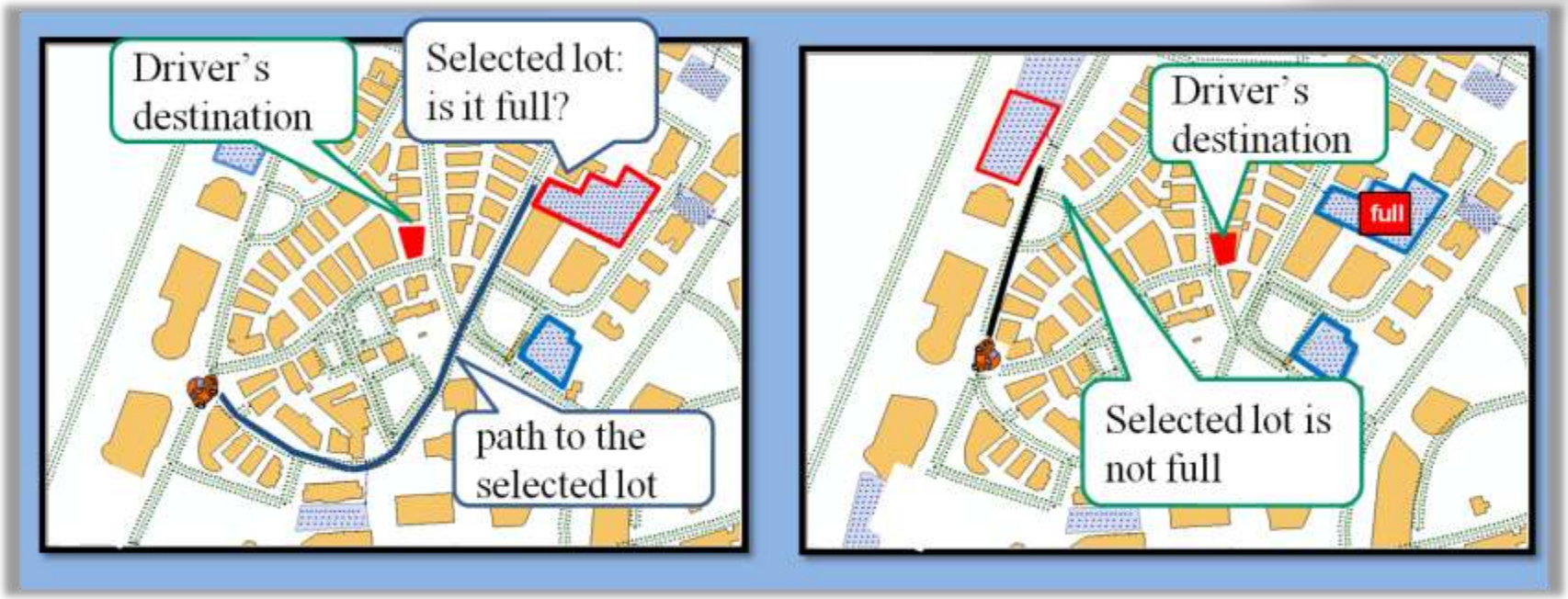
For each scenario, estimates of occupancy rate, distance to destination, search time



Scenario, certainty	Average dist to the office	Average parking search	**Parked in Bialik Garage**
A, low	150	8.8 min	348
B, low	243	6.6 min	514
C, high	**214**	**5.5 min**	**600**

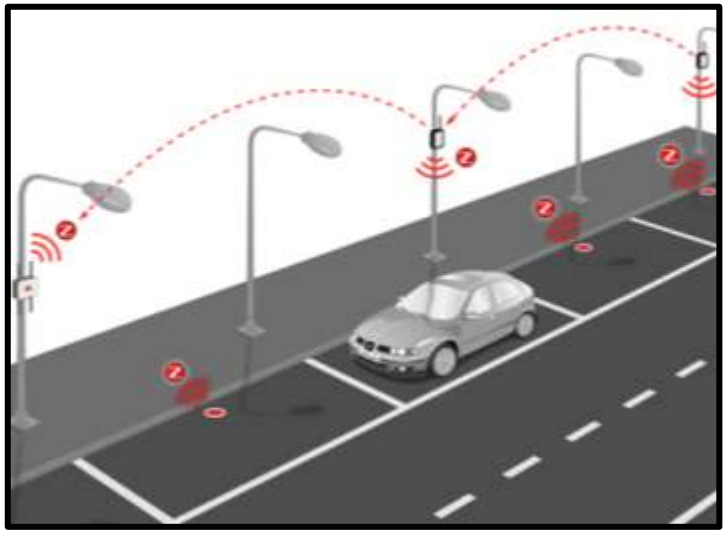
Example of the model outputs

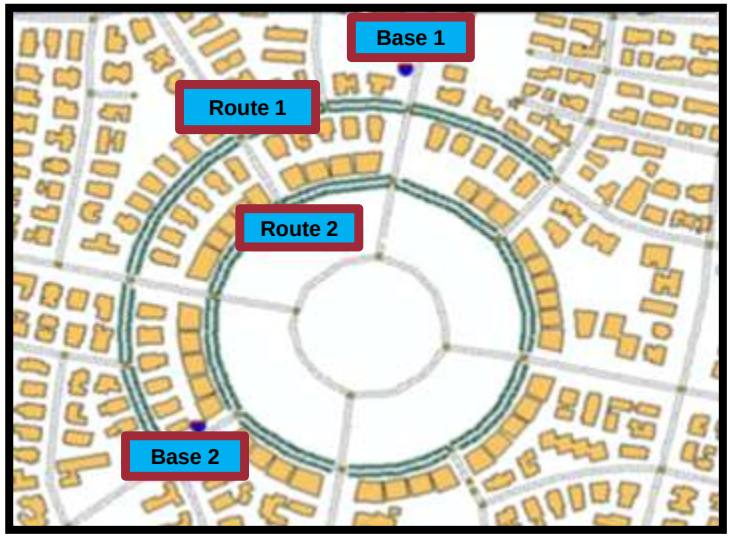
PARKAGENT: New garage will not justify itself unless signpost system will be introduced



The signpost system that directs drivers to the lots that have vacant places decreases search time by 30%

PARKAGENT: Estimating the necessary level of inspection for a new censor technology





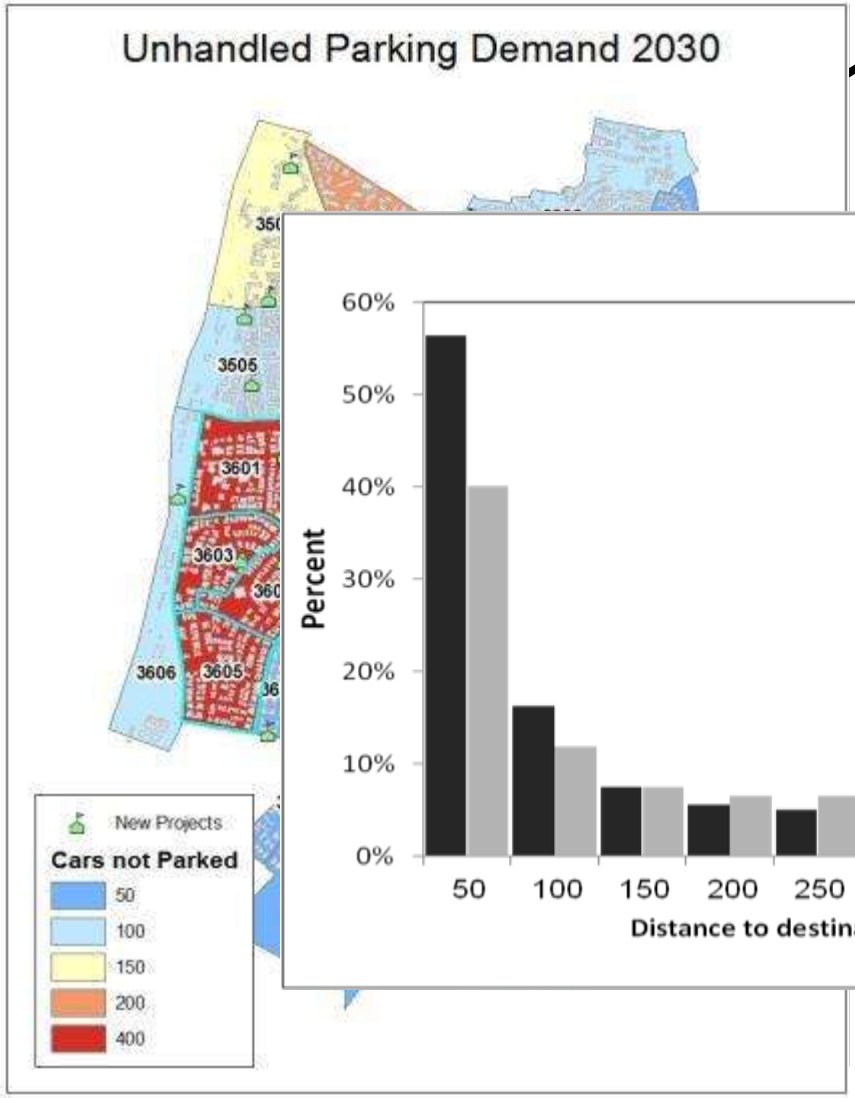
TYPE	Route	Base
Parking events	1268	1263
Parking violations	204	190
Number of empty parking's checked	278	0
Number of valid driver's checked	2373	0
Number of drivers that have a ticket	31	0
Number of tickets issued	313	180
Total number of parking checked	5281	180
Ticket / checks ratio	**0.046**	**1**

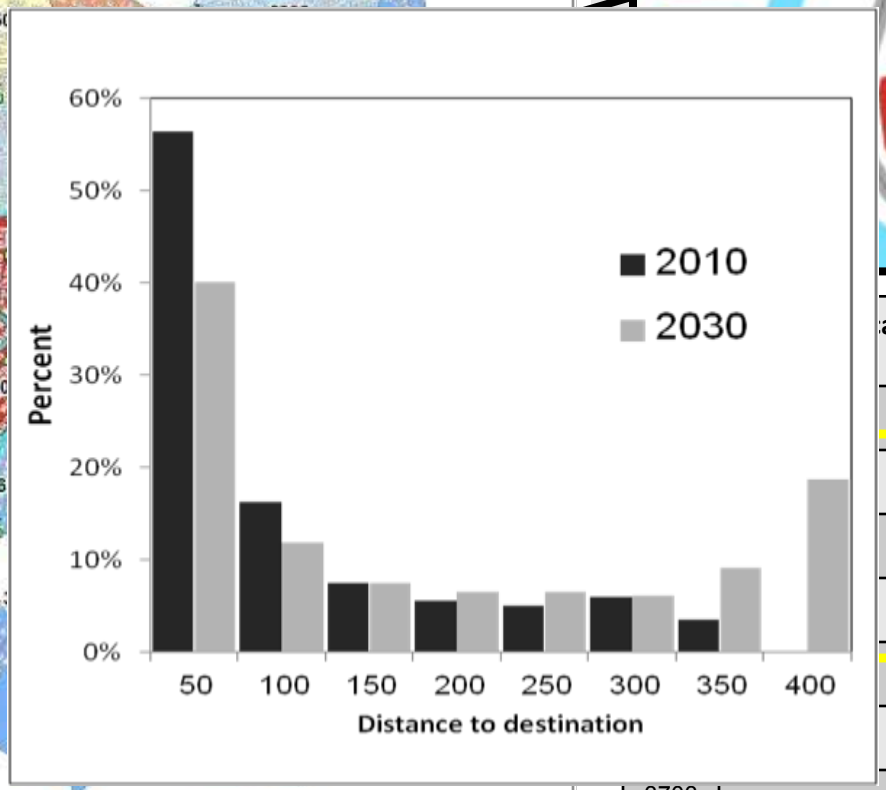
15% violations

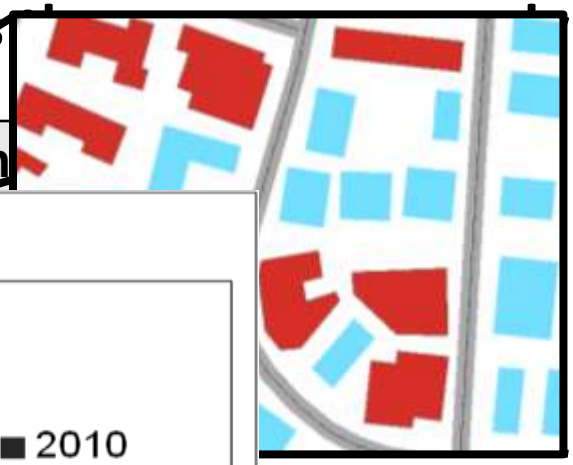
TYPE	Route	Base
Parking events	1282	1222
Parking violations	365	362
Number of empty parking's checked	274	1
Number of valid driver's checked	1971	0
Number of drivers that have a ticket	35	0
Number of tickets issued	232	337
Total number of parking checked	1225	338
Ticket / checks ratio	**0.09**	**0.99**

30% violations

PARKFIT: Planning parking in Bat-Yam (200,000) in 2030





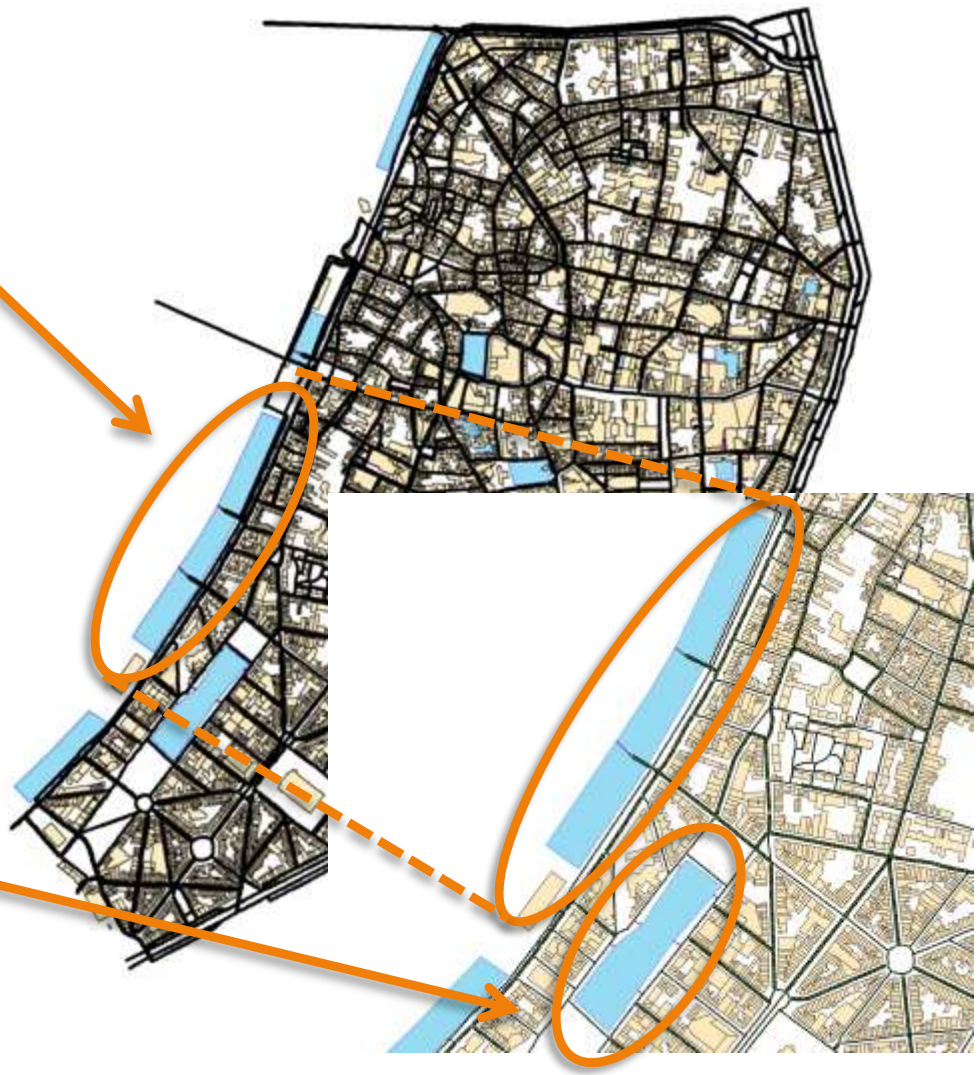


ar	Growth of parking supply	Parking deficit
	~100	~460
	0	~400
	50	~600
	0	~950
	0	~330
	0	~380
3703 ~720	360	~360
3704 ~360	0	~360
3705 ~325	0	~325

Parking management and policy assessment

Antwerp application (Geert Tasseron, Nijmegen)

- Closure of huge free parking lot of 3000 places along the quay
- Use PARKAGENT to study the effects of new underground **paid** parking lot of 1000 pp
- Study on effects of closure of free parking lot Gedempte Zuiderdok



Our data and models are sufficient for the knowledge-based parking policy making at all levels, from assessment of local parking solutions to establishment parking policy for the neighborhood, region, or entire city

THANK YOU!