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A Parking Location Choice Model for MATSim

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Why is parking important?

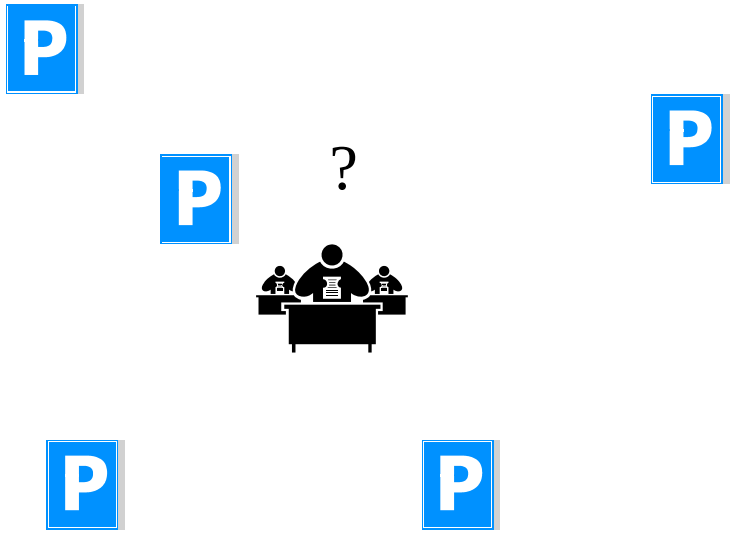
- Some studies identified 30% to 50% of traffic at central business district as parking search traffic
- Other studies report that parking policy can influence both transportation mode and traffic volumes

Problem definition

For a given activity destination, select from the set of public parkings in the neighbourhood so that the agent‘s utility is maximized?

Parking characteristics

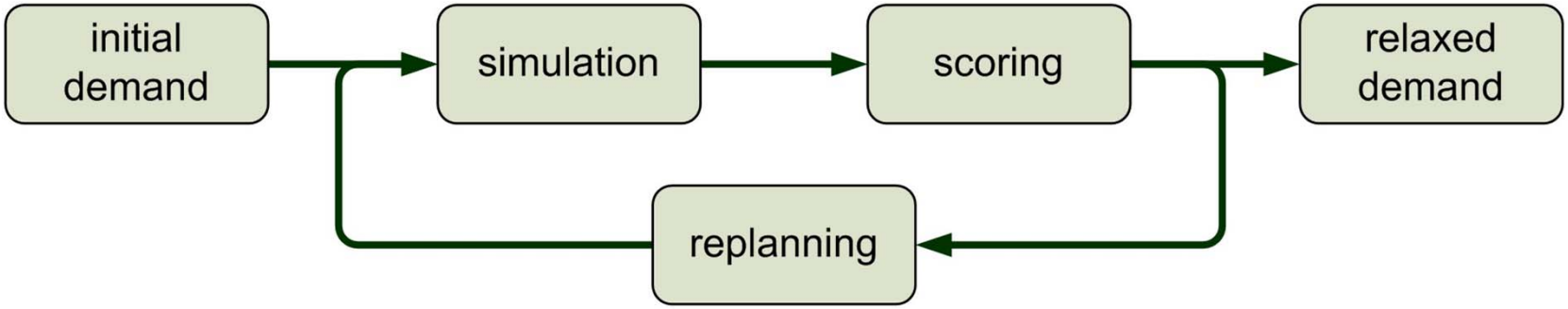
- price
- walking distance
- capacity
- parking access
- parking type
- (Etc.)



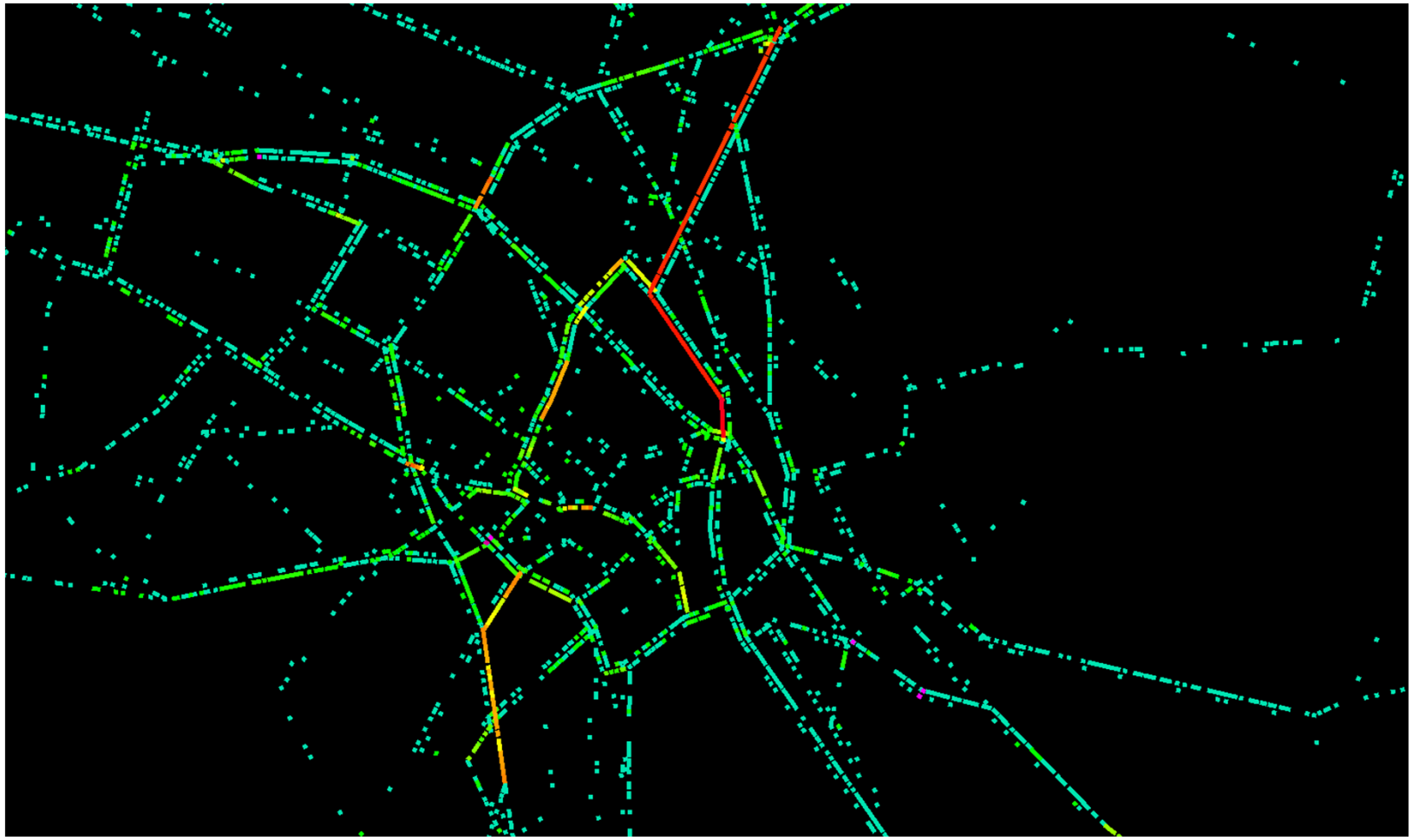
Parking Location Choice (not Parking Search!)

Demand Optimization in MATSim

MATSim (Multi-Agent Transport Simulation)



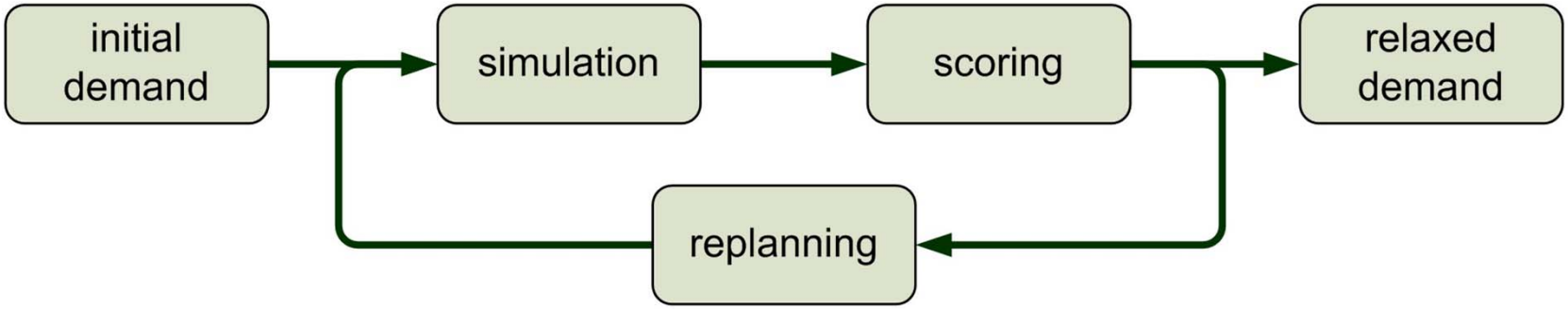
Demand Optimization in MATSim



Source: www.matsim.org

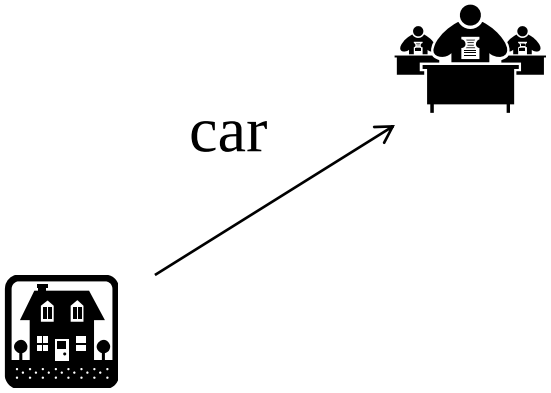
Demand Optimization in MATSim

MATSim (Multi-Agent Transport Simulation)

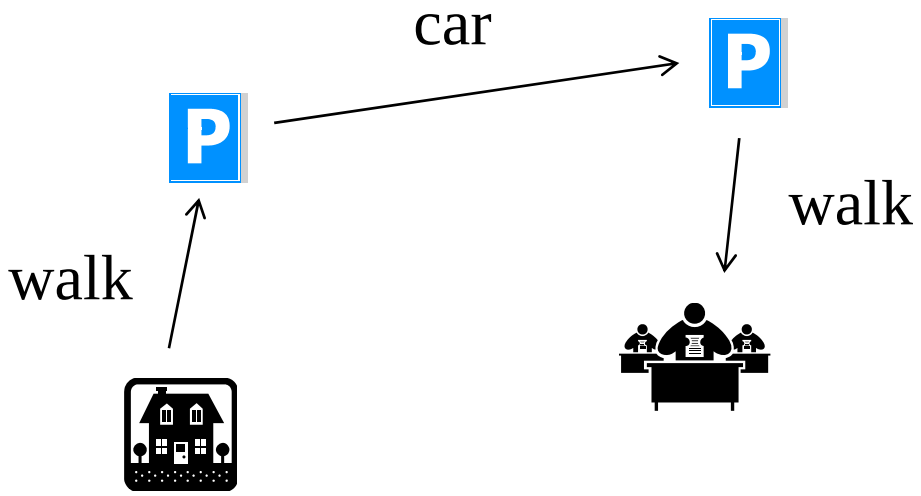


No changes to the MATSim simulation

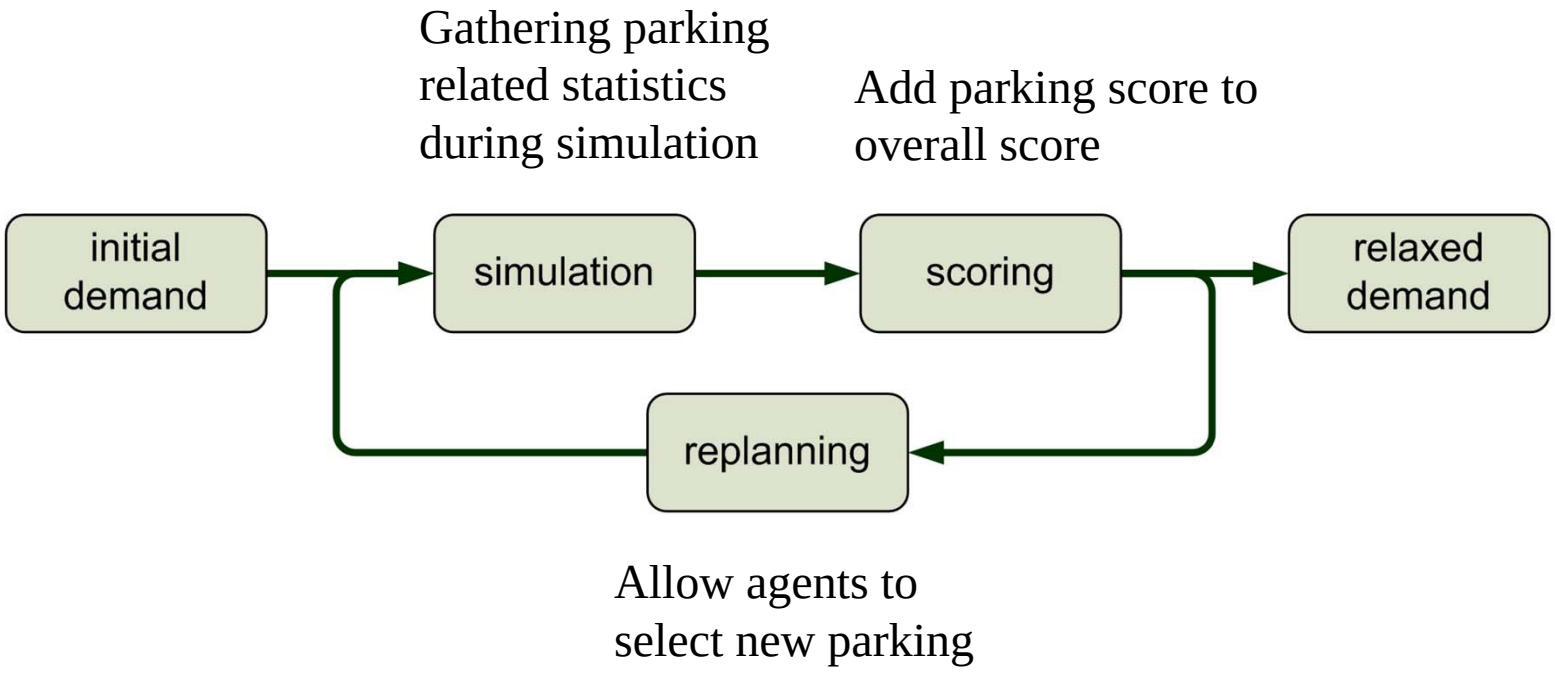
Till now



With parking



Parking location choice - implementation overview



Parking scoring function for experiments

- Components of the parking scoring function:
  - ParkingPriceScore
    - Parking duration, parking price, income
  - ParkingAccessScore
    - access time, any other access disutility
  - ParkingWalkingScore
    - distance, target activity duration and type
  - ParkingCapacityViolationScore
    - how full is parking at arrival time (this can be explicit or implicit)

- Weightes chosen:
  - Parking gets a total score between 0 and 5
  - ParkingCapacityViolationScore gets 10 times higher weight than other 3 Scores

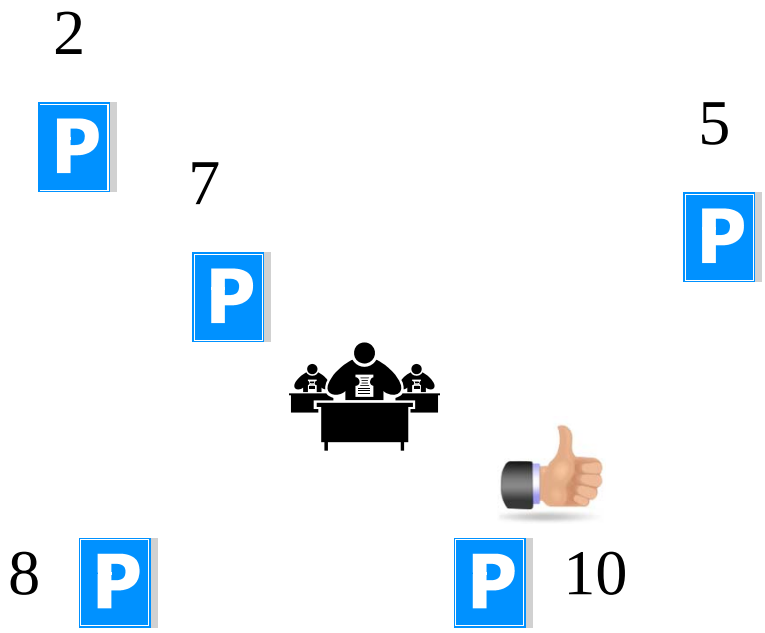
Parking location choice - replanning

Select, which parking to replan from all parkings done during the „previous“ day:

```
If (setOfParkingsWithCapacityViolation not empty){
        Select randomly one parking from
setOfParkingsWithCapacityViolation;
} else {
        Select randomly one parking from from all parkings.
}
```

Parking location choice – replanning (cont.)

Try to find parking with potentially higher score for the selected target activity (based parking statistics/estimates gathered during traffic simulation) in neighbourhood of target activity:

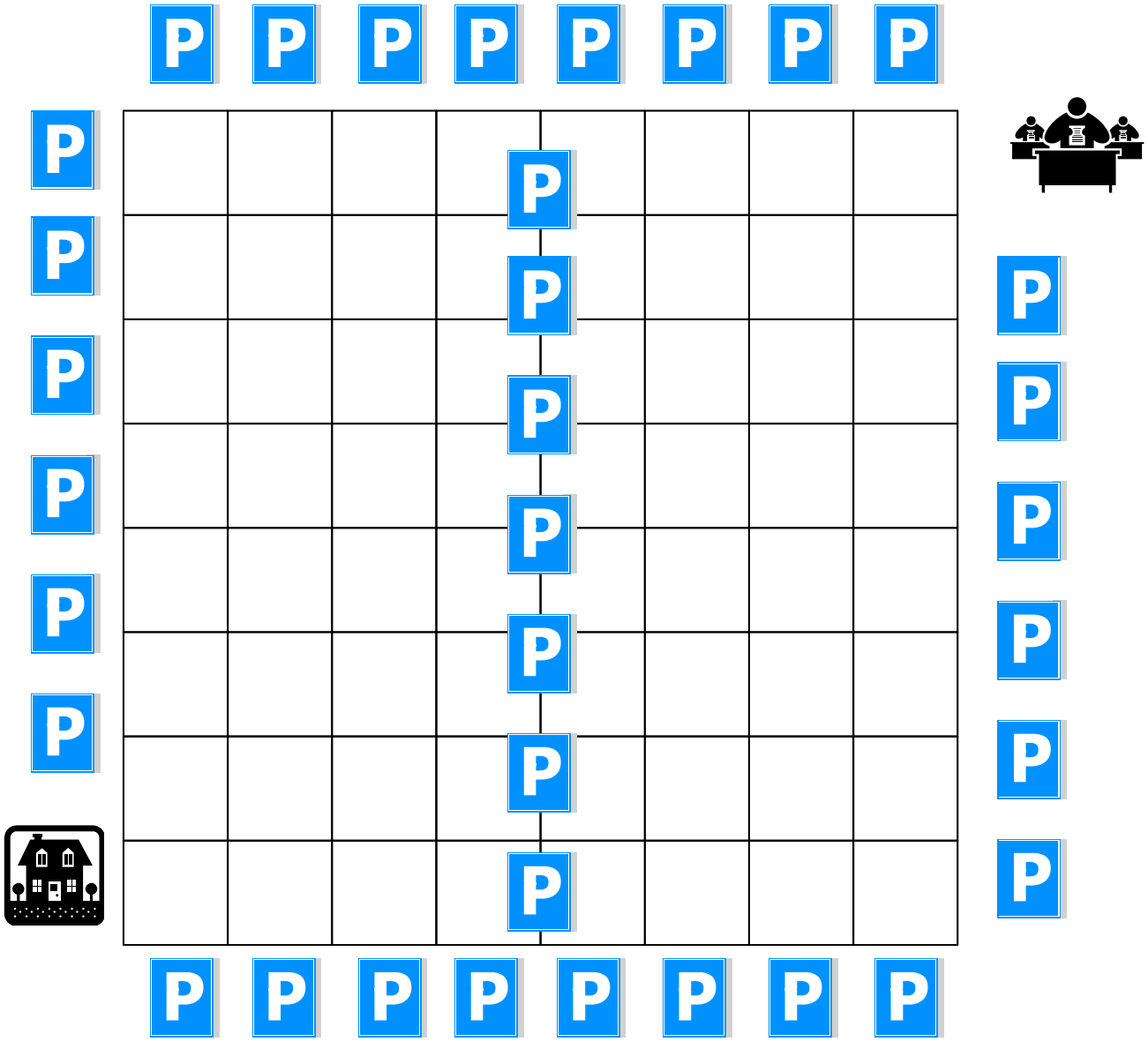


(the parking type choice also happens in this step)

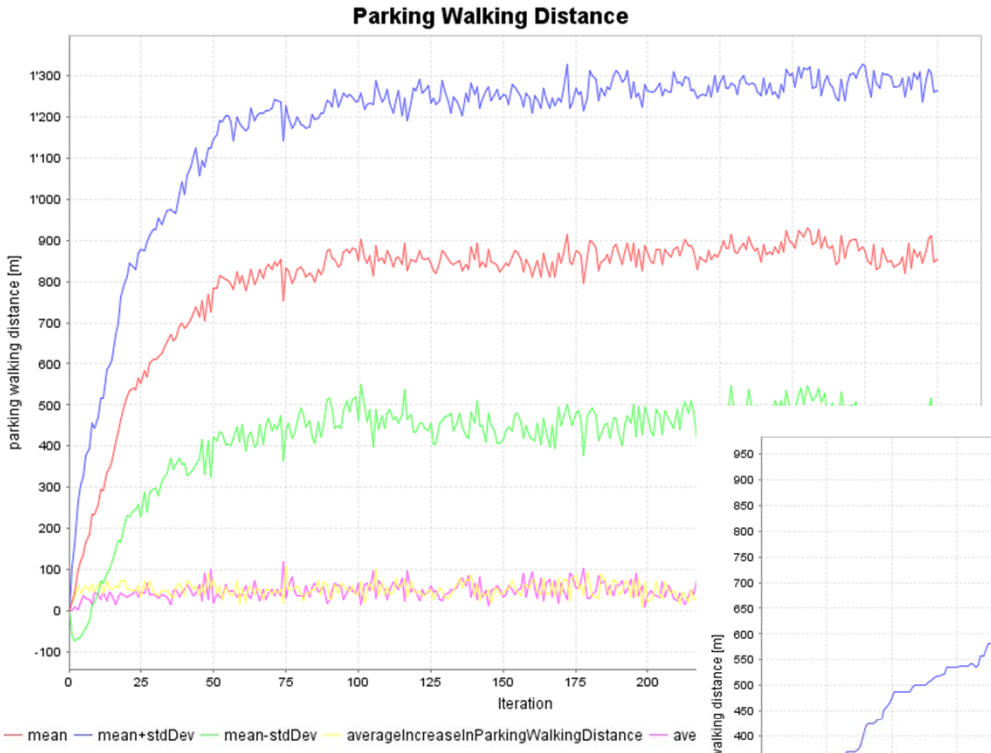
Experiments and sensitivity analysis results

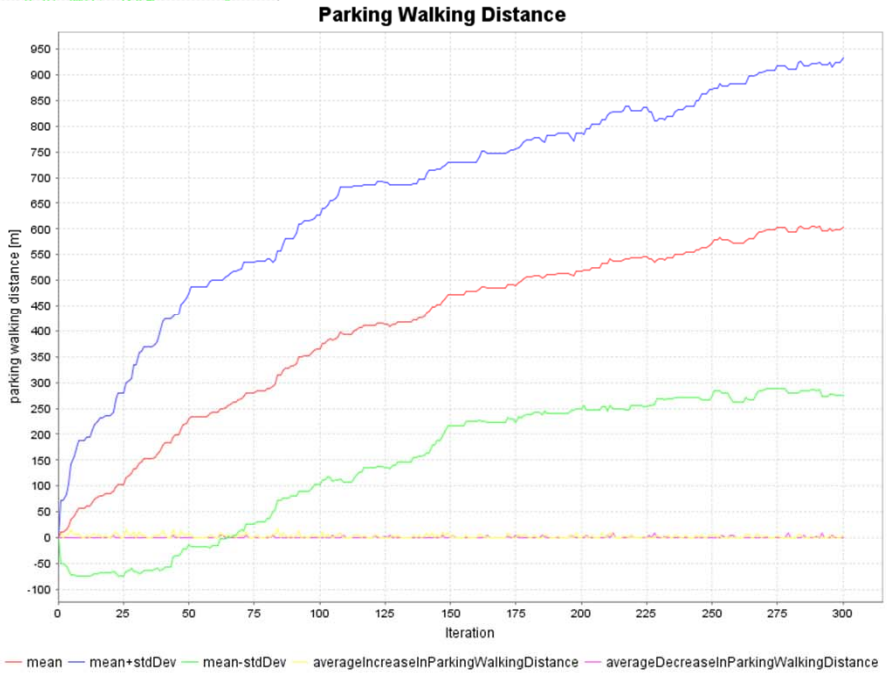
- Using small test scenario
- Run with one million agents on the test network tried out

Scenario layout (chess board)

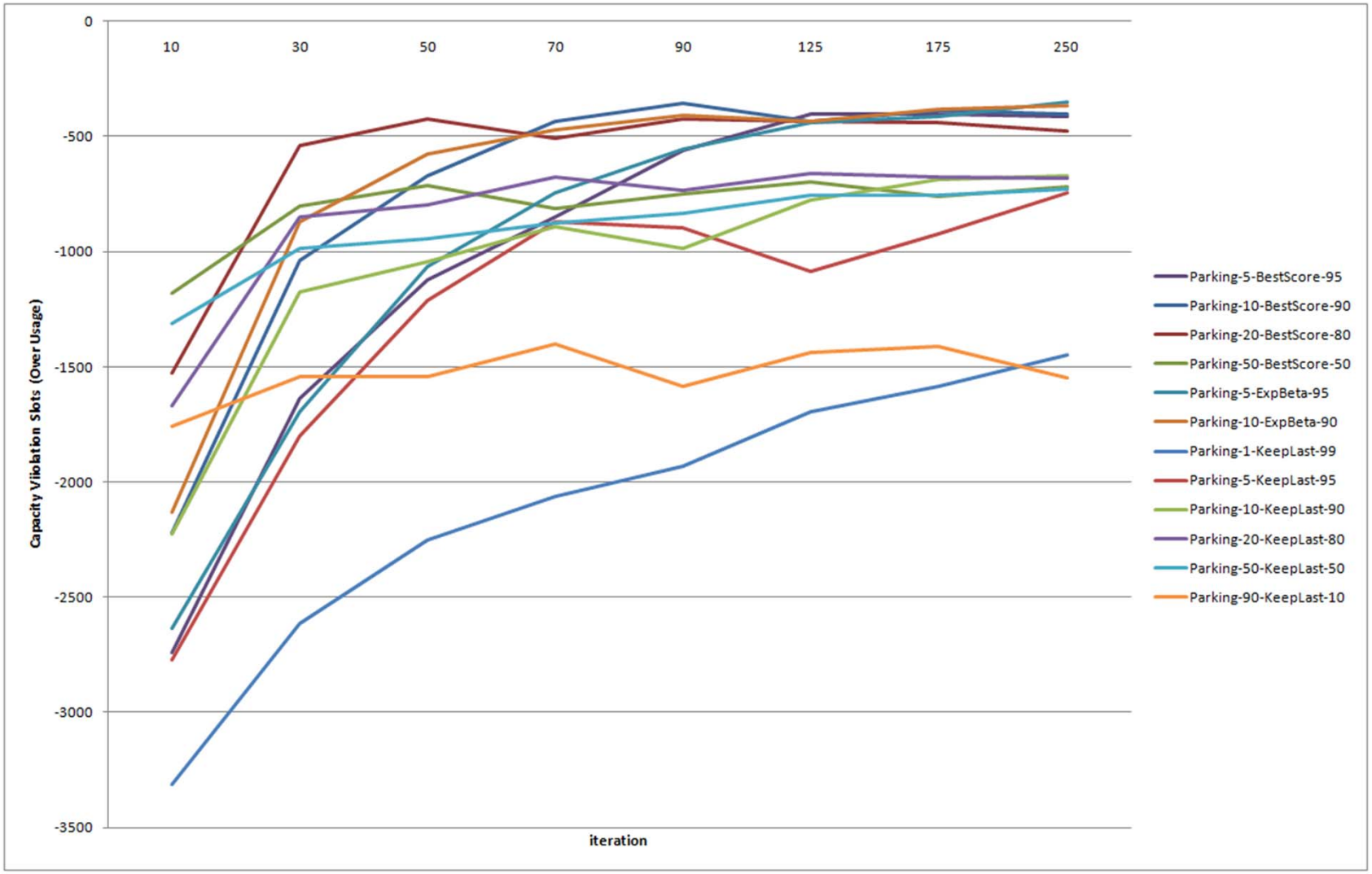


Does system relax? How many iterations?

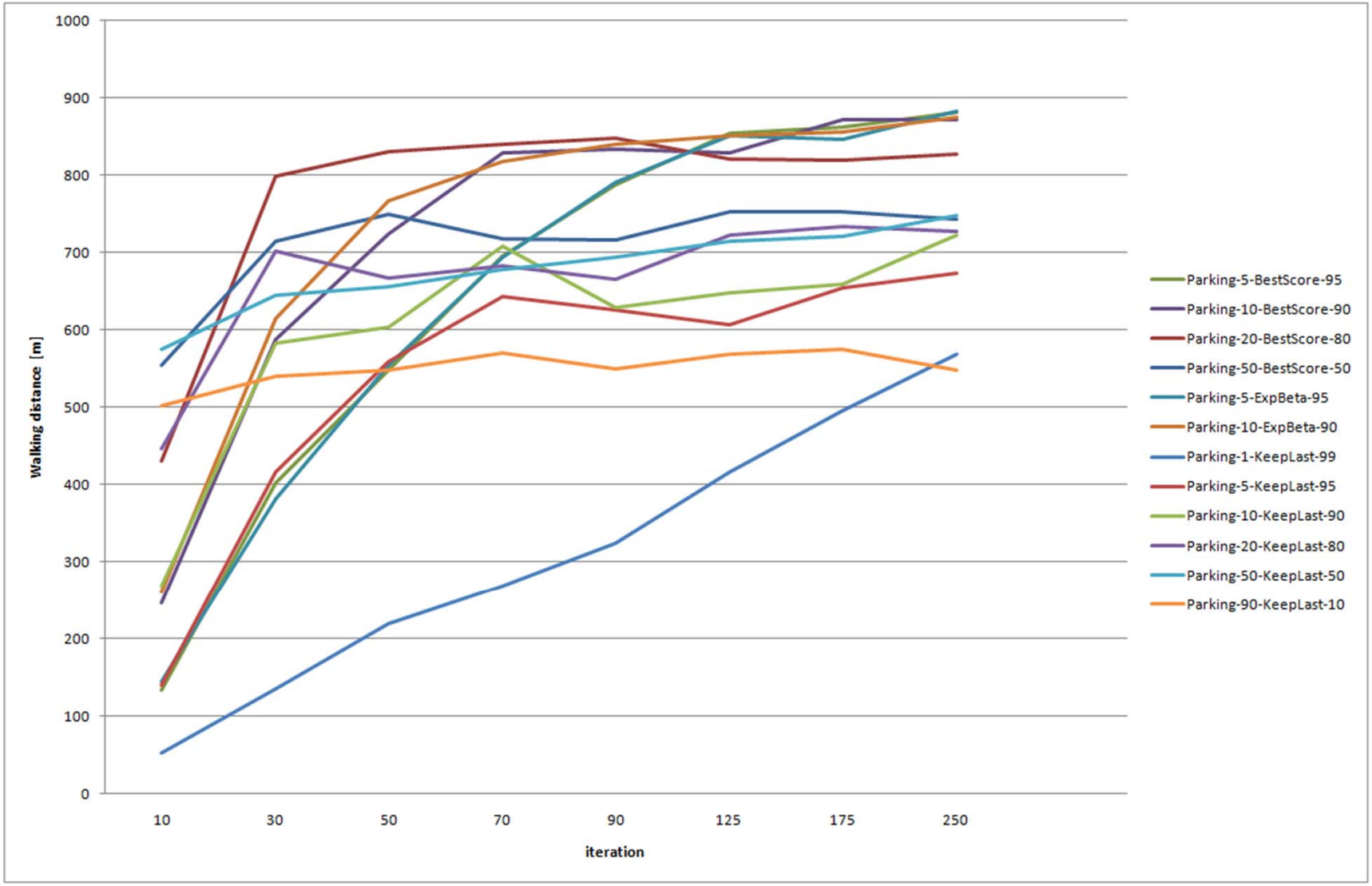




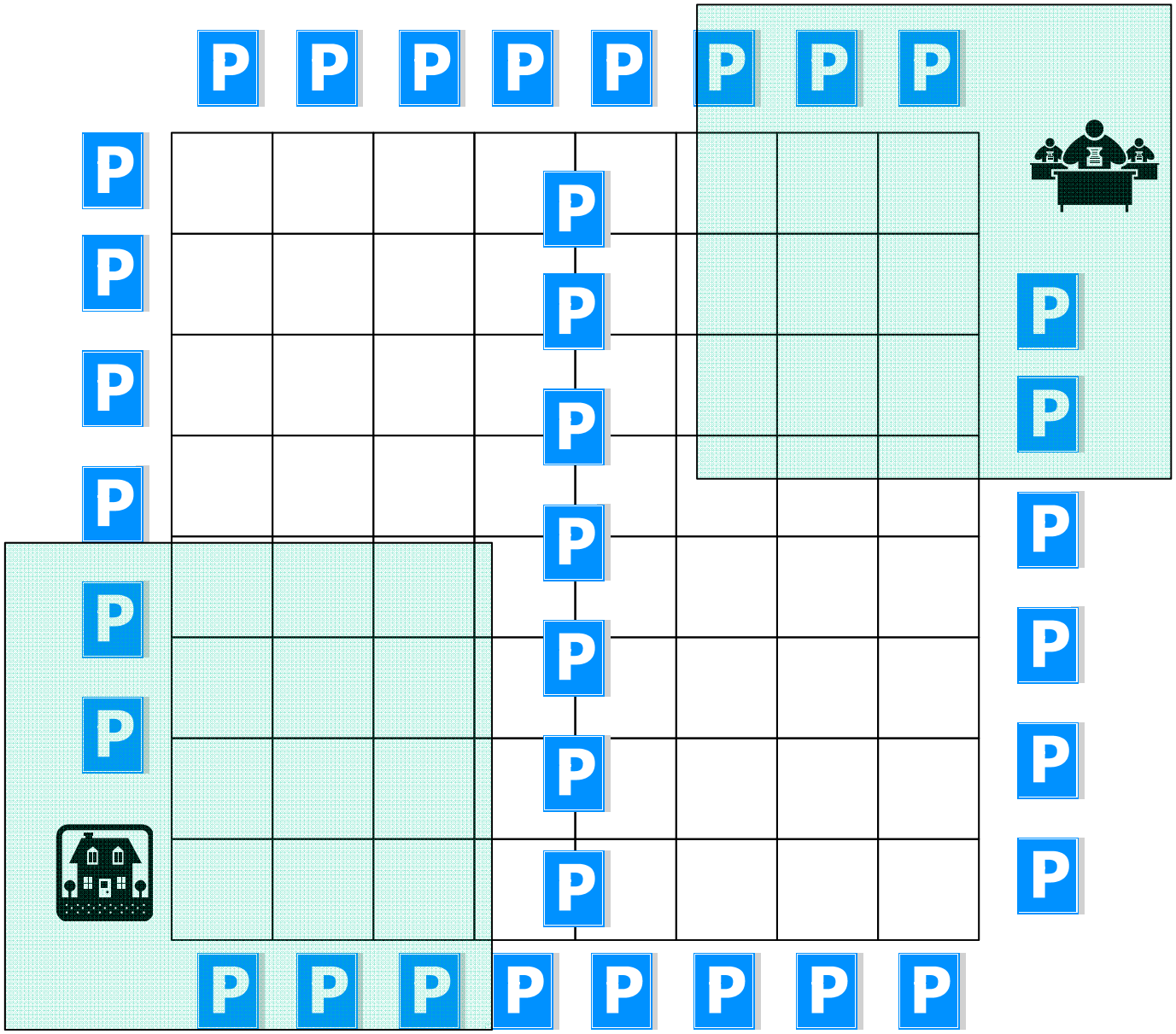
Relaxation measure 1: capacity violation reduction



Relaxation measure 2: walking distance

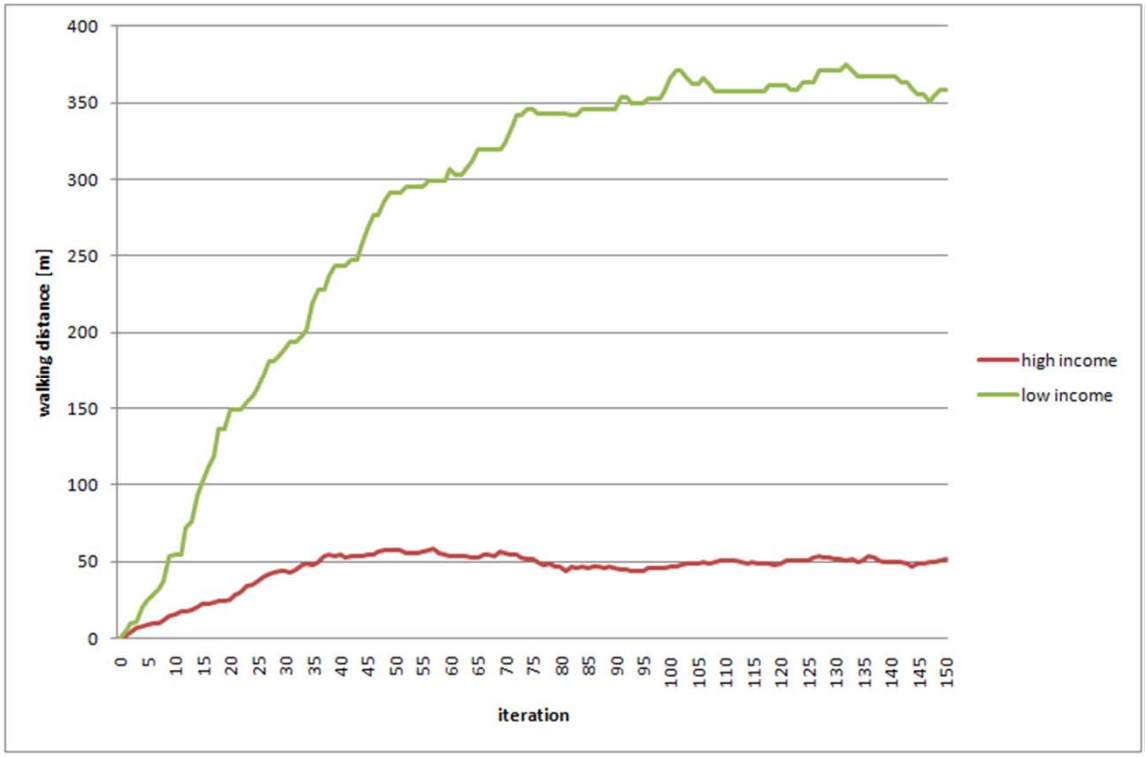


Scenario layout – grouping of parkings

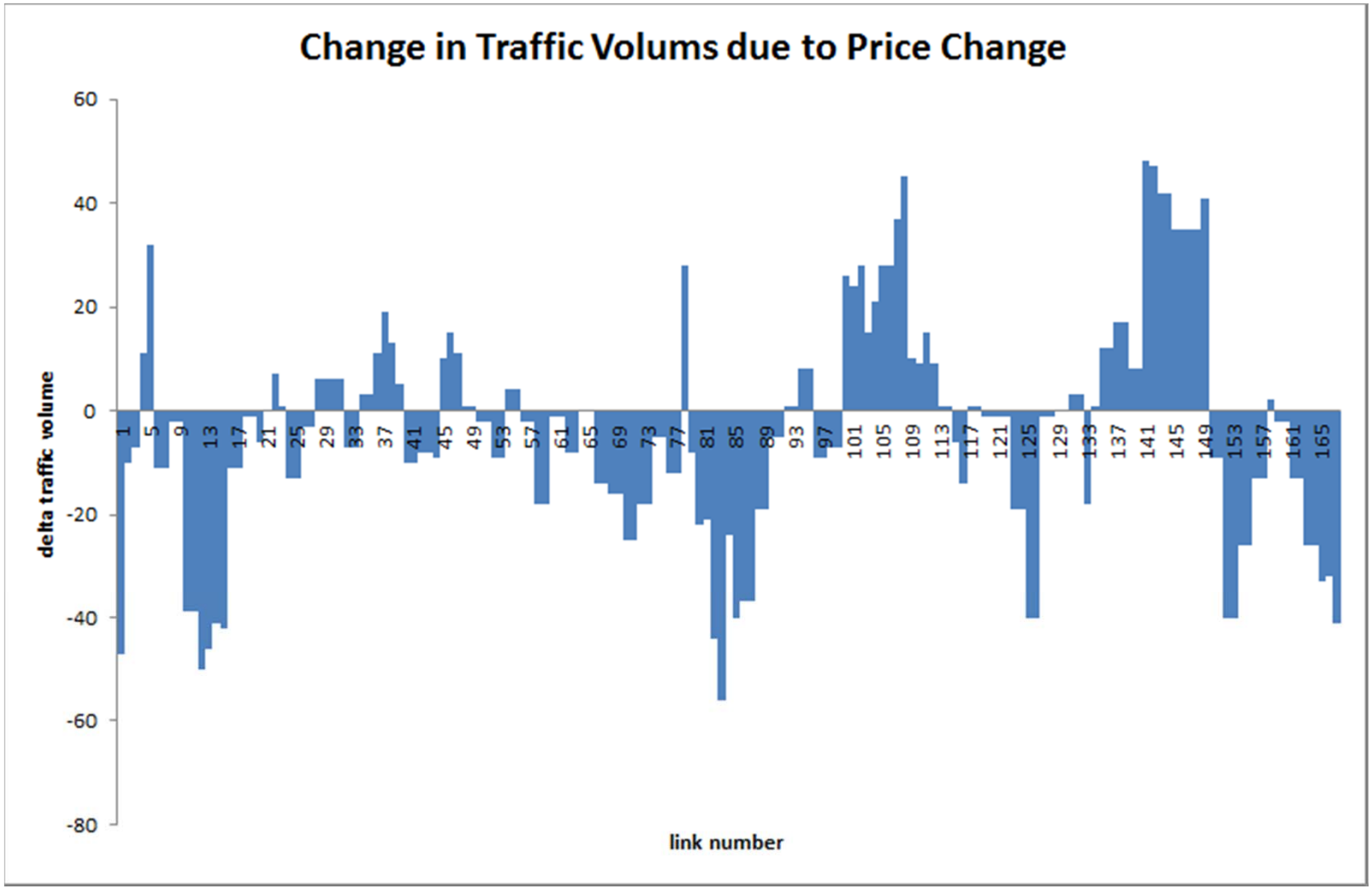


Parking price and income

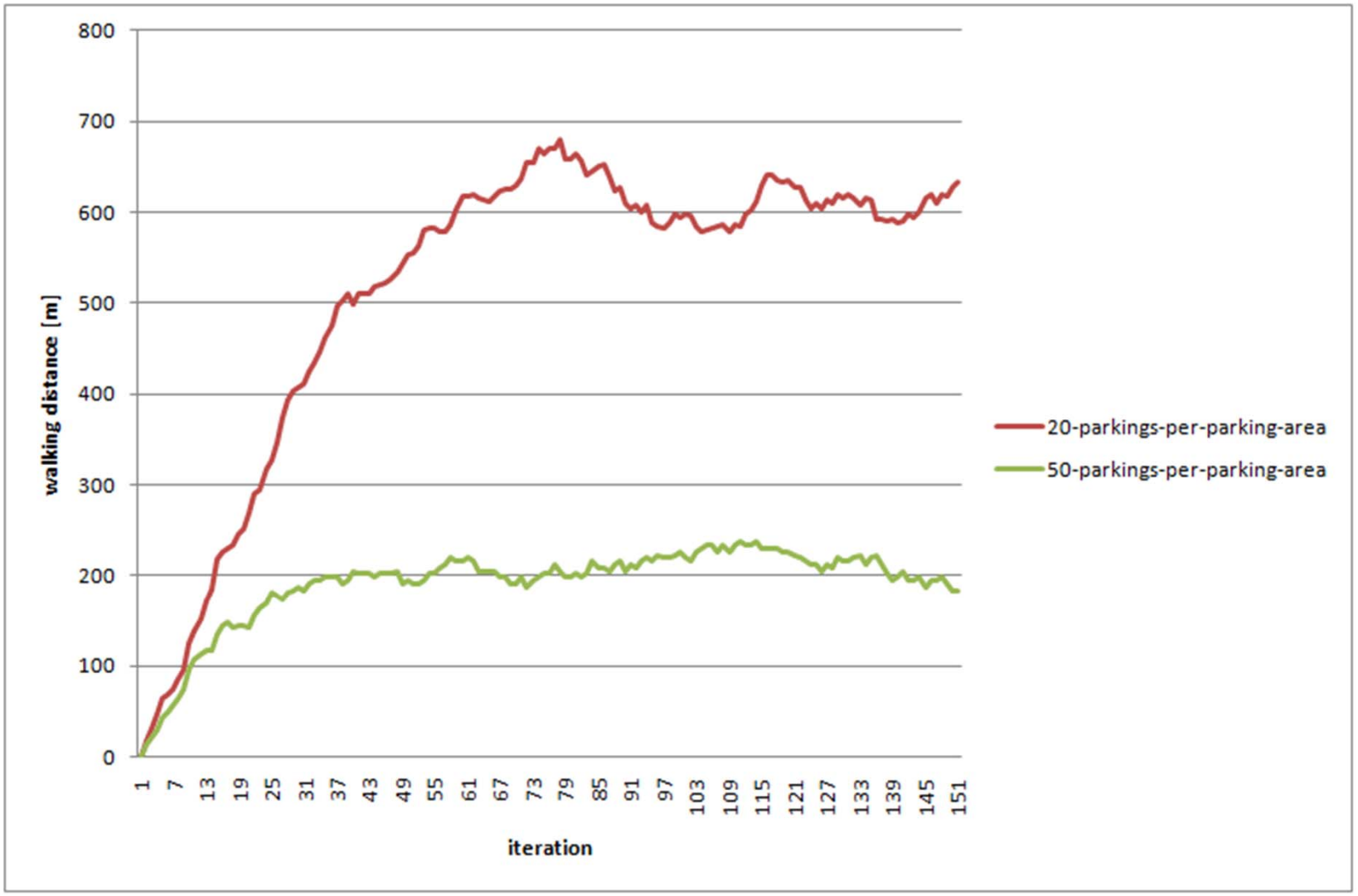
- Two groups: one with very high and one with very low income (50% of people belong to each group)
- Parkings close to home and work are MUCH more expensive than the parkings further away.



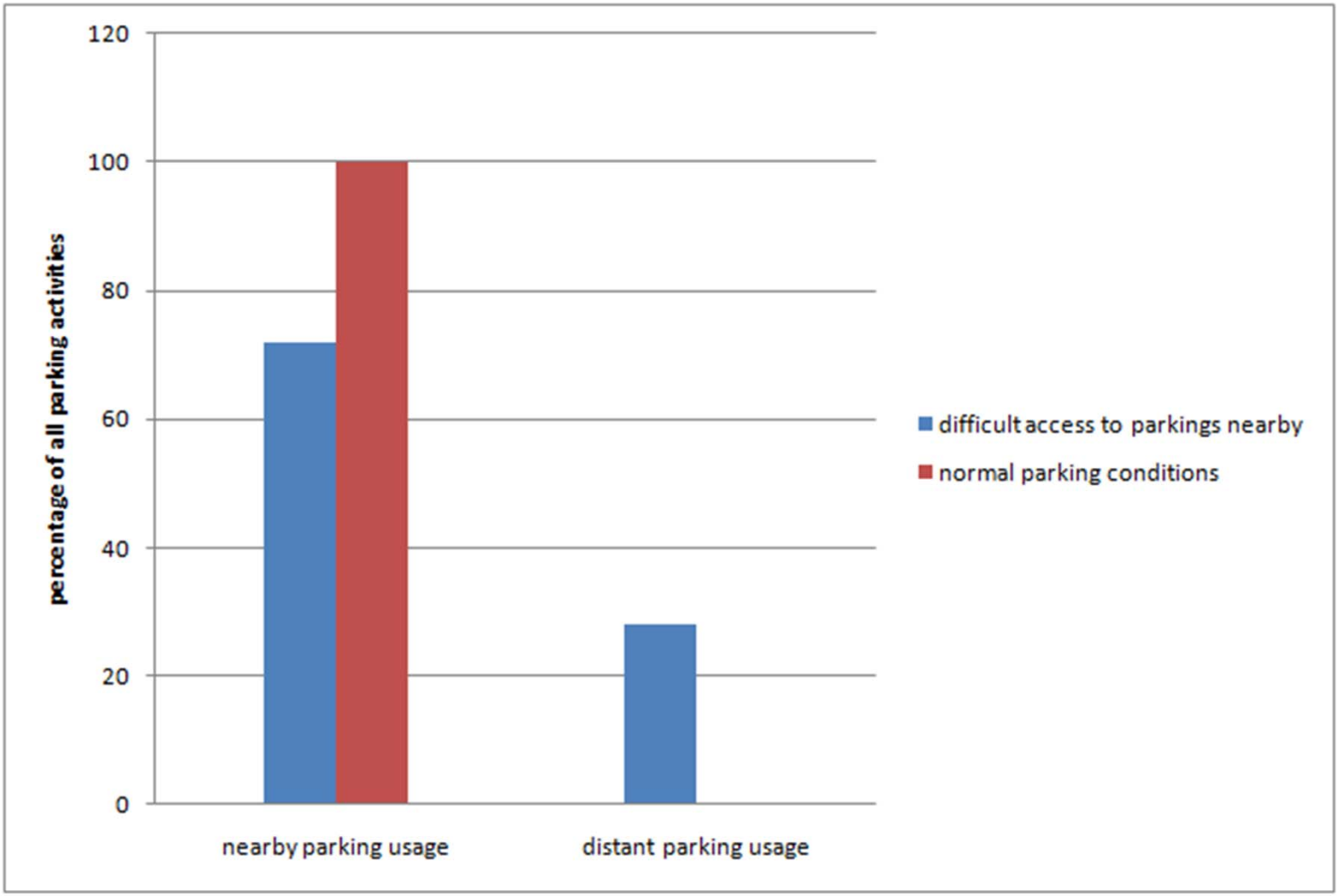
Parking price and income (con't)



Parking supply



Introducing parking access constraints



Don’t look at single agents!

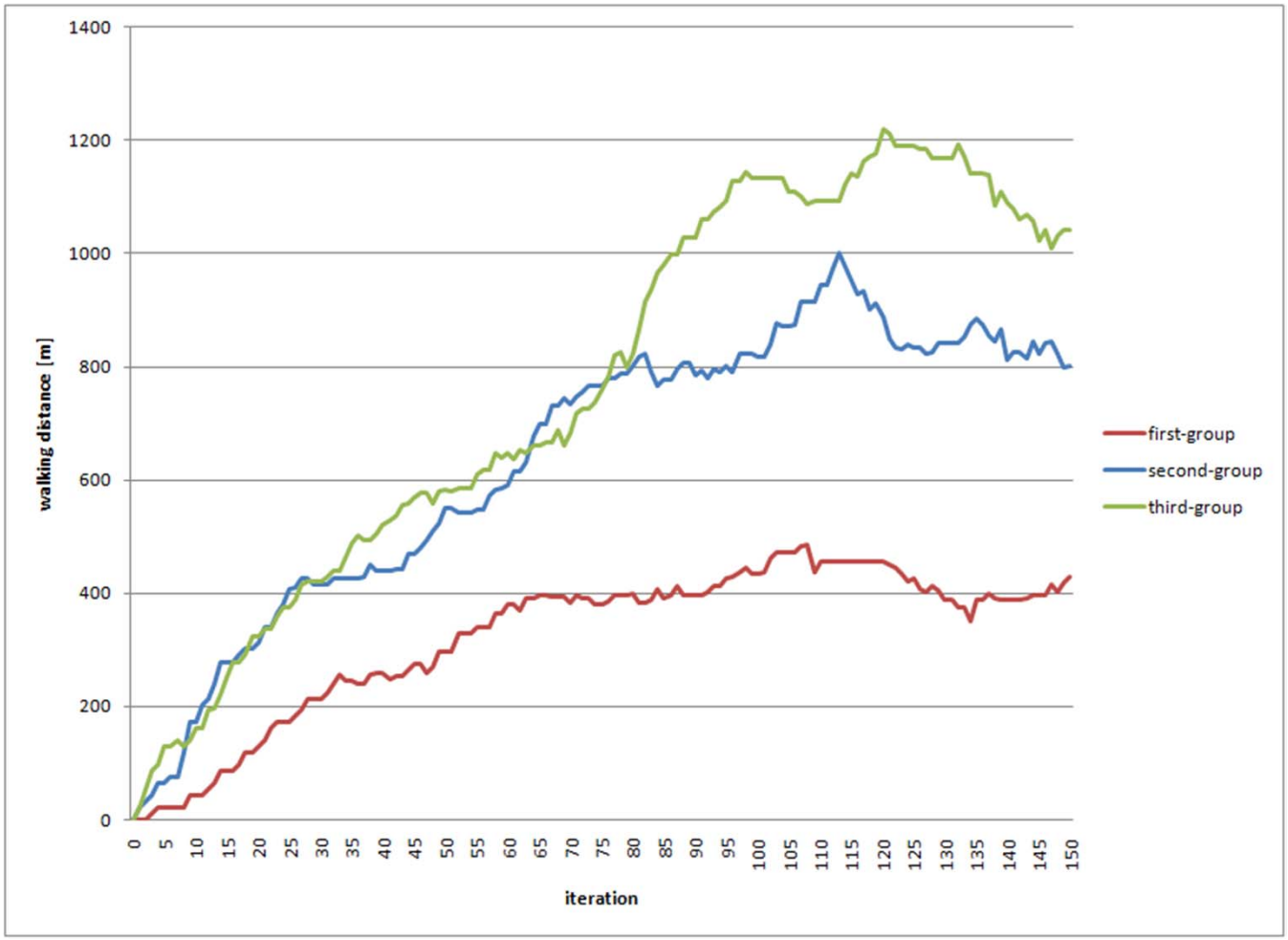
- System is changing in each iteration (trying to optimize)
- Don’t look individual agents but on aggregate values!

- This means, that it may happen that isolated agents may have wrong parking behavior, but average behavior should be right

- Experiment
  - Enumerate agents from 1 to 99 and each agent departs one minute ahead of time than the next agent
  - This means that there is a clear temporal advantage towards the parking for agents departing earlier
  - Even though this advantage can get lost (e.g. agent 32 may get a worse parking than agent 33)
  - Aggregated statistics should be right!

Temporal aggregated advantage

First-group: 1-33, second-group: 34-66, third-group: 67-99



Parking type (in progress)

Working on test cases

- Reserved disabled people parking at shops
- (or reserved electric vehilce parkings)

Future Work

- Integrating into official MATSim release
- Improve replanning algorithm for better optimization

Long term:

- Add parking search into QueueSim (within day replanning)

Questions?